

A SYSTEMATIC MONOGRAPH
OF THE
FLATFISHES (HETEROSOMATA)

VOL. I
PSETTODIDÆ, BOTIIDÆ, PLEUROXECTIDÆ

BY

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ASSISTANT KEEPER IN THE DEPARTMENT OF ZOOLOGY



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PREFACE

THIS volume is the first part of a systematic revision of the Flatfishes (Heterosomata), and includes three out of the five recognised families—the Psettoidea, Bothidae, and Pleuronectidae. The families Soleidae and Cynoglossidae will form the subject of the second and concluding volume.

The work is based primarily on the rich collection of the British Museum (Natural History). In addition, the author has been able to study a very large number of specimens belonging to other museums, either by personal visits abroad, or by the generous loans made by museums to the British Museum, and often allowed to extend over a prolonged period.

For these loans and similar courtesies, including the supplying of photographs of, and notes on, specimens which could not be lent, the thanks of this Department are due to the following institutions: Fishery Board for Scotland (Aberdeen); South Australian Museum (Adelaide); Zoologisch Museum (Amsterdam); Laboratorium voor het Onderzoek der Zee (Batavia); Bergens Museum (Bergen); Zoologisches Museum der Universität (Berlin); Instituto di Zoologia, Università (Bologna); Queensland Museum (Brisbane); Indian Museum (Calcutta); Museum of Comparative Zoology (Cambridge, Mass.); South African Museum (Cape Town); Canterbury Museum (Christchurch, N.Z.); s'Rijk's Museum van Natuurlijke Historie (Leiden); Zoological Museum of the Academy of Sciences (Leningrad); Department of Oceanography, University (Liverpool); Fishmongers' Company (London); Ministry of Agriculture and Fisheries (London and Lowestoft); Zoologische Sammlung des Bayerischen Staates (Munich); Science Society of China (Nanking); American Museum of Natural History (New York); Muséum National d'Histoire Naturelle (Paris); Academy of Natural Sciences (Philadelphia); Museu Nacional (Rio de Janeiro); California Academy of Sciences (San Francisco); Stanford University (California); Württemberg. Naturaliensammlung (Stuttgart); Australian Museum (Sydney); Zoological Institute, Tokyo Imperial University (Tokyo); Naturhistorisches Museum (Vienna); United States National Museum (Washington, D.C.); Dominion Museum (Wellington, N.Z.).

In addition to the help of the various officials of these institutions, the author has received assistance in other ways from so many colleagues in nearly every country of the world, that it is almost invidious to select for mention here the following names: Professor L. F. de Beaufort (Amsterdam), Monsieur P. Chabanaud (Paris), Professor C. L. Hubbs (Michigan), Professor W. H. Longley (Baltimore), Mr. J. T. Nichols (New York), Mr. A. E. Parr (Yale), Dr. P. Schmidt (Leningrad), Dr. S. Tanaka (Tokyo).

To Lieut.-Colonel W. P. C. Tenison, D.S.O., however, the indebtedness of the author and of the Zoological Department calls for very special mention; not only for the care, skill and knowledge of fishes which he has brought to bear on the preparation of the large number of text-figures, but also for the assistance which his familiarity with the subject has enabled him to give to the author in the course of his work. In addition, Colonel Tenison paid a visit to the United States specially for the purpose of examining types of Flatfishes contained in the museums of Washington, New York, and Cambridge, Mass. The sketches and notes which he brought back from this visit have been of the greatest possible use to the author in enabling him to refer to their proper positions a number of species which, without re-examination, must have remained obscure.

The Flatfishes are one of the most interesting groups of fishes to the scientific zoologist on account of their remarkable departure in general symmetry from the bilateral shape which is characteristic not only of the vast majority of fishes, but of the vertebrates in general. The evolutionary steps by which this modification has been brought about in the natural history of the group, and the ontogenetic modifications by which it is brought about in the history of the individual, have been extensively discussed and described without the interest of the facts having been exhausted, and possibly without all the facts themselves having been brought to light. When it is added to this that the group includes some of the most important and valuable food-fishes in various parts of the world, it is somewhat surprising to find that there has been no attempt at a comprehensive systematic revision since the publication of Volume IV of Dr. Gunther's Catalogue in 1862. The families dealt with in the present volume were represented in that Catalogue by 22 genera and 60 species. These numbers are here increased to 82 genera and 300 species. Of the species no less than 247 are now represented in the Museum collection, 8 have been studied by the author in the collections of other museums, 21 were examined by Colonel Tenson in America, and only 24 have had to be included solely on the evidence of the published descriptions.

W. T. CALMAN,

Keeper of Zoology

BRITISH MUSEUM (NATURAL HISTORY),

January 12th, 1934

A SYSTEMATIC MONOGRAPH
OF THE
FLATFISHES (HETEROSOMATA)

A. GENERAL PART.

I. ORIGIN AND SYSTEMATIC POSITION OF THE HETEROSOMATA.

In the 'Systema Naturæ' of Linnaeus all the Flatfishes known to him were placed in a single genus, *Pleuronectes*, and it was not until the publication of Cuvier's 'Le Règne Animal' that any real attempt was made to indicate the relationships of the various groups of Bony Fishes. In Cuvier's (1817)¹ classification the Flatfishes are raised to the rank of a family, and are associated with the Gadoids, Gobiescoids, Cyclopterids, Echeneids and Ophiocephalids in the division of sub-brachial malacopterygians, characterised by the thoracic position of the pelvic fins and the absence of spines in the dorsal fin. Johannes Müller (1846), who first made use of the relation between air-bladder and gullet for the definition of higher divisions, removed the sub-brachial malacopterygians from the abdominales or physostomes, placing them nearer to the acanthopterygians. In his classification, however, the Pleuronectoids and Gadoids are still associated, a new order, Anacanthini, being erected to include these fishes as well as the Ophidioids. This association of the Flatfishes with the Gadoids was retained in many subsequent classifications, and, indeed, is to be found in a number of modern text-books. Thus, Günther (1880) divided the order Anacanthini into two main divisions—Anacanthini Pleuronectoidei and Anacanthini Gadoidei. Cope (1871) appears to have been the first to recognise the Flatfishes as a distinct order, to which he applied the name Heterosomata, originally invented by Duméril, but he also regarded them as related to the Cods. Gill (1893) regarded the Heterosomata as a suborder of his Teleocephali, equal in rank to the Anacanthini, close to which it was placed. Jordan and his collaborators recognised the Heterosomata as a suborder of the order Acanthopteri, in which it was placed near the Ribbon-fishes (Tæniosomi) and the Cods (Anacanthini). In discussing the systematic position of the Heterosomata, Jordan and Evermann (1898, p. 2002) state: "Its near relationship is probably with the Gadidae, although the developed pseudobranchiae and the thoracic ventral fins indicate an early differentiation from the anacanthine fishes".

Among other views as to the relationships of the Flatfishes, mention may be made of Gill's (1887, p. 86) tentative suggestion that "the Heterosomatous fishes may have branched off from the original stock, or progenitors of the Tæniosomous fishes", an

¹ See list of references, p. 52.

ide which he never elaborated. Agassiz (1842, p. 200) placed the Flatfishes near the Chaetodontidae and Scorpididae, and Holt (1864, p. 438) hinted at an affinity with such deep-bodied fishes as *Platax* or *Dasyllus*, or even with *Zeus*.

In 1902, Boulenger (1902) and Thilo (1902), working independently, came to the conclusion that the John Dories (*Zeidae*) were nearly related to the Flatfishes, and Boulenger associated the two groups with *Amphistium*, a fossil fish from the Upper Eocene, in a division of the Acanthopterygii to which he gave the name Zeorhombi. Regan (1910, p. 484) first drew attention to the perch-like characters of *Psettodes*, which he regarded as the most generalised member of the Heterosomata and "simply an asymmetrical Percoid", he suggested that the rest of the Flatfishes had arisen from a form not very unlike *Psettodes*. Later, Regan (1913) placed the Heterosomata as a specialised offshoot from the order Percomorphi, a position which it occupies in his latest classification of the Bony Fishes (1929). In his most recent arrangement of the Bony Fishes, Jordan (1923, p. 107) still places the Heterosomata near the

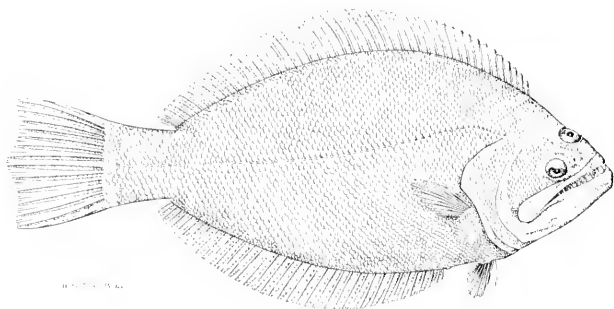


FIG. 1.—*Psettodes erumei*. (1/3)

Anacanthini and Allotriognathi (Ribbon-fishes, etc.), but remarks that "the flounders and soles, having no spines and the ventral fins thoracic with an increased number of rays, should not be placed far from the percormorphous series."

All the authors so far mentioned appear to regard the Flatfishes as a natural group derived from a single stock, whether Gadoid, Zeoid or Percoid. Recently, however, Kyle (1921, p. 118) has concluded that the origin of the group has been polyphyletic. "With regard to Origin," he writes, "the conclusion is reached that the Flat-fishes are not a homogeneous group. *Symphurus* represents the earliest origin, and has sprung from a stock which has given rise, amongst others, to the Macrurids and Trachypterus. The *Bothus* type is related to the *Psettodes*, the Rhomboids have a near relation in *Stomatocoides*, and *Zeus* is an advanced relative; the Pleuronectoids are distinct from both. *Psettodes*, the 'Percoid', appears to have sprung from a different line of evolution, and is a modern accession to the ranks of Flat-fishes." The evidence on which these conclusions are based, however, is at times somewhat difficult to follow, and does not always appear convincing.

As will be shown in the section devoted to classification, there seem to be good reasons for regarding the Heterosomata as a homogeneous group, of which *Psettodes* (Fig. 1) is the least specialised member, with the proviso that a more detailed study

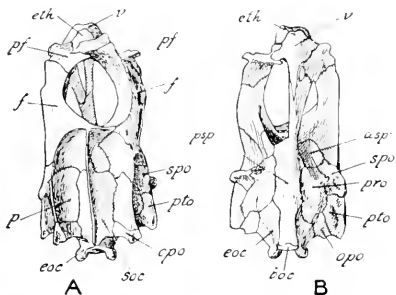


FIG. 2.—*Psettolodes erumei*. A, Dorsal view of skull. B, Ventral view of skull. *asp.*, alisphenoid; *boc.*, basi-occipital; *eoc.*, ex-occipital; *epo.*, epiotic; *eth.*, ethmoid; *f.*, frontal; *opo.*, opisthotic; *p.*, parietal; *pf.*, praefrontal; *pro.*, pro-otic; *psp.*, parasphenoid; *pto.*, pterotic; *soc.*, supra-occipital; *spo.*, sphenotic; *v.*, vomere. ($\times 1\frac{1}{2}$)

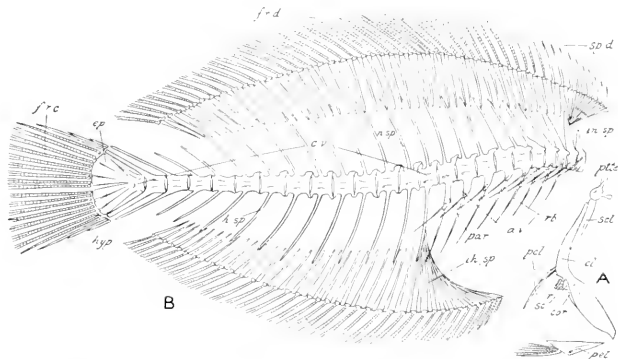


FIG. 3.—*Psettolodes erumei*. A, Pectoral arch and pelvic bone. B, Vertebral column and skeleton of fins. *a.v.*, abdominal vertebra; *c.v.*, caudal vertebra; *cl.*, cleithrum; *cor.*, hypercoracid; *ep.*, epural; *f.r.c.*, fin-ray of caudal fin; *f.r.d.*, soft fin-ray of dorsal fin; *h.sp.*, haemal spine; *hyp.*, hypural; *ih.sp.*, interhaemal spine; *m.sp.*, internatural spine; *n.sp.*, neural spine; *par.*, parapophysis; *pcl.*, post-cleithrum; *pel.*, pelvic bone; *p.le.*, post-temporal; *r.*, radial; *rb.*, rib; *sc.*, hypercoracid; *scl.*, supra-cleithrum; *spd.*, spine of dorsal fin. ($\times 1\frac{1}{2}$)

of the "Soles" (Soleidae and Cynoglossidae) may possibly provide evidence of their origin from a stock of Percoids different to that which gave rise to the "Flounders"¹ Genera intermediate between *Psettodes* and the more specialised Flatfishes do not exist to-day, but it is not difficult to see how such a form as *Paralichthys* or *Atheresthes* might have been derived from this primitive genus. In considering the origin of the

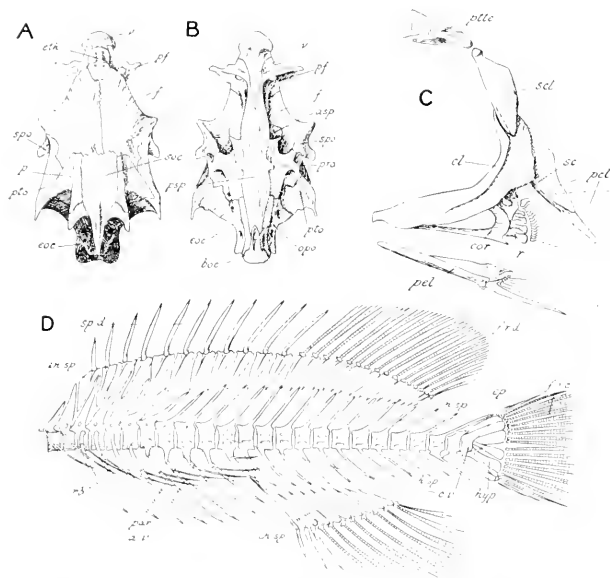


FIG. 4. *Pinnophelus stauara*. A, Dorsal view of skull ($\times \frac{1}{2}$). B, Ventral view of skull ($\times \frac{1}{2}$). C, Postoral arch and pelvic bone ($\times \frac{1}{2}$). D, Vertebral column and skeleton of nms ($\times \frac{1}{2}$). Lettering as in Figs. 2 and 3.

Heterosomata as a whole, therefore, instead of comparing the highly specialised Turbot with the John Dory, or the Halibut with the Cod, it is clearly of greater importance to compare *Psettodes* itself with representatives of the groups of fishes from which the Flatfishes are believed to have been derived. Leaving out of consideration the aberrant Allotriognathu, it will be convenient to consider in turn the evidence both for and against a Gadoid, Zeoid and Percoid ancestry respectively.

¹ See p. 17.

Cunningham (1897, p. 498) was the first to throw doubt on the validity of associating the Flatfishes and Gadoids, remarking that "there can be no doubt that the Gadidae and Pleuronectidae, instead of being closely allied, are very remote from each other in structure and descent". Subsequently, Boulenger (1902) and Regan (1910B) have produced good reasons for the separation of the two groups. The Heterosomata and Anacanthini agree in having the mouth more or less protractile and bordered above

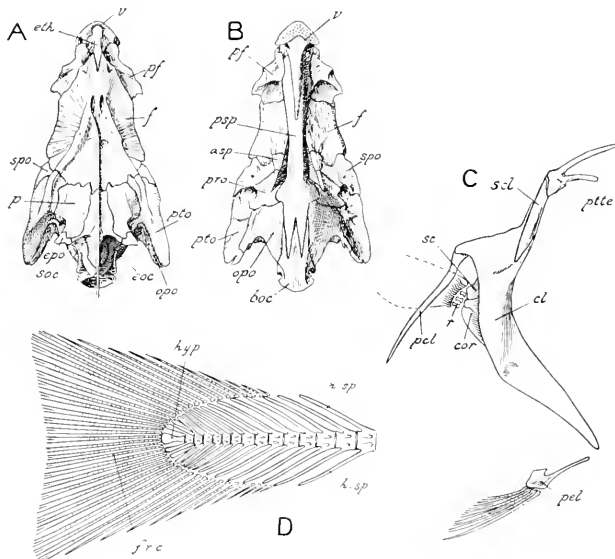


FIG. 5.—*Gadus callarias*. A, Dorsal view of skull. B, Ventral view of skull. C, Pectoral arch and pelvic bone. D, Posterior part of vertebral column and caudal fin. Lettering as in Figs. 2 and 3. ($\times \frac{1}{2}$)

by the præmaxillaries alone; the parietals are separated by the supra-occipital; there is no orbitosphenoid; the pectoral arch is attached to the skull; and there is no mesocoracoid. Comparison of the osteology of *Psettolodes* with that of a generalised Gadoid (Figs. 2, 3, 5), however, reveals the following important differences, among others: (1) The spinous rays of the dorsal fin and the spinous first ray of the pelvic in *Psettolodes* are wanting in the Gadoids; (2) in *Psettolodes* the pelvic bones are directly attached to the cleithra of the pectoral arch, whereas in the Gadoids they are connected

with them by means of a ligament, (3) in *Psettodes* the caudal fin is normally formed, with 17 principal rays, of which 15 are branched, but in the Gadoids the caudal fin is formed mainly of dorsal and anal rays, the true homocercal fin being much reduced, (4) there is no air-bladder in the adult *Psettodes*, but this is present in the Gadoids; (5) in *Psettodes* there are well-developed pseudobranchia, whereas in the Gadoids these structures, if present, are reduced and glandular, and (6) in *Psettodes* the opisthotic bone is small, whereas in the Gadoids it is large, and extends downwards

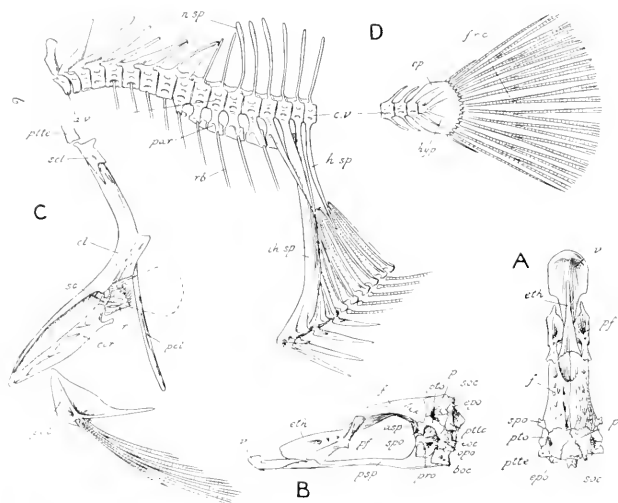


FIG. 10. *Zeacaber*. A, Dorsal view of skull. B, Lateral view of skull. C, Pectoral arch and pelvic bone. D, Portions of vertebral column, caudal fin, and anterior part of anal fin. Lettering as in Figs. 2 and 3.

to the basi-occipital, separating the pro-otic and ex-occipital. As Regan (1908b, p. 486) has remarked, "the absence of spinous fin-rays, the large number of rays in the pelvic fins, and the indirect attachment of the pelvic bones to the cleithra may be regarded as primitive features, and it is probable that these fishes—the Gadoids—have evolved from generalised *Limna*, such as the *Aulopode*."

In suggesting a near relationship of the Heterosomata to the Zenke, Thilo (1902a, p. 332) emphasised the following points of resemblance: (1) The general form of the body; (2) the number of abdominal vertebrae; (3) the structure of the bony supports of the anal fin; (4) the structure of the pelvic bones; (5) the form of the pectoral arch; (6) the connection of pectoral and pelvic fins; and (7) the form of the urohyal.

He also drew attention to the resemblance between the air-bladder of the young Turbot and that of *Zeus*, and to the presence of small spines on the gill-covers of young Turbot similar to those which occur as a juvenile character in the John Dory. On closer investigation many of these features are seen to be comparatively little importance, and comparison of the internal anatomy, and more particularly of the osteology, of *Psettodes* with that of *Zeus* produces very little evidence to support the view that these fishes are in any way closely related.¹ The peculiar characters of the order Zeomorphi as defined by Regan (1910A) are, almost without exception, absent in *Psettodes*. These include the more or less separate spinous anal fin; the caudal fin with only 12 or 13 principal rays, of which 10 to 12 are branched, and, in addition, 1 to 3 small, simple rays above and below; the simple post-temporal, which bridges the posterior temporal fossa, is rigidly united to the epiotic or parietal above and to the opisthotic or pterotic below, and has a "temporal plate" firmly attached along its anterior edge; the cleithrum, which runs upwards internal to the supra-cleithrum

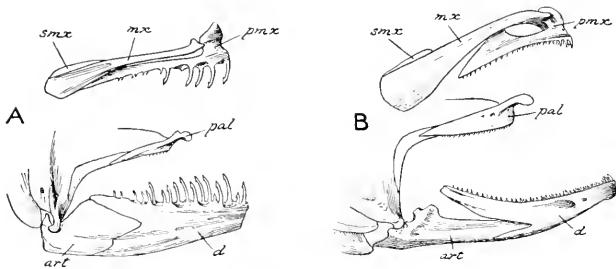


FIG. 7.—Jaws and palatine bones of A, *Psettodes erumei*; B, *Epinephelus itajara*. art., articular; d., dentary; mx., maxillary; pal., palatine; pmx., premaxillary; smx., supplemental maxillary. ($\times \frac{1}{2}$)

and ends in a pointed projection just behind the post-temporal; the single post-cleithrum on each side; the first vertebra, which is very firmly attached to the cranium; the præcaudal region of the vertebral column, in which the anterior neural spines are directed backwards, but the posterior spines are erect or even point forwards (Fig. 6). In the Zeomorphi, moreover, each pelvic fin is composed of a spine and of from 5 to 9 branched rays, a character suggesting affinities with the Berycomorphi.

Finally, on comparing *Psettodes* with a generalised Percoid (Figs. 2, 3, 4), the resemblances are so striking that there can be very little doubt as to its relationship with these fishes; indeed, apart from the asymmetry and the long dorsal and anal fins, *Psettodes* might almost be placed in the Percoid family Serranidae. The most important features of resemblance include the form of the dorsal fin, which in *Psettodes* has about the first 10 rays composed of slender spines and does not extend forward on to the head; the caudal fin, which has 17 principal rays, of which 15 are branched; the pelvic fins, each of which consists of a spine and 5 soft rays. The maxillary is provided with a well-developed supplemental maxillary, and the form of the mouth is that of a typical perch. Apart from its asymmetry, the skull is in most respects

¹ See Regan (1910B, p. 486).

almost exactly similar to that of a generalised Serranid, and the pectoral arch,¹ the attachment of the pelvic fins and the form of the vertebral column are all quite Percoid. Even more important than these characters themselves is the combination of 24 vertebrae (10 pre-caudal, 14 caudal), 17 principal caudal rays (15 branched), and pelvic fins of a spine and 5 soft rays, with the pelvic bones directly attached to the cleithra. Such a combination is commonly found among the Percoid fishes, but occurs in no other group.²

There is another character, the importance of which does not appear to have been generally realised, which may be of some value, if not in actually indicating lines of descent among Bony Fishes, at least in confirming already suspected relationships. This is the form of the otoliths (Fig. 8), which, by a comparison of fossil forms with those from existing fishes, may be shown to have undergone comparatively little change in course of time.³ The sagitta of *Psettodes*⁴ is seen at once to be quite

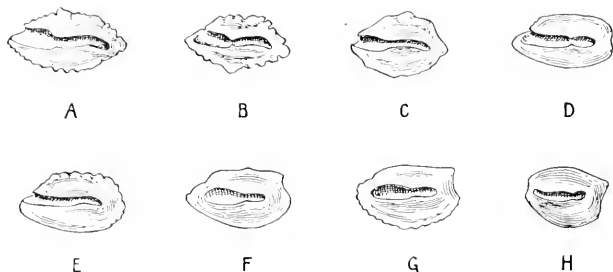


FIG. 8. — Sagitta of A, *Trinephelus mouto* (· 2½); B, *Psettodes erumei* (· 2); C, *Eucitharus longuata* (· 3); D, *Hippoglossus hippoglossus* (· 2); E, *Scophthalmus rhombus* (· 2½); F, *Hippoglossoides platessoides* (· 3); G, *Pleuronectes flexus* (· 3); H, *Solea solea* (· 2½).

unlike that of the Gadoids, and even more unlike the curious sagittae of the Zeonids. It agrees closely, however, with those of the Percoids, resembling that of *Percia* in shape and that of *Centrofomus* in the form of the sulcus. "The otolith of *Psettodes erumei*," writes Frost, "resembles in every feature those of the suborder Percoida." Moreover, the sagitta of *Eucitharus* is also markedly percoid in form, those of *Hippoglossus* and of the members of the family Bothidae (*Vonoglossus*, *Bothus*, *Lepidothombus*, *Scophthalmus*) are described as sub-Percoid, and those of the Pleuronectidae and Soleidae can, for the most part, be shown to have been derived from this type in spite of their specialised features. These facts not only provide striking confirmation of the Percoid ancestry of the Flatfishes, but also provide additional evidence in favour of their being a homogeneous group.

¹ Chabanaud (1931, p. 295) states that there is only a single post cleithrum in *Psettodes belcheri*. I have examined two skeletons of *Psettodes erumei*, and find in both two closely united bones (Fig. 3).

² See Regan (1929, p. 324).

³ A valuable comparative study of the otoliths of recent Neopterygian fishes has been made by Frost, whose series of papers was published in the 'Annals and Magazine of Natural History' (1925, 1926).

⁴ See Frost (1930, p. 232, pl. IX, fig. 1).

To summarise the above, the conclusion is reached that *Psettodes* is the least specialised member of the Heterosomata, and all the available anatomical evidence supports the view that it has been derived from a generalised Percoid stock. Further, the same evidence suggests that the Heterosomata represent a homogeneous group, although it is just possible that the Soleidae and Cynoglossidae may have arisen from another part of the Percoid stem. As was pointed out above, the suggestion has been made that *Psettodes* is a modern addition to the Flatfishes, and is not related to the other Heterosomata. In the present state of our knowledge it is perhaps impossible to produce conclusive evidence against this view, but if, as seems likely on other grounds, the Flatfishes have been derived from a Percoid stock, then *Psettodes* provides just that intermediate stage which might be expected.

The manner in which the Flatfishes have evolved from their symmetrical progenitors is the subject of a considerable literature, and some of the more important features of this problem are considered in the section devoted to the evolution of asymmetry. It seems reasonable to suppose that the original Flatfishes arose from some marine Percoid ancestor which had adopted the habit of resting on one side—a habit which is found to-day in such families as the Serranidae and Labridae. The fact that some of the Wrasses frequently rest or sleep lying down on one side at the bottom was first noticed by Möbius (1867), and afterwards confirmed by Verrill (1897, p. 136) and Boulenger (1920); Verrill himself suggested the derivation of the Flatfishes from symmetrical fishes with this habit. "The common Tautog or Black-fish (*Tautoga onitis*)," he writes, "has the common habit of resting upon one side, half buried among gravel, or partly under stones, and is often curved in strange positions. It is easy to imagine that the flounders originated from some symmetrical ancestral form that acquired, like the tautog, the habit of resting upon one side, at first only when sleeping, but afterwards continually, owing to the greater protection that this habit and its imitative coloration afforded. The one-sided coloration and the changes in the position of the eyes, etc., would gradually follow in accordance with well-known laws of evolution." It seems possible that some forms may well have gradually increased this resting period, until they finally came to lie on one side continuously, concealed from both their prey and their natural enemies by the similarity of their coloration to the ground on which they lay, merely darting out at intervals to seize other fishes. Little is known of the living *Psettodes*, but it has been suggested that its habits may be of this nature.

II. FOSSIL HETEROSOMATA.

The known examples of fossil Flatfishes are comparatively few, and provide no evidence as to the origin of the order. The fact that such diverse forms as *Bothus* (= *Platophrys* auct.) and *Solea* were already in existence in the Middle Eocene is of interest in indicating the antiquity of the group.

I have examined four examples of *Eobothus minimus* (Agassiz), preserved in the Geological Department of the British Museum, all from the Middle Eocene of Monte Bolca. Originally described as *Rhombus minimus*,¹ this species was afterwards made the type of a new genus by Eastman (1914, p. 328), who considered it as allied to the Turbot and Brill group (*Scophthalminae*). It certainly belongs to the sinistral family Bothidae, but appears to be more nearly related to the existing genera *Bothus* and *Engyprospion*.² I have also studied examples of *Solea kirchbergana* (Meyer), a typical Soleid from the Miocene of Wurtemberg, and the type of *S. eocenica*, Woodward (1910), from the Middle Eocene of Egypt. Jordan and his collaborators have described a

¹ Agassiz (1839-42, p. 289, pl. xxxiv, fig. 1).

² *Rhombus stamati*, Pauca, from the Oligocene of Roumania, should perhaps be placed in this genus.

few forms from the Miocene of California, but these again represent comparatively modern types of Flatfishes.¹

As has been already noted (p. 2), Boulenger (1902) associated the Zeala and Pleuronectidae with the Eocene genus *Amphistium* in his division Zeorhombi, and regarded the last named as allied to the symmetrical ancestor of the Flatfishes. Careful examination of three examples of *Amphistium paradoxum*, Agassiz,² all from Monte Bolca, has convinced me that Regan (1910) was correct in regarding this fish as a Peroid, a view that is confirmed by a study of Eastman's (1914, pl. xiv) figure of the second species of *Amphistium*, *A. bozzianum*, Massalongo. As Regan has suggested, this genus is perhaps related to the existing *Psettus* or *Platax*, and Boulenger's restoration of *A. paradoxum* shows several features of *Psettodes* or *Zeus* which are not to be seen in the fossils.

III. EVOLUTION OF ASYMMETRY WITHIN THE ORDER.

Although the body of a Flatfish exhibits some asymmetry, it is in the head region that the most pronounced changes have taken place, so that it will be convenient first to deal with the organs of the head, and afterwards to consider the skeleton of the body, the fins, scales, viscera and so on.

The most obvious peculiarity of the Heterosomata as a whole, and one which serves to distinguish them from all other fishes, is the presence of both eyes on the one side of the head—the left in some species, the right in others (see p. 27). In the generalised *Psettodes* the eye of the blind side is on the dorsal edge of the head and has a vertical range of vision (Fig. 1). A similar condition is found in *Itheresthes*, *Reinhardtius*, *Cleisthenes* and *Parophrys*, all of the subfamily Pleuronectinae, but there is reason to believe that in *Reinhardtius*, and possibly in the other genera also, this is a secondary feature rather than a primitive one. The eyes may be separated by a flat or somewhat concave space of varying width, or, more generally, by a bony ridge. In some forms the width of the interorbital region differs in the sexes.

Examination of the skull³ (Figs. 2, 10) shows that in all Flatfishes the "upper" (dorsal) eye is enclosed in a complete bony orbit, whereas the "lower" eye is bounded on its outer side merely by the muscles connected with the jaws. Between the eyes is a strong bony interorbital bar, formed mainly by the frontal bone of the ocular side,⁴ which has been displaced outwards and downwards. The broadened frontal of the blind side may also share in the formation of this bar, and in such forms as *Psettodes*, *Hippoglossus* and *Scophthalmus* sends forward a bony process for this purpose. In *Glyptocephalus* this process is reduced to a slender rod of bone, and in *Pleuronectes* it merely forms a short pointed projection (Fig. 9). The main portion of the frontal bone of the blind side, however, is on the upper (dorsal) side, that is to say, on the wrong side of its eye, although its relations with the prefrontal region and with the other bones of the skull are perfectly normal. Traquair (1895) suggested that this part of the frontal of the blind side represented a new process sent forwards to meet another directed backwards from the corresponding prefrontal, the resulting bar or bridge of bone, the pseudomesial bar, being regarded by him as necessary to maintain the requisite stability of the cranium. This interpretation appears doubtful in view of the normal relations of the bone in other respects. The interorbital septum,

¹ These forms are: *Fis. the. calif.*, Gilbert; *F. boveri*, Jordan; *Isomma pristinum*, Jordan; *F. cal. antiquae* (Jordan), and *Zeorhombus rufiger*, Jordan. The published restorations show a number of features which cannot readily be seen in the illustrations of the actual fossils.

² See Woodward (1907), p. 474.

³ For 2000 figures and descriptions of the crania of various Heterosomata see Traquair (1895), *Scophthalmus*, *Hippoglossus*, *Pleuronectes*; Cunningham (1896), *Solea*; Cole and Johnstone (1902), *Fis. cal. rufic.*; Kyle (1921), *Fis. Calif.*; *Bothus*, *Reinhardtius*, *Pleuronectes*, *Solea*, *Symphodus*.

⁴ The "upper" or "ocular" side of the fish is referred to throughout as the ocular side, the "lower" or "unipointed" side as the blind side.

whether composed of membrane, cartilage, or a thin lamina of bone, has very much the same relation to the eyes as in symmetrical fishes, but has come to lie in a morphologically horizontal instead of in a vertical plane. Apart from the reduction in the extent to which the frontal bone of the blind side contributes to the formation of the interorbital bar in the more specialised forms, the relations of the two frontals with the eyes is constant throughout the Heterosomata, although in such forms as *Bothus* and *Engyprosopon*, in which the eyes in the mature male are separated by a wide, concave space, the primary relations tend to be obscured by secondary modifications, such as the forcing upwards and backwards of the roof of the cranium on to

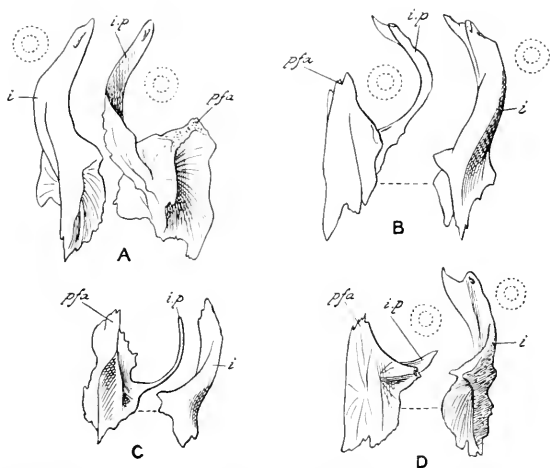


FIG. 9.—Disarticulated frontal bones of a, *Scophthalmus maximus*; b, *Hippoglossus hippoglossus*; c, *Glyptocephalus cynoglossus*; d, *Pleuronectes platessa*. [After Traquair.] i., interorbital bar; i.p., interorbital process; pfa., präfrontal articulation.

the posterior wall, or even over the pectoral arch.¹ In such forms as *Solea* and *Symphurus* the skull is again very specialised, and, as is the case with *Bothus*, the asymmetry appears to increase with age.

Traquair's interpretation of the pseudomesial bar as a new formation was in harmony with the assumption that the migration of the eye causes, or is caused by, a twisting of the whole interorbital region of the cranium—a view which seems to have been widely accepted. As far as the skull in general is concerned, it is a fact that the otic and occipital regions have undergone comparatively little change, and in *Psettodes* are nearly symmetrical, whereas the orbital region has been greatly modified; the ethmoid region, apart from the präfrontals, has undergone considerably less

¹ Kyle (1921, p. 78, pl. v, figs. 12-15).

change than the interorbital. As Regan has pointed out, however, embryological work on the metamorphosis of Flatfishes, and more particularly on the development of the cranium, provides no evidence in support of Traquair's view of the twisting of the facial region of the skull. This work may now be briefly considered.

As is well known, when first hatched the larval Flatfish has one eye on each side of the head, and swims vertically near the surface of the sea in the normal manner. At an early stage one eye migrates round the upper surface of the head and comes to lie more or less close to its fellow of the other side, and from this time onwards the fish lies on the bottom with the ocular side uppermost. The larva has generally been described as symmetrical when newly hatched, but, although this may be true of the eyes, it is doubtful whether the developing skeleton, viscera, etc., are ever quite symmetrical after the larva has left the egg, or, at any rate after the yolk-sac has disappeared. The metamorphosis, and more especially the relation of the eyes to the

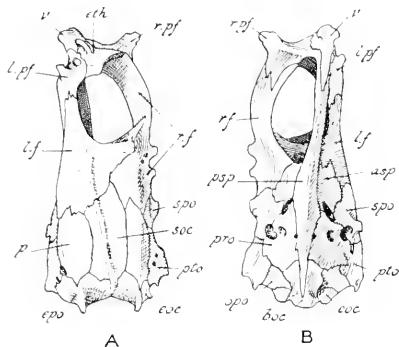


FIG. 10.—*Pleuronectes platessa*. A, Dorsal view of skull. B, Ventral view of skull. lf, left frontal; l.pf, left praefrontal; rf, right frontal; r.pf, right praefrontal. Other lettering as in Fig. 2 (p. 11).

chondrocranium, has been studied in some detail by Williams (1902) in *Pseudopleuronectes* and *Scophthalmus*, by Mayhoff (1914) in *Pleuronectes*, and by Berrill (1925) in *Pleuronectes* and *Solea*. At an early stage after hatching no cartilages are developed above the eyes, but early in the metamorphosis the postorbital bar on each side grows forward to meet the corresponding parathyroid process to form a complete supra-orbital bar, which connects the ethmoid with the otic region of the chondrocranium. These bars are, of course, the precursors of the frontal bones, and are more or less completely reabsorbed¹ before the bones commence to ossify. Almost as soon as they are completed, however, that of the blind side disappears, with the exception of the postorbital portion and sometimes a small part at its anterior end. That is to say, that part of the supra-orbital bar which lies in the path of the migrating eye is absorbed, and the eye subsequently passes through the gap thus formed until it reaches the

¹ The partial or complete absorption of the supra-orbital bars before ossification of the frontals etc. takes place has been recorded in the ontogeny of several symmetrical Bony Fishes—see Norman (1926), p. 42.

supraorbital bar of the opposite side. This bar of the ocular side becomes twisted over towards that side of the head by the movement of the two eyes into their final position, and the ethmoid region of the chondrocranium is likewise affected at the same time. The supra-orbital bar of the ocular side is subsequently reabsorbed also, except for its anterior part, which remains as a stump—the hamulus ethmoideus. As soon as the shifting of the eyes has been completed the frontal bones make their appearance in the positions already indicated.

In all four species of Flatfishes investigated there is, thus, during the ontogeny a lengthy preparation for a comparatively short metamorphosis. In view of this, it seems highly improbable that any twisting of the skull has been brought about by the efforts made by the fish to see with the lower eye. As Regan (1910B, p. 485) has pointed out, "it is wrong to say that the two eyes are on one side as the result of the twisting of the orbital region of the skull, for the first step is the migration of one eye into the territory of its frontal bone, causing resorption of cartilage in the larva, and in the adult producing the effect that the orbital part of its frontal ossifies round it or even entirely outside it. The displacement of the frontal of the lower eye has enlarged the area of that of the upper eye; but it seems wrong to speak of any part of the latter bone as a new formation, least of all that part which has the same position and the same relations (except to the eye) as it would have if the skull were symmetrical". The movement of both eyes into their final position on the side of the head is accompanied by a certain degree of torsion of the orbital part of the cranium, but this is certainly not caused by the migration of the eye.¹

The recent work of Kyle (1921) on the asymmetry of the Heterosomata is very difficult to follow, and I am unable properly to understand his views as to the causation of the migration of the eye. His description of the development during metamorphosis of a subocular ligament below the eye of the blind side, which "forces the eye to follow the deflected frontals to the other side", is somewhat confused, and the interpretation is not in accordance with other embryological work. According to the view expressed by this author, the ossifications which subsequently appear in this ligament to form the pseudomesial bar of Traquair represent new and special structures; at the same time, he hints at the homology of the pseudomedial bar with the subocular shelf found in a number of normal Bony Fishes.

The phylogenetic process by which the asymmetry of the eyes of the Flatfishes has been acquired and established has been a matter of considerable controversy, and cannot be discussed here. Leaving out of consideration the theory that the change from the normal bilateral condition was originally brought about by a single mutation, it seems fairly certain that this change must have occurred through gradual modification. The two chief lines of argument, based respectively on the Darwinian principle of natural selection and the Lamarckian theory of the inherited effects of use and disuse, have been well summarised by Cunningham (1890, p. 51; 1892, p. 193). It seems reasonable to suppose that a symmetrical fish which took to resting on its side would try to make some use of the eye on the under side, and that the change in the position of the eyes may have been initiated by the continual pressure of the lower eye against the edge of the frontal bone.² The pressure from the migrating eye was probably the original cause of the resorption of the supra-orbital bar lying in its path, an event which now takes place in the ontogeny before there is any sign of movement on the part of the eye itself, as a preparation for the subsequent invasion by the eye of the territory of the frontal bone of that side.

The important work of Parker and Mayhoff on the optic chiasma in the Heterosomata will be considered in the section devoted to reversal (p. 28). It will be of interest to mention here, however, that, apart from the optic nerves and the larger

¹ The view advanced by Rosenthal, and afterwards elaborated by Steenstrup (1864), that the eye of the blind side has penetrated through the tissues of the head to the place it now occupies, and has there formed for itself a new orbit, is one which is supported by no evidence, either anatomical or embryological.

² See Regan (1926, p. 85).

size of the olfactory lobe and nerve of the ocular side, the brain of the adult Flatfish shows no marked asymmetry, and is essentially similar to that of an ordinary Peroid fish. The anterior part of the brain is twisted to the ocular side, so that both olfactory lobes and nerves lie on the same side of the morphological median line.

The position of the nasal organs of the two sides of the head exhibits considerable asymmetry in many Flatfishes, and provides a character of taxonomic importance (see p. 37). In *Psettodes* the nasal organs are nearly symmetrical, that of the blind side being a little nearer to the median line than that of the ocular side. In the remainder of the group the organs are nearly or quite symmetrical in position in the "Soles" (Soleidae and Cynoglossidae), whereas, in the majority of the genera of Bothidae and Pleuronectidae, that of the blind side has accompanied or followed the eye in its migration and lies close to the median line of the head (Fig. 11). As far as the modification of the anterior part of the skull is concerned, such genera as *Solea* and *Cynoglossus* are equally, if not more specialised than, say, *Pleuronectes* and *Scophthalmus*, in which the nasal organs are markedly asymmetrical. It is of interest

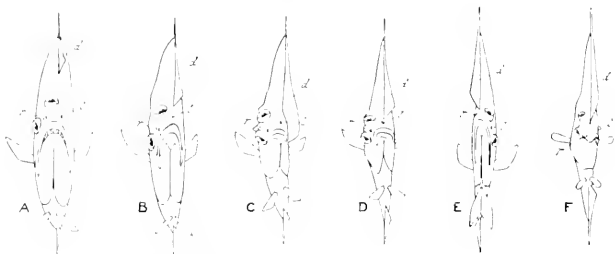


FIG. 11.—Front views of A, *Psettodes erumei*; B, *Hippoglossus hippoglossus*; C, *Pleuronichthys decurrens*; D, *Pleuronectes platessa*; E, *Scophthalmus maximus*; F, *Solea solea*; to show the relative positions of the nasal organs and the anterior extension of the dorsal fin. *d*, dorsal fin; *l*, left nasal organ; *r*, right nasal organ.

to note that the only "Flounders" with symmetrical nasal organs are to be found in the Pleuronectid subfamily Rhombosoleinae, and that these all agree in having comparatively small eyes—a character which they share with the "Soles". It seems possible that the symmetrical position of the nasal organs in these fishes may be correlated with the size of the eyes, since the migration of a small eye would occasion much less disturbance of the anterior part of the head than would that of a larger eye.¹

The anterior extension of the dorsal fin on to the head may be conveniently considered here, since its relation to the eyes and nostrils is a character of considerable taxonomic value, and one of some importance to the understanding of the asymmetry of the head. In the generalised *Psettodes* the first spine of the dorsal fin is situated on the nape and well behind the eyes, but in all other Heterosomata the fin has extended forward at least to above the eye, and in some genera it reaches the extremity of the snout. This extension is along the ridge of the supra-occipital, and thence along the bar formed by the union of the prefrontal and frontal of the blind side above the upper eye, *i.e.* along the pseudoniestal bar instead of along the morphological median line. Above the eye the fin is not infrequently bent over a little

¹ See Norman (1929b, pp. 257-8).

towards the blind side, and in some specialised genera (*e.g. Pleuronchthys*) one or more rays of the anterior part of the fin may be on the blind side of the head (Fig. 11). The anterior extension of the dorsal fin in Flatfishes appears to have been effected in one or other of two ways. In some forms the first few interneural spines (interspinous bones) are inclined forwards, so that the first of these may actually occupy a horizontal position, thus carrying the rays of the dorsal fin to the required place; in others the anterior interneural spines seem to have themselves moved forward along the upper surface of the cranium from a position in the region of the supra-occipital to one on the frontal of the blind side (Fig. 12). In the genus *Solea* the anterior interneural spines, which are inclined forward, are supported by a special curved spine-like bone lying nearly parallel to the axis of the cranium. This may represent a detached and much modified interneural spine.

The structure of the anterior part of the dorsal fin suggests that phylogenetically the forward extension in the Heterosomata must have taken place after the two eyes had established themselves on the same side of the head, or, at any rate, after this

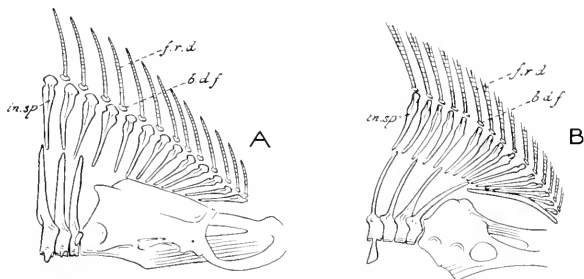


FIG. 12.—Skeleton of anterior part of dorsal fin and hinder part of skull of A, *Pleuronectes platessa*; B, *Solea solea*. *b.d.f.*, basal bone of dorsal fin; *f.r.d.*, ray of dorsal fin; *in.sp.*, interneural spine. ($\times 1$.)

process had been initiated, a view which is fully confirmed by a study of its ontogeny. In most genera the anterior extremity of the fin in the larva lies behind the eyes, in much the same position as that of the first dorsal spine in the adult *Psettolodes*. As soon as the migrating eye has passed over the top of the head the dorsal fin moves forward to take up its final position. In other genera, however, the forward movement of the fin takes place before the eye has had time to pass over the edge of the head. In *Scophthalmus* and related forms the anterior extremity of the fin may overhang the eye as it passes over the edge of the head, or the eye may actually pass through the tissues of the basal part of the fin. In *Arnoglossus* the anterior part of the post-larval dorsal fin becomes detached from the ethmoid region of the cranium, and the eye passes through the slit thus formed.¹ This passage of the eye through a slit between the fin and the head was observed in a living, but unfortunately unidentified larval form taken in Japan by Nishikawa (1891). In *Bothus*, another highly specialised genus, the dorsal fin again extends forward before the migration of the eye is complete, but does not become detached from the cranium. Instead, an

¹ Kyle (1913, p. 47). See also Facciola [1900, Boll. Soc. Zool. Ital., (2) 1, (ix), pp. 169-189, 1 pl.].

opening appears between some of the anterior interneural cartilages, through which opening the eye passes¹. In *Solea* the eye passes over the top of the head below the overhanging extremity of the fin as in *Scophthalmus*, but in *Symphurus* (*Plagusia*), as was first observed by Agassiz (1870), the migrating eye has to pass through the tissues of the head, emerging on the other side close to the other eye.²

The muscles of the head in the Heterosomata likewise exhibit a greater or lesser degree of asymmetry, and the various crests and hollows on the skull for their attachment are generally more prominent on the ocular side. The anterior segments of the dorsal lateral muscles are elongated and bent anteriorly, so that they lie on the dorsal surface of the head on either side of the anterior extension of the dorsal fin. The eye-muscles, as well as those connected with mastication and respiration, are markedly asymmetrical, especially in those forms which spend the whole of their lives on the sea floor.³

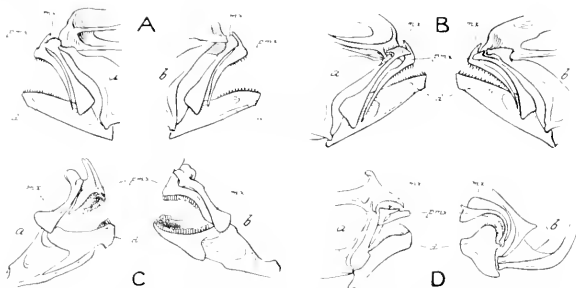


FIG. 13.—Jaws of, *a*, *Pseudorhombus asotus*, *b*, *Psittichthys melanostictus*, *c*, *Pleuronectes platessa*; *d*, *Solea solea*. *a*, of ocular side; *b*, of blind side. *d*, dentary; *mx*, maxillary; *pmx*, premaxillary.

In many Flatfishes the jaws and dentition exhibit a marked asymmetry, but this is of a secondary nature and not related to the original asymmetry produced by the change in the position of the eyes. *Psittodes*, which probably lies on the bottom and makes short dashes after approaching fishes, has a larger mouth than any other Flatfish, and is the only genus in which the supplemental maxillary bone is developed (Fig. 7). The jaws and dentition are very nearly equally developed on both sides, and are essentially perch-like, the teeth being strong and pointed. In the sinistral Bothidae the mouth is terminal, with the lower jaw prominent, and the jaws and teeth, if not actually symmetrical, are usually well developed on both sides of the head (Fig. 13*A*). The Pleuronectidae, also with terminal mouths and prominent lower jaws, fall into two main divisions. In the first, of which *Hippoglossus* is a typical example, the mouth is large and subsymmetrical, and the dentition more or less equally developed on both sides (Fig. 13*B*). These are all strongly swimming forms which live mainly on small fishes or other agile creatures, and go in active pursuit of their prey. In the

¹ Imery (1857), p. 405, figs 1, 2. KYLE (1911, pp. 48, 99).

² KYLE (1921, p. 195, figs 1, 2).

³ See Cole and Johnston (1902, p. 178, fig. 1, eye-muscles of *Pleuronectes*); Cunningham (1890, p. 4, general account of muscles of *Solea*).

second group, typified by *Pleuronectes*, the mouth is much smaller, and the whole jaw apparatus is more strongly developed on the blind side (Fig. 13C). The teeth are much more developed on this side of the jaws, and are frequently entirely wanting on the ocular side. These are the forms which have taken to feeding on the bottom, mainly on molluscs and other invertebrates. The mechanism by which the torsion of the jaws has been brought about has been well described by Cole and Johnstone (1902, p. 30) in *Pleuronectes*. In the Soleida and Cynoglossida the mouth is invariably small, and the lower jaw is never prominent; the jaws are markedly asymmetrical, those of the blind side being much better developed, and are

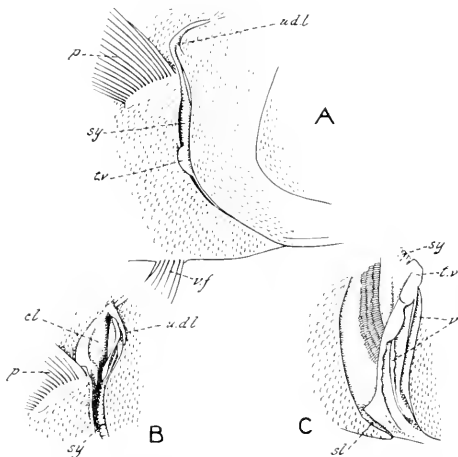


FIG. 14.—A, Opercular apparatus of *Hippoglossus hippoglossus*; B, upper dermal lobe of same (deflected); C, branchiostegal membrane of same, showing the sliding valves. [After Schmidt]. *cl.*, a smooth projection above the clavicle to which the upper dermal lobe is firmly applied; *p.*, pectoral fin; *sl.*, the sliding surface of the emarginate urohyal; *sy.*, syphon; *lv.*, tongue valve; *u.d.l.*, upper dermal lobe; *v.*, sliding valves; *v.f.*, pelvic fin.

strongly curved, the convexity of the lower jaw fitting the concavity of the upper (Fig. 13D). Small teeth are present in the jaws of the blind side, whereas those of the ocular side are either edentulous or with a few feeble teeth (Cunningham, 1890, p. 41). These Flatfishes feed largely on the bottom, mostly at night, finding their food, which consists of invertebrates and small fishes, by means of the senses of smell and touch.

In a valuable paper Schmidt (1915) has described a number of interesting adaptations connected with the respiratory apparatus of Flatfishes. This work is, unfortunately, written in Russian, and, as it lacks even an abstract in any other language,

his observations and conclusions may be given in some detail here¹. Schmidt points out that the normal method of fish respiration, in which first the mouth is opened and both opercula raised, thus enlarging the buccal cavity and allowing the water to enter, and subsequently the mouth is closed and the water ejected through the gill-openings, would be a difficult matter for a fish lying on its side on the bottom. Not only would considerable force be required to raise the operculum of the blind side, but the action of the exhalant current of water would tend to lift the body of the fish from the bottom. Further, the danger of clogging the delicate gill-lamellae with particles of sand or mud which might enter the lower branchial chamber would be a very real one. These factors have led to the adoption of a special respiratory process in the Heterosomata, and consequently to the evolution of some interesting mechanical adaptations².

It appears that, as a general rule, a Flatfish does not open the gill-opening along its whole length as is the case in other fishes, during either the inspiratory or the expiratory phase. The apparatus designed to keep the opening closed is divided into three main parts (Fig. 14): (1) an "upper" (= dorsal) dermal lobe; (2) a siphon; and (3) the "sliding valves" of the branchiostegal membranes. The upper dermal lobe forms a projection above the pectoral fin, which by its close application to the smooth hinder wall of the branchial cavity forms a valve, preventing the entrance of water into the buccal cavity when the pressure within the latter is diminished. Just below the pectoral fin the slightly emarginate edge of the operculum and the hinder wall of the branchial cavity form by their apposition a short tube, the "siphon", which is sometimes further defined by a distinct ridge on the branchial wall. The margin of the siphon on its opercular side is folded, providing for dilation, and a special fold of membrane on the inner surface of the posterior edge of the operculum forms a valve which closes the aperture of the siphon when the pressure within the buccal cavity is diminished. Normally in Flatfishes the siphon serves for the ejection of water during expiration. A "tongue" valve may be present below the siphon; this is an outgrowth from the hinder edge of the operculum, and forms the lower margin of the siphon when the latter is open. In some Flatfishes the soft margin of the operculum in the region of the siphon is crenulate or frilled (Fig. 14). The sliding valves are folds of membrane developed along the edges of the branchiostegal membranes and along the branchiostegal rays, which, by their close application to the smooth wall of the branchial cavity, effectually prevent the entrance of any water, at the same time allowing free sliding movements of the branchiostegal membranes.

In the form of the sliding valves, as well as in the general manner in which the closing of the lower part of the gill-opening is effected, the various genera of Flatfishes exhibit considerable differences, which are dealt with in detail by Schmidt. He recognises three main types of structure in this part of the respiratory apparatus. In the first, characteristic of all the Pleuronectinae, and found also in certain genera of Bothidae (*Pseudohombus*, *Bothus*, etc.), the branchiostegal membranes of the two sides are united by means of the posterior (seventh and eighth) branchiostegal rays, which are fused at their ends, and the sliding valves are well developed. In the second type, found in *Psettoides*, in *Eucitharus* among the Parachannae, and probably throughout the Scophthalminae, the two branchiostegal membranes are not fused, the lower edges being free and overlapping (Fig. 15); the sliding valves are usually developed. In the third type, found only in the families Soleidae and Cynoglossidae, the membranes are fused, but there is no actual union of the posterior branchiostegal rays, and there are no sliding valves.

Finally, it may be noted that the respiratory apparatus of Flatfishes exhibits a certain degree of asymmetry. The same general structural plan is apparent on both sides of the head, but there are differences in detail—a narrower siphon, more

¹ I am indebted to Mr. B. P. Uvarov for a translation of this paper.

² It must be borne in mind that Schmidt's work was carried out wholly on preserved specimens, and his interpretation of the parts played by the various structures involved in the respiratory activities has not yet been confirmed by experiments on living fishes.

strongly developed sliding valves, etc., on the blind side. There can be little doubt that under normal circumstances, when the fish is lying quietly on the bottom, expiration takes place mainly through the upper siphon, that of the blind side being kept closed.

In the body the asymmetry of the Heterosomata is considerably less marked than in the head, but is to be seen in the musculature, vertebral column and viscera,¹ as well as in the fins and their supports. Practically all the modifications can be shown to be related to the adoption of a demersal habit, and many of them are correlated with the adoption of progression by undulating movements of the body and marginal fins. In *Psettodes*, and other actively predaceous forms such as *Hippoglossus*, the asymmetry of the body is, as a rule, less marked than in typically bottom-living forms such as *Pleuronectes* and *Solea*.

The structure of the lateral muscles of the blind side is essentially the same as that of those of the ocular side, but the musculature is nearly always more feebly developed on the former. Some asymmetry is exhibited in the muscles of the

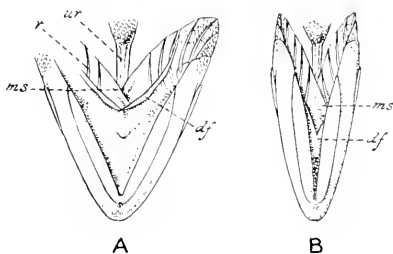


FIG. 15.—Opercular apparatus of *Psettodes erumei*. A, Ventral view of head with the jaws stretched apart; B, the same with the jaws nearly closed. [After Schmidt.] *df.*, dermal fold closing the cavity below the branchiostegal membranes; *ms.*, muscle band along the edge of the branchiostegal membrane; *r.*, branchiostegal rays; *ur.*, lower sliding edge of orohyal.

abdominal region, and, in a greater degree, by the muscles connected with the paired fins, gill-arches, jaws and so on. The vertebral column of *Psettodes* is very nearly symmetrical, but in all other Flatfishes the individual vertebrae exhibit a greater or lesser degree of asymmetry, which is less marked in those of the caudal region, and only slightly developed in the last few caudal vertebrae and in the hypural elements of the caudal fin.² According to Kyle (1921, p. 86) the general effect of these asymmetries is to produce "longitudinal curvatures [or torsion] of the vertebral column and vertical lateral flexures". The same author has pointed out that the asymmetry of the viscera is acquired at a very early stage in the development of the individual.³

¹ The taxonomic value of the modifications in these organs is discussed in the section devoted to classification (p. 46).

² See Cole and Johnstone (1902, p. 49, etc.).

³ Schmidt (1915, p. 444) has drawn attention to the asymmetrical position of the anal papilla, which in all Flatfishes, including those in which the vent is placed on the blind side, is situated on the ocular side of the median line. The function of this papilla, which is equally developed in both sexes, is not known.

Apart from the anterior part of the dorsal fin, which has been already considered, the median fins (dorsal, anal and caudal) show little asymmetry. The pectoral fins are subequal in *Psettodes* and in a number of other genera. In all the more specialised forms, however, that of the blind side is reduced in size, and may even be altogether wanting (e.g. *Soleidae* and certain genera of *Bothidae*). In some of the *Soleidae* and in all the *Cynoglossidae* both pectoral fins are absent. The difference in the size of the pectoral fins of the two sides is not accompanied by any marked changes in the pectoral arch, which, apart from a certain degree of flexure, usually exhibits comparatively little asymmetry. In the more generalised genera of *Bothidae*, *Pleuronectidae* and *Soleidae* the pelvic fins are nearly symmetrical, and more or less subequal but in some of the more specialised forms that of the ocular side is placed on the median line of the body, and a little in advance of that of the blind side. In other genera this asymmetry is carried still further, the pelvic fin of the ocular side having an elongate base and forming a fringe along the lower edge of the anterior part of the fish, the fin of the blind side remaining small and short-based. In others, again, the bases of both pelvic fins are elongate (Figs 24, 25). In some members of the *Pleuronectid* subfamily *Rhombosoleinae*, and in certain of the *Soleidae* and *Cynoglossidae*, the pelvic fin of the blind side is absent.

The scales of Flatfishes, although similar in shape and size on the two sides of the body, generally exhibit differences in spinulation. Thus, in a large number of genera the scales of the ocular side are ctenoid, those of the blind side cycloid, and in others the scales are ctenoid on both sides, but the spinules are nearly always more strongly developed on those of the ocular side. In genera in which the scales are partly or entirely replaced by bony tubercles, these are usually more feebly developed or altogether absent on the blind side. In many of the *Soleidae*, fishes which mostly feed by night, relying almost entirely on the senses of smell and touch to find their prey, the blind side of the anterior part of the head is provided with flexible tactile filaments, which probably represent modified scales. Similar filamentous processes are found on the blind side of the head in certain sole-like genera of *Rhombosoleinae*, which also appear to have nocturnal habits—an interesting case of parallelism (Norman, 1926B, p. 257).

The lateral line exhibits some asymmetry, more particularly in the head region. It may be noted that the supra-orbital canal of the blind side, when developed, runs close to the corresponding canal of the ocular side along the interorbital bar, *i.e.* along the morphological median line of the head. In the region of the body the lateral line is well developed on both sides of the body in *Psettodes*, as well as in the majority of the genera of the family *Pleuronectidae* and in certain genera of *Bothidae*. In the *Pleuronectid* subfamily *Perclopettinae*, and in a large number of the genera of *Bothinae*, the lateral line is either very feebly developed and scarcely apparent to the naked eye on the blind side, or is altogether wanting on that surface. In the *Soleidae* and *Cynoglossidae* the lateral line may be developed on both sides of the body or only on the ocular side. In many *Cynoglossids* more than one lateral line may be present on the body, and there may be a complicated anastomosing system of canals on the head.

The general absence of pigment on the blind side is another of the characteristic features of the *Heterosomata*. In certain forms a few spots, blotches or bars of black or brown may be normally present on the blind side, or this may be partially or nearly completely stained with brown or grey, but in the vast majority of Flatfishes, apart from the ambicolorate examples to be mentioned in the next section, this surface is unpigmented. That this asymmetry of colour is correlated with a demersal habit is clear, and is confirmed by a study of the development of individual Flatfishes. The pelagic larva, with an eye on either side of the head, usually has chromatophores on both sides of the body, but as soon as it takes to lying on the bottom those on the lower surface disappear. In some forms, however, the larva appears to be unpigmented until it becomes a bottom feeder (Williams, 1962, p. 10).

Mention may be made here of the Greenland Halibut (*Ranhardthus*), in which the body of the adult fish is generally speaking more plump than in most other Flatfishes,

the "upper" eye is nearly on top of the head, and the blind side of the head and body is pigmented, although the coloration is paler than on the ocular surface. The large, symmetrical mouth, strong teeth, elongate body, slender caudal peduncle and powerful lunate tail are all characters which denote an active piscivorous fish, which probably spends the greater part of its time away from the sea floor. There can be little doubt that the pigmentation of the blind side, like the plumpness of the body and the position of the "upper" eye, has been secondarily acquired by a fish which has to a great extent forsaken the normal habits of the group, a view which is borne out by a study of its development. The pelagic larval stage, as in other Flatfishes, is pigmented on both sides, although the coloration of the right side (*i. e.* the future ocular side) is darker. After passing into the bottom stage the pigment of the blind side gradually disappears, and this surface becomes quite white to the naked eye; later on, pigment is again developed on the blind side (Jensen, 1925, p. 10).

The powers possessed by Flatfishes of changing their coloration to simulate the ground on which they lie are well known. The view of Cunningham (1890, pp. 110-113)¹ that the colour changes are due to the action of light, and have nothing to do with the colour of the ground, does not meet with much favour among other investigators, and it is now generally believed that a definite relation exists between the coloration of the ocular surface of the fish and that of the ground on which it lies.

Sumner (1911) has conducted a series of interesting experiments on the Mediterranean *Bothus podas*, in which living individuals were placed successively on various backgrounds, consisting of patterns of black and white squares, black and white circles and so on. It was found that a fish placed on a background of this nature responded more slowly than when placed on more accustomed grounds (sand, pebbles, gravel, mud, etc.), but did succeed in simulating the artificial background to a remarkable degree. The skin patterns were found to vary not only with the relative amounts of black and white in the background, but also with the *degree of subdivision of the areas* of the latter. Further, it was found that with repetition of the experiment on the same individual the rate at which the fish was able to simulate its surroundings was considerably accelerated. Sumner points out that the capacity of the fish to adapt itself to different backgrounds is definitely limited to the black, grey and brown of its ordinary environment, and brilliantly coloured grounds seemed to be beyond its powers of imitation. Moreover, the species is provided with permanent spots and other markings due to the special grouping of the chromatophores in the skin, and, although these vary in relative intensity and may even disappear altogether, they always occupy the same position when present.

The work of Mast (1916) and Kuntz (1918) on *Paralichthys* and *Ancylopsetta* is even more striking. Mast found that *Paralichthys* was able to assume various colours which corresponded very closely with the background on which the fish was placed, although some shades proved more difficult to simulate than others. Reds of various tints were found to be simulated much less accurately than whites, greys, blacks, browns, greens, blues, yellows or oranges; further, on yellow or brown backgrounds the responses were much more rapid than on reds, greens or blues, on which it might take two or three months for the fish to complete the colour change. As in the case of *Bothus*, the time required by a particular individual to copy the ground could be decreased by repetition.

Recently, Hewer (1926, 1931) has analysed the colour patterns of *Psettodes* and a number of British Flatfishes. He remarks that the permanent markings "exist for the most part as morphological entities, and that the background on which the fish is placed induces the nearest approximation for the fish concerned". The distribution of these specialised spots, such as the dark patches, orange and black, and white spots, is regarded as being of an ancient nature, such a distribution being fairly constant in *Psettodes*, and also being found in some form or another in all the other species examined. The dark patches found in so many Flatfishes, of which the two situated on the lateral line are perhaps the most characteristic, are believed by this author

¹ See also Cunningham and McMunn (1893).

to have been derived from a vertically barred pattern, such as occurs in many Percoids and in the young *Psittodus*. "The vertical bars," he writes, "are not harmful (and may be protective) in a vertically swimming fish with only the vertical shadows to hide in, but this break-up of the surface is essential, except in very special circumstances, to a fish lying closely on the bottom." Hower also investigated the normal habit of the species in question, and found that, in spite of the possession of the permanent pattern of spots and markings, presumably inherited from ancestral forms, there was a considerable measure of agreement in every case between the general effect of the pattern of a particular species and the colour and pattern of its normal environment.

With regard to the mechanism of the colour changes, Ballowitz (1893) and others have shown that the chromatophores in the skin are surrounded by a dense network of nerve-fibres, and the experiments of Pouchet (1876) on the Turbot and other fishes showed conclusively that the responses are controlled by stimuli received through the eyes by way of the central and sympathetic nervous systems. It had long been known that blind fishes were incapable of adaptive colour changes, and Pouchet¹ demonstrated that if the eyes are destroyed, or if the optic nerves or the main sympathetic trunks are severed, changes in the chromatophores do not take place. The experiments of Sumner and Mast have confirmed these main conclusions, and the fact that the colour changes in Flatfishes are controlled by the nervous system, and that the necessary stimuli are received through the eyes, may be regarded as established. Mast further concludes that the ability of the fishes which he studied to adjust the relations between the various types of chromatophores is due to the fact that they possess colour vision. Thus, although it is unlikely that there is any actual visual comparison of the skin with the ground, it is necessary for the fish to survey the ground around it before it is able to simulate the colour and pattern. This survey is rendered possible by the possession of an accessory organ, the *recessus orbitalis* (Holt, 1894),² associated with each eye, peculiar to the Flatfishes. This is a sac-like evagination of the membranous wall of the orbit, which, like the cavity of the orbit itself, is filled with fluid. By means of this apparatus the eyes can be protruded above the surface of the head to a remarkable degree, an obvious advantage to a fish lying more or less buried in the sand. Once protruded the eyes can be moved freely and independently in all directions, and retraction is subsequently effected by means of the eye-muscles.

IV. ALBINISM, AMBICOLORATION AND REVERSAL³

The percentage of "sports" is perhaps higher in the Heterosomata than in any other group of fishes. Some of these are of great interest and are dealt with in this section, but there is no evidence at all that they are in any way connected with the problem of the origin of species.⁴

¹ Similar results have been obtained in fishes other than Flatfishes by Seecoy, Busch, and other workers. References to their papers will be found in the bibliography of Mast's paper (1916).

² See also Cole and Johnston (1902, p. 176).

³ I take this opportunity of placing on record my indebtedness to a number of gentlemen and institutions, who have sent me specimens of abnormally coloured Flatfishes during the last few years. My thanks are especially due to the Fishmongers' Company, the Marine Biological Association, Plymouth, and to Messrs. A. F. Brunner, D. W. Gilburn, I. M. Davis, J. F. Jenkins, A. H. Patterson, I. Smith, I. J. Stewart and W. H. Webster.

⁴ The literature dealing with albinism, ambicoloration and other abnormalities of coloration is an extensive one. References to many of the works are given in the systematic part under the individual species. The following should be consulted in connection with ambicoloration, etc.: Kitzema-Bos (1887), Cunningham (1891), Grand (1892A, 1892B), Cunningham (1892, 1893), Cunningham and McMunn (1894), Bateson (1894), Holt (1894), Cunningham (1895, 1907), Franz (1916), Gemmill (1917), Hussakof (1914), Schmakenbleck (1923), Norman (1929), 1927A).

As in other groups of fishes, albinism is by no means uncommon, and examples lacking pigment on a part or on the whole of the ocular side have been described in such diverse genera as *Scophthalmus*, *Limanda*, *Platichthys*, *Pleuronectes* and *Solea*. As a rule the albinism is of a partial character, and may be of a patchy nature, producing an effect which is sometimes referred to as piebald.¹ Even in the more completely albino examples there is nearly always some pigment on the head on the ocular side, generally extending from the tip of the snout backwards to about the region of the præoperculum, and complete absence of pigment on this surface is very rare indeed (Fig. 16). Often the pigment extends further back, and examples with the hinder part of the ocular side white and the anterior part normally coloured are not uncommon. Xanthochroism, a condition in which only the orange and red pigment is developed and the fish assumes a bright golden colour, does not appear to

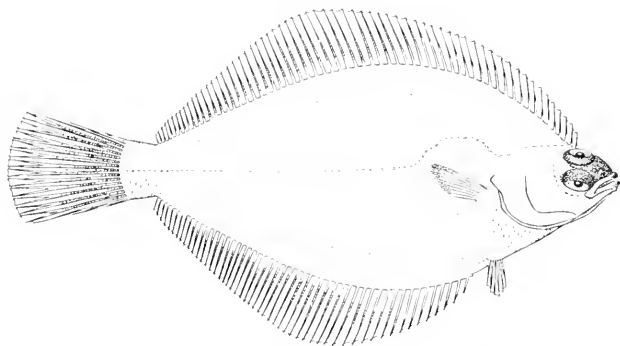


FIG. 16.—Dab (*Limanda limanda*). Albino specimen. (1/2.)

have been recorded in many Flatfishes, but I have seen a small Dab (*Limanda*) from Dymchurch, Kent, which exhibited this abnormality.

Of greater interest is the occurrence among Flatfishes of examples in which pigment is developed on the blind side as well as on the ocular side, a condition for which Cunningham has suggested the term "ambicoloration"². A great deal has been written concerning this phenomenon, and various theories advanced as to its causation, but few of the authors concerned seem to have appreciated the fact that there is more than one type of pigmentation of the blind side in Flatfishes, and some confusion of thought has consequently resulted. After examining a large series of abnormally coloured Flatfishes, I have been led to conclude that pigmentation of the lower side may be divided into three categories: for convenience these may be referred to as "staining", "spotting" and "true ambicoloration".

¹ Areas on the head or body devoid of pigment frequently follow an injury to the fish, and especially one which affects any part of the vertebral column.

² It may be observed that in the Witch (*Glyptocephalus*) the blind side is normally grey instead of white, a number of chromatophores being developed. Other Flatfishes have been described in which the blind side is normally pigmented to some extent (e.g. *Leurospetta*, *Eryngophrys*).

In the first type the development of chromatophores in certain regions of the skin of the blind side produces irregular patches of dull pigment which give the lower surface a stained appearance. As a rule, this coloration of the blind side is considerably less marked than that of the ocular side, and lacks the characteristic spots and markings of the latter. Flounders with large irregular areas, or even with the greater part of the blind side stained with brownish or grey, are quite common, and a similar condition is found in Plaice, Dab, Lemon Sole and other species. It seems probable that the pigmentation of the blind side artificially produced by Cunningham in Flounders which had been exposed for a prolonged period to the action of light reflected from below the fish was of this type (Cunningham and McMunn, 1894). The ambicoloration described by Hussakof (1914) in two specimens of the American *Paralichthys dentatus* may also be of this nature. As far as this type of pigmentation is concerned, Cunningham's explanation of its causation may be the correct one. According to his view, the pigmentation of certain regions of the blind side in some Flatfishes is due to the action of light entering horizontally or obliquely, and reaching areas of the skin which are not in contact with the bottom, in course of time causing these areas to become pigmented. He suggested that such a phenomenon is more likely to occur among Flatfishes living on a hard ground instead of on a sandy bottom, where they are unable to bury themselves in the normal manner.

In the second type the blind side exhibits a varying number of black or brown spots. Frequently these have an irregular arrangement, and present the pebbled appearance already described as occurring on the ocular side. Plaice and Flounders with a spotted lower surface are of fairly frequent occurrence, and Bumpus (1868) has described a similar condition in the American species, *Pseudopleuronectes americanus*. Sometimes the spots and blotches have a regular arrangement, and Turbot and Brill with a series of large, round, dark spots along the upper and lower edges of the body on the blind side, with or without an additional black blotch on the lateral line, the remainder of the skin being unpigmented, are quite common. According to Giard, the pebbled condition of the lower surface is so common that it was considered by Damberton, Bonnaterre, Lacepede and other early French ichthyologists to be a specific character of the Turbot. It is of some interest to note that these spots and blotches, when present on the blind side, occupy the same positions as the characteristic dark spots present on the ocular side in so many Flatfishes, which have been shown to have been derived from ancestral vertical bars (see p. 22). They are, in fact, as Holt (1864) has pointed out, "precisely those which are the most conspicuous in the metamorphosing and pelagic stage."

The third type, the true ambicoloration, appears to be of a different nature from both those already described, and has an important bearing on the question of asymmetry. Here the coloration of the blind side closely resembles that of the ocular surface, even to the characteristic spots and markings. In ambicolorate Plaice, for example, there seems to be a more or less close correspondence in position between the orange spots of the "upper" and those of the "lower" side.¹ True ambicoloration is frequently partial in character, the hinder part of the blind side being coloured like the upper surface, the front part remaining white. In other examples the pigment on the blind side extends forward nearly to the head, and an area in the region of the viscera is also coloured. In others, again, the pigmentation of the blind side covers the whole body as well as a part of the head, only a patch on the anterior part of the head remaining white (Fig. 17). Very occasionally the ambicoloration is complete, and no trace of white is to be seen on the blind side of the fish.

Ambicolorate examples have been recorded in a number of Flatfishes (Turbot, Brill, Dab, Flounder, Lemon Sole, Plaice, Sole, etc.), but the condition seems to be much more common in some species than in others, and to present a more complete appearance in certain forms. Thus, Turbot in which the ambicoloration is complete except for a patch on the head are by no means uncommon, whereas, partially ambicolorate examples are rare. Brill (a closely related species) exhibiting any degree

¹ See Bateson (1894, p. 497), Ehdulst (1911, p. 72).

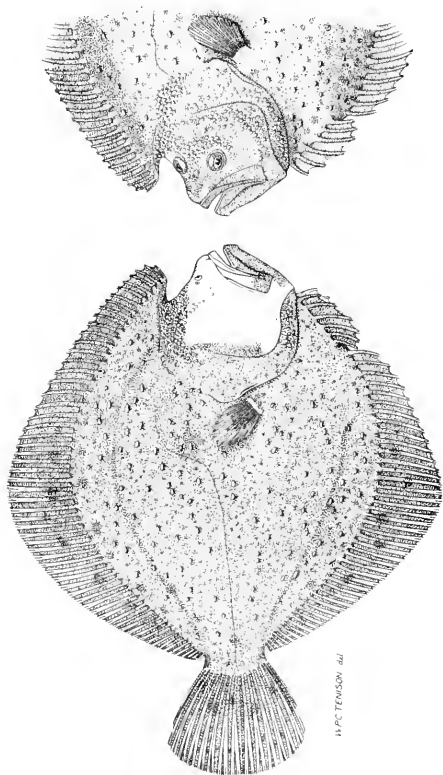


FIG. 1.—Turbot (*Scophthalmus maximus*)—Ambicolorate specimen. (—about 1/2)

of true ambicoloration are very rare. Partially and nearly totally ambicolorate Plaice are frequently encountered, but, as in the Turbot, those in which the pigmentation of the blind side is most extensive usually retain the white patch on the head. Ambicolorate Flounders are fairly common, and in this species examples in which the blind side is entirely pigmented occur from time to time. Partially ambicolorate Dabs are not uncommon, but Soles or Lemon Soles exhibiting this condition are very rare. Of the 51 ambicolorate Flatfishes examined by me, the species concerned and the number of examples of each were as follows: Turbot 14, Brill 2, Halibut 1, Dab 9, Flounder 10, Plaice 15.

Where the ambicoloration is only partial no other variations in the structure of the fish are noticeable, but where the pigmentation of the blind side is complete or almost complete it is nearly always accompanied by other variations in the direction of symmetry¹. These are concerned with the scales and associated structures, the upper eye, the anterior part of the dorsal fin, and the paired fins. In the Dab (*Limanda*) the scales are normally mostly ctenoid on the ocular side and cycloid or feebly ctenoid on the blind side. In totally ambicolorate examples the scales of the blind side are mostly distinctly ctenoid, and in specimens in which the pigmentation of the blind side is confined to the posterior part of the body, the scales in the pigmented area are often more strongly spiculated than those in the unpigmented area. Similarly, in ambicolorate Flounders (*Platichthys*) the bony tubercles tend to be more strongly developed on the blind side than in normal examples. In normal Turbot (*Scophthalmus*) the characteristic bony tubercles are either absent, or but feebly developed on the blind side of the head and body; in total or nearly total ambicolorates these are strongly developed on both sides (Fig. 17).

In Flatfishes such as the Turbot, Dab, Flounder and Plaice the migration of the eye is completed before the forward extension of the dorsal fin takes place (p. 15), but in ambicolorate examples this migration appears to be arrested or delayed². As a result the anterior movement of the fin is obstructed, and this grows forward to form a fleshy hook above the eye³. This hook, which forms so characteristic a feature of ambicolorate Flatfishes, is present only where the pigmentation of the blind side is complete or nearly so. As far as the Turbot is concerned, Cunningham⁴ has laid down the generalisation that hooking of the dorsal fin occurs in all examples that exhibit pigmentation of the blind side in front of an imaginary line drawn through the opercular bone (Fig. 17).

Finally, Flatfishes with the blind side completely or almost completely pigmented nearly always show some variations towards symmetry in the paired fins. In normal Turbot, Plaice and Flounder the pectoral fin of the ocular side is larger than that of the blind side, but in ambicolorate examples the fin of the blind side is often a little larger than usual. Similarly the pelvic fins of ambicolorate Flounders and Plaice are more nearly exactly symmetrical in form and position than are those of normal individuals. Of special interest in this connection is the Australian and New Zealand genus *Rhombosola*, in which normally only the pelvic fin of the ocular side (*l.e.* the right side) is present, this is elongate, placed on the median line of the body and united with the anal. In members of this genus ambicoloration is not only

¹ It is possible that such variations *always* accompany complete or nearly complete ambicoloration. Examples of Lemon Sole, Dab and Sole have been described in which the blind side was nearly entirely pigmented, but the fish were said to be normal in other respects. It is possible that closer examination of these specimens would have revealed at least minor modifications of the scales, etc.

² Holt (1894, pp. 42-43, text) has described an adult Sole in which the eye of the blind side had remained on that side of the head, nearly opposite to that of the ocular side, but was to a large extent embedded in the skin. There was no trace of pigmentation on the blind side, and the skull was almost normal.

³ Sometimes in Turbot and Brill the eyes are normal in position, but a short portion of the anterior part of the dorsal fin is free. This condition, which probably accompanies *delayed* migration of the eye, is not necessarily associated with ambicoloration.

⁴ Cunningham and MacMunn (1894, p. 809).

accompanied by the characteristic hook above the eye, but individuals completely or nearly completely pigmented on the blind side have *two* pelvic fins of similar form and equal size (Fig. 18).¹

Mention may be made here of an interesting individual of the Turbot described by Cunningham (1907). This fish was only 44 mm. in total length, the eyes were on the *right* side, the ocular side was unpigmented except for an area in the region of the eyes, and the blind side was deeply pigmented except for the head and the dorsal region above it. This provides a unique case, albinism, ambicoloration and reversal being combined in the same individual.

Various theories have been brought forward to explain the phenomenon of ambicoloration, but these cannot be considered in any detail here. It has been suggested that fish showing this condition swim as larvæ in a vertical position for a longer period than usual, and thus expose the future blind side to the light for a greater length of time. McIntosh (1902) has observed, however, that in normal larvæ the pigmentation

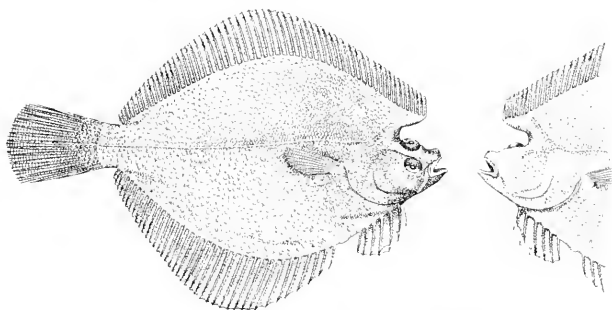


FIG. 18.—*Rhombosolea tapirina*. Ambicolorate specimen. ($\frac{1}{2}$.)

of the lower surface is paler even before the change to a demersal habit occurs, and that even in cases where the pelagic life is unduly prolonged the same feature is noticeable. Cunningham's views as to the effects of light on the pigmentation of the blind side have been already mentioned, and other theories involve the consideration of such matters as germinal factors, interference with the mechanism of embryonic transformation, mutation in the direction of secondary bilateral symmetry, and so on. The available evidence suggests that ambicoloration merely represents variation in the direction of the original bilaterally symmetrical condition of the ancestors of the Flatfishes. It is to be observed that the part of the fish last affected by ambicoloration, namely, the anterior part of the head, represents the most asymmetrical portion. There is absolutely no evidence that the behaviour of ambicolorate individuals is in any respect different from that of normal Flatfishes.

Reversal, or the occurrence of individuals with the eyes and colour on the side which is generally eyeless and unpigmented in the species, is a not uncommon phenomenon in certain Flatfishes.² In the great majority of Flatfishes all the individuals

¹ Norman (1926B, pp. 278-280).

² As Bateson (1894) has pointed out, discontinuous variation of this nature is well known in other groups of animals. In Molluscs, for example, reversed or sinistral shells are not uncommon in Gastropods, and may even characterise a race or subspecies.

of a particular species are either right-sided (dextral) or left-sided (sinistral), but in a few species reversed individuals occur in varying numbers. In the Fluke (*Pleuronectes*) and the Halibut (*Hippoglossus*), for example, the fish is normally dextral, but very occasionally a sinistral individual is recorded. In the European Flounder (*Platichthys flesus*) and in the Starry Flounder (*P. stellatus*) of the North Pacific, also normally dextral species, reversed individuals are more common. Duncker, who examined samples of Flounders from various localities, found that the percentage of sinistral individuals varied from 5 to 30. In the Pacific species this percentage may be even higher¹. In the so-called Bastard Halibut (*Paralichthys californicus*) of California, a sinistral species, individuals with eyes on the right side are almost as common as those with eyes on the left side. Some species of *Hippoglossina* and *Axyschinus*, also American genera, are likewise indifferently sinistral or dextral.

The work of Parker (1903) on the optic nerves of the Heterosomata, afterwards confirmed by Mayhott (1912), is of particular interest, not only in connection with these reversed individuals, but also with the general classification of the group. The results of this work may be briefly summarised. In ordinary Bony Fishes the optic chiasma is dimorphic in character, the right nerve crossing above the left about as often as the left above the right². In the families Soleidae and Cynoglossidae, and in *Psittodes*, the chiasma is again dimorphic, and it follows that in these Flatfishes the optic nerves must be partly incrossed when the nerve of the migrating eye is dorsal, and that they almost cross each other twice when this is ventral. In all other Flatfishes, whether dextral or sinistral, the nerve of the migrating eye is dorsal; that is to say, in dextral forms (*Pleuronectidae*) the nerve of the left eye is dorsal, in sinistral forms (*Bothidae*) that of the right eye is dorsal. The only exceptions to this rule are provided by the reversed individuals just mentioned. In the case of a left-sided individual of a normally dextral genus (e.g. *Platichthys*), instead of the nerve of the migrating eye being dorsal, that nerve is dorsal which is normally dorsal in the genus, in this case the left nerve. Similarly, although individual examples of certain species of *Paralichthys* are indifferently sinistral or dextral, as this is normally a left-sided genus, the nerve of the right eye is always dorsal (Fig. 19).

This monomorphism of the optic chiasma, which is clearly a specialisation, would appear to have been adopted on account of its mechanical advantage (Parker, 1903, pp. 220, 235). This view is confirmed by the fact that Duncker (1900) has shown that in the Flounder there is a differential death-rate, that of sinistral (i.e. reversed) individuals being higher than that of normal ones. As far as the optic nerves are concerned, a reversed Flatfish is not a mirror image of a normal one, and, according to Parker, the monomorphism of the chiasma is established even before the larva is hatched. This fact lends additional support to the view already expressed (p. 12) that the Flatfish larva is never really symmetrical.

It is difficult to understand why reversed individuals should be comparatively common in some species and very rare or quite unknown in others. In any case, in view of Parker's conclusions, it is clear that Thilo (1902b) was incorrect in regarding the occurrence of dextral and sinistral individuals in nearly equal numbers as a primitive feature. In *Psittodes*, on the other hand, in which the chiasma is dimorphic as in the "Soles" and normal fishes, the occurrence of dextral and sinistral individuals in nearly equal numbers is very probably a primitive feature (Regan, 1919b, p. 488).

As already remarked, the reversed Flatfish is not a mirror image of a normal individual of the same species, and it is of interest to find that in the genus *Rhombosolenia* of Australia and New Zealand there is a tendency to reproduce partially or completely the pelvic fin of the blind side (normally absent in this genus) in reversed examples (Norman, 1929c, p. 280). The single pelvic fin is normally elongate, median

¹ Prof. Hubbs has pointed out to me in a letter that in Japan he found *Platichthys stellatus* normally reversed (i.e. sinistral), whereas in California the number of dextral and sinistral individuals was about equal, and in material from Alaska about 75% of the fishes were reversed (i.e. material in the British Museum, although small in numbers, bears out this conclusion).

² In the 100 examples examined the right nerve was dorsal in 514, the left in 476.

in position, and united with the anal fin. In the British Museum collection there is a specimen of *Rhombosolea tapirina*, in which the eyes are on the left side, the left pelvic is elongate, median and united with the anal; the right pelvic is also developed, lateral in position, short-based and with only four rays. Kyle (1900a) has described a new genus and species of Flatfish from New Zealand as *Apsetta thompsoni*.¹ Apart from the position of the eyes, which are on the left side, and the presence of two nearly equal but somewhat asymmetrically placed pelvic fins, each composed of six rays, this fish appears to be identical with *Rhombosolea plebeia*, a species common in New Zealand; it is, in fact, merely a reversed example of that species. According to Hutton (1876), such reversed individuals are not uncommon. The same author (Hutton, 1874) has described and figured a reversed example of *R. plebeia* with a single median pelvic fin united with the anal as usual in the genus, suggesting that reversal is not always accompanied by development of the pelvic of the blind side.

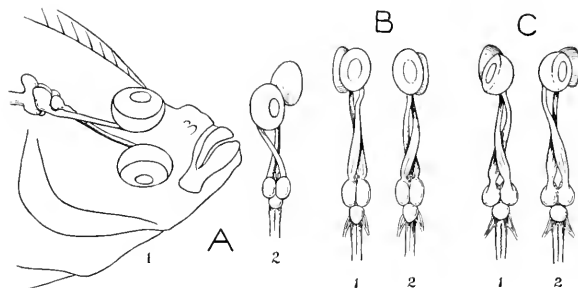


FIG. 10.—Optic chiasma in Heterosomata. A, Anterior part of brain, eyes and optic nerves of *Pleuronectes platessa*: 1, lateral view from the ocular side; 2, dorsal view. The forebrain and the olfactory lobes have been removed. [After Mayhoff.] B, Dorsal views of anterior parts of brains (with cerebral hemispheres removed), eyes and optic nerves of *Paralichthys californicus* (sinistral species): 1, sinistral individual; 2, dextral individual. [After Parker.] C, The same of *Platicthys stellatus* (dextral species): 1, sinistral individual; 2, dextral individual. [After Parker.]

Cunningham² has drawn special attention to the fact that "in a sinistral Flat Fish, whether it is normally sinistral like the Turbot, or abnormally like a reversed Flounder, the viscera are in the same position as in a dextral specimen; the liver is on the left side, the coils of the intestine on the right. The reversal of the relations of the two sides externally does not affect the relations of the internal organs, which remain constant". This is exactly what might be expected. In the normal symmetrical fish the liver is on the left side of the intestine; thus, a fish lying on its left side would have the liver on the blind side, but in one lying on its right side, the liver would be on the ocular side of the abdominal cavity.

¹ The type is said to have been deposited in the Natural History Department, University College, Dundee, but it cannot now be found.

² Cunningham and MacMunn (1894, p. 801).

V. DEVELOPMENT

The various stages in the development of a number of Flatfishes have now been studied in detail, especially of those species which are valued as food. References to the more important papers describing the eggs, larvae and young are given in the systematic part of this work under the individual species. The main features of Flatfish development are too well known to require description at length, but one or two points, which are of interest in connection with problems of taxonomy or geographical distribution, may be briefly considered.¹

The eggs of the great majority of the Flatfishes are buoyant and pelagic, the only exception among those which have been studied being *Pseudopleuronectes americanus*, of which the eggs are said to be demersal and adhesive. Those of *Solea* have a number of small oil-globules at the surface of the yolk, but in all the members of the families Bothidae and Pleuronectidae the oil-globule is either single or absent altogether (Fig. 20). It is of some interest that, in addition to the monomorphic optic chiasma mentioned in the previous section, the sinistral Bothidae are well distinguished from the dextral Pleuronectidae by the form of the eggs.² Those of *Paralichthys*, *Eucitharus*, *Arnoglossus*, *Bothus*, *Scophthalmus*, *Lipidohombus*, *Phrynorhombus* and *Zenogobius* have a single oil-globule in the yolk, those of *Hippoglossus*, *Hippoglossoides*, *Limanda*, *Microstomus*, *Glyptocephalus*, *Platichthys* and *Pleuronectes* have an undivided yolk without an oil-globule.³

In most respects the early larvae of the Flatfishes are very similar to those of ordinary symmetrical fishes, and it is only as the time for the metamorphosis approaches that they assume the specialised features characteristic of the group. The post-larval characters may be roughly divided into two categories, permanent and temporary. The former includes the migration of the eye, growth of the pelvic and caudal fins, enclosure of the abdomen, etc., and need not be considered further. The second category includes purely temporary organs which are developed during post-larval life and disappear when the transformation is complete or even before. These are the air-bladder, post-larval teeth, dorsal tentacles, spines, pigmentation and so on. In a genus such as *Arnoglossus*, where these temporary post-larval characters are more remarkable and diverse than in any other genus of Flatfishes, a full knowledge of these characters may be of considerable assistance in elucidating the taxonomy of the group, a fact which is well brought out by a study of Kyle's work on the European species.

One of the most characteristic temporary characters of the post-larval *Arnoglossus* is the long appendage or tentacle on the head (Fig. 21A). This appears quite suddenly, according to Kyle, as the result of a longitudinal splitting of the upper margin of the embryonic dorsal fin in the region of the second ray of that fin; it appears long before the fin-rays are developed and disappears with equal rapidity during the period of the migration of the eye. This appendage is not peculiar to *Arnoglossus*, but is also present during the early stages in *Bothus*, in which genus, however, it disappears at a very early stage of post-larval development (Fig. 21B). It probably also occurs in other related genera from tropical and temperate seas. Kyle (1913, p. 39) regards the tentacle as a means of guarding against damage to the anterior part of the cranium, which at this stage is quite unprotected. In the post-larval *Symphus* (Cynoglossidae) the first three rays of the dorsal fin are somewhat prolonged, this number being later increased to five.

A certain number of species of sinistral Flatfishes (Bothidae) develop spines in one form or another during the post-larval stages. In *Arnoglossus* there is a well-developed

¹ For many of the facts concerning larval and post-larval Flatfishes the author is indebted to a able paper by Kyle (1913.)

² Rees (1910), p. 189.

³ In *Pseudopleuronectes americanus*, the egg, when first extruded, has no oil globule, but in 1-2% one is developed at a later stage.

system of spines round the edges of the body, on the abdomen, on the caudal fin and on the base of the pelvic fin, but there are none on the head (Fig. 21A). The arrangement of these spines is more or less constant in a particular species, and provides a useful character for distinguishing the post-larvæ of the European species. The spines gradually disappear as metamorphosis approaches, although some may be retained to form spinules on the scales. In post-larvæ identified by Kyle as *Ancyclopes* sp. the first six or seven rays of the dorsal fin are elongated and the edge of the præoperculum is provided with a strong spiny armature; in addition, there is a strong spine on each side of the dorsal fin in the sphenotic region of the head. Similar, but rather more feeble, spines occur on the head in the post-larval Turbot and Brill (*Scophthalmus*) etc. (Fig. 21C), and the skull itself may be provided with spinous protuberances ("otocystic spines") in post-larval *Lepidorhombus*, *Phrynorhombus* and *Zeugopterus*. All these structures disappear at or before the metamorphosis. The post-larval teeth present in *Arnoglossus*, *Bothus* and other genera are of the same nature as the spines described above, and appear to be cast off at about the same time.

An air-bladder is developed as a transient post-larval character in many Flatfishes. According to Kyle (1921, p. 109), "sinistral forms have almost invariably an air-bladder lying more or less on the left side . . . dextral forms have either no air-bladder or the air-bladder more or less on right side." Among our own Flatfishes,

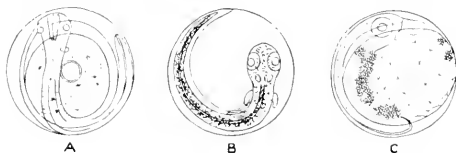


FIG. 20.—Egg of A, Brill (*Scophthalmus rhombus*) [after McIntosh]; B, Plaice (*Pleuronectes platessa*) [after Ehrenbaum]; C, Sole (*Solea solea*) [after Cunningham]. Greatly enlarged

those of the family Pleuronectidæ (Halbut, Dab, Lemon Sole, Witch, Flounder and Plaice) have no trace of an air-bladder at any stage of their development. In the sinistral Bothidæ, on the other hand, this is generally present, but within the sub-family Scophthalminæ an air-bladder is present only in the post-larval Turbot and Brill, and wanting in all the other genera. In the genus *Solea* an air-bladder is present in post-larval *S. solea* and *S. lascaris*, but absent in *S. variegata*.

An interesting feature of the development of Flatfishes is the length of the pelagic larval and post-larval life, as this may have an important bearing on the distribution of the species. In a general way, two types of larvæ may be distinguished: those with a very short pelagic life and early metamorphosis (e.g. *Limanda*, *Platichthys*, *Pleuronectes*), and those in which the pelagic life is more prolonged (e.g. *Arnoglossus*, *Bothus*). In *Arnoglossus* the metamorphosis is said to take place at the surface, and it has been stated that the young stages of *Bothus* may lead a pelagic life for a short time after the transformation has taken place (Kyle, 1913, p. 5). Generally speaking, the Flatfishes of northern seas have a short pelagic life, and it is mostly among species of tropical and subtropical regions that the metamorphosis is delayed. Frequently post-larvæ of some species of *Bothus* are captured in mid-ocean many miles from land, often at considerable depths below the surface, and the "Thor", "Dana", "Discovery" and other vessels have collected large numbers of these larval forms with the eyes still symmetrical in mid-Atlantic, in some cases hundreds of miles from the nearest shore. In this genus the pelagic larval life is very long. In *B. podas*,

for example, metamorphosis does not take place until the larva has reached a length of 30 to 40 mm,¹ and a post-larval *Bothus* of unknown species of more than 50 mm in length with the eyes still symmetrical has been recorded.² In the absence of knowledge of the larval characters it is impossible to be certain whether the larvae captured

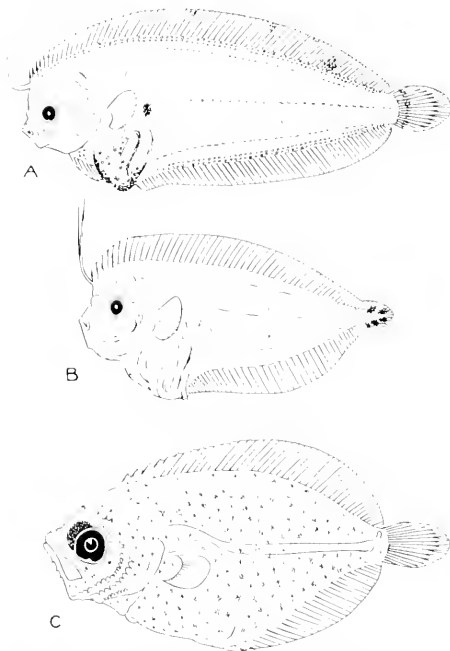


FIG. 100. A, Post larva of *Teniglossus imperialis* (18 mm.), the spots round the margins indicate distribution of spines; B, post larva of *Bothus podas* (8 mm.); C, post larval *Scophthalmus maximus* (about 8 mm.), showing the spines on the head. (A and B: Kishinouye, C: after Holt)

¹ The following figures give some idea of the relative lengths at which various Flatfishes undergo metamorphosis. They do not always give an indication of the actual duration of larval life, as there is considerable variation in the rate of growth of the larva. *Platichthys flesus*, 10-12 mm.; *Granulus platessa*, about 14-16 mm.; *Microstomus kitt*, 20 mm.; *Glyptocephalus cynoglossus*, 10-15 mm.; *Teniglossus* spp., 14-40 (or 50) mm.; *Bothus podas*, 20-40 mm.

² Kishinouye, p. 99.

in mid-Atlantic belong to European or to American species, but it seems probable that the majority of them are of American origin. It is of interest to note that most of those taken by Danish vessels were from the Sargasso Sea, which is practically dead water, uninfluenced by currents. This fact led Kyle (1913, p. 112) to suggest that these post-larval forms "have been derived from adults living at or near the spot where they were found," and that the "Sargasso Sea has a pelagic, flatfish fauna of its own," a suggestion which seems very improbable.

Regan (1916, p. 148) has written: "It may be inferred that the distribution of a benthic species along a coast may be helped by a pelagic larval phase, but that unless this be prolonged it will not serve to establish the species in places separated from its original habitat by a wide sea." There is a species of *Bothus* (*B. mellissi*) found only at St. Helena and Ascension in the Atlantic Ocean, which is very closely related to the European *B. podas*, which extends westwards to the Azores and southwards down the coast of Africa to Angola. There can be little doubt that at some time examples of *B. podas* were able to reach these islands by virtue of their prolonged pelagic life. It also seems reasonable to infer that a species such as *Syacium micurum*, which is found not only on the Atlantic coast of tropical America, but also on the coast of West Africa, as well as pairs of closely related species occurring on the two sides of the Atlantic (e.g. *Citharichthys spilopterus* and *C. stampflii*), must have a larval life of considerable duration.

Most Flatfishes exhibit certain changes in form and proportions during the period of growth after the metamorphosis and assumption of a demersal habit. As in most Bony Fishes, the head and eye are proportionately larger in the young than in the adult, the snout is generally shorter, and the interorbital space narrower. In adult individuals the maxillary extends further back in relation to the eye than it does in younger ones. The actual proportionate increase in the size of the mouth, however, is very slight, the apparent difference being due mainly to the change in the position of the eye. The depth of the body is nearly always less in young examples.¹ In species distinguished by having one or more rays of the dorsal and anal fins prolonged, or in which some of the rays of the paired fins are elongate, the length of these rays is proportionately less in the young and gradually increases with age. The development of spines and other processes on the head, and of tubercles or granular plates on the head and body, is also less marked in immature individuals. The number of gill-rakers sometimes shows a slight increase with age. Finally, quite considerable changes in the colours and markings may take place during the growth of certain species.

VI. SEXUAL DIFFERENCES.

The differences between the sexes in certain species is most marked, especially in the family Bothidae, and may be concerned with the scales, rostral and orbital spines, interorbital width, form of the fins, coloration, and (in one species) with the teeth.

In the Pleuronectinae only two genera exhibit sexual dimorphism, namely, *Liopsetta* and *Pleuronectes*, and in both this is connected with the character of the scales. In all the species of *Liopsetta* the scales are much rougher in the male. In the Plaice (*Pleuronectes platessa*) the scales are usually mostly cycloid, but not infrequently some of them are feebly ctenoid in the male, especially in the small Baltic race (see p. 354). The closely related *Pleuronectes pallasii* shows no sexual differences.

In those species in which cephalic spines or protuberances are developed, these may be confined to the male, as in species of *Perissias*, *Engyprosopon*, *Crossorhombus* and *Bothus*, or strong in the male and feebly developed in the female, as in *Citharichthys cornutus*, *Lophonectes gallus* and *Tæmiopsetta ocellata*. In the last-named species the spines round the orbits are much stronger in the male than in the female, and none of the rays of the dorsal and anal fins are prolonged in the latter; in the

¹ Except in very young *Bothus*.

closely related *I. radula*, however, the spines are about equally developed in both sexes and some of the dorsal and anal rays are prolonged in the female also, although these are less elongate than the corresponding rays in the male

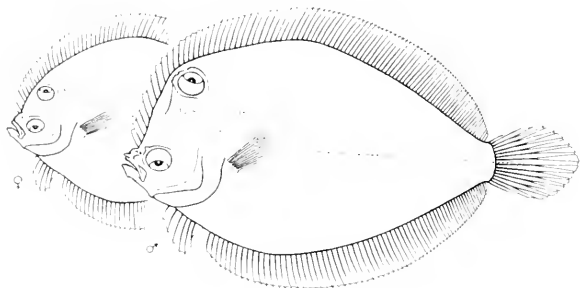


FIG. 22. *Bothus podas*. Male and female (1/2)

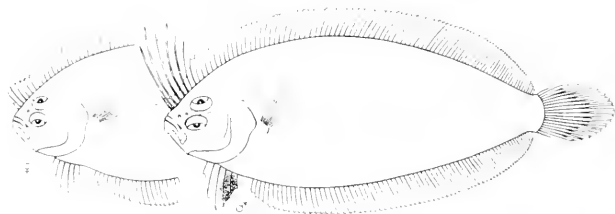


FIG. 23. *Droglossus imperialis*. Male and female (1/2)

Frequently the development of rostral or orbital spines is accompanied by a sexual difference in the width of the interorbital region. In such genera as *Syacium*, *Citharichthys* (*cornutus*), *Penissias*, *Engyprosopon*, *Crossorhombus* and *Parabothus*, the interorbital space is wider in the male, but this curious feature attains its maximum development in certain species of *Bothus* (*Platophylax* auctt.). The greater width of the space between the eyes in the male is most marked in mature individuals, and in

the European *B. podas* the adults of the two sexes are so unlike that they were originally described as distinct species (Fig. 22).¹ Even in young males, however, the inter-orbital space is already broader than in females of the same size, although the characteristic spines, protuberances and roughened ridges on the head do not make their appearance until later.

The form of the fins, and more particularly of the dorsal fin, may present sexual differences in certain species. In some, for example, the anterior dorsal rays in the male are prolonged to a greater extent than the corresponding rays in the female (e.g. *Arnoglossus imperialis* (Fig. 23), *Lophonectes gallus*, *Marleyella bicolorata*); in others, these rays may be very elongate in the male and of normal length in the female (e.g. *Arnoglossus tapeinosoma*, *Brachypleura novæ zeelandiæ*). In other genera (e.g. *Samaris*) this elongation of the anterior dorsal rays may occur in both sexes. In the genus *Tæniopsetta*, instead of the anterior rays, it is the 10th to 13th as far as the 13th to 18th rays of the dorsal fin that are prolonged. In *Arnoglossus*, *Marleyella*, and one or two other genera, some or all the rays of the pelvic fin, or at least of that of the ocular side, are more or less elongate in the male, and in *Tæniopsetta* the first few rays of the anal fin are prolonged.

It is of interest to note that in such genera as *Bothus* and *Arnoglossus* the species present considerable variation in the degree to which the sexes are differentiated. In *Arnoglossus imperialis*, for example, the first few dorsal rays are very much more elongate in the male than in the female, whereas, in the closely related *A. laterna* and *A. thori*, apart from a very slight difference in the pigmentation (the black spot on the pelvic fin of the ocular side is darker in the male), the sexes are alike.²

Finally, *Marleyella bicolorata* exhibits a form of sexual dimorphism unknown in any other Flatfish. The anterior rays of the dorsal fin, as well as those of the pelvic of the ocular side, are much longer in the male, and, in addition, the teeth on the ocular side of the upper jaw extend on to the outer surface of the jaw in this sex.

VII. CLASSIFICATION.

A. GENERAL.

The earlier ichthyologists nearly all regarded the Flatfishes as constituting a single family, Pleuronectidæ. This was the arrangement adopted by Jordan and Goss (1889, p. 225), who further subdivided the family into seven subfamilies: Hippoglossinæ, Pleuronectinæ,³ Samarinaæ, Platessinæ, Oncopterinaæ, Soleinæ and Cynoglossinæ. Leaving out the Samarinaæ and Oncopterinaæ, the members of which were unknown in his time, the remaining five subfamilies defined by Jordan and Goss correspond respectively to the genera *Hippoglossus*, *Rhombus*, *Platessa*, *Solea* and *Plagusia* of Curvier (1817). Jordan and Goss recognised the distinctness of the "Soles" from the "Flounders", but stated that "the characters which mark them as a group seem no more important than those which set off one subfamily of flounders from another." These authors also showed that the Bibroniudæ, a family of Flatfishes recognised by some Italian ichthyologists, is composed entirely of larval forms and has no place in the system. Jordan and Evermann (1898, p. 2602) included the Flatfishes in a single suborder, Heterosomata, and recognised two distinct families, Pleuronectidæ and Soleidæ, the last including the Tongue Soles (*Cynoglossus*, *Symphurus*) as well as the true Soles. The Pleuronectidæ were further subdivided by them into Hippoglossinæ, Pleuronectinæ and Psettinæ, and the Soleidæ into Soleinæ and Cynoglossinæ.

¹ The associated changes in the cranium of old males have been described by Kyle (1921, p. 78, figs.).

² See Kyle (1913, pp. 30, 94).

³ Rhombinæ, Psettinæ or Bothinæ of other authors . . . Scophthalminæ in this work.

In 1900 Kyle (1900a) published a valuable paper on the classification of the Heterosomata, making use of several new characters of some importance. He arranged the various groups as follows:

Families	Subfamilies.
Pleuronectidae	Hippoglossinae.
	Pleuronectinae.
	Hippoglossorhombinae.
	Rhombinae.
Soleidae	Soleinae.
	Achirinae.
	Cynoglossinae.
	Solei-pleuronectinae.
	Incerta sedis?

In 1910 Regan (1910b) proposed an entirely new classification of the group, based on a careful study of the anatomy, and especially of the osteology, of a number of genera. He divided the order into two suborders, Psettoideae and Pleuronectoideae, the former containing a single family, Psettoidea. The Pleuronectoideae were further divided into two main divisions, Pleuronectiformes and Soleiformes, corresponding to the Pleuronectidae and Soleidae of Jordan and Evermann, each of which contained a dextral and a sinistral family. Each of the families of Pleuronectiformes was split up into three subfamilies. Expressed in tabular form, Regan's arrangement of the Heterosomata stands as follows:

Order Heterosomata
Suborder Psettoideae.
Family Psettoidea
Suborder Pleuronectoideae
Division Pleuronectiformes
Family Bothidae
Subfamily Paralichthinae.
.. Platophrinae
.. Bothinae
Family Pleuronectidae
Subfamily Pleuronectinae.
.. Samarinae
.. Rhombosolemae.
Division Soleiformes
Family Soleidae.
.. Cynoglossidae

In a later classification Regan (1920) omitted the suborders and divisions, recognising five families: Psettoidea, Bothidae, Pleuronectidae, Soleidae and Cynoglossidae. The subfamilies of Bothidae and Pleuronectidae recognised in his original classification were retained, but the South African genus *Paralichthodes* was removed from the subfamily Samarinae and placed in a separate subfamily, Paralichthodinae.¹ In his most recent classification of fishes Jordan (1923) has followed Regan in the main as far as the Flatfishes are concerned, merely raising most of the subfamilies to the rank of families. Apart from the creation of another subfamily in the dextral Pleuronectidae, the *Pachlosettinæ*, my own work on the group² has provided no valid reason for interfering with Regan's latest arrangement, which would appear to be a perfectly natural one. The reasons for adopting this classification, many of which appear in Regan's earlier paper, may now be briefly outlined.

¹ See also Regan (1920, p. 213).

² This has been mainly on the "Flounders", which form the subject of this volume. The Soleidae and Cynoglossidae have not yet been extensively studied.

It is quite clear from what has been said in discussing the origin and evolution of the Flatfishes that *Psettodes*, the most generalised of existing Flatfishes, is sharply marked off from all other members of the order and must rank as the type of a distinct family. The principal characters distinguishing the Psettodidæ are as follows: the occurrence of dextral and sinistral individuals in equal numbers, the dimorphic optic chiasma, the posterior origin of the dorsal fin, the presence of spinuous rays in the dorsal and pelvic fins, the large, symmetrical mouth, with well-developed supplemental maxillary, the strong teeth, the toothed palatines, the normal urohyal with the lower edge scarcely curved, the nearly symmetrical position of the nasal organs, and the small number of vertebræ (24). *Psettodes* shares most of these characters with its perch-like ancestors, and, as Regan (1920, p. 324) has pointed out, it may have retained so many Percoid features "because it has not adopted progression along the bottom by undulating movements of the body and marginal fins to the same extent as other flat-fishes."

In all the remaining families the dorsal fin extends forward on to the head at least to above the eye, all the fin-rays are articulated, and the number of vertebræ is never less than 28. This increase in the number of vertebræ, which reaches its maximum in the Cynoglossidæ, some of which may have as many as 70, is difficult to explain in terms of any of the orthodox theories of evolution. That increase in the number of muscle segments (the number of vertebræ being, of course, determined by the number of myomeres) must be a mechanical advantage to a fish which has taken to swimming by undulating movements of the whole body cannot be denied. At the same time, in view of the fact that the number of vertebræ in *Psettodes*, as well as in a number of families of Percoid fishes, seems to be rigidly fixed at 24, it is difficult to see how natural selection can be evoked to explain the increase in number in more specialised Flatfishes. "We are almost compelled to believe," writes Regan (1926, p. 85), "that muscular movements, the efforts of a fish to swim in a certain way, may lead to an alteration in the number of muscle segments of its descendants."

The "Soles", as represented by the families Soleidæ and Cynoglossidæ, have generally been regarded as forming a distinct group, but most authors have looked upon them as degraded "Flounders". It is true that these fishes are, in many respects, highly specialised, but nearly all the more superficial characters in which they differ from the "Flounders" can be shown to be adaptive, and to be correlated with their special habits, such as the method of locomotion, burying themselves in sand or mud by day and seeking their prey mainly by night by the use of the senses of smell and touch, and so on. There appear to be very few genera of Bothidæ or Pleuronectidæ that could fairly be described as leading in the direction of the Soleidæ or Cynoglossidæ, and, in spite of the dearth of positive characters to define the two groups, the line of demarcation between the "Soles" on the one hand and the "Flounders" on the other is a definite one. Without a detailed study of the two families concerned, it is difficult to come to any definite conclusions about the origin of the "Soles". I would suggest, however, that these families have not been derived either from the Bothidæ or Pleuronectidæ, but that both the dextral Soleidæ and the sinistral Cynoglossidæ have probably sprung independently from generalised *Psettodes*-like stock. The presence of a dimorphic optic chiasma in these fishes led Parker (1903, p. 235) to the same conclusion, and he regarded the "Soles" as a natural group, and the "degenerate descendants of the original stock of flatfishes that had not yet passed beyond the stage of dimorphic chiasmata". The fact that the nasal organs of the "Soles" are symmetrically placed as in *Psettodes*, whereas, in most other Flatfishes that of the blind side has accompanied or followed the eye in its migration and lies nearly on the median line of the head, provides further confirmation of this view. Finally, the structure of the eggs and the form of the post-larva¹ in the Soleidæ and Cynoglossidæ again suggests that they have been derived from primitive Flatfishes rather than from the "Flounders". The small mouth, with the lower jaw

¹ See Kyle (1921)

never prominent, the jaws of the blind side strongly curved and toothed, the absence of a free præopercular margin, the absence of ribs, etc., are all characters which are shared by the Soleidae and Cynoglossidae, but in spite of these resemblances, it seems doubtful whether the two families are really very closely related.¹

Mention may be made of certain Australian and New Zealand genera of the Pleuronectid subfamily Rhombosoleinae (*Ammotretis*, *Colistium*, *Peltorhamphus*), some of the species of which exhibit a striking general resemblance to members of the Soleidae. This resemblance, which is, perhaps, most marked in *Colistium*, is shown by the general form of the body, the shape of the head, particularly its præorbital part, the small eyes, the symmetrical nasal organs, the strongly curved jaws of the blind side, the absence of teeth in those of the ocular side, and the extension of the dorsal fin to the end of the snout. The development of membranous folds on the blind side of the rays of the marginal fins, the modification of many of the scales on the blind side of the head to form filamentous processes, and the fringed lower lip, are other Soleid features.² Many of these characters, however, are probably correlated with nocturnal habits, or with the habit of burrowing in sand or mud, and have almost certainly been evolved within the subfamily. It seems improbable that any of the above-mentioned genera are closely related to the "Soles", which they superficially resemble, but provide a striking example of parallelism.³

The work of Parker was later than that of Jordan and his collaborators and that of Kyle, and these workers did not appreciate the importance of right- or left-sidedness in the "Flounders", sometimes including dextral and sinistral genera within the same subfamily. The monomorphism of the optic chiasma in these Flatfishes, unaffected by the occurrence of reversed individuals in certain species, is of primary importance, and the differences in the structure of the eggs in dextral and sinistral forms (see p. 30) provides further evidence in favour of the division of the "Flounders" into two families, one dextral, the other sinistral. The arrangement of the olfactory laminae in the nasal organs, originally believed to be another character separating the two families,⁴ has been shown to be of only generic importance.⁵

The sinistral family Bothidae may be subdivided into three subfamilies, distinguished mainly by the form of the pelvic fins (Fig. 24) and the structure of the vertebrae. In the Paralichthinae (A) the pelvic fins are usually both short-based, although in some genera that of the ocular side is somewhat extended; its anterior ray, however, is never far in advance of the first ray of the pelvic fin of the blind side. The two fins are symmetrical or that of the ocular side is nearly median in position. The pelvic fins are supported by the pelvic bones and are placed behind the cleithra.⁶ In the vertebral column all, or nearly all, the præcaudal vertebrae have the parapophyses downwardly directed, and these are either united directly with one another or connected by bridges to form closed hæmal arches. There are no transverse apophyses in the caudal vertebrae. In the second subfamily, Bothinae, the pelvic fin of the blind side has a short base as in the Paralichthinae, but that of the ocular side has become elongate, and is placed along the median line of the body, the first ray of this fin is situated well in advance of that of the fin of the blind side (B). The elongate pelvic fin is supported by a cartilaginous plate which is placed in advance of the cleithra, and extends forward to the urohyal; the fin of the blind side is supported by the pelvic bone as in the Paralichthinae. The præcaudal vertebrae have the parapophyses connected or united as in the previous subfamily, but well-developed transverse

¹ Another character which distinguishes both the Soleidae and Cynoglossidae from all the "Flounders" is the absence of a post-cleithrum in the pectoral arch.

² See Norman (1926b, p. 259).

³ A study of the osteology of the Rhombosoleinae, and of the optic chiasma in the various genera, would be of considerable interest. Unfortunately, the material in the British Museum is insufficient for such an investigation.

⁴ See Regan (1910b, p. 489).

⁵ See Norman (1926b, p. 258).

⁶ For a full account of the pelvic fins and associated structures see Kyle (1906b, pp. 340-343).

apophyses are present in the caudal vertebræ. In the third subfamily, Scopthalmi-
minæ, both pelvic fins are elongate and extend forward to the urohyal, and both are
supported by cartilaginous plates placed in advance of the cleithra (C). In the vertebral
column, the parapophyses of the præcaudal vertebræ are separate and apophyses are
well developed in the caudal vertebræ.

With two exceptions, *Etropus* in the Paralichthi-
næ and *Læops* in the Bothini-
næ, the mouth is large or at least of moderate size in the family Bothidæ, and the jaws
and dentition are about equally developed on both sides. In the Paralichthi-
næ and

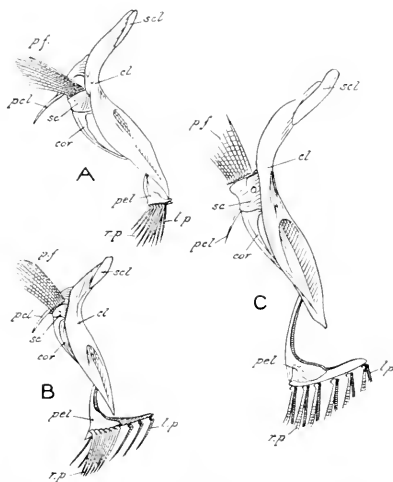


FIG. 24.—Pectoral arch and pelvic bones of A, *Pseudorhombus arsius* ($\times \frac{1}{2}$); B, *Arnoglossus imperialis* ($\times 1$); C, *Scopthalmus maximus* ($\times \frac{1}{2}$). cl., cleithrum; cor., hypocoracoid; l.p., left pelvic fin; p.f., pectoral fin; pcl., post-cleithrum; pel., pelvic bone; r.p., right pelvic fin; sc., hypercoracoid; scl., supra-cleithrum. [From blind side.]

Scopthalmi-
næ the lateral line is nearly always well developed on both sides of the
body; in the Bothini-
næ it is feebly developed or wanting on the blind side in the majority
of the genera

In the dextral Pleuronectidæ five subfamilies may be recognised, distinguished
mainly by differences connected with the position of the anterior part of the dorsal
fin in relation to the nasal organ of the blind side, the form and position of the pelvic
fins, the form of the hypocoracoids, the presence or absence of pectoral radials (Fig.
25), the form of the parapophyses on the præcaudal vertebræ, the arrangement of the
olfactory laminae, and the presence or absence of the lateral line on the blind side of
the body.

With the exception of the genera of *Rhombosolema* already mentioned, in all the *Pleuronectidae* the nasal organ of the blind side has a companion or followed the eye in its migration and lies nearly on the edge of the head. The taxonomic importance of the position of the first ray of the dorsal fin with relation to this nasal organ has been dealt with at some length by Kyle (1900B). In the *Pleuronectinae* and the closely related *Perclopettinae* the origin of the fin is behind the nasal organ of the blind side and above the "upper" eye. In the two subfamilies *Samarrinae* and *Paralichthodinae* the fin extends forward in front of the eye to the snout, in the first subfamily below the nasal organ of the blind side, in the second above it. In the last subfamily, *Rhombosolema*, in the more generalised forms the dorsal fin commences behind the nasal organ as in the *Pleuronectinae*, but in other genera it extends forward on the snout above the nasal organ.

The pelvic fins in the *Pleuronectidae* (Fig. 25) are usually short-based and supported by the pelvic bones behind or below the cleithra. In the *Pleuronectinae* and *Perclopet-*

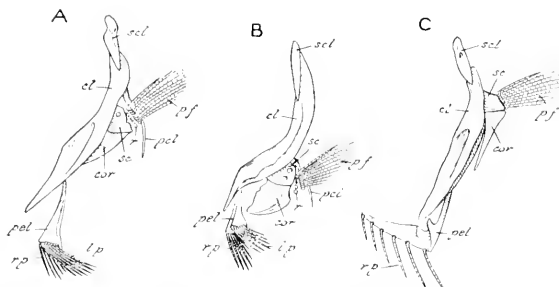


FIG. 25 - Pectoral arch and pelvic bones of a, *Pleuronectes platessa* ($\frac{1}{2}$), b, *Trachyleptura novae zelandiae* ($\frac{1}{2}$), c, *Rhombosolea plebeia* ($\frac{1}{2}$), radial. Other lettering as in Fig. 24. From blind side.

settinae (A) the two fins are more or less symmetrically placed, but in the *Paralichthodinae* and *Samarrinae* that of the ocular side is situated on the median line and is somewhat in advance of that of the blind side (B). In the *Rhombosolema* the pelvic fin of the ocular side is median, elongate, extends forward to the urohyal, and is supported by a cartilaginous plate placed in advance of the cleithra. In five of the eight known genera of this subfamily this fin is united with the anal.¹ In most of the genera the pelvic fin of the blind side is also developed, but this is much smaller and has a base which is short or of moderate length. In *Rhombosolea* (c), however, only the pelvic fin of the ocular side is present.²

The pectoral arch provides two characters which may be used to distinguish the subfamilies of *Pleuronectidae*. In the *Pleuronectinae*, *Perclopettinae*, *Samarrinae* and *Paralichthodinae* pectoral radials are present, but in the *Rhombosolema* these are

¹ The presence of an elongate pelvic fin on the median line presents a mechanical advantage to a fish which relies upon undulating movements of the marginal fins to aid progression. When this extends forward to below the jaws, and is united posteriorly with the anal, the whole of the body of the fish is surrounded by practically continuous fins - dorsal, caudal, anal and pelvic.

² Except sometimes in reversed examples (see p. 29).

wanting, the rays being inserted directly on the hypercoracoid. In the Samarinae the hypocoracoids are expanded, but in all the remaining subfamilies these bones are narrowed forward below (Fig. 25).

In the vertebral column, the parapophyses of the præcaudal vertebrae are separate in the Pleuronectinae, Pæcilopsettinae and Rhombosoleinae, the last pair are connected by a bridge in the Paralichthodinae, and in the Samarinae all the parapophyses are united to form closed hæmal arches, which bear the slender ribs at their extremities.

In his classification of the Flatfishes, Kyle (1900b) made use of one very interesting character which has been already mentioned, namely, the arrangement of the olfactory laminae in the nasal organs. The differences in the structure of these organs in various Flatfishes had been previously noticed by Bateson (1889), and this character was used by Regan (1910b) to differentiate the dextral Pleuronectidae from the sinistral Bothidae. Kyle stated that in *Psettodes* and the Bothidae, as well as in the Soleidae and Cynoglossidae, the laminae radiate from or are arranged transversely to a central rachis. This rosette-like form of nasal organ is characteristic of the majority of symmetrical Bony Fishes.¹ In the dextral Pleuronectidae, on the other hand, he found that in all the genera examined the laminae were only slightly raised above the level of the basal supporting membrane, and were arranged parallel to each other and to the main axis

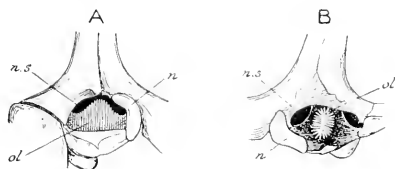


FIG. 26.—Nasal organ of *o*cular side of A, *Hippoglossus hippoglossus*; B, *Scophthalmus maximus*. [After Kyle.] *n.*, nasal bones; *n.s.*, nasal sacs; *ol.*, olfactory laminae.

of the body, without a central rachis (Fig. 26). I have carefully tested this character in a number of genera and species not examined by Kyle, and find that, although it is of considerable value in defining genera or even subfamilies, it is of less importance than was formerly supposed. The form and arrangement of the laminae are described in the diagnoses of the genera concerned, but some indication of the variation encountered within the different families and subfamilies may be given here (Fig. 27). In many of the genera of Bothidae the laminae radiate from or are arranged transversely to a central rachis of some length. In others (e.g. *Thysanopsetta*, *Hippoglossina*) the laminae have a radiating arrangement, but the rachis is very short. In others, again (e.g. *Tanipsetta*, *Bothus*, *Mancopsetta*, *Phrynosombus*) the central rachis has disappeared, and the laminae, although well-developed, may be much reduced in number, and either arranged in slightly radiating form or parallel to each other and to the main axis of the body.

Among the Pleuronectidae the parallel arrangement described by Kyle is by no means constant. In the subfamily Pleuronectinae (in which the laminae are often well raised) it occurs in all the genera with the sole exception of *Atheresthes*, in both species of which the two series of laminae are arranged transversely to a central rachis.² Jordan and Evermann (1898, p. 2609) regarded this genus as one of the most primitive

¹ For a good account of the nasal organs in Bony Fishes generally, see Burne (1909), Derscheid, (1924).

² I am indebted to Prof. C. L. Hubbs for drawing my attention to this fact.

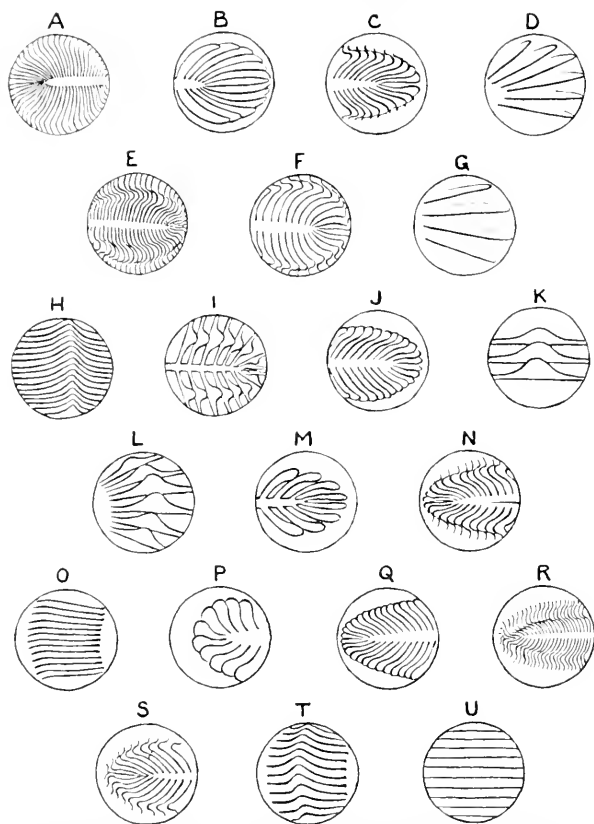
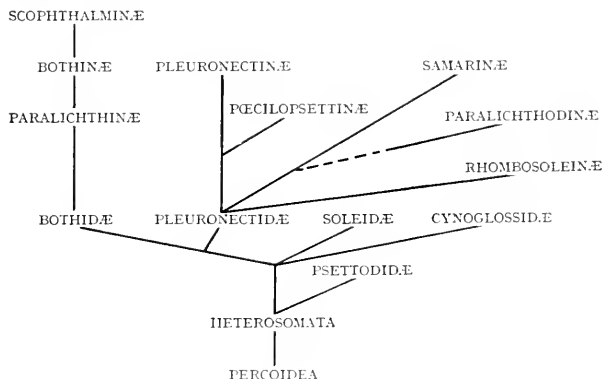


FIG. 27. Arrangement of olfactory laminae in nasal organ of ocular side of: A, *Psettodes erumei*; B, *Ithysonopsetta naresi*; C, *Pseudorhombus spinosus*; D, *Laeonopsetta ocellata*; E, *Fucitharus linguatula*; F, *Arnoglossus lateralis*; G, *Bothus podas*; H, *Mancopsetta maculata*; I, *Laeops nigro-maculatus*; J, *Luciops pectoralis*; K, *Phrynosomus norvegicus*; L, *Phrynosomus regius*; M, *Zeuropterus punctatus*; N, *Atheresthes stomias*; O, *Pleuronectes platessa*; P, *Piccolipsetta colorata*; Q, *Paralichthodes adgoensis*; R, *Oncopterus darwini*; S, *Colistium nudipinnis*; T, *Immotectis rostratus*; U, *Rhombosolea plebeia*. Diagrammatic.

among existing Flatfishes, and it is of some interest to note that *Atheresthes* resembles *Psettodes*, not only in this character, but also in having the "upper" eye on the dorsal surface of the head and most of the teeth in the jaws barbed. In all other characters, however, *Atheresthes* is a typical Pleuronectid, and an examination of the optic nerves shows it to be a truly dextral form. It is very doubtful, therefore, whether the resemblances to *Psettodes* indicate close relationship with that genus. In the Pœcilopsettinæ, formerly included in the Pleuronectinæ, the laminae are comparatively few in number, well raised from the basal membrane, and radiate from a central rachis. In the Paralichthodinæ the laminae are likewise arranged transversely to or radiate from a rachis. In the Samarinae the nasal organs are very small, the laminae being only slightly raised, but these have the parallel arrangement (without rachis) characteristic of the Pleuronectinæ. Finally, in the subfamily Rhombosoleinæ both types of arrangement of the laminae are found, and the central rachis may be shown to have been lost within the subfamily.¹ In the more generalised forms (e.g. *Oncopterus*, *Psammodiscus*, *Pelotretis*, *Azygopus*) the laminae are arranged in pinnate form with a long central rachis, in *Colistium* they radiate from a very short rachis, and in *Ammotretis*, *Peltothamphus* and *Rhombosolea* the rachis has been lost and the laminae have the parallel arrangement of the Pleuronectinæ.

To summarise the above, the order Heterosomata may be divided into five families. Of these, the sinistral Bothidæ and the dextral Pleuronectidæ may each be further subdivided into three and five subfamilies respectively. The relationships of the various families and subfamilies are indicated in the following diagram :



B. GENERIC AND SPECIFIC CHARACTERS.

The characters used for the distinction of genera and species are necessarily either external or of such a nature that they can be observed without elaborate dissection. These are too numerous and varied to be dealt with in any detail, but it may be of interest to consider briefly some of the more important structural modifications and

¹ Norman (1926B, p. 258, fig.).

their taxonomic value¹. In the systematic part of this monograph the classification is believed to be a more or less natural one, and in the arrangement of genera within the subfamilies, and even of species within the genera, an attempt has been made to show their relationships to one another and to indicate probable lines of descent within the larger divisions. Many of the characters used in the definition of genera and species may be shown to be related to special habits, and particularly to the nature of the food and the feeding habits. Many others appear to have no adaptive significance, but in this connection it may be observed that the habits of very few Flatfishes have been studied, and these are far from thoroughly understood.

The relative proportions of the various parts of the fish—depth of body, length of head, length of snout, diameter of eye, width of interorbital space, length and depth of caudal peduncle, height of fin-rays, etc., as well as the shape of the head and body, are usually only characters of specific value, but are important in so far as they provide a means of expressing what may be called the general "form" of the species.

The position of the nasal organ in relation to the anterior part of the dorsal fin has been already considered, and like the structure of the nasal organs themselves, provides a valuable generic or specific character. The form of the nostrils, and especially of their valves, would appear at first sight to be of taxonomic value, but closer investigation reveals considerable variation even within the limits of a single species. In two genera of Parachthinae, *Eucitharus* and *Citharoides*, the posterior nostril is much larger than in any other Flatfish, and is covered by an extensive membranous valve extending downwards towards the mouth. These genera, with large deciduous scales, branched dorsal and anal rays, the hinder rays twisted a little towards the blind side of the caudal peduncle, large mouth with strongly projecting lower jaw and curved mandible, toothed vomer, etc., occupy an isolated position in the subfamily, and bear some resemblance to *Lepidohombus* of the Scopthalminae, to which they, or Flatfishes of a similar type, may have given rise. In *Eucitharus* and *Citharoides* the branchial septum is entire, but in the region occupied by the foramen in *Lepidohombus* the partition between the two branchial cavities is formed only by a fragile membrane.

The position of the eyes in relation to each other and to the edge of the head is fairly constant in most species, and, due allowance being made for age, and, in some species, for sexual differences, provides a useful specific character. The presence or absence of rostral or orbital spines, or of rugose prominences or ridges on the interorbital or post-orbital regions, may also be of value in distinguishing related species, or may even be used for the definition of genera. The presence of the "upper" eye on the dorsal edge of the head, the development of scales on the surfaces of the eye-balls, and the presence of membranous orbital tentacles, are usually characters of generic importance.

The size of the mouth, although scarcely deserving the importance given to it by Günther (1862, p. 400) and other earlier workers, is, nevertheless, a character of considerable importance in the distinction of species, genera, or even larger groups. Thus, in the subfamily Pleuronectinae the genera mostly fall into two main groups, one in which the mouth is large, or at least of moderate size, and the jaws and dentition nearly equally developed on both sides, and the other in which the mouth is small and asymmetrical, with the jaws and dentition more developed on the blind side. Such genera as *Veraspa* and *Cludoderma* appear to be transitional between the two groups, and *Isopsetta*, with a small, asymmetrical mouth and obtuse teeth, bears a marked general resemblance to *Psittichthys*, a member of the large-mouthed group. In all three subfamilies of Bothidae the jaws and dentition are nearly always more or less equally developed on both sides, although in some of the more specialised genera the teeth are stronger on the blind side. The subfamilies Parachthinae and Bothinae each include one genus—*Etiopus* in the former and *Lacops* in the latter—in which the jaws are unequally developed and the teeth almost entirely confined to the blind side. In *Chascanopssetta*, a deep-water Bothine genus from the Indo-Pacific, the mouth is

¹ The Soleidae and Cynglossidae are not considered here, as these families will form the subject of the second volume of this work.

not only of relatively huge size, but the gape is capable of considerable expansion. In a closely related form, *Pelecanichthys*, the mouth is even larger, the lower jaw projects well beyond the extremity of the snout, and the mandibular membranes are so voluminous as to form a distinct gular pouch. All these fishes are piscivorous, and the wide mouth, expanding gape and distensible stomach enable them to seize and devour the large fishes that have been found in their stomachs. The teeth in the jaws are small and curved, those of the mandibles being depressible inwards, and the gill-rakers are quite rudimentary.

The form and arrangement of the teeth, although closely linked with the nature of the food, provide valuable generic and specific characters. The large, symmetrical mouth and strong teeth of the Halibut or the Turbot, which are in the habit of leaving the bottom and going in active pursuit of other fishes, are well adapted for such feeding habits. Similarly, the smaller asymmetrical mouth of the Plaice or Flounder, with the obtuse or incisor-like teeth developed mainly on the blind side, is correlated with the habit of feeding on small invertebrates or fishes, which live on the sea floor and are seized from above with the lower side of the jaws. Comparison of the normal diet of the Plaice with that of the Flounder reveals the fact that the former includes a much greater percentage of molluscs in its food; the incisor-like teeth in the jaws and the molariform teeth of the lower pharyngeals in the Plaice are better fitted to deal with food of this type than are the obtusely conical teeth of the Flounder.

The form of the lower pharyngeals and their teeth, and the form and number of the rakers on the gill-arches are likewise associated with the nature of the food, but provide good specific or even generic characters in certain groups of Flatfishes. In all the Bothidae and many of the Pleuronectidae the lower pharyngeals have the form of a pair of narrow, rod-like bones, usually armed with one, two or more rows of sharply pointed teeth. In some of the Pleuronectidae, however, and especially in the more specialised Pleuronectinae with asymmetrical jaws and dentition, these bones are broader, with their inner edges angular, and are united to a greater or lesser extent to form a triangular plate, which is armed with series of conical, rounded or molariform teeth. Starting with a form like the Dab (*Limanda*), in which the lower pharyngeals are narrow, separate, and each armed with two series of conical teeth, it is possible to trace a complete series of stages, culminating in a solid triangular plate formed by the union of two broad pharyngeals, covered with a mosaic of molariform teeth, such as is found in species of *Liopsetta* and *Platichthys*. In the Plaice (*Pleuronectes*) the lower pharyngeals are firmly united, but are not so broad as in the genera just mentioned, and the round molar-like teeth retain traces of the primitive biserial arrangement found in *Limanda*.

In addition to the position of the origin of the dorsal fin already mentioned, both median and paired fins provide a number of taxonomic characters of varying importance. Chief among these are the branched or unbranched character of the individual rays, the presence or absence of scales along the rays, their height or length, whether free or united by membrane, the development of a scaly sheath at the base of the dorsal and anal fins, the length of the pectoral fin, the absence of the pectoral or pelvic of the blind side, the union of the pelvic with the anal, and the shape of the caudal. The number of rays in the dorsal and anal fins, an important specific character, is dealt with below.

The presence or absence of an "anal spine" was originally considered to be a feature of some importance, and one author has recently employed this as a generic character (see p. 86). This so-called spine is the lower extremity of a curved bone, generally of considerable size, which is referred to throughout this work as the first interhæmal spine. It forms the posterior boundary of the abdominal cavity, curving downwards and forwards and ending in a point just behind the anus. Above it fits into a deep groove on the anterior face of the hæmal spine of the first caudal vertebra (Fig. 3). Both Kyle (1900B) and Cole and Johnstone (1902) have pointed out that the projection or otherwise of this spine depends to a large extent on the state of preservation of the specimen, and they regard its projection through the thin skin

which normally covers it as a post-mortem condition. Nevertheless, if the appearance of the outer point cannot always be relied upon, the form of the spine in the different species may be a useful character.

Among other purely external characters, the form of the scales on the two sides of the body, their size, their transformation into tubercles or membranous processes, the presence of supplementary scales, etc., as well as the structure and course of the main branches of the lateral line, all provide features of taxonomic importance. In *Psettodes* and in most genera of Pleuronectidae the main lateral line is well developed on both sides of the body, but in most of the Bothidae this is either feebly developed or absent altogether on the blind side. The presence or absence of a supratemporal branch, running upwards and forwards in the region of the nape, is another useful character. A remarkable modification of this branch is found in certain genera of Pleuronectinae, curiously enough all occurring in the North Pacific. Here the supratemporal branch runs forward from the anterior part of the main lateral line as usual, but it then forks into two branches, a short one directed anteriorly and a more or less lengthy posterior one which runs just below the dorsal fin (Figs 234-245). In *Lepidopsetta* this posterior branch is not very elongate, and in other respects the genus is exactly like *Limanda*, to which it is closely related; in *Inopsetta* it is very short indeed. In their key to the genera of Pleuronectinae, Jordan and Evermann (1898, p. 2607) have made use of this character to separate two groups of primary importance, but it would seem to be of less value than they supposed. In the genus *Platichthys* the supratemporal branch is not normally provided with this posterior prolongation, but there is a Flounder (*P. flesus*) in the collection of the British Museum in which this branch is forked and the posterior prolongation is of fair length.

Kyle (1900b, p. 346) has discussed the value of the alimentary canal as a taxonomic character at some length, but concludes that this marks "a specialisation in structure and habits and cannot be used in classification." Examination of the abdominal cavity in a large number of species, however, has convinced me that, like the lower pharyngeals, the form of the alimentary canal provides a useful character for distinguishing the species in the more specialised genera of small-mouthed Pleuronectinae, and may even be used for the definition of genera or higher groups. The two most important features are the intestinal tract (referred to throughout as the intestine)—its length and the manner in which it is coiled in the abdominal cavity—and the "pyloric" appendages—their presence or absence, size and number. These appendages may be grouped round the junction between those parts of the intestinal tract usually referred to as the stomach and duodenum, or there may be two or more in this situation with others placed further down the intestine. The group of Pleuronectine genera including *Microstomus*, *Embassichthys*, *Tanakius* and *Glyptocephalus* have generally been marked off from the remainder of the small-mouthed members of the subfamily as a primary division, distinguished by a generally more elongate body and by an increased number of vertebrae, fin-rays and of scales in a longitudinal series. Such an arrangement is clearly an artificial one, and it is doubtful whether these genera really form a natural group. *Microstomus* and *Embassichthys* appear to have been derived from some form very like *Pseudopleuronectes*, and it is possible that *Tanakius* is most nearly related to *Dexistes*. It is of some interest to find that the general elongation of the body, with the corresponding increase in the number of vertebrae and fin-rays, has been accompanied in all four genera by a striking modification of the alimentary canal. This is usually elongate, and the second coil extends into the secondary body-cavity of the ocular side. In other genera (e.g. *Pleuronectes*) the intestine may project slightly into the secondary body-cavity, but in all the above-mentioned genera the second coil, which lies close to the reproductive organ of that side, runs well backwards alongside the inter-mal spines on the ocular side. A somewhat similar condition is found in the Soleidae, in which two to four coils of the intestine may enter the body-cavity of the ocular side.

Finally, perhaps the commonest and most widely-used characters for the distinction of species of Flatfishes are the numerical ones—the number of rays in the dorsal, anal,

pectoral, pelvic and caudal fins, the number of scales in a longitudinal and in a transverse series, the number of pores in the lateral line, and the number of vertebræ. Of these, the number of rays in the dorsal and anal fins is perhaps the most important, and, since this is correlated with the number of vertebræ and is subject to the same fluctuations, the two characters may be considered together. Jordan (1893) has shown that, as a general rule, Flatfishes from tropical seas have fewer vertebræ than those from temperate or arctic seas, at least as far as the "Flounders" are concerned. Further,

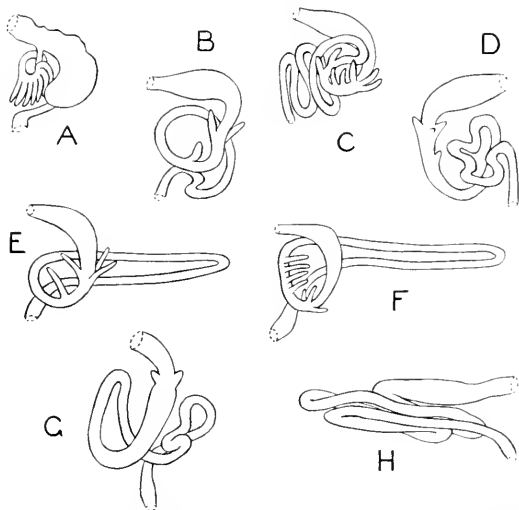


FIG. 28.—Intestine and "pyloric" appendages of A, *Psettodes erumeri*; B, *Limanda limanda*; C, *Pseudopleuronectes yokohamae*; D, *Pleuronectes platessa*; E, *Microstomus kitt*; F, *Glyptocephalus cynoglossus*; G, *Platichthys flesus*; H, *Zebrias zebra*. Diagrammatic. D and H from ocular side, others from blind side. (A and H after Wu.)

as has been pointed out by Collett (1880, p. 148), within the limits of certain species having a wide distribution in arctic and temperate regions the average number of vertebræ and fin-rays is markedly higher in samples from more northerly localities than in those from regions further south. This has been tested by me in *Paralichthys olivaceus* and *Hippoglossoides platessoides limandoides*, and the same phenomenon has been recorded in other fishes.¹ The well-known work of Johannes Schmidt on *Zoarces viviparus*² has shown that the differences in the number of vertebræ in samples from different localities may be correlated with environmental factors, particularly with

¹ See Hubbs (1921, 1925).

² For references see Hubbs (1926).

such factors as temperature, salinity, etc. Hubbs (1922, 1924, 1925, 1926) has more recently published a series of important papers dealing with this matter, and concludes that "the addition of somites, which is practically synonymous with the growth of the embryo, proceeds faster under accelerating than under retarding conditions of development, but terminates relatively sooner and more abruptly. As a consequence, warm or brackish water forms of a fish have as a general rule fewer vertebrae than the forms inhabiting cooler or more saline water." There can be little doubt that a statistical study of large numbers of specimens of a species of Flatfish would reveal the existence, in some species at least, of a number of well-marked races, distinguished mainly by numerical characters similar to those mentioned above. Duncker has shown that the Plaice of the Baltic differs from that of the North Sea in having an average of one vertebra less, five rays less in both dorsal and anal fins, and one more ray in the pectoral fin (see p. 354).

VIII. GEOGRAPHICAL DISTRIBUTION

The general distribution of the families and subfamilies of Heterosomata included in the present volume is summarised below, the latitudinal range being indicated in the accompanying diagram (Fig. 29).

1. *Psettodidae*.

Includes a single genus, with one species from tropical West Africa and another from the Indo-Pacific.

2. *Bothidae*.

(a) *Paralichthinae*—Widely distributed in tropical and temperate seas. Eleven genera are represented on the Atlantic coast of North and South America, and the same number on the Pacific coast; of these, eight genera are represented by species on both coasts. On the Atlantic coast the subfamily ranges from the region of Cape Cod to the Magellan-Falkland Islands plateau, and on the Pacific coast from British Columbia to Chile. The genera *Syacium* and *Citharichthys*, from both coasts of America, are also represented on the coast of West Africa, in the case of *Syacium* by the same species (*micranum*) as that of the western Atlantic, and in the case of *Citharichthys* by a species very closely related to one from the Atlantic coast of tropical America. Species of *Paralichthys* occur on both sides of America, and there is one species in China and Japan. The single species of *Eucetharus* is found in the Mediterranean and on the West African coast. *Citharoides* is represented by a single species from the Cape and from Japan. There are no representatives of this subfamily on the coasts of north-western Europe. There are six genera in the Indo-Pacific, where the subfamily ranges from the Red Sea and the east coast of Africa eastwards through the Indian Ocean and Archipelago to the Pacific. In the Pacific it appears to extend its range northwards to about latitude 45° N., and southwards to about latitude 35° S.

(b) *Bothinae*—Also widely distributed in tropical and temperate seas. On the Atlantic coast of America it is represented by the genus *Bothus*, which ranges from Long Island to Rio de Janeiro, and by *Mancopsetta* and *Ichtyopsetta* from the Magellan-Falkland Islands plateau. The same species of *Mancopsetta* is also found near Prince Edward's Island in the southern part of the Indian Ocean. On the Pacific coast of America species of *Bothus* again occur, and this genus is also represented on the eastern side of the Atlantic as well as in the Mediterranean. There are no species common to the two sides of the Atlantic, but *Bothus ocellatus* of the Atlantic coast of tropical America is closely related to *B. melissi* of St. Helena and Ascension, and to *B. podas* of the Mediterranean and west coast of Africa, etc. On the eastern side of the Atlantic the subfamily ranges considerably farther north than the Paralichthinae, extending as far as northern Scotland, the Cattegat and Christiansahord. *Argoglossus* is a widely distributed genus, being found on the coasts of north-western Europe and in the

Mediterranean and Black Sea, as well as throughout the Indo-Pacific. One of the Mediterranean species (*thori*) is also found on the coast of north-west Africa, and another (*imperialis*) extends southwards along the West African coast to Angola. There is one species found at the Cape. There are no endemic West Africa Bothinae.

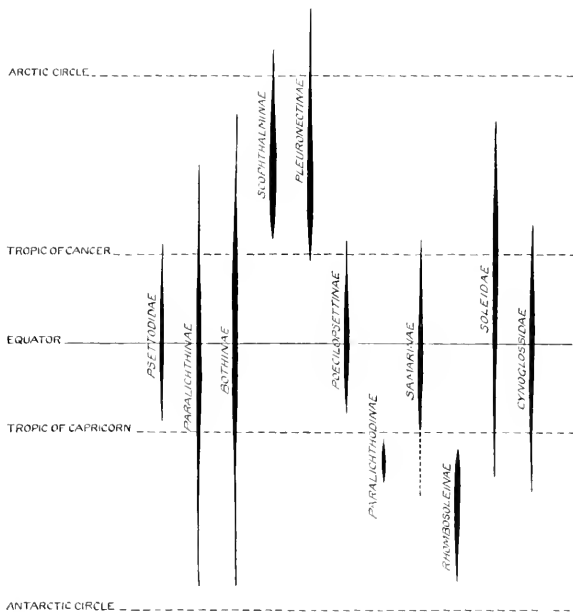


FIG. 29.—Diagram illustrating latitudinal range of families and subfamilies of Heterosomata.

There are eleven genera in the Indo-Pacific, including *Bothus* and *Arnoglossus*, where the subfamily ranges from the Red Sea and the east coast of Africa through the Indian Ocean and Archipelago, and right across the Pacific to the west coast of America. In the Pacific the range extends northwards to Japan and southwards to southern Australia and New Zealand.

(c) *Scophthalmina*.—This subfamily is represented by four genera, and is confined to the North Atlantic and Mediterranean, with a northerly range to about latitude 70° N in the eastern Atlantic. The southernmost limit of its range is a little obscure. A species of *Scophthalmus* (*aquosus*) on the coast of America extends as far as South Carolina. *Lepidorhombus* (*whiffiagonis*) is said to occur on the coast of north-western Africa.

3. *Pleuronectida*.

(a) *Pleuronectina*.—This subfamily is entirely confined to Arctic and northern seas. There are ten genera represented in the North Atlantic, all of which are also represented in the North Pacific. In the Atlantic the southerly limit of the range is New York on the western side and the Straits of Gibraltar on the eastern side. *Platichthys* and *Pleuronectes* enter the Mediterranean, the former being also found in the Black Sea. There are twenty-eight genera represented in the North Pacific, and the range of the subfamily extends southwards to southern Japan and to California. *Lipsetta* is a genus including four species, of which one occurs on the Atlantic coast of North America, two in the North Pacific, and the fourth (*glacialis*) has a very wide range along the arctic shores of Russia and Siberia, Alaska and arctic Canada. *Hippoglossus*, *Reinhardtius* and *Hippoglossoides* extend as far north as Bear Island and Spitzbergen.

(b) *Pacilopsettinæ*.—Two species of *Pacilopsetta* occur in the western Atlantic, off the coast of New England, in the Gulf of Mexico, and off British Honduras. The remaining two genera and other species of *Pacilopsetta* are from the Indo-Pacific, ranging from Natal through the Indian Ocean and Archipelago to southern Japan and the Hawaiian Islands.

(c) *Palaichthodina*.—A single genus and species from south-east Africa.

(d) *Samariina*.—Four genera, confined to the tropical and subtropical Indo-Pacific, ranging from East Africa to northern Australia, China, southern Japan and the Hawaiian Islands.¹

(e) *Rhombosoleinæ*.—This subfamily has an interesting distribution. One genus (*Oncopterus*) occurs on the south-eastern coasts of South America, from the Rio Grande do Sul to San Mathias Bay, Patagonia. The locality of the related genus *Psammodescus* is unknown. The remaining six genera are from southern Australia, New Zealand and neighbouring islands. The most northerly record of any member of the subfamily is about latitude 30° S, the most southerly Auckland Islands and Campbell Island.

IX. NOTES ON MEASUREMENTS, ETC.

1. The *total length* is measured from the tip of the lower jaw to the extremities of the longest caudal rays.

2. The *length of the head* is measured from the tip of the lower jaw to the extremity of the bony operculum.

3. The *depth of the body* refers to the greatest depth without the marginal fins. Where the bases of these fins are covered with scales, it is generally more convenient to measure the depth on the blind side.

4. Both the depth of the body and the length of the head are compared with the *length of the fish*, which is measured from the tip of the lower jaw to the base of the caudal fin.

5. The *length of the snout* is measured from its tip to the anterior margin of the foremost eye.

6. The *diameter of the eye* refers to the longitudinal diameter of the eye-ball itself, and not that of the orbit.

¹ The validity of the type locality (New Zealand) of *Brachypleura novae-zelandiae* is open to doubt.

7. The *interorbital width* is, in most cases, the distance between the inner margins of the eye-balls. Where the eyes are separated by a flat or concave space bounded by a pair of sharp ridges forming the inner edges of the orbits the distance between these ridges is measured.

8. In indicating the size of the mouth the position of the hinder edge of the maxillary in relation to the lower eye is given. By the *length of maxillary* is meant the total length of the upper jaw, measured from the extremity of the snout, and this includes the præmaxillary as well as the maxillary itself. Unless otherwise stated, the jaws are measured on the ocular side of the head.

9. By *dental formula* $\frac{4 + 13 - 15}{2 - 3 + 12 - 16}$ it is understood that there are 4 teeth on the ocular side of the upper jaw and 13 to 15 on the blind side; in the lower jaw there are 2 or 3 teeth on the ocular side and 12 to 16 on the blind side.

10. The size of the scales is not indicated by means of a formula, as this not infrequently leads to confusion. The number of *scales in the lateral line* is generally counted just above the line itself, from a point opposite the upper angle of the gill-opening to the base of the caudal fin. In those species in which the scales are easily rubbed off it is sometimes necessary to count those in the lateral line itself. Where the number of pores in the lateral line is less than the number of scales, this fact is usually indicated. The number of scales in a transverse series between the lateral line and the middle of the back is counted in an oblique row.

By *caudal peduncle twice as deep as long* is meant that the least depth of the muscular part of the tail is twice as great as its length, which is measured from opposite the last rays of the dorsal and anal fins to the posterior part of the peduncle; the length does not include the basal part of the caudal fin itself, which may be covered with scales.

X. BIBLIOGRAPHICAL METHOD.

In preparing the synonymy of each species an attempt has been made throughout to limit this as far as possible, by including only the essential references. Thus, all quotations from purely popular works and manuscript names have been excluded.¹ Extracts from purely nominal lists have usually been omitted, especially where the species in question is from a region covered by earlier references, as have references to descriptions, etc., copied verbatim from earlier authors and accompanied by copies of original figures. In general, the papers cited in each synonymy are those which have some bearing on taxonomy, or which extend or alter the known distribution of the species. In doubtful cases I have erred on the side of liberality, and included a number of references at the expense of the length of the bibliography. In cases where the development of the species has been investigated, a list of the more important papers dealing with the eggs, larvæ and young has been added below the main synonymy.

In the case of current journals, etc., the abbreviations used are, for the most part, those adopted by the compilers of the 'Zoological Record'. For the earlier works, the abbreviations used by Sherborn in his 'Index Animalium' have been followed.² With very few exceptions, every reference has been taken from the original work and has been checked by myself.

¹ Papers in Japanese and Russian, unprovided with an abstract, have usually been omitted unless of special importance.

² I take this opportunity of expressing my sincere appreciation of the valuable help provided by the 'Index Animalium', which has not only greatly lessened the risks of omission, but has considerably lightened the labour of preparing the synonymies. My best thanks are due to Dr. C. Davies Sherborn for frequent help and advice on matters nomenclatorial freely given during the preparation of this monograph.

XI. ABBREVIATIONS.

The following abbreviations have been adopted for names of institutions in the lists of specimens in the collection of the British Museum (Natural History), etc., given with each species in the systematic part of this work :

Amer. Mus. Nat. Hist.	American Museum of Natural History, New York.
Amsterdam Mus.	Zoologisch Museum, Amsterdam.
Austr. Mus.	Australian Museum, Sydney.
Bergen Mus.	Zoologiske Afdeling, Bergens Museum.
Brussels Mus.	Musee Royale d'Histoire Naturelle de Belgique, Brussels.
Calif. Acad. Sci.	California Academy of Sciences, San Francisco.
Caribb. Biol. Lab.	Caribbean Biological Laboratories Inc., Biloxi, Miss.
Domn. Mus.	Dommon Museum, Wellington.
Fish. Board Scotland	Fishery Board for Scotland, Aberdeen.
Imp. Inst.	Imperial Institute, London.
Ind. Mus.	Indian Museum (Zoological Survey of India), Calcutta
Leiden Mus.	's Rijks Museum van Natuurlijke Historie, Leiden.
Leningrad Mus.	Academie des Sciences de l'Union des Republiques Sovietiques Socialistes, Musee Zoologique.
Liverpool Univ.	Department of Oceanography, University of Liverpool.
Mar. Biol. Assoc.	Marine Biological Association of the United Kingdom, Plymouth.
Minist. Agric. Fish.	Ministry of Agriculture and Fisheries, London.
Mus. Comp. Zool.	Museum of Comparative Zoology, at Harvard College, Cambridge, Mass.
Paris Mus.	Museum National d'Histoire Naturelle, Paris.
Queensland Mus.	Queensland Museum, Brisbane.
S. Austr. Mus.	South Australian Museum, Adelaide.
Sci. Exped. Research Assoc.	Scientific Expeditionary Research Association.
Stanford Univ.	Stanford University, California.
Stuttgart Mus.	Wurtembergische Naturaliensammlung, Stuttgart.
Tokyo Imp. Univ.	Zoological Institute, Science Faculty, Tokyo Imperial University.
U.S. Nat. Mus.	United States National Museum (Smithsonian Institution), Washington, D.C.
Zool. Samml. Munich	Zoologische Sammlung des Bayerischen Staates, Munich.
Zool. Soc. Coll.	Collection of the Zoological Society of London.

XII. LIST OF PAPERS REFERRED TO IN GENERAL PART.

- AGASSIZ, A. 1870. On the young Stages of Bony Fishes. II. Development of the Flounders. *Proc. Amer. Acad.*, XIV, pp. 1-25, pls. III-X.
- AGASSIZ, J. I. R. 1842. Recherches sur les poissons fossiles. . . . IV.
- BALLOUWITZ, E. 1894. Die Nervenendigungen der Pigmentzellen. . . . *Zeitschrift Wiss. Zool.*, LVI, pp. 673-706, pls. XXXV-XXXIX.
- BATHSON, W. 1886. The Sense Organs and Perceptions of Fishes; with Remarks on the Supply of Bait. *Journ. Mar. Biol. Assoc.*, (2) I, pp. 225-250, pl. XX.
- 1894. Materials for the Study of Variation. . . . London, 8. Flatfishes, pp. 466-473.
- BERKELEY, N. J. 1925. The Development of the Skull in the Sole and the Plaice. *Quart. Journ. Mar. Sci.*, LXIX, pp. 217-244, text-figs.
- BOS, J. R. 1887. Einige Bemerkungen über Pleuronectiden. *Biol. Centralbl.*, VI, pp. 270-273.
- BOUTING, E. G. 1929. Observations on the nocturnal Behaviour of certain Inhabitants of the Society's Aquarium. *Proc. Zool. Soc. London*, 1929, pp. 356-362.

¹ Many of the bottles of specimens in the collection of the British Museum (Natural History) are labelled "Smithsonian Institution", "U.S. Bureau of Fisheries", "U.S. Fishery Commission", "Albatross", etc., all these appear in the lists as having been received from the United States National Museum.

- BOULENGER, G. A. 1902. Notes on the Classification of Teleostean Fishes. IV. On the Systematic Position of the Pleuronectidae. *Ann. Mag. Nat. Hist.*, (7) X, pp. 295-304, text-fig.
- BUMPUS, H. C. 1898. A recent Variety of the Flatfish, and its Bearing upon the Question of discontinuous Variation. *Science*, n.s., VII, pp. 197, 198.
- BURNE, R. H. 1909. The Anatomy of the Olfactory Organ of Teleostean Fishes. *Proc. Zool. Soc. London*, 1909, pp. 610-663, text-figs.
- CHABANAUD, P. 1931. Sur la ceinture et quelques autres éléments morphologiques des poissons hétérosomates. . . . *Bull. Soc. zool. Fr.*, LVI, pp. 386-398, text-figs.
- COLF, F. J., and JOHNSTONE, J. 1902. L.M.B.C. Memoirs. No. VIII. *Pleuronectes* (The Plaice). *Proc. L'pool. Biol. Soc.*, XVI, pp. 145-306, pls. i-xi.
- COLLETT, R. 1880. Fiske. Norske Nordhavs-Exped., *Zool.*, 164 pp., 5 pls., text-figs.
- COPE, E. D. 1871. Contribution to the Ichthyology of the Lesser Antilles. *Trans. Amer. Phil. Soc.*, (2) XIV, pp. 445-483, text-figs.
- CUNNINGHAM, J. T. 1890. A Treatise on the Common Sole. . . . Plymouth, 4', 147 pp., 18 pls.
- 1891. An Experiment concerning the Absence of Colour from the lower Sides of Flat fishes. *Zool. Anz.*, XIV, pp. 27-32, text-fig.
- 1892. The Evolution of Flat-fishes. *Natural Science*, I, pp. 191-199, 635-638.
- 1893. Researches on the Coloration of the Skins of Flat-fishes. *Journ. Mar. Biol. Assoc.*, (2) III, pp. 111-118, text-figs.
- 1895. Additional Evidence on the influence of Light in producing Pigments on the lower Sides of Flat-fishes. *Journ. Mar. Biol. Assoc.*, (2) IV, pp. 53-59, text-figs.
- 1897. Recapitulation. *Science Progress*, (2) I, pp. 483-510.
- 1907. A peculiarly abnormal Specimen of Turbot. *Proc. Zool. Soc. London*, 1907, pp. 174-181, pl. xi.
- and McFENN, C. A. 1893. On the Coloration of the Skins of Fishes, especially of Pleuronectidae. *Phil. Trans. Roy. Soc.*, B CI.XXXIV, pp. 765-812, pls. lvi-iv, text figs.
- CUVIER, G. 1817. *Le Règne Animal*. Ed. r. Fishes, II, pp. 104-351.
- DEKSCHEID, J. M. 1924. Structure de l'organe olfactif chez les poissons. I. Osteichthyes Teleostei Malacoptygii. *Ann. Soc. roy. Belgique*, LIV, (1923), pp. 79-162, text-figs.
- DÜNCKER, G. 1896. Variation und Verwandtschaft von *Pleuronectes flesus* L. und *Pl. platessa* L. . . . *Wiss. Meeresuntersuch.*, Abt. Helgoland, N.F., I (2), pp. 47-103, 4 pls.
- 1900. Variation und Asymmetrie bei *Pleuronectes flesus* L. (Statistisch untersucht). *Wiss. Meeresuntersuch.*, Abt. Helgoland, N.F., III (2), pp. 335-406, pls. xi-xiv, text-figs.
- EASMAN, C. R. 1914. Catalog of the Fossil Fishes in the Carnegie Museum. II. Supplement to the Catalog of Fishes from the Upper Eocene of Monte Bolca. *Mem. Carnegie Mus.*, VI, pp. 315-348, pls. xiii-xiv, text-figs.
- ELMHIRST, R. 1911. On Some ambicoloured Flat-fish from the Clyde. *Ann. Scott. Nat. Hist.*, 1911, pp. 77-79.
- EMERY, C. 1883. Contribuzioni all'Ittiologia. VI. Metamorfofi del *Rhomboidichthys podas* L. *Mitt. zool. Stat. Neapel*, IV, pp. 495-499, 1 fig.
- FRANZ, V. 1910. Zur Physiologie und Pathologie der Chromatophoren. *Biol. Centralbl.*, XXX, pp. 150-158, text-figs.
- FROST, G. A. 1930. A Comparative Study of the Otoliths of the Neopterygian Fishes. *Heterosomata*. *Ann. Mag. Nat. Hist.*, (10) V, pp. 231-239, pl. ix.
- GEMMILL, J. F. 1912. The Teratology of Fishes. Glasgow, 4'. Abnormalities of coloration, pp. 56-59.
- GIARD, A. 1892A. Sur la persistance partielle de la symétrie bilatérale chez un turbot (*Rhombus maximus* L.). . . . *C.R. Soc. Biol. Paris*, (9) IV, pp. 31-34.
- 1892B. The Evolution of Flat-fish. *Natural Science*, I, pp. 356-359.
- GILL, T. N. 1887. The Classification and Relations of the Ribbon-fishes. *American Naturalist*, XXI, p. 86.
- 1893. Families and Subfamilies of Fishes. *Mem. Nat. Acad. Washington*, VI, pp. 127-138.
- GUNTHER, A. 1862. Catalogue of the Fishes in the British Museum. IV. Pleuronectida, pp. 399-504.
- 1880. An Introduction to the Study of Fishes. Edinburgh, 8', 720 pp., text-figs.
- HEWER, H. R. 1926. Studies in Colour-changes in Fish, II-IV. *Phil. Trans. Roy. Soc.*, B CCXXV, pp. 177-200, pls. xiii-xv, text-figs.
- 1931. Studies in Colour-changes in Fish, V. *Journ. Linn. Soc. London, Zool.*, XXXVII, pp. 493-512, pls. xxxiii, xxxiv, text-figs.
- HOLT, E. W. L. 1894. Studies in Teleostean Morphology from the Marine Laboratory at Cleethorpes. *Proc. Zool. Soc. London*, 1894, pp. 413-449, pls. xxviii-xxx.

- HERBES, C. L. 1921. The Latitudinal Variation in the Number of Vertical Fin rays in *Leptocottus armatus*. Occ. Papers Mus. Zool. Univ. Michigan, XCIV, 7 pp.
1922. Variations in the Number of Vertebrae and other meristic Characters of Fishes correlated with the Temperature of Water during Development. American Naturalist, LVI, pp. 360-372.
1924. Seasonal Variation in the Number of Vertebrae of Fishes. Papers Michigan Acad. Sci. Arts, II, (1922), pp. 207-214.
1925. Racial and seasonal Variation in the Pacific Herring, California Sandlance and California Anchovy. Calif. Fish Game Bull., VIII, 23 pp.
1926. The structural Consequences of Modifications of the developmental Rate in Fishes. American Naturalist, LX, pp. 57-81.
- HUSSAKOFF, I. 1914. On two ambicolorate Specimens of the Summer Flounder, *Paralichthys dentatus*, with an Explanation of Ambicoloration. Bull. Amer. Mus. Nat. Hist., XXXIII, pp. 95-109, text figs.
- HUTTON, F. W. 1874. Notes on some New Zealand Fishes. Trans. N. Zealand Inst., VI, pp. 104-107, pls. xviii-xix.
1876. Contributions to the Ichthyology of New Zealand. Trans. N. Zealand Inst., VIII, pp. 209-218.
- JENSEN, A. S. 1925. On the Fishery of the Greenlanders. Medd. Komm. Havundersøg. Kjøb., Ser. Fiske., VII (7), 39 pp., text figs.
- JORDAN, D. S. 1893. Temperature and Vertebrae, a Study in Evolution. Wilder Quarter-Century Book, Ithaca, pp. 13-36.
1923. A Classification of Fishes, including Families and Genera as far as known. Stanford Univ. Publ., Biol. Sci., III (2), pp. 79-243.
- and EVERMANN, B. W. 1898. The Fishes of North and Middle America. . . . III. Bull. U.S. Nat. Mus., XLVII (3). Flatfishes, pp. 2602-2712, pls. cccxxi-cccxxxviii.
- and GOSS, D. K. 1889. A Review of the Flounders and Soles (Pleuronectidae) of America and Europe. Rep. U.S. Com. Fish, Washington, XIV, (1886), pp. 225-312, 9 pls.
- KRITZ, A. 1918. The histological Basis of adaptive Shades and Colors in the Flounder *Paralichthys albigattus*. Bull. U.S. Bur. Fish, Washington, XXXV, (1915-16), pp. 1-28, pls. 1-11.
- KYLE, H. M. 1909. On a new Genus of Flat-fishes from New Zealand. Proc. Zool. Soc. London, 1909, pp. 980-992, text figs.
1909. The Classification of the Flat-fishes (Heterosomata). Rep. Fishery Board Scotland, XVIII, pp. 138-307, pls. xi-xii.
1912. Flat-fishes (Heterosomata). Rep. Danish Ocean. Exped. 1908-10, II, VI, 150 pp., 4 pls., text-figs.
1921. The Asymmetry, Metamorphosis and Origin of Flat-fishes. Phil. Trans. Roy. Soc., B, CCXI, pp. 75-129, pls. iv-x.
- McINTOSH, W. C. 1902. Notes from the Gatty Marine Laboratory, St. Andrews. XXII. On abnormal Coloration in the Pleuronectida. Ann. Mag. Nat. Hist., (7) IX, pp. 291-296.
- MAST, S. O. 1916. Changes in Shade, Color and Pattern in Fishes and their Bearing on the Problems of Adaptation and Behaviour, with especial Reference to the Flounders *Paralichthys* and *Enchlopseta*. Bull. U.S. Bur. Fish, Washington, XXXIV, (1914), pp. 173-238, pls. xix-xxxvii.
- MAYHOFF, H. 1912. Über das "monomorphe" Chiasma opticum der Pleuronectiden. Zool. Anz., XXXIX, pp. 78-80, text-figs.
1914. Zur Ontogenese des Kopfes der Plattfische. Zool. Anz., XLIII, pp. 389-404.
- MOHR, K. A. 1897. Das Verhalten einiger Fischer bei Nacht. Zool. Garten, VIII, pp. 148-159.
- MULLER, J. 1849. Über den Bau und die Grenzen der Ganoiden und über das natürliche System der Fische. Abh. K. Akad. Wiss. Berlin, (1844), pp. 117-216, 9 pls.
- NIISHIKAWA, F. 1897. On a Mode of the Passage of the Eye in a Flat-fish. Annot. Zool. Japon., I, pp. 73-76, text figs.
- NORMAN, J. R. 1920a. The Development of the Chondrocranium of the Eel (*Unguilla vulgaris*), with Observations on the comparative Morphology and Development of the Chondrocranium in Bony Fishes. Phil. Trans. Roy. Soc., B, CCXIV, pp. 399-464, text figs.
- 1920b. A Report on the Flatfishes (Heterosomata) collected by the F. I. S. "Endeavour". . . . Biol. Res. "Endeavour", V, pp. 219-308, text-figs.
- 1927a. Ambicolorate Flatfishes. Natural History Magazine, I (2), pp. 57-59, text-figs.
- 1927b. The Flatfishes (Heterosomata) of India, with a List of the Specimens in the Indian Museum. J. Rec. Indian Mus., XXIX, pp. 7-47, pls. ii-vii, text-figs.
- PARKER, G. H. 1903. The Optic Chiasma in Teleosts and its Bearing on the Asymmetry of the Heterosomata (Flatfishes). Bull. Mus. Comp. Zool., XI, pp. 221-242, 1 pl.

- POUCHET, G. 1876. Des changements de coloration sous l'influence des nerfs. J. Anat. Physiol. Paris, XII, pp. 1-90, 113-195, pls. 1-3v.
- RIGAN, C. T. 1910a. The Anatomy and Classification of the Teleostean Fishes of the Order Zeomorphi. Ann. Mag. Nat. Hist., (8) VI, pp. 481-484.
- 1910b. The Origin and Evolution of the Teleostean Fishes of the Order Heterosomata. Ann. Mag. Nat. Hist., (8) VI, pp. 484-496, text-figs.
- 1913. The Classification of the Percoid Fishes. Ann. Mag. Nat. Hist., (8) XII, pp. 111-145.
- 1916. Larval and post-larval Fishes. Rept. Brit. Antarctic. ("Terra Nova") Exped. 1910, Zool., 1, 4, pp. 125-156, 16 pls., text-figs.
- 1920. A Revision of the Flat-fishes (Heterosomata) of Natal. Ann. Durban Mus., II, pp. 205-222, text-figs.
- 1926. Organic Evolution. Rept. Brit. Assoc. Adv. Sci. (Southampton, 1925), pp. 75-86.
- 1929. Fishes. Article in Encyclopædia Britannica, 14th Ed., IX Heterosomata, pp. 324-325.]
- SCHMIDT, P. 1915. Respiratory Adaptations of Pleuronectids [in Russian]. Bull. Acad. Imp. Sci. Petrograd, 1915, pp. 421-444, text-figs.
- SCHNAKENBECK, W. 1923. Ueber Färbungsanomalien bei Pleuronectiden. Wiss. Meeresuntersuch., Abt. Helgoland, N.F., XV, No. 10, 20 pp., 1 pl.
- STILLENSTRUP, J. J. 1864. Bidrag til en rigtigere Opfatelse af Skjævheden hos flynderne (Pleuronectides) . . . Overs. Dansk. Vid. Selsk. Forhandl., (1863), pp. 145-194, 1 pl., text-figs.
- SUMNER, F. B. 1911. The Adjustment of Flat-fishes to various Backgrounds. Journ. Exper. Zool., N, pp. 409-505, 13 pls.
- THILO, O. 1902a. Die Vorfahren der Schollen. Bull. Acad. Imp. Sci. St. Petersburg, (V) XIV, (1901), pp. 315-350, 2 pls., text-figs.
- 1902b. Die Umbildungen am Knochengengerüste der Schollen. Zool. Anz., XXV, pp. 305-320, text-figs.
- 1902c. Die Vorfahren der Schollen. Biol. Centralbl., XXII, pp. 718-728, text-figs.
- 1907. Das Schwimmen der Schwimmbalgen bei den Schollen. Zool. Anz., XXXI, pp. 393-406, text-figs.
- 1908. Die Augen der Schollen. Biol. Centralbl., XXVIII, pp. 602-608, text-figs.
- TRAQUAIR, R. H. 1865. On the Asymmetry of the Pleuronectide as elucidated by an Examination of the Skeleton in the Turbot, Halibut and Plaice. Trans. Linn. Soc. London, XXV, pp. 263-290, pls. XXIX-XXXII, text-figs.
- VIRKILL, A. E. 1897. Nocturnal and diurnal Changes in the Colors of certain Fishes and of the Squid (*Loligo*) with Notes on their sleeping Habits. Amer. Journ. Sci., (4) III, pp. 135-139.
- WILLIAMS, S. R. 1902. Changes accompanying the Migration of the Eye and Observations on the Tractus Opticus and Tectum Opticum in *Pseudopleuronectes americanus*. Bull. Mus. Comp. Zool., XL, pp. 1-57, pls. 1-v, text-figs.
- WOODWARD, A. S. 1901. Catalogue of the fossil Fishes in the British Museum (Natural History), IV. [Flatfishes, pp. 606-611.]
- 1910. On a fossil Sole and a fossil Eel from the Eocene of Egypt. Geol. Mag., N.S., (V) VII, pp. 402-405, 1 pl.

B. SYSTEMATIC PART.

Order HETEROSOMATA.

Allied to the Percomorphi, but asymmetrical, with both eyes on one side of the head. Body strongly compressed, with the præcaudal region short, dorsal and anal fins long, caudal fin generally with 17 principal rays (15 branched) or fewer, pelvic fins generally with 6 rays or fewer, thoracic or jugular, with the pelvic bones directly attached to the cleithra. Air-bladder absent in the adult. Mouth more or less protractile, bordered above by the premaxillaries only. Parietals separated by the supra-occipital, interorbital bar mainly formed by the frontal of ocular side, frontal of blind side extending to præfrontal external to upper eye, no orbitosphenoid. Pectoral arch attached to skull by a forked post-temporal, no mesocoracoid. Vertebral column of solid centra coossified with the arches; posterior præcaudal vertebrae with downwardly directed parapophyses.

Five families

SYNOPSIS OF THE FAMILIES.

- I Dorsal fin not extending forward on the head, the anterior rays spinous, each pelvic fin with a spine and 5 soft-rays, maxillary with supplemental bone, palatines toothed, vertebrae 24 (10 + 14), eyes on the right or left side 1. PSETOIDÆ
- II Dorsal fin extending forward on the head at least to above the eye, none of the rays spinous, pelvic fins without spines, maxillary without supplemental bone, no palatine teeth; vertebrae never fewer than 28 (9 + 19).
- A Preoperculum with a free margin, lower jaw generally prominent; nasal organ of blind side generally near edge of head, optic chiasma monomorphic, the nerve of the left eye in dextral forms and that of the right eye in sinistral forms, always dorsal; one or two post-cleithra on each side, ribs present
- 1 Eyes on the left side (except in reversed examples), nerve of the right eye always dorsal, egg with a single oil-globule in the yolk 2. BATHIDÆ
- 2 Eyes on the right side (except in reversed examples), nerve of the left eye always dorsal, egg without oil-globules 3. PLEUROPECTIDÆ
- 1 Preopercular margin not free, hidden by the skin and scales of the head; lower jaw never prominent, nasal organs symmetrical in position, optic chiasma dimorphic, the right or the left nerve dorsal without reference to dextrality or sinistrality, no post-cleithrum, no ribs
- 1 Eyes on the right side 4. SOLEIDÆ
- 2 Eyes on the left side 5. CYNGLOSSIDÆ

Family I. PSETTODIDÆ.

Eyes on the right or left side; optic chiasma dimorphic. Dorsal fin not extending forward on the head, the anterior rays spinous. Pelvic fins nearly symmetrical, thoracic, each of a spine and 5 soft-rays. Mouth large, terminal, with straight cleft; lower jaw prominent; jaws and dentition equally developed on both sides; maxillary with a well-developed supplemental bone; teeth strong; palatines toothed. Urohyal normal, the lower edge scarcely curved. Præoperculum with free margin. Nasal organ of blind side scarcely higher than the other; olfactory laminae numerous, radiating from a rather short central rachis. Vertebrae 24 (10 + 14); præcaudal parapophyses downwardly directed and united to form closed hæmal arches. Two post-cleithra on each side;¹ pectoral radials well developed.

A single genus from tropical seas.

Genus I. PSETTODES.

Psettodes, Bennett, 1831, Proc. Conim. Zool. Soc. (12), p. 147 [*Psettodes belcheri*, Bennett].
Sphagomorus, Cope, 1869, Trans. Amer. Phil. Soc. Philad., xii, p. 407 [*Pleuronectes erumei*, Schneider].

Body ovate or rather elongate, not greatly compressed. Eyes separated by a flat, scaled space of moderate width, the upper placed on the dorsal surface of the head. Mouth large, the length of the maxillary more than half that of head. Teeth straight or curved, pointed, some of them with barbed tips;² in 2 or 3 series in both jaws, those of the inner row larger, depressible, those of the outer row fixed; a small patch of teeth on the vomer and a single row on each palatine; patches of teeth on tongue. No gill-rakers, but gill-arches with groups of teeth; lower pharyngeals very narrow, slender, not united, each with 2 (or 3) rows of slender curved teeth, those of the inner row larger. Most of the soft-rays of the dorsal fin and nearly all those of the anal branched, not scaled; a low scaled sheath at bases of dorsal and anal; tip of first inter-hæmal spine not projecting in front of anal. Pectoral fins subequal, middle rays branched. Scales rather small, adherent, with fine diverging striæ and finely crenulated margins. Lateral line well developed on both sides of body, with a low curve above the pectoral fin; no distinct supratemporal branch; tubules branched. Vent nearly median, just in front of anal fin; several pyloric appendages.

Two species from tropical West Africa and from the Indo-Pacific.

SYNOPSIS OF THE SPECIES.

- I. Depth $2\frac{1}{2}$ to $2\frac{3}{4}$ in length, head $3\frac{1}{6}$ to $3\frac{3}{8}$; lower jaw $3\frac{1}{2}$ to $4\frac{1}{2}$ in length of fish (without caudal); 32 to 38 scales round caudal peduncle; caudal fin without dark spots 1. *erumei*.
II. Depth $2\frac{1}{2}$ to $2\frac{3}{4}$ in length, head $3\frac{3}{8}$ to $3\frac{1}{2}$; lower jaw $4\frac{1}{2}$ to 5 in length of fish (without caudal); 29 to 30 scales round caudal peduncle; caudal fin with vertical rows of large dark spots 2. *belcheri*.

1. PSETTODES ERUMEI (Schneider).

Pleuronectes erumei, Schneider, 1801, in Bloch, Syst. Ichth., p. 150.

Hipploglossus erumei, Cuvier, 1829, R. Anim., ed. 2, ii, p. 349; Ruppell, 1830, Fische Rothen Meeres, p. 121; Cantor, 1850, J. Asiat. Soc. Bengal, xviii (2), p. 1198; Bleeker, 1852, Verh. Batav. Gen., xxiv, Pleuron., p. 13.

¹ According to Chabanaud (1931, Bull. Soc. zool. Fr., lvi, p. 395) there is only one post-cleithrum on each side. I have examined two skeletons of *P. erumei* and find two post-cleithra on each side in this species. The bones are closely united, but in each case the suture is quite distinct.

² See Rendahl, 1921, 'Fauna och Flora,' p. 182, figs.

- Pleuronectes naitika*, Cuvier, 1829, R. Annu., ed. 2, 11, p. 340.
Hippoglossus dentex, Richardson, 1848, Zool. "Sulphur", p. 102, 1849, 15 Rept. Brit. Assoc. (Cambr.), 1848, p. 278.
Hippoglossus orthorhynchus, Richardson, 1849, 15 Rept. Brit. Assoc. (Cambr.), 1848, p. 278.
Hippoglossus onographus, Richardson, 1849, *loc. cit.*, p. 279.
Psettodes erumei, Günther, 1862, Cat. Fish., iv, p. 102. Playfair and Günther, 1866, Fish. Zanzibar, p. 112. Bleeker, 1866-72, Atlas Ichth., xi, p. 1, Pleuron., pl. 1, fig. 2; Kner, 1869, Reise "Novara", Zool., 1, 5, Fische, p. 282. Klunzinger, 1870, Verh. zool. bot. Ges. Wien, xxi, p. 570. Day, 1877, Fish. India, p. 422, pl. xvi, fig. 1. Saville Kent, 1897, Great Barrier Reef, p. 297, pl. xlv, fig. 5; Barnard, 1925, Ann. S. Afr. Mus., xxi, p. 383, pl. xvii, fig. 1. Norman, 1926, Biol. Res. "Endeavour", v, p. 224; Norman, 1927, Keel Ind. Mus., xix, p. 8, fig. 1; Oshima, 1927, Japan. J. Zool., Trans. Abstr., 1 (5), p. 178. Weber and Beaufort, 1929, Fish. Indo Austral. Arch., v, p. 97, fig. 24. McCulloch, 1929, Mem. Aust. Mus., v, p. 270; Wu, 1932, Thes. Facult. Sci. Univ. Paris, A, 244 (268), p. 73.
Phagomorus erumei, Cope, 1869, Trans. Amer. Phil. Soc. Philad., xii, p. 407.
Psettodes onographus, Bleeker, 1871, Ned. Tijdschr. Dierk., iv, p. 139.

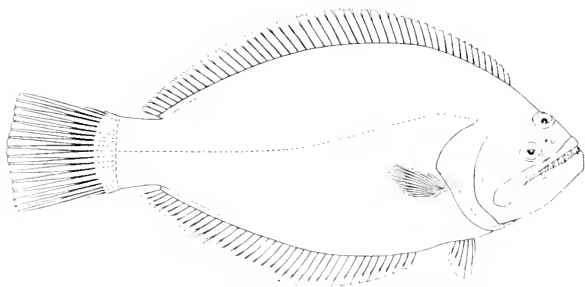


FIG. 25. *Psettodes erumei*. B.M. (N.H.) 1927.1.6.2. 1/2.

Depth of body $2\frac{1}{2}$ to $2\frac{1}{2}$ in the length, length of head $3\frac{1}{6}$ to $3\frac{2}{3}$. Snout as long as or a little longer than eye, diameter of which is 5 (young) to 7 in length of head and greater than interorbital width. Maxillary extending to well beyond posterior edge of eye, length 1 to $1\frac{1}{2}$ in that of head, length of lower jaw $3\frac{1}{2}$ to $4\frac{1}{2}$ in that of fish (without caudal). 68 to 76 scales in a longitudinal series above lateral line, 22 to 28 between lateral line and middle of back, 32 to 38 round caudal peduncle. Dorsal 50-50, origin above or a little behind level of hinder edge of lower eye. Anal 34-43. Pectoral of ocular side with 14 to 16 rays, length $2\frac{1}{4}$ to $2\frac{3}{4}$ in that of head. Caudal with 17 rays (15 branched), truncate or double-truncate, caudal peduncle deeper than long. Brownish or greyish, sometimes with four broad dark transverse bars, body sometimes with small scattered white spots, dorsal, anal and posterior part of caudal darker, the caudal sometimes with a distinct blackish band posteriorly, pectoral with small dark spots.

TYPE—Zoologisches Museum der Universität, Berlin.

DISTRIBUTION—East Africa and the Red Sea to the Pacific.

SPECIMENS EXAMINED:

53, 105 mm.)	Persian Gulf	Fownsend
1 (540 mm.), stuffed.	Muscot	Jayakar.
1 (409 " ")	"	Fownsend.
1 (195 " ") skin	Zanzibar.	Playfair.

1 (105 mm.), skeleton.	India.	Hardwicke.
1 (440 "), stuffed.	"	Madras Mus.
1 (208 "),	Madras.	Day.
1 (320 "),	Coast of Orissa.	Ind. Mus.
1 (225 "),	Mouth of R. Hughli.	"
1 (355 "),	Singapore.	Intern. Fisheries Exhib.
1 (135 "),	"	E. India Co.
2 (180, 205 mm.).	Singapore Fish Market.	Raffles Mus.
3 (100-160 mm.), skins.	Penang.	Cantor.
1 (193 mm.).	Batavia Fish Market.	Hardenberg.
1 (58 "),	Amboyna.	Frank.
1 (280 "),	Java Sea (6°41' S., 111°55' E.)	Hardenberg.
1 (230 "), skeleton.	China.	Swinhoe.
1 (202 "),	"	Reeves.
1 (156 "),	Amoy.	Ping.
1 (112 "),	Japan.	Frank.
2 (250, 295 mm.).	Off Bowen, Queensland.	Austr. Mus. (" Endeavour ")

Also 3 from off Gloucester Head, Queensland (Austr. Mus.); several from India, Burma and the Andaman Is. (Ind. Mus.); and 1 from Colombo, Ceylon, and 5 from Singapore (Mus. Comp. Zool.).

Attains a length of about 2 feet.

2. PSETTODES BELCHERI, Bennett.

Psettodes belcheri, Bennett, 1831, Proc. Comm. Zool. Soc. (12), p. 147; Cope, 1869, Trans. Amer. Phil. Soc. Philad., xiii, p. 407; Chabanaud and Monod, 1927, Bull. Com. Etud. Hist. Sci. Afriq. Occ. Fr., (1926), p. 280; Monod, 1927, Faune Colon. Franç., 1, p. 720.

Psettodes erumei (part), Günther, 1862, Cat. Fish., iv, p. 402.

Psettodes bennettii, Stendachner, 1870, Sitzber. Akad. Wiss. Wien, lx (1), p. 976.

Psettodes erumei, Pellegrin, 1905, Act. Soc. Linn. Bordeaux (6) x (lx), p. 30, fig.; Ehrenbaum, 1911, Fischerbote, v, p. 361, fig.; Pellegrin, 1914, Ann. Inst. océanogr. Paris, xi (4) p. 73; Metzelaar, 1919, Trop. Atlant. Visschen, p. 275; Fowler, 1919, Proc. U.S. Nat. Mus., lvi, p. 248.

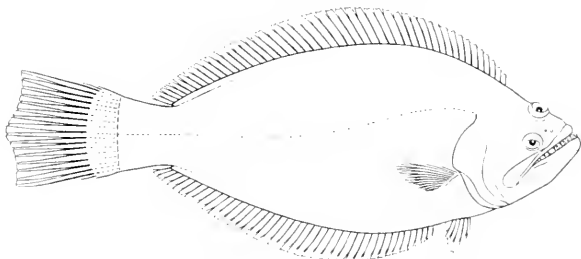


FIG. 31.—*Psettodes belcheri*. B.M. (N.H.) 1920.8.12.69. $\frac{1}{2}$.

Closely related to *P. erumei*, but depth of body $2\frac{1}{2}$ to $2\frac{3}{4}$ in the length, length of head $3\frac{3}{8}$ to $3\frac{1}{2}$. Length of lower jaw $4\frac{1}{2}$ to 5 in that of fish (without caudal). 21 to 22 scales between lateral line and middle of back, 29 or 30 round caudal peduncle. Length of pectoral of ocular side 2 to $2\frac{1}{4}$ in that of head. Brownish or blackish, with irregular darker spots or blotches; sometimes some small scattered white spots;

dorsal and anal fins with irregular darker markings, and with narrow pale margins, caudal with vertical rows of large dark spots, which tend to form irregular cross-bars, and with a narrow pale posterior margin

TYPE—British Museum (Nat. Hist.),¹ Reg. No. 57.6.13.165

DISTRIBUTION—Tropical West Africa

SPECIMENS EXAMINED:

1 (315 mm), stuffed. Holotype (?)	West Africa (?)	Zool. Soc. Coll.
1 (54 " ")	Off Mauritania.	Minist. Agric. Fish.
1 (395 " ")	Lagos	Cadman.
1 (205 " ")	Gaboon.	Gerrard.
1 (155 " ")	Accra, Gold Coast	Irvine.
1 (200, 230 mm.)	Sierra Leone.	Low

Family 2. BOTHIDÆ.

Eyes on the left side, except in reversed examples in certain species, optic chiasma monomorphic, the nerve of the right eye always dorsal. Dorsal fin extending forward on the head at least to above the eye, all the fin-rays articulated. Each pelvic fin of 6 or fewer rays. Mouth terminal, with the lower jaw more or less prominent, maxillary without a supplemental bone; palatines toothless. Lower edge of urohyal deeply emarginate, so that the bone appears forked. Preoperculum with free margin. Nasal organ of blind side near edge of head. Vertebrae never fewer than 30. On each side one or two post-cleithra, pectoral radials present. Ribs present. Egg with a single oil-globule in the yolk.

Three subfamilies may be recognised.

SYNOPSIS OF THE SUBFAMILIES

- I Pelvic fins generally short-based, but that of ocular side, if somewhat extended, never with the anterior ray much in advance of first ray of that of blind side; pelvic fins supported by the pelvic bones and situated behind the cleithra, either symmetrical or with the fin of the ocular side nearly median in position; caudal vertebrae without transverse apophyses. 1 PARALICHTHINÆ
- II Pelvic fin of blind side short-based; that of ocular side elongate, extending forward to the urohyal, supported by a cartilaginous plate placed in advance of the cleithra, its anterior ray well in advance of first ray of that of blind side; caudal vertebrae with well-developed apophyses. 2 BOTHINÆ
- III Both pelvic fins elongate, extending forward to the urohyal, supported by cartilaginous plates placed in advance of the cleithra; caudal vertebrae with well-developed transverse apophyses. 3 SCOPHTHALMINÆ

The following genera described in Japanese² belong to this family, but as the diagnoses are very brief and no mention is made of the form of the pelvic fins, I am unable to place them with certainty. Both are compared with *Pseudohombus*, however, and may be related to that genus.

ASTERORHOMBUS, Tanaka, 1915, *Dobuts. Zasshi* ('Zool. Mag'), xxvii, No. 325, p. 507—type *A. stellifer*, Tanaka. Based on a single example, 110 mm in length (without caudal), from Nagasaki Market.

SCIPORHOMBUS, Tanaka, 1915, *tom cit*—type *S. pallidus*, Tanaka. Based on a single example, 80 mm in length (without caudal), from Nagasaki Market.

¹ This specimen bears a label " *Lophiopssetta eromci*, Zoological Soc. Coll.", and a small ticket on which is the number " 347 ". There can be little doubt that this is Bennett's original specimen, which formed part of a collection presented to the Zoological Society by Capt. Belcher, R.N. No mention of the size of the specimen is made in the original description.

² I am indebted to Dr. Tanaka for English translations of these diagnoses.

Subfamily I. PARALICHTHINÆ.

Characters as given in the synopsis above. Twenty-one genera, mostly from tropical and temperate seas.

SYNOPSIS OF THE GENERA.

- I. Pelvics subequal and subsymmetrical.
- A. Lateral line equally developed on both sides of body; mouth of moderate size or rather large, maxillary more than $\frac{1}{4}$ head.
1. Teeth in bands in both jaws; rays of dorsal and anal not scaled.
- a. Dorsal origin above middle of eye, its anterior rays widely separated; lateral line with distinct curve above pectoral; gill-rakers short and broad 1. TEPHRINETES.
- b. Dorsal origin in front of upper eye, its anterior rays close together; lateral line with very slight curve above pectoral; gill-rakers long and slender 2. THYSANOPSETTA.
2. Teeth uniserial in both jaws; rays of dorsal and anal more or less scaled on both sides.
- a. Jaws and dentition nearly equally developed on both sides; lower pharyngeals with numerous minute villiform teeth; pectoral of ocular side not prolonged.
- α. Lateral line without distinct supratemporal branch.
- * Teeth very small, no canines anteriorly; origin of dorsal about above middle of eye.
- † Gill-rakers rather long and slender; tip of first interhæmal spine projecting in front of anal; scales of ocular side ctenoid 3. HIPPOGLOSSINA.
- †† Gill-rakers rather short and stout; tip of first interhæmal spine feeble, not projecting; scales of ocular side cycloid 4. LIOGLOSSINA.
- ** Teeth strong or of moderate size, some distinct canines anteriorly; origin of dorsal in front of or above anterior part of eye; tip of first interhæmal spine feeble, not projecting 5. PARALICHTHYS.
- β. Lateral line with distinct supratemporal branch.
- * Scales small or of moderate size, 58 to 100 in lateral line 6. PSEUDORHOMBUS.
- ** Scales larger, less than 50 in lateral line 7. TARPHOPS.
- b. Jaws equally developed on both sides, but dentition better developed on blind side; lower pharyngeals each with 3 or 4 rows of strong, obtusely-pointed teeth; pectoral of ocular side more or less prolonged, often much longer than head; scales all cycloid; origin of dorsal above anterior part of eye 8. XYSTREURYS.
- B. Lateral line absent on blind side; mouth small, maxillary less than $\frac{1}{4}$ head 9. TENIOPSETTA.
- II. Pelvics subsymmetrical, but that of ocular side the larger; teeth small or of moderate size, without canines anteriorly.
- A. Scales all strongly ctenoid; origin of dorsal above anterior edge or anterior part of eye 10. ANCYLOPSETTA.
- B. Scales all cycloid, embedded in skin; origin of dorsal in front of eye 11. GASTROPSETTA.

- III. Pelvics more or less subequal, that of ocular side median.
- A. Lateral line without distinct curve anteriorly.
1. Teeth biserial above, uniserial below; anterior teeth of upper jaw enlarged; gill-rakers short or of moderate length; interorbital space more or less broad in male 12 SYACIUM
 2. Teeth uniserial in both jaws
 - a. Mouth of moderate size or rather large, maxillary $1\frac{3}{4}$ to $3\frac{1}{2}$ in head; jaws and dentition about equally developed on both sides, teeth somewhat enlarged anteriorly
 - a. Gill-rakers short, stout 13 CYCLOPSETTA
 - β . Gill-rakers of moderate length, slender 14 CITHARICHTHYS
 - b. Mouth small, maxillary $3\frac{1}{2}$ to $4\frac{1}{2}$ in head; jaws of blind side curved, much more strongly toothed than those of ocular side, none of the teeth enlarged 15. ETROPUS.
- B. Lateral line with distinct curve above pectoral
1. Posterior nostril of blind side a small opening, without membranous valve; scales rather small, lateral line feebly developed or absent on blind side; rays of dorsal and anal simple, scaled.
 - a. Pectoral of blind side well developed
 - a. Jaws and dentition about equally developed on both sides, rays of pelvic of blind side prolonged, pectoral of ocular side smaller than that of blind side; gill-rakers rather long, slender 10. TRICHOSETTA
 - β . Dentition nearly entirely confined to blind side of jaws; pelvic of blind side without elongate rays; pectoral of ocular side larger than that of blind side; gill-rakers very short 17. ENGYOPHRYS.
 - b. Pectoral of blind side rudimentary, shorter than eye; second rays of dorsal prolonged 18. PERISSIAS.
 - c. No pectoral on blind side (in adult); none of the rays of dorsal prolonged 19. MONGOLENE
 2. Posterior nostril a large opening, covered by a membranous valve, scales large; lateral line well-developed on both sides of body; rays of dorsal and anal branched, not scaled.
 - a. Teeth uniserial (except anteriorly in upper jaw), with distinct canines, vomer with teeth; origin of dorsal behind lower part of posterior nostril; tubules of lateral line simple 20. EUCITHARUS
 - b. Teeth in bands (at least in adults); no distinct canines, vomer toothless; origin of dorsal above posterior nostril; tubules of lateral line forked 21. CITHAROIDES.

Genus I. TEPHRINECTES.

Lephris (non Latreille, 1804), Günther, 1862, Cat. Fish, IV, p. 406 (*Pleuronectes sinensis*, Lacépède), *Lephrinctes*, Günther, 1862, Ann. Mag. Nat. Hist., (3) 8, p. 475 (*Pleuronectes sinensis*, Lacépède), Wu, 1932, Thes. Faunt. Sci. Univ. Paris, A, 244 (268), p. 75.
Feltracra, Jordan, 1907, Proc. U. S. Nat. Mus., XXXI, p. 279 (*Pleuronectes sinensis*, Lacépède)

Body oblong, compressed. Eyes normally on the left side, separated by a very narrow, naked concave space. Olfactory laminae rather numerous, arranged transversely to a long central rachis. Mouth of moderate size, the length of the maxillary more than $\frac{1}{2}$ that of head, jaws and dentition about equally developed on both sides, bands of small conical teeth in both jaws, vomer toothless. Gill-rakers short, broad, with spinate margins, lower pharyngeals each with several rows of small conical teeth. Dorsal fin commencing well behind posterior nostril of blind side and above middle of upper eye, its anterior rays much more widely separated

than those which follow; all the rays branched, not scaled. Pectoral fins unequal, that of ocular side larger; middle rays branched. Pelvic fins short-based, subequal and subsymmetrical. Scales small, feebly ctenoid on ocular side, cycloid on blind side. Lateral line equally developed on both sides of body, with a distinct curve above the pectoral fin; a supratemporal branch: tubules branched. Vent a little on ocular side, just in front of anal fin. Vertebrae 27 (10 + 17).

A single species from China.

1. *TEPHRINECTES SINENSIS* (Lacepède).

Pleuronectes sinensis, Lacepède, 1802, Hist. Nat. Poiss., iv, pp. 595, 638, pl. xiv, fig. 1.

Platessa sinensis, Cloquet, 1826, Dict. Sci. Nat., xli, p. 405.

Platessa chinensis, Gray, 1834, Illustr. Indian Zool., pl. xciv, fig. 1; Richardson, 1840, 15 Rept. Brit. Assoc. (Cambr., 1845), p. 277.

Platessa chinensis var. *caeruleo-oculata*, Richardson, 1840, *loc. cit.*, p. 277.

Platessa vclafracta, Richardson, 1846, *loc. cit.*, p. 278.

Tephris sinensis, Günther, 1862, Cat. Fish., iv, p. 406; Jordan and Seale, 1905, Proc. Davenport Acad. Sci., x, p. 16, pl. xi; Seale, 1914, Philipp. J. Sci., ix, p. 78.

Tephrinectes sinensis, Günther, 1862, Ann. Mag. Nat. Hist., (3) x, p. 475; Oshima, 1927, Japan J. Zool., Trans. Abstr., i (5), p. 192; Chabanaud, 1929, Bull. Mus. Hist. Nat. Paris, (2) 1, p. 370; Wu, 1932, Thés. Facult. Sci. Univ. Paris, A. 244 (268), p. 75.

Vclifracta sinensis, Jordan, 1907, Proc. U.S. Nat. Mus., xxxii, p. 239.

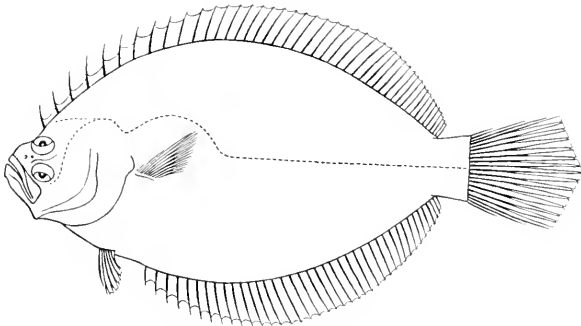


FIG. 32.—*Tephrinectes sinensis*. B.M. (N.H.) 65.5.2.29. $\times \frac{2}{3}$.

Depth of body about twice in the length, length of head $3\frac{1}{4}$ to $3\frac{3}{4}$. Upper profile of head distinctly concave above eyes. Snout as long as or longer than eye, diameter of which is $5\frac{1}{2}$ to nearly 6 in length of head; upper eye in advance of lower and meeting edge of head. Maxillary extending to below middle of eye or beyond, length $2\frac{1}{2}$ to $2\frac{3}{4}$ in that of head; lower jaw scarcely projecting, about $\frac{1}{2}$ head. 10 or 11 gill-rakers on lower part of anterior arch. 76 to 80 scales in lateral line. Dorsal 46-49. Anal (34) 36-39; first interhaemal spine not projecting. Pectoral of ocular side with 12 or 13 rays, length $1\frac{3}{4}$ in that of head. Pelvics 6. Caudal with 20 rays (14 branched), double-truncate; caudal peduncle nearly twice as deep as long

Brownish, head and body with a number of small dark spots, with or without pale margins, median fins blotched and spotted with darker.

TYPE.—Not traced¹

DISTRIBUTION.—Chinese seas; coast of Indo-China.

SPECIMENS EXAMINED:

2 (300 mm), stuffed.	China.	Reeves.
1 (188 ..)	"	Swinhoe.
1 (139 ..)	Anov, China.	Chen.
1 (185 ..)	"	Haslar Coll.

This species appears to be indifferently sinistral or dextral.

Genus 2. THYSANOPSETTA.

Thysanopsetta, Gunther, 1880, Shore Fishes "Challenger", p. 22 [*Thysanopsetta naresi*, Gunther].

Body rather elongate, compressed. Eyes on the left side, separated by a narrow, flat, scaled space. Olfactory laminae few in number, radiating from a short central rachis. Mouth of moderate size, the length of the maxillary nearly $\frac{1}{2}$ that of head, jaws and dentition about equally developed on both sides, rather broad bands of small conical teeth in both jaws; vomer toothless. Margin of gill-cover fringed; gill-rakers long, slender, lower pharyngeals each with several rows of small conical teeth. Dorsal fin commencing above nostrils of blind side and just in front of upper eye, anterior rays close together; all the rays simple, not scaled. Pectoral fins unequal, that of ocular side larger; rays all simple. Pelvic fins short-based, subequal and subsymmetrical. Scales small, ctenoid on both sides of body. Lateral line equally developed on both sides of body, with a very slight curve above the pectoral fin, no supratemporal branch, tubules simple. A prominent flat lobe (? including the urino-genital papilla) behind the pelvic fin of ocular side and above the commencement of the anal fin; vent a little on blind side.

A single species from south-eastern South America.

The relationships of this genus are somewhat obscure, but it may conveniently be placed near *Tephymectes*, with which it agrees in the bands of small teeth and unscaled dorsal and anal rays. It may be readily distinguished, however, by the absence of a curve in the lateral line, the more anterior origin of the dorsal fin, and by the simple median fin-rays, long, slender gill-rakers, etc.

1. THYSANOPSETTA NARESI, Gunther.

Thysanopsetta naresi, Gunther, 1880, Shore Fishes "Challenger", p. 22, pl. xi, fig. 5; DeLin, 1901, Rev. chil. Hist. Nat., iv, (1900), p. 104; Dollo, 1904, Res. Voy. "Belgica", Zool., Poiss., p. 91; Norman, 1930, "Discovery" Reports, ii, p. 35b.

Depth of body $2\frac{1}{2}$ to $2\frac{1}{2}$ in the length, length of head 4 to 5. Upper profile of head generally a little notched in front of eyes. Snout shorter than eye, diameter of which is 3 to $3\frac{1}{2}$ in length of head and more than twice the interorbital width, upper eye a little in advance of lower, and close to edge of head. Maxillary extending to below middle of eye or not quite as far, length a little more than 2 in that of head, lower jaw scarcely projecting, $1\frac{2}{3}$ to nearly 2 in head. 20 to 23 gill-rakers on lower part of anterior arch. 67 to 72 scales in lateral line. Dorsal 84-90. Anal 61-66; first interhaemal spine not projecting. Pectoral of ocular side with 9 or 10 rays, length about $\frac{1}{2}$ that of head. Pelvics 6. Caudal with 15 simple rays, rounded, caudal peduncle short. Brownish or greyish, mottled and spotted with darker, and

¹ I am informed by Prof. I. Roule and Mr. P. Chabanaud that the types of fishes described by Cuvèrte are not now to be found in the collections of the Paris Museum.

with small dark spots forming fine irregular lines running along the body between the series of scales; all the fin-rays finely dotted with brown or black.

TYPE.—British Museum (Nat. Hist.). Reg. No. 79.5.14.58.

DISTRIBUTION.—Magellan-Falkland Islands region of south-eastern South America.

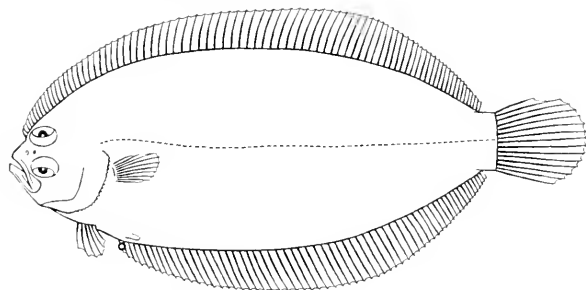


FIG. 33.—*Thysanopsetta narest*. B.M. (N.H.) 79.5.14.58. ♂.

SPECIMENS EXAMINED :

1 (175 mm.).	Holotype.	Off C. Virgins, Argentine, 55 fms.	" Challenger."
2 (160 ,,).		" " " "	" "
4 (63-132 mm.).		" " " " 45-44 fms.	" W. Scoresby "
2 (41-61 ,,).		West of the Falkland Is., 79-78 fms.	" "
2 (100-127 ,,).		Off E. Falkland Is., 57-63 fms.	" Discovery "
10 (34-80 ,,).		N.W. of the Falkland Is., 52 fms.	" W. Scoresby "
		[From stomach of <i>Merluccius</i> .]	
5 (37-45 ,,).		N.W. of the Falkland Is., 55-58 fms.	" "
1 (142 mm.).		N. of Falkland Is., 120-73 fms.	" "
2 (70-75 mm.).		" " " " 63-62 fms.	" "

Genus 3. HIPPOGLOSSINA.

Hippoglossina, Steindachner, 1876, SitzBer. Akad. Wiss. Wien, lxxiv (1), p. 13 [*Hippoglossina macrops*, Steindachner]; Jordan and Evermann, 1898, Bull. U.S. Nat. Mus., xlvii (3), p. 2029.

Body ovate, compressed. Eyes normally on the left side,¹ separated by a bony ridge. Olfactory laminae not numerous, radiating from a rather short central rachis. Mouth of moderate size or large, the length of the maxillary more than $\frac{1}{2}$ that of head; jaws and dentition about equally developed on both sides; teeth small, pointed, not much enlarged anteriorly, uniserial in both jaws; vomer toothless. Gill-rakers rather long and slender; lower pharyngeals each with numerous rows of minute, pointed teeth. Dorsal fin commencing well behind posterior nostril of blind side and above middle of eye; most of the rays simple, scaled on both sides. Anal fin preceded by projecting tip of first interhæmal spine. Pectoral fins unequal, that of ocular side larger, but not prolonged; middle rays branched. Pelvic fins short-based, subequal and subsymmetrical. Scales small, ctenoid on ocular side, ctenoid

¹ *H. stomata* and *H. macrops* are indifferently dextral or sinistral.

or cycloid on blind side. Lateral line equally developed on both sides of body, with a distinct curve above the pectoral fin; no distinct supratemporal branch. Vent a little on blind side, in front of anal fin.

Three species from the Pacific coast of Lower California, Central and north-western South America.

SYNOPSIS OF THE SPECIES.

- I. Maxillary to below posterior part of eye, 2 to $2\frac{1}{4}$ in head, dorsal 67-70, anal 52-54; 13 or 14 gill-rakers on lower part of anterior arch 1. *stomata*.
- II. Maxillary to below middle of eye or a little beyond, $2\frac{1}{2}$ to $2\frac{3}{4}$ in head.
- A. Dorsal 65-67, anal 51-52; highest rays of dorsal about 2 in head; 12 gill-rakers on lower part of anterior arch 2. *macrops*.
- B. Dorsal 60-63, anal 47-49; highest rays of dorsal 2! in head, 8 or 9 gill-rakers on lower part of anterior arch 3. *bolmani*.

HIPPOGLOSSINA STOMATA, Eigenmann & Eigenmann.

Hippoglossina stomata, Eigenmann and Eigenmann, 1890, Proc. Calif. Acad. Sci., (2) III, p. 22; Jordan and Evermann, 1898, Bull. U.S. Nat. Mus., XLVII (3), p. 2620; Starks and Morris, 1907, Univ. Calif. Pub. Zool., III (11), p. 242; Gilbert, 1915, Proc. U.S. Nat. Mus., XLVI, p. 377; Hubbs, 1916, Univ. Calif. Pub. Zool., XVI (13), p. 168; Starks, 1918, Calif. Fish Game, IV (4), p. 7, fig. 87.

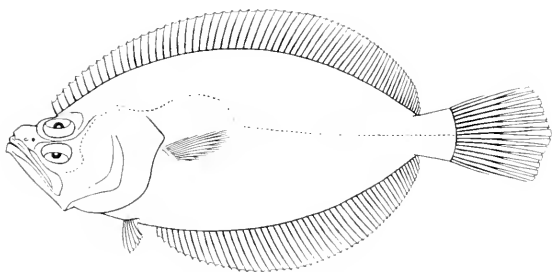


FIG. 34.—*Hippoglossina stomata*. B.M. (N.H.) 915: 19, 164.

Depth of body $2\frac{1}{2}$ to $2\frac{3}{4}$ in the length, length of head $2\frac{1}{2}$ to $3\frac{1}{4}$. Snout as long as or a little longer than eye, diameter of which is about $\frac{1}{5}$ in length of head, lower eye a little in advance of upper. Maxillary extending to below posterior part of eye, length 2 to $2\frac{1}{2}$ in that of head, lower jaw $1\frac{1}{2}$ to $1\frac{3}{4}$ in head. Gill-rakers long, slender; 13 or 14 on lower part of anterior arch. About 80 scales in lateral line. Dorsal 67-70; highest rays more than $\frac{1}{2}$ length of head. Anal 52-54. Pectoral of ocular side with 11 rays, length about 2 in that of head. Pelvics 6. Caudal with 17 rays (13 branched), rounded or double-truncate, caudal peduncle about as deep as long. Brownish, with numerous spots of bluish, pale or darker brown, five pairs of large dark brown ocelli near upper and lower edges of body, each alternate one longer and

more conspicuous, fins profusely mottled with lighter and darker, pectoral fin barred; a dark spot above and below on the caudal peduncle immediately in front of base of fin, clearly visible on blind side.

TYPE.—United States National Museum. No. 41905.

DISTRIBUTION.—Southern California.

SPECIMENS EXAMINED:

1 (320 mm.). Co-type.

San Diego.

Eigenmann.

3 (73-115 mm.).

California.

U.S. Nat. Mus.

2. HIPPOGLOSSINA MACROPS, Steindachner.

Hippoglossina macrops, Steindachner, 1876, SitzBer. Akad. Wiss. Wien, lxxiv (1), p. 13, pl. III; Gunther, 1881, Proc. Zool. Soc. London, p. 21; Jordan and Goss, 1889, Rep. U.S. Com. Fish., xiv (1886), p. 242; Jordan and Evermann, 1898, Bull. U.S. Nat. Mus., xlvii (3), p. 2621; Abbott, 1899, Proc. Acad. Nat. Sci. Philad., p. 475.

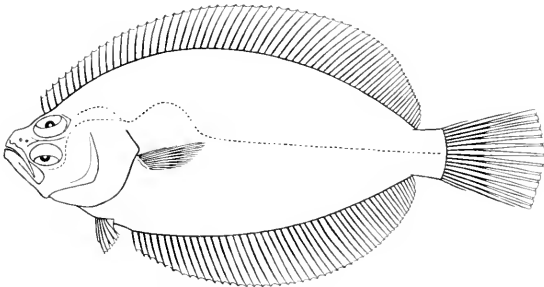


FIG. 35.—*Hippoglossina macrops*. B.M. (N.H.) 79.8.20.5. · 1/2.

Depth of body $2\frac{1}{4}$ to $2\frac{3}{4}$ in the length, length of head 3 to $3\frac{1}{2}$. Snout shorter than eye, diameter of which is $3\frac{3}{4}$ to nearly 4 in length of head; lower eye a little in advance of upper. Maxillary extending to below middle of eye or a little beyond, length $2\frac{2}{3}$ to $2\frac{1}{2}$ in that of head; lower jaw 2 to $2\frac{1}{4}$ in head. Gill-rakers long, slender; 12 on lower part of anterior arch. 76-79 scales in lateral line. Dorsal 65-67; highest rays about $\frac{1}{2}$ length of head. Anal 51-52. Pectoral of ocular side with 10 or 11 rays, length $1\frac{1}{8}$ to $2\frac{1}{2}$ in that of head. Pelvics 6. Caudal with 17 rays (13 branched), rounded; caudal peduncle deeper than long. Brownish, with obscure darker spots and blotches on head, body and fins.

TYPE.—Vienna Museum.

DISTRIBUTION.—Coast of Chile.¹

SPECIMENS EXAMINED:

2 (132, 205 mm.).

Trinidad Channel, Magellan Strait.

Coppinger ("Alert").

¹ As suggested by Abbott, the type locality (Mazatlan) given by Steindachner is almost certainly incorrect.

3 HIPPOGLOSSINA BOLLMANI, Gilbert

Hippoglossina macrops (non Stendachner), Jordan and Bollman, 1890, Proc. U. S. Nat. Mus., xii, (1890), p. 178.

Hippoglossina bollmani, Gilbert, 1891, Proc. U. S. Nat. Mus., xiii, (1890), p. 122; Jordan and Evermann, 1898, Bull. U. S. Nat. Mus., xlvii (3), p. 2021; Meek and Hildebrand, 1928, Field Mus. Publ. Chicago, Zool. Ser., xv, No. 249, p. 973.

Hippoglossina vagrans, Garman, 1899, Mem. Mus. Comp. Zool., xxiv, p. 221.

Depth of body $2\frac{2}{3}$ to $2\frac{3}{4}$ in the length, length of head 3. Snout shorter than eye, diameter of which is $3\frac{2}{3}$ to 4 in length of head; lower eye slightly in advance of upper. Maxillary extending about to below middle of eye, length $2\frac{1}{3}$ to $2\frac{2}{3}$ in that of head, lower jaw about 2 in head. Gill-rakers moderately long and slender; 8 or 9 on lower part of anterior arch. 70-75 scales in lateral line. Dorsal 60-63; highest rays 2 $\frac{1}{2}$ in length of head. Anal 47-49. Pectoral of ocular side 2 in length of head.

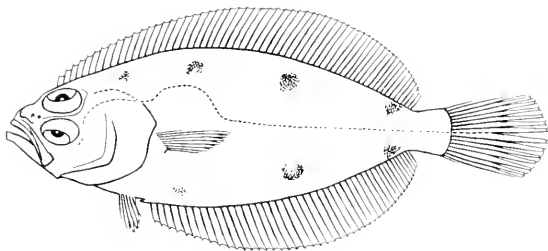


FIG. 36.—*Hippoglossina bollmani*. U.S.N.M. 41147. ♂.

Greyish brown, with a number of small, round, bluish spots, a series of four large black spots near upper edge of body and 2 or 3 similar spots near lower edge; median fins dusky, with small whitish spots, pectoral and pelvic dusky.

TYPE.—United States National Museum No. 41143.

DISTRIBUTION.—Pacific coast of Colombia.

Numerous specimens of this species were dredged by the "Albatross" (Stn. 2805) at a depth of $51\frac{1}{2}$ fathoms. The largest specimen in the collection of the United States National Museum is 160 mm. in total length.

Col. Tenison has examined the types of *H. vagrans* in the Museum of Comparative Zoology, No. 28549, and informs me that this species is identical with *H. bollmani*.

Genus 4. LIOGLOSSINA

Lioglossina, Gilbert, 1891, Proc. U. S. Nat. Mus., xiii, (1890), p. 122 [*Lioglossina tetrophthalmus*, Gilbert, Jordan and Evermann, 1898, Bull. U. S. Nat. Mus., xlvii (3), p. 2022.

Close to *Hippoglossina*, but the scales are all cycloid, the first interhaemal spine is feeble and does not project in front of the anal fin, and the gill-rakers are rather short and thick.

A single species from the Gulf of California.

1. *LIGLOSSINA TETROPHthalmus*, Gilbert.

Lioglossina tetrophthalmus, Gilbert, 1891, *tom. cit.*, p. 122; Jordan and Evermann, 1898, *Bull. U.S. Nat. Mus.*, xlvii (3), p. 2622.

Depth of body $2\frac{1}{2}$ in the length, length of head $3\frac{1}{4}$. Snout about as long as eye, diameter of which is $(3\frac{1}{2})$ 5 in length of head; lower eye slightly in advance of upper. Maxillary extending nearly to below posterior margin of eye, length $2\frac{1}{2}$ in that of head; 9 gill-rakers on lower part of anterior arch. 97 scales in lateral line. Dorsal 76-83; commencing above anterior part of eye, highest rays 3 in length of head. Anal 58-62. Pectoral of ocular side with 11 rays, length less than $\frac{1}{2}$ that of head. Pelvics 6. Caudal sharply double-truncate; caudal peduncle $1\frac{1}{2}$ times as deep as long. Dusky brownish, with two pairs of conspicuous round black spots edged with grey, the anterior pair above and below middle of straight part of lateral line, the posterior smaller, nearer edges of body, and opposite hinder parts of dorsal and anal

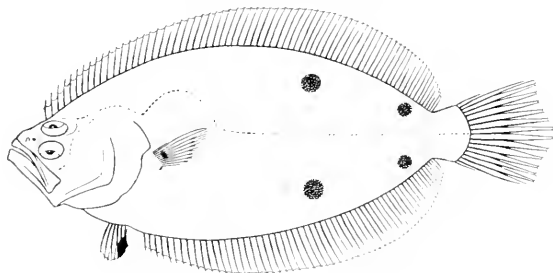


FIG. 37.—*Lioglossina tetrophthalmus*. U.S.N.M. 47266. — 4.

fins; median fins obscurely blotched with darker; pelvic fin of ocular side with a conspicuous black blotch margined with white; pectoral with a dark spot near its base.

TYPE.—United States National Museum. No 47268.

DISTRIBUTION.—Gulf of California

The two types were collected by the "Albatross" at Stations 3014 and 3016, at depths of 29 and 76 fathoms. The type specimen figured measures 320 mm. in total length

Genus 5 PARALICHTHYS.

Paralichthys, Girard, 1858, U.S. Pacific R.R. Survey, x. Fishes, p. 146 [*Pleuronectes maculosus*,

Girard]; Jordan and Evermann, 1898, *Bull. U.S. Nat. Mus.*, xlvii (3), p. 2624.

Cropsetta, Gill, 1863, *Proc. Acad. Nat. Sci. Philad.*, (1862), p. 330. *Hippoglossus californicus*, Ayres].

Chanopsetta, Gill, 1861, *Proc. Acad. Nat. Sci. Philad.*, suppl. (Cat. Fish. E. Coast N. Amer.), p. 50 [*Pleuronectes oblongus*, Mitchell]; Gill, 1864, *Proc. Acad. Nat. Sci. Philad.*, p. 218. *Platessa ocellaris*, De Kay.

Body ovate or oblong, compressed. Eyes normally on the left side,¹ separated by a bony ridge or flat space of moderate width. Olfactory laminae in moderate

¹ *P. californicus* is almost as frequently dextral as sinistral.

number, radiating from or arranged transversely to a fairly long central rachis. Mouth large, the length of the maxillary $\frac{1}{2}$ or nearly $\frac{1}{2}$ that of head. Jaws and dentition about equally developed on both sides; teeth strong or of moderate size, rather slender and sharply pointed, more or less enlarged anteriorly, uniserial in both jaws; vomer toothless. Gill-rakers of moderate length or rather long, generally slender; lower pharyngeals each with numerous rows of minute pointed teeth. Dorsal fin commencing above or immediately behind posterior nostril of blind side and in front of or above anterior part of eye; most of the rays simple, scaled on both sides. Tip of first interhæmal spine feeble, not projecting in front of anal fin. Pectoral fins unequal, that of ocular side larger, middle rays branched, but not prolonged. Pelvic fins short-based, subequal and subsymmetrical. Scales small, feebly ctenoid or cycloid, small supplementary scales sometimes present. Lateral line equally developed on both sides of body, with a distinct curve above the pectoral fin; no distinct supratemporal branch. Vent on blind side, in advance of or above first ray of anal fin. Vertebrae 34 to 41 (10—11 = 24—30).

Nineteen species from both coasts of America and from China and Japan.¹

SYNOPSIS OF THE SPECIES.

Atlantic Species.

- I (12) 13 to 17 gill-rakers on lower part of anterior arch.
- A. Dorsal 70-74 (77), anal 52-57, teeth rather small 1. *obignyana*
- B. Dorsal (80) 87-95, anal (60) 65-75, teeth strong 2. *dentatus*.
- II 7 to 11 (12) gill-rakers on lower part of anterior arch
- A. Eyes separated by a flat space (except in very young), $4\frac{1}{2}$ to 8 in head.
1. Scales all cycloid
- a. Origin of dorsal just behind posterior nostril of blind side.
- α. Interorbital width equal to or a little less than eye, which is $5\frac{1}{2}$ to 8 in head; 85 to 100 scales in lateral line 3. *lethostigma*.
- β. Interorbital width rarely more than $\frac{2}{3}$ eye, which is $4\frac{1}{2}$ to 6 in head; 70 to 82 scales in lateral line 4. *albigutta*
- γ. Interorbital width much less than eye, which is 5 to $5\frac{3}{4}$ in head; about 115 scales in lateral line 5. *squamulentus*
- b. Origin of dorsal above posterior nostril of blind side; interorbital width equal to eye, which is $6\frac{1}{2}$ to 8 in head; 73 to 77 scales in lateral line 6. *brasiliensis*
2. Scales ciliated; two distinct circular ocelli on body; about 100 scales in lateral line 7. *bicyclophorus*.
- B. Eyes separated by a narrow ridge, $3\frac{1}{2}$ to 5 in head
1. 88 to 95 scales in lateral line; eye 4 to 5 in head
- a. Depth $2\frac{1}{4}$ to $2\frac{3}{4}$ in length; 4 distinct circular ocelli on body 8. *oblongus*
- b. Depth $2\frac{1}{4}$ in length; 3 distinct circular ocelli on body 9. *isocetes*.
2. About 90 scales in lateral line; eye $3\frac{1}{2}$ to $3\frac{3}{4}$ in head; 2 or 3 distinct circular ocelli on body 10. *tricellatus*.

¹ The following species of *Paralichthys* have recently been described by Ginsburg, but his paper was received too late for inclusion in this monograph.

1. *Paralichthys schmitti*, Ginsburg, 1932, Proc. U.S. Nat. Mus., lxxxii (20), p. 1. Described from a single example (U.S.N.M., No. 88831), 455 mm. in total length, from Juan Fernandez Island, Chile. Probably identical with *P. hilgendorfi*, Steadachner.

Paralichthys tropicus, Ginsburg, 1933, *ibid.*, p. 5. Described from a single example (U.S.N.M., No. 34919), 321 mm. in total length, from off Trinidad, West Indies, 31 fathoms. Very close to *P. squamulentus*, Jordan and Gilbert.

Pacific Species.

- I. 94 to 140 scales in lateral line; dorsal 66-84, anal 51-64; eye 4 to 8 in head.
- A. 20 gill-rakers on lower part of anterior arch; scales of ocular side ctenoid, those of blind side cycloid.
1. Depth $2\frac{1}{2}$ to $2\frac{3}{4}$ in length; dorsal 69-74, anal 52-57 . . . 11. *californicus*.
 2. Depth $2\frac{1}{2}$ in length; dorsal 72-83, anal 58-63 . . . 12. *æstuaricus*.
- B. 15 to 18 gill-rakers on lower part of anterior arch; scales of ocular side ctenoid, those of blind side cycloid.
1. Depth 2 to $2\frac{1}{2}$ in length; maxillary (in adults) to a little beyond posterior edge of eye . . . 13. *adpersus*.
 2. Depth $2\frac{1}{2}$ to $2\frac{3}{4}$ in length; maxillary (in adults) to well beyond posterior edge of eye . . . 14. *olivaceus*.
- C. 12 to 14 gill-rakers on lower part of anterior arch; scales all cycloid . . . 15. *woolmani*.
- D. 9 to 11 gill-rakers on lower part of anterior arch; scales of ocular side ctenoid, those of blind side cycloid.
1. 140 scales in lateral line; maxillary to beyond eye, which is $7\frac{2}{3}$ in head . . . 16. *fernandezianus*.
 2. 94 scales in lateral line; maxillary to below posterior edge of eye, which is $5\frac{1}{2}$ in head . . . 17. *hilgendorfi*.
- II. About 80 scales in lateral line; dorsal 72-73, anal 56; 18 to 21 gill-rakers on lower part of anterior arch; eye $4\frac{1}{2}$ to $5\frac{1}{4}$ in head . . . 18. *microps*.
- III. 75 scales in lateral line; dorsal 87, anal 70; 20 gill-rakers on lower part of anterior arch; eye 3 in head . . . 19. *caruleosticta*.

1. PARALICHTHYS ORBIGNYANA (Valenciennes).

Platessa orbignyana, (Valenciennes) Jenyns, 1842, Zool. Voy. "Beagle", IV, Fish, p. 137; Valenciennes, 1847, Voy. Amér. Mérid., V, 2, Poissons, p. 10, pl. xvi, fig. 1.

Paralichthys brasiliensis (non Ranzani), Jordan and Goss, 1889, Rep. U.S. Com. Fish. xiv, (1886), p. 246; Berg, 1895, An. Mus. nac. B. Aires, iv, p. 77; Jordan and Evermann, 1898, Bull. U.S. Nat. Mus., xlvii (3), p. 2629; Fowler, 1927, Proc. Acad. Nat. Sci. Philad., lxxxviii, (1926), p. 273.

Pseudorhombus dentatus, Perugia, 1891, Ann. Mus. Stor. nat. Genova, (2) x [xxx], p. 629.

Paralichthys brasiliensis (part), Ribeiro, 1915, Arch. Mus. nac. Rio de J., xvii, Heterosomata, p. 13.

Xystrearys ribeiroi, Fowler and Bean, 1923, Proc. U.S. Nat. Mus., lxxiii (19), p. 26.

Depth of body $2\frac{1}{4}$ to $2\frac{2}{3}$ in the length, length of head $3\frac{1}{4}$ to nearly 4. Upper profile of head straight or slightly concave. Snout longer than eye, diameter of which is 6 to 7 in length of head and greater than interorbital width; eyes separated by a flat space, their anterior margins about level. Maxillary extending to a little beyond posterior edge of eye, length a little more than 2 in that of head; lower jaw somewhat projecting, $1\frac{2}{3}$ to $1\frac{3}{4}$ in head. Teeth rather small, canines of moderate size. 16 or 17 gill-rakers on lower part of anterior arch. Scales all cycloid; 90 to 100 in lateral line; very few supplementary scales. Dorsal 70-74 (77); commencing above posterior nostril of blind side and just in front of eye. Anal 52-57. Pectoral of ocular side with 11 rays, length $2\frac{1}{2}$ to $2\frac{3}{4}$ in that of head. Caudal double-truncate; caudal peduncle more than twice as deep as long. Brownish, mottled and spotted with darker, and sometimes also with pale spots; pectoral fin not very distinctly barred.

TYPE.—Not traced.

DISTRIBUTION.—Coasts of Brazil, Uruguay and Argentina.

SPECIMENS EXAMINED:

2 (227, 275 mm.).	Rio de Janeiro.	Mus. Comp. Zool.
3 (105-325 ,, ,).	Rio Grande do Sul.	Ihering.
1 (170 mm.).	Montevideo.	Stanford Univ.
1 (210 ,, ,), skin.	Bahia Blanca.	"Beagle."

¹ The fact that Jenyns quotes Valenciennes' name in 1842 appears to be due to the earlier publication of the Atlas of D'Orbigny's voyage.

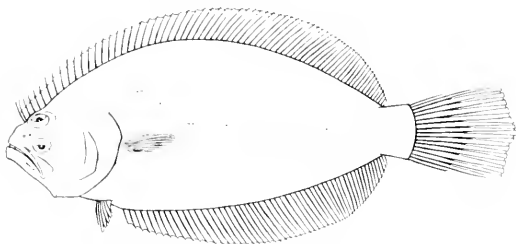


FIG. 38. *Paralichthys obliquiana*. B.M. (N.H.) 85, 2, 1, 74. ♀

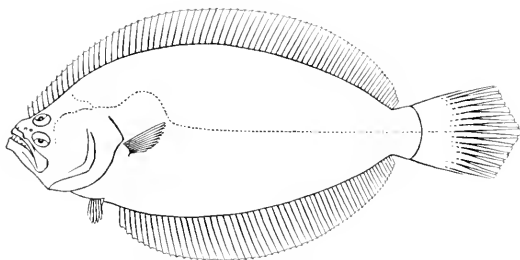


FIG. 38a. *Paralichthys obliquiana*. Type of *Xystreus riberoi*. U.S.N.M. 83494. ♀

Judging from a drawing of the type-specimen No. 83494 made by Col. Temson, *Xystreus riberoi*, Fowler and Bean, from Rio de Janeiro, is probably this species.¹ The proportions, scale and fin-ray counts, etc., are almost identical, but the drawing shows a distinct supratemporal branch of the lateral line.

2. PARALICHTHYS DENTATUS (Linnaeus).

SUMMER FLOUNDER

Pleuronectes dentatus, Linnaeus, 1760, Syst. Nat., ed. 12, p. 458; Mitchill, 1815, *Fl. Lit. Phil. Soc. N. York*, 1, p. 399.

Pleuronectes melanogaster, Mitchill, 1815, *loc. cit.*, p. 399.

Platessa ocellaris, De Kay, 1842, N.H. New York (Fish.), p. 399.

Pseudorhombus ocellaris, Günther, 1862, Cat. Fish., IV, p. 439.

Chernopsetta ocellaris, Gill, 1864, Proc. Acad. Nat. Sci. Philad., p. 278.

Pseudorhombus dentatus, Goode and Bean, 1886, Proc. U.S. Nat. Mus., 11, (1879), p. 122.

¹ This has now been confirmed by Prof. C. F. Hubbs, who informs me that he has examined the type in the United States National Museum.

Paralichthys ocellaris, Jordan and Gilbert, 1883, Proc. U.S. Nat. Mus., v, (1882), p. 617.

Paralichthys ophyras, Jordan and Gilbert, 1883, Bull. U.S. Nat. Mus., xvi, p. 822.

Paralichthys dentatus, Goode, 1884, Nat. Hist. Aquat. Anim. (Fisheries Fish. Indust. U.S., I), p. 178, pl. xlii; Jordan and Goss, 1889, Rep. U.S. Com. Fish., xiv, (1886), p. 246; Jordan and Evermann, 1898, Bull. U.S. Nat. Mus., xlvii (3), p. 2629, pl. cccclxxiii, fig. 922; Bean, 1902, Ann. Rep. Forest Fish Game Comm. N.Y., vi, (1901), p. 472; Bigelow and Welsh, 1925, Bull. U.S. Bur. Fish., xl (1), (1924), p. 491, fig. 249; Nichols and Breder, 1927, Zoologica, ix, p. 179, fig.; Hildebrand and Schroeder, 1928, Bull. U.S. Bur. Fish., xlii (1), (1927), p. 165, fig. 86.

EGGS, LARVÆ AND YOUNG.

Agassiz, 1878, Proc. Amer. Acad., xiv, p. 1, figs.; Hildebrand and Cable, 1931, Bull. U.S. Bur. Fish., xlvi, (1930), p. 464, figs.

Depth of body about $2\frac{1}{4}$ in the length, length of head $3\frac{1}{2}$ to 4. Upper profile of head straight. Snout longer than eye, diameter of which is 6 to 7 in length of head and somewhat greater than interorbital width; eyes separated by a flat space, their

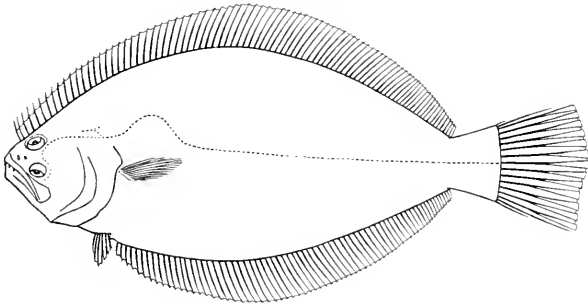


FIG. 39.—*Paralichthys dentatus*. B.M. (N.H.) 79.10.9.65. 4

anterior margins about level. Maxillary extending to beyond posterior edge of eye, length about 2 in that of head; lower jaw not projecting, $1\frac{2}{3}$ to $1\frac{3}{4}$ in head. Teeth strong, canines of moderate size. 14 to 17 (occasionally 12 or 13)¹ gill-rakers on lower part of anterior arch. Scales all cycloid; about 108 in lateral line; supplementary scales present. Dorsal (80) 87-95; commencing immediately behind posterior nostril of blind side and just in front of eye. Anal (60) 65-75. Pectoral of ocular side with 11 rays, length about 2 in that of head. Caudal double-truncate; caudal peduncle $1\frac{1}{4}$ to $1\frac{1}{2}$ times as deep as long. Brownish or greyish, variously spotted with white and dark brown; generally a row of 4 or 5 round dark spots, sometimes ocellated, along upper edge of body, and a similar row of 3 or 4 along lower edge, a pair above and below anterior part of lateral line, and a single spot on middle of straight portion; these spots are rarely absent, but sometimes inconspicuous; median fins uniform or with indistinct and irregular darker markings.

TYPE.—Linnean Society of London ²

¹ See Hildebrand and Cable, 1931, *loc. cit.*, p. 465.

² This is a well-preserved skin, 280 mm. in total length, bearing a label in Garden's handwriting. A second skin, 296 mm. long, from the same source, is also in the possession of the Society. Both probably came from South Carolina. [See Gunther, 1859, Proc. Linn. Soc. London, (Oct.), pp. 29, 37.]

DISTRIBUTION Atlantic coast of North America, from the coast of Maine¹ to Florida

SPECIMENS EXAMINED:

1 (440 mm l.)	Woods Hole, Mass.	U.S. Nat. Mus.
2 (128, 130 mm l.)	Hampton Roads	Mus. Comp. Zool
3 (35-85 " " l.)	Charleston Harbour, S. Carolina	Charleston Mus.
4 (110-140 " " l.)	" " " "	" " "

Also 2 young specimens from Florida (Mus. Comp. Zool.), and the type and second specimen (Linnæan Soc.).

This species is said to attain a length of about 3 feet and a weight of about 15 pounds

Hussakof (1914, Bull. Amer. Mus. Nat. Hist., xxxiii, p. 95, figs.) has described two examples of this species partially pigmented on the blind side (see p. 24).

Pleuronectes melanogaster appears to have been an ambicolorate example of this species

3. PARALICHTHYS LETHOSTIGMA, Jordan and Gilbert.

SOUTHERN FLOUNDER †

Platesa oblonga (non Mitchell), De Kay, 1842, N.H. New York (Fish), p. 299, pl. xlviii, fig. 139.

Pseudorhombus oblongus, Gunther, 1862, Cat. Fish., iv, p. 426.

Pseudorhombus vora (part), Gunther, 1862, *loc. cit.*, p. 429.

Chenopsella dentata, Gill, 1864, Proc. Acad. Nat. Sci. Philad., p. 218.

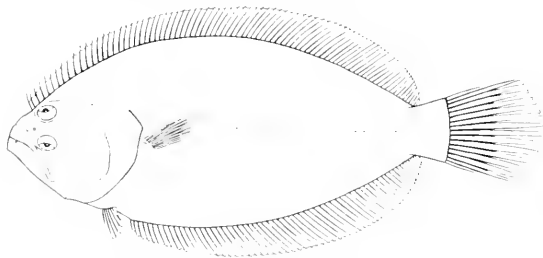


FIG. 39. *Paralichthys lethostigma*. B.M. (N.H.) 1923.12.18.11 3.

Pseudorhombus dentatus, Goode, 1880, Proc. U.S. Nat. Mus., ii, (1879), p. 110; Goode and Bean, 1880, *loc. cit.*, p. 123.

Paralichthys dentatus, Jordan and Gilbert, 1883, Proc. U.S. Nat. Mus., v, (1882), pp. 502, 617; Jordan and Gilbert, 1883, Bull. U.S. Nat. Mus., xvi, p. 822.

Paralichthys lethostigma, Jordan and Gilbert, 1885, Proc. U.S. Nat. Mus., vii, (1884), p. 237; Jordan and Goss, 1889, Rep. U.S. Com. Fish., xiv, (1886), p. 247, pl. iii, fig. 7; Jordan and Evermann, 1898, Bull. U.S. Nat. Mus., xlvii (3), p. 2030; Bean, 1902, Ann. Rep. Forest Fish Game Comm. N.Y., vi, (1901), p. 473.

EGGS, LARVAE AND YOUNG

Hildebrand and Cable, 1931, Bull. U.S. Bur. Fish., xlvi, (1930), p. 194, figs.

¹ Occasionally as far north as Cape Cod.

Depth of body $2\frac{1}{2}$ to $2\frac{3}{4}$ in the length, length of head $3\frac{1}{2}$ to $3\frac{3}{4}$. Upper profile of head nearly straight. Snout longer than eye, diameter of which is $5\frac{1}{2}$ to nearly 8 in length of head and (in adults) equal to or a little greater than interorbital width; eyes separated by a flat space, their anterior margins about level. Maxillary extending to beyond posterior edge of eye, length about 2 in that of head; lower jaw not projecting about $1\frac{1}{2}$ in head. Teeth strong, canines of moderate size. 9 to 11 (occasionally 8 or 12)¹ gill-rakers on lower part of anterior arch. Scales all cycloid: 85 to 100 in lateral line; supplementary scales present. Dorsal 78-93 (95); commencing immediately behind posterior nostril of blind side and just in front of eye. Anal (58) 60-74. Pectoral of ocular side with 11 or 12 rays, length about 2 in that of head. Caudal double-truncate; caudal peduncle twice or more than twice as deep as long. Dark olive brown, obscurely spotted and mottled with darker, and with traces of some white spots; median fins generally with round dusky spots.

TYPE.—Not traced.²

DISTRIBUTION.—Atlantic coast of America, from New York to Trinidad.

SPECIMENS EXAMINED:

1 (210 mm.).	North Carolina.	Amer. Mus. Nat. Hist.
1 (147 ,,).	Beaufort, North Carolina.	Ginsburg.
3 (150-230 mm.).	Charleston Harbour, South Carolina.	Charleston Mus.
1 (302 mm.).	Florida.	U.S. Nat. Mus.
12 (170-290 mm.).	Biloxi Bay to Horn Is., Mississippi.	Caribb. Biol. Lab.
1 (150 mm.).	Tobago.	Guppy.
2 (210, 330 mm.).	Two of —	Haslar Coll.
	the types of <i>P. vorax</i> .	

This species has been frequently confused with *P. dentatus*, from which it may be distinguished by the smaller number of gill-rakers, lower average number of dorsal and anal rays, and by the coloration.

4. PARALICHTHYS ALBIGUTTA, Jordan and Gilbert.

GULF FLOUNDER

Paralichthys albigutta, Jordan and Gilbert, 1883, Proc. U.S. Nat. Mus., v, (1882), p. 302; Jordan and Gilbert, 1883, Bull. U.S. Nat. Mus., xvi, p. 823; Jordan and Goss, 1889, Rep. U.S. Com. Fish., xiv, (1886), p. 248; Jordan and Evermann, 1898, Bull. U.S. Nat. Mus., xlvii (3), p. 2631.

EGGS, LARVÆ AND YOUNG.

Hildebrand and Cable, 1931, Bull. U.S. Bur. Fish., xlvi, (1930), p. 464, figs.

Perhaps identical with *P. lethostigma*, but with somewhat larger eye, narrower interorbital space, rather fewer dorsal and anal rays, and larger scales. Interorbital width rarely more than $\frac{2}{3}$ diameter of eye, which is $4\frac{1}{2}$ (young) to about 6 in length of head. 70 to 82 scales in lateral line. Dorsal (72) 74-80. Anal 56-62. Brownish or olivaceous, mottled and spotted with darker, and generally with numerous pale spots; young with 3 more or less distinct ocellated spots forming a triangle, a pair above and below the lateral line just behind the curve and the third on the middle of its straight portion; these spots frequently persisting in the adult; median fins with dark spots and blotches and with some smaller pale spots; pectoral finely spotted with brown.

TYPE.—United States National Museum.

DISTRIBUTION.—South Atlantic and Gulf coasts of the United States

SPECIMENS EXAMINED:

6 (75-90 mm.).	North Carolina.	Amer. Mus. Nat. Hist.
1 (295 mm.).	Cedar Key, Florida.	Jordan.
2 (232, 280 mm.).	S.W. Florida.	Amer. Mus. Nat. Hist.
1 (150 mm.).	Apalachicola Bay, Florida.	Ginsburg.

¹ See Hildebrand and Cable, 1931.

² No type specimen appears ever to have been designated.

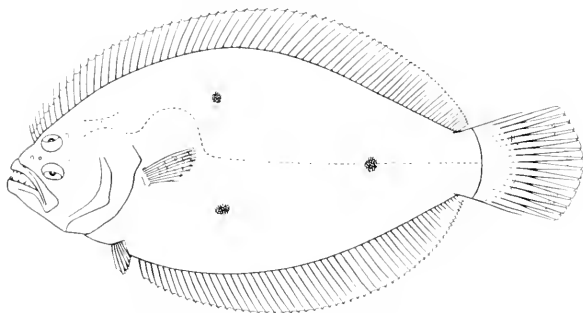


FIG. 41. *Paralichthys albigutta*. B.M. (N.H.) 1930.8.6.1. — 1/2

The confusion of this species with *P. lethostigma*, as well as with *P. dentatus*, makes it impossible adequately to disentangle the synonymy of the three species. Hildebrand and Cable (1931, *loc. cit.*), who have examined a large series of specimens from Beaufort, North Carolina, find themselves unable to recognise more than one form with a small number of gill-rakers, and it is possible that *lethostigma*, *albigutta* and *squamilentus* will eventually have to be regarded as representing one variable species. The size of the scales, however, a character which is not considered by these authors, seems to provide a means of distinguishing these forms, coupled with the size of the eye and the width of the interorbital space, as well as the average number of rays in the dorsal and anal fins.

This species is said to reach a smaller size than *lethostigma* or *dentatus*.

5. PARALICHTHYS SQUAMILENTUS, Jordan and Gilbert

Paralichthys squamilentus, Jordan and Gilbert, 1883, Proc. U.S. Nat. Mus., v, (1882), p. 303; Jordan and Gilbert, 1883, Bull. U.S. Nat. Mus., xvi, p. 823; Jordan and Goss, 1886, Rep. U.S. Com. Fish., xiv, (1886), p. 248; Jordan and Evermann, 1898, Bull. U.S. Nat. Mus., xlvii (1), p. 2031, pl. cclxxix, fig. 923.

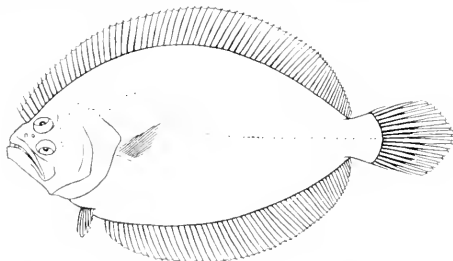


FIG. 42. *Paralichthys squamilentus*. B.M. (N.H.) 5, 12, 14, 59. — 1/2

Closely related to *P. albigitta*. Depth of body about 2 in the length, length of head $3\frac{1}{4}$ to $3\frac{3}{4}$. Upper profile of head nearly straight. Snout longer than eye, diameter of which is 5 to $5\frac{3}{4}$ in length of head and much greater than interorbital width; eyes separated by a flattish space, the upper a little in advance of lower. Maxillary extending to below posterior edge of eye or a little beyond, length 2 in that of head; lower jaw a little projecting, $1\frac{1}{2}$ in head. Teeth rather strong, canines large. 6 gill-rakers on lower part of anterior arch. Scales all cycloid; about 115 in lateral line; no supplementary scales. Dorsal 75-78; commencing immediately behind posterior nostril of blind side and just in front of eye. Anal 59-61. Pectoral of ocular side with 12 or 13 rays, length about $\frac{1}{2}$ that of head. Caudal rounded; caudal peduncle twice as deep as long. Brownish; the body and fins obscurely spotted with darker; caudal mottled with white; pectoral with dark cross-bars and some dark spots.

TYPE.—United States National Museum. No. 30862.

DISTRIBUTION.—South Atlantic and Gulf coasts of the United States.

SPECIMENS EXAMINED:

2 (119, 121 mm.).
1 (360 mm.).

Pensacola, Florida.
Dry Tortugas, Florida.

U.S. Nat. Mus.
Longley.

6. PARALICHTHYS BRASILIENSIS (Ranzani).

Hippoglossus brasiliensis, Ranzani, 1840, De Nov. Pisc., (2) [N. Comm. Ac. Sci. Inst. Bonon., v], p. 10, pl. III.

Rhombus aramaca, Castelnau, 1855, Anim. Nouv. Rares Amér. Sud, II, p. 78, pl. XI, fig. 3.

? *Pseudorhombus dentatus*, Gunther, 1862, Cat. Fish., IV, p. 425.

Pseudorhombus vorax (part), Gunther, 1862, *tom. cit.*, p. 429.

Pseudorhombus brasiliensis, Günther, 1869, Trans. Zool. Soc., vi, p. 429.

Paralichthys patagonicus, Jordan and Goss, 1889, Rep. U.S. Com. Fish., XIV, (1886), p. 248; Berg, 1895, Au. Mus. nac. B. Aires, IV, p. 77; Evermann and Kendall, 1909, Proc. U.S. Nat. Mus., XXXI, p. 107.

Paralichthys brasiliensis (part), Ribeiro, 1915, Arch. Mus. nac. Rio de J., XVII, Heterosomata, p. 13.

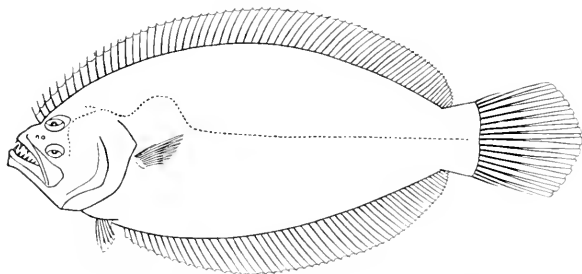


FIG. 43.—*Paralichthys brasiliensis*. One of the types of *Pseudorhombus vorax*. $\times \frac{1}{4}$.

Depth of body $2\frac{1}{2}$ to $2\frac{2}{3}$ in the length, length of head $3\frac{3}{4}$ to 4. Upper profile of head a little notched in front of upper eye. Snout longer than eye, diameter of which is $6\frac{1}{2}$ to 8 in length of head and about equal to interorbital width; eyes separated by a flat space, their anterior margins about level. Maxillary extending to a little beyond

posterior edge of eye, length about 2 in that of head; lower jaw a little projecting, $1\frac{1}{2}$ to $1\frac{2}{3}$ in head. Teeth strong, canines large. 10 or 11 gill-rakers on lower part of anterior arch. Scales all cycloid; 73 to 77 in lateral line; few supplementary scales. Dorsal 70-75; commencing above posterior nostril of blind side and well in front of eye. Anal 52-56. Pectoral of ocular side with 10 or 11 rays, length $1\frac{1}{2}$ to $2\frac{1}{2}$ in that of head. Caudal rounded or double-truncate; caudal peduncle about $1\frac{2}{3}$ times as deep as long. Brownish, indistinctly blotched or mottled with darker and with numerous small, more or less distinct, pale spots; often a dark spot at base of upper and lower rays of caudal fin; median fins with some large dark spots and with a number of smaller pale spots; pectoral with irregular dark cross-bars.

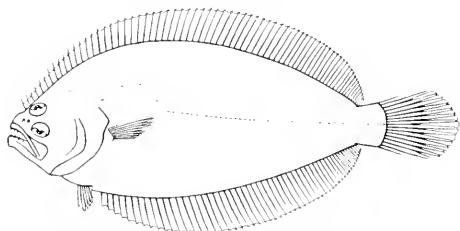


FIG. 44.—*Paralichthys brasiliensis*. Type of *P. patagonicus*. M.C.Z. 11399. $\times \frac{1}{2}$.

TYPE.—Istituto di Zoologia, Università di Bologna.

DISTRIBUTION.—Atlantic coast of South America, from southern Brazil to Patagonia.

SPECIMENS EXAMINED:

♀ 1 (670 mm.), stuffed.	Port Famine, Magellan Strait,	Zool. Soc. Coll.
♂ 1 (385 ..),	S. America.	Schomburgk.
♂ 1 (320 mm.).	—	—

There appears to be little doubt as to the identity of *P. patagonicus* with the species described by Ranzani as *brasiliensis*. The type of Jordan and Goss's species [Mus. Comp. Zool., No. 11399] has been examined by Col. Tension and is illustrated here. The proportionately larger eye ($5\frac{1}{4}$ in head) and narrower interorbital space are accounted for by the smaller size of the specimen.

7. PARALICHTHYS BICYCLOPHORUS, Ribeiro

Paralichthys bicyclophorus, Ribeiro, 1915, Arch. Mus. nac. Rio de J., xvii, Heterosomata, p. 14, fig.

Depth of body about $2\frac{1}{2}$ in the length, length of head nearly 4. Upper profile of head nearly straight. Snout longer than eye, diameter of which is $5\frac{1}{2}$ in length of head, and greater than interorbital width; eyes separated by a flat space, the lower a little in advance of upper. Maxillary extending almost to below posterior edge of eye. Teeth apparently of moderate size. 11 gill-rakers on lower part of anterior arch. Scales ciliated; 103 in lateral line, supplementary scales present. Dorsal 84, origin in front of eye. Anal 95. Pectoral of ocular side about 2 in length of head. Caudal double-truncate. Brownish, mottled and spotted with darker and with traces of paler markings; a large round black ocellus margined with paler below the

junction of the straight and curved portions of the lateral line, and a similar but smaller ocellus on the middle of the straight part.

TYPE.—Museu Nacional, Rio de Janeiro.

DISTRIBUTION.—Rio de Janeiro

This species is known only from the two types, each 330 mm. in total length

8. PARALICHTHYS OBLONGUS (Mitchill).

FOUR-SPOTTED FLOUNDER.]

Plewonectes oblongus, Mitchill, 1815, Tr. Lit. Phil. Soc. N. York, i, p. 391.

Platessa quadrocellata, Storer, 1848, Proc. Boston Soc. Nat. Hist., ii, (1847), p. 242; Storer, 1867, Hist. Fish. Massach., p. 203, pl. xxxi, fig. 3.

Platessa quadrocellaris, Gill, 1861, Proc. Acad. Nat. Sci. Philad., Suppl. (Cat. Fish. E. Coast N. Amer.), p. 51.

Chenopsetta oblonga, Gill, 1864, Proc. Acad. Nat. Sci. Philad., p. 218.

Paralichthys oblongus, 1881, Goode, Proc. U.S. Nat. Mus., iii, (1880), p. 472; Jordan and Gilbert, 1883, Bull. U.S. Nat. Mus., xvi, p. 824; Jordan and Goss, 1889, Rep. U.S. Com. Fish., xiv, (1886), p. 249, pl. iii, fig. 8; Goode and Bean, 1895, Ocean. Ichth., p. 436; Jordan and Evermann, 1898, Bull. U.S. Nat. Mus., xvii (3), p. 2632, pl. cccxxiv, fig. 924; Bean, 1902, Ann. Rep. Forest Fish Game Comm. N.Y., vi, (1901), p. 473; Bigelow and Welsh, 1925, Bull. U.S. Bur. Fish., xl (1), (1924), p. 494, fig. 250; Nichols and Breder, 1927, Zoologica, ix, p. 177, fig.

EGGS, LARVÆ AND YOUNG.

Agassiz, 1878, Proc. Amer. Acad., xiv, p. 1, figs.

Depth of body $2\frac{1}{4}$ to $2\frac{3}{8}$ in length, length of head $3\frac{3}{8}$ to 4. Upper profile of head straight or slightly concave above eyes. Snout about as long as or longer than eye, diameter of which is $\frac{1}{4}$ to $\frac{1}{3}$ in length of head; eyes separated by a prominent, narrow ridge, their anterior margins about level. Maxillary extending to below posterior

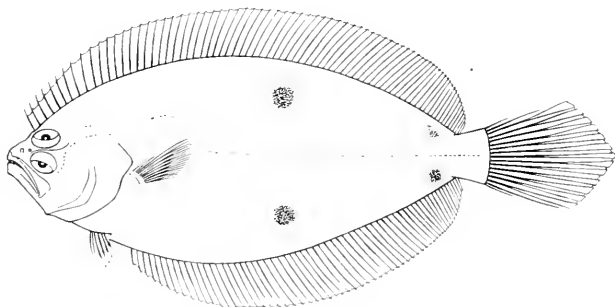


FIG. 45.—*Paralichthys oblongus*. B.M. (N.H.) 1930.9.4.3. $\times \frac{1}{2}$.

part of eye, length $2\frac{1}{2}$ in that of head; lower jaw not projecting, $1\frac{7}{8}$ in head. Teeth rather small, canines moderate. 7 to 10 gill-rakers on lower part of anterior arch. Scales cycloid or feebly ctenoid; about 95 in lateral line; no supplementary scales. Dorsal (72) 75-82 (86); commencing just behind posterior nostril of blind side and

above anterior edge or anterior part of eye. Anal (58) 60-68 (70). Pectoral of ocular side with 11 rays, length a little more than $\frac{1}{2}$ that of head. Caudal pointed; caudal peduncle rather deeper than long. Greyish or brownish, generally mottled or blotched with darker. 4 rather conspicuous ocelli, each surrounded by a pinkish area, a pair just behind middle of body and near its edges, and another below last rays of dorsal and above last rays of anal respectively.

TYPE — Not traced.

DISTRIBUTION — Coasts of New England and New York, extending into deeper water as far as the 100 fathoms line.

SPECIMENS EXAMINED:

1 (302 mm.),	Woods Hole, Mass.	U.S. Nat. Mus.
2 (88, 115 mm.),	Vineyard Sound, Mass.	"
1 (107 mm.),	Buzzards Bay, "	"
1 (285 "),	Approx. 40° 10' N., 73° 36' W.	Amer. Mus. Nat. Hist.
1 (252 "),	N. Atlantic.	Mus. Comp. Zool.

9. PARALICHTHYS ISOSCELES, Jordan

Paralichthys isosceles, Jordan, 1890, Proc. U.S. Nat. Mus., XII, p. 330.

Apparently close to *P. oblongus* and *P. triocellatus*. Depth of body $2\frac{1}{2}$ in the length, length of head $3\frac{3}{4}$. Diameter of eye 5 in length of head, eyes separated by a narrow, nearly or quite naked ridge. Maxillary scaled, length $2\frac{1}{4}$ in that of head. Teeth slender, sharp, the anterior moderately enlarged. 8 or 9 gill-rakers on lower part of anterior arch. Scales finely ciliated; 88 to 90 in lateral line. Dorsal 84. Anal 66. Length of pectoral of ocular side $1\frac{1}{2}$ in that of head. Caudal double-truncate. Greyish brown, more or less mottled with darker. Snout and lower jaw with dark spots, a vague dark spot just above curve of lateral line and another behind pectoral; three large black ocelli forming a triangle, a pair above and below lateral line and near edges of body, the third on lateral line just before end of dorsal. Hms all more or less speckled or mottled with dark, pelvic blackish, with two or three small, inky spots.

TYPE — United States National Museum.

DISTRIBUTION — Bahia, Brazil.

Known only from the 4 types, 125 to 280 mm. in total length.

This species may prove to be identical with *P. triocellatus*. Allowing for the difference in the sizes of the specimens described by Jordan and those of *triocellatus* in the British Museum, the two are very similar, but Jordan records 88 to 90 scales in the lateral line in *isosceles*.

10. PARALICHTHYS TRIOCELLATUS, Ribeiro

Paralichthys triocellatus, Ribeiro, 1904, Lavouira (Bol. Soc. Nac. Agric.), 4-7, (1903), p. 192; Ribeiro, 1915, Arch. Mus. Nac. Rio de J., XVII, Heterosomata, p. 13, fig.; Ribeiro, 1918, Arch. Mus. Nac. Rio de J., XXI, p. 192.

Paralichthys oblongus, Regan, 1914, Rep. Brit. Antarct. ("Terra Nova") Exped., 1910, Zool., 1, 1, p. 23.

Depth of body $2\frac{1}{3}$ to $2\frac{1}{2}$ in the length, length of head $3\frac{1}{4}$ to $3\frac{1}{2}$. Upper profile of head a little concave in front of upper eye. Snout equal to or shorter than eye, diameter of which is $3\frac{1}{4}$ to $3\frac{3}{8}$ in length of head, eyes separated by a low narrow ridge, their anterior margins about level. Maxillary extending to a little beyond middle of eye, length about 2 in head, lower jaw not projecting, $1\frac{1}{2}$ to $1\frac{3}{8}$ in head. Teeth of moderate size, canines not much enlarged. 8 or 9 gill-rakers on lower part of anterior arch. Scales mostly feebly tenoid on ocular side, cycloid on blind side, about 60 in lateral line; very few supplementary scales. Dorsal 82-86, commencing immediately behind posterior nostril of blind side and in front of eye. Anal 67-69. Pectoral

of ocular side with 10 or 11 rays, length $1\frac{2}{3}$ to $1\frac{3}{5}$ in that of head. Caudal double-truncate; caudal peduncle more than twice as deep as long. Brownish, with traces of irregular darker markings; a pair of conspicuous ocelli above and below the straight portion of the lateral line, midway between it and the dorsal and anal fins; a similar ocellus, sometimes wanting, on hinder part of lateral line; distal part of pelvic fin of ocular side dusky.

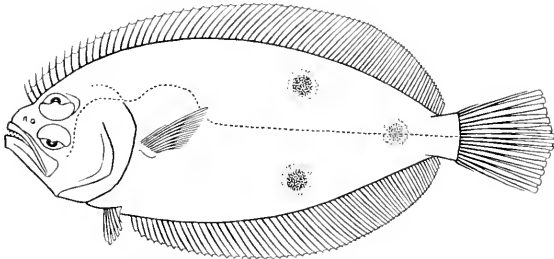


FIG. 46.—*Paralichthys triocellatus*. B.M. (N.H.) 1913.12.4.259. $\times \frac{1}{2}$.

TYPE.—Museu Nacional, Rio de Janeiro.

DISTRIBUTION.—Coast of Brazil.

SPECIMENS EXAMINED:

4 (80–135 mm.).

C. Frio, Brazil, 40 fms.

“Terra Nova”

Also a photograph of the type.

11. PARALICHTHYS CALIFORNICUS (Ayres).

[BASTARD HALIBUT, MONTEREY HALIBUT.]

Pleuronectes maculosus (non Cuvier),¹ Girard, 1856, Proc. Acad. Nat. Sci. Philad., vii, (1854), p. 155.

Paralichthys maculosus, Girard, 1858, U.S. Pacific R.R. Survey, x, Fishes, p. 147; Gunther, 1862, Cat. Fish., iv, p. 431; Gill, 1864, Proc. Acad. Nat. Sci. Philad., p. 197; Lockington, 1880, Proc. U.S. Nat. Mus., ii, (1879), p. 79.

Hippoglossus californicus, Ayres, 1862–3 (?), Proc. Calif. Acad. Sci., ii, (1859), p. 29; ii, (1860), fig. 10.

Pseudorhombus californicus, Gunther, 1862, Cat. Fish., iv, p. 426.

Uropsetta californica, Gill, 1863, Proc. Acad. Nat. Sci. Philad., (1862), p. 330; Gill, 1864, Proc. Acad. Nat. Sci. Philad., p. 198.

Paralichthys californicus, Jordan and Gilbert, 1883, Bull. U.S. Nat. Mus., xvi, p. 821; Jordan and Goss, 1889, Rep. U.S. Com. Fish., xiv, (1886), p. 245; Jordan and Evermann, 1898, Bull. U.S. Nat. Mus., xlvii (3), p. 2625; Starks and Morris, 1907, Univ. Calif. Pub. Zool., iii (11), p. 242; Starks, 1918, Calif. Fish Game, iv (4), p. 9, fig. 89.

Depth of body $2\frac{1}{2}$ to $2\frac{2}{3}$ in the length, length of head $3\frac{1}{2}$ (young) to $4\frac{1}{2}$. Upper profile of head nearly straight. Snout as long as or longer than eye, diameter of which is 4 (young) to 7 in length of head and somewhat greater than interorbital width; eyes separated by a flat space, the upper a little in advance of lower. Maxillary (in adults) extending to beyond posterior edge of eye, length a little more than 2 in that of head;

¹ A species of *Pseudorhombus* (see p. 104).

lower jaw scarcely projecting, about $1\frac{2}{3}$ in head. Teeth rather strong, canines of moderate size. About 20 gill-rakers on lower part of anterior arch. Scales feebly ctenoid on ocular side, mostly cycloid on blind side; about 100 in lateral line; numerous supplementary scales present, especially on anterior part of body. Dorsal 69-74, commencing just behind posterior nostril of blind side and just in front of eye. Anal 52-57. Pectoral of ocular side with 10 to 12 rays, length about $\frac{1}{2}$ that of head. Caudal double-truncate, caudal peduncle about as deep as long. Greyish brown, sometimes mottled or spotted with paler and darker, the head sometimes sprinkled with black dots, young brownish, with bluish spots.

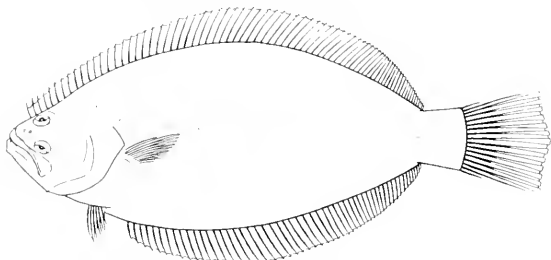


FIG. 47. —*Paralichthys californicus*. B.M. (N.H.) 99: 11, 15, 281. ♀.

TYPE —Not traced

DISTRIBUTION —Coast of California, from San Francisco to the Gulf of California

SPECIMENS EXAMINED:

1 (330 mm.).	San Francisco.	Eigenmann.
1 (345 ").	Magdalena Bay.	U.S. Nat. Mus.
1 (295 ").	San Diego.	" "
10 (70-290 mm.).	" "	Jordan.
1 (160 mm.).	" "	U.S. Nat. Mus.

This species is said to attain to a length of 3 feet and a weight of 60 pounds. It is indifferently sinistral or dextral.

12. PARALICHTHYS ÆSTUARIUS, Gilbert and Scofield

Paralichthys æstuaris, Gilbert and Scofield, 1898, Proc. U.S. Nat. Mus., xx, (1897), p. 199, pl. XXXIX, Jordan and Evermann, 1898, Bull. U.S. Nat. Mus., XLVII (3), p. 2020. Gilbert and Starks, 1904, Mem. Calif. Acad. Sci., IV, p. 198.

Paralichthys magdalene, (Abbott) Jordan and Evermann, 1898, Bull. U.S. Nat. Mus., XLVII (1), p. 2871.

Very close to the preceding species, but depth of body $2\frac{1}{2}$ in the length; gill-rakers rather shorter, 20 on lower part of anterior arch, dorsal 72-83, anal 58-63. Pale chocolate brown.

TYPE —United States National Museum. No. 48128

DISTRIBUTION —Mouth of Colorado River, Mexico

SPECIMENS EXAMINED:

1 (190 mm.)	Paratype	Shoal Point, Mouth of Colorado R., Mexico	Gilbert
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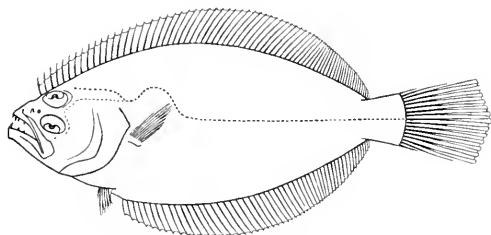


FIG. 48.—*Paralichthys æstuarinus*. B.M. (N.H.) 97.1.12.61. $\times \frac{1}{2}$.

All the known specimens of this species are small, measuring from 6 to 9 inches in length.

13. PARALICHTHYS ADSPERSUS (Steindachner).

? *Hippoglossus kingii*, Jenyns, 1842, Zool. Voy. "Beagle", iv, Fish., p. 138, pl. xxvi.¹

Pseudorhombus adpersus, Steindachner, 1867, SitzBer. Akad. Wiss. Wien, lv (1), p. 709, pl. II.

Paralichthys adpersus, Jordan and Goss, 1889, Rep. U.S. Com. Fish., xiv, (1886), p. 246; Abbott, 1890, Proc. Acad. Nat. Sci. Philad., p. 363; Thompson, 1916, Proc. U.S. Nat. Mus., 1, p. 468;

Evermann and Radcliffe, 1917, Bull. U.S. Nat. Mus., xciv, p. 140.

? *Pseudorhombus kingii*, Reed, 1897, Cat. Peces Chilenos (An. Univ. Chile), xciv, p. 16.

? *Paralichthys kingii*, Delin, 1901, Rev. Chil. Hist. Nat., iv, (1900), p. 104; Fowler, 1927, Proc. Acad. Nat. Sci. Philad., lxxviii, (1926), p. 282.

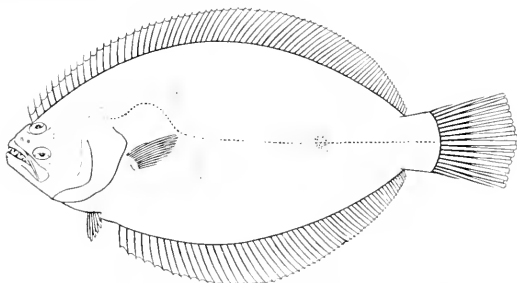


FIG. 49.—*Paralichthys adpersus*. B.M. (N.H.) 73.4.3.231. $\times \frac{1}{2}$.

Depth of body 2 to $2\frac{1}{2}$ in the length, length of head $3\frac{1}{4}$ to $3\frac{2}{5}$. Upper profile of head nearly straight. Snout a little longer than eye, diameter of which is $4\frac{1}{2}$ to $6\frac{1}{2}$ in

¹ No specimen was preserved, the description being based on a coloured drawing made by Mr. King, an officer of the "Beagle". This drawing shows the dorsal fin with a distinct anterior portion, lower than the remainder and with the membrane notched between the rays.

length of head and greater than interorbital width. eyes separated by a flat space, the upper a little in advance of lower. Maxillary (in adults) extending to a little beyond posterior edge of eye, length $2\frac{1}{4}$ to $2\frac{1}{2}$ in head, lower jaw not projecting, $1\frac{3}{4}$ in head. Teeth of moderate size, canines not much enlarged. 16 or 17 (18) gill-rakers on lower part of anterior arch. Scales ctenoid on ocular side, cycloid on blind side; about 105 in lateral line; some supplementary scales present. Dorsal (67) 72-74; commencing behind posterior nostril of blind side and above anterior margin or anterior part of eye. Anal (54) 57-58. Pectoral of ocular side with 12 rays, length $\frac{1}{2}$ or nearly $\frac{1}{2}$ that of head. Caudal double-truncate, caudal peduncle about twice as deep as long. Brownish, mottled and variegated with darker spots, blotches and rings, three larger and more distinct ocelli on body, one above commencement of straight part of lateral line, one at an equal distance below but a little more posteriorly, and a third on the straight portion, traces of other ocelli at upper and lower edges of body; median fins mottled and spotted with brown; pectoral with irregular dark cross-bars.

TYPE.—Vienna Museum.

DISTRIBUTION.—Coasts of Peru and Chile.

SPECIMENS EXAMINED:

1 (80 mm.),	Peru,	Amer. Mus. Nat. Hist.
1 (310 ..),	Iquique, Chile,	Godfrey Mus.
1 (68 ..),	Lota, ..	Stanford Univ.
? 1 (495 ..),	Stuffed, Pescadores Bay, Chile	Whately,
? 1 (650 ..),	.. Juan Fernandez Is.,	Read.

This species appears to have been confused by many authors with the common *Paralichthys* of Mazatlan (*P. woolnani*), from which it may be readily distinguished by the ctenoid scales on the ocular side and the larger number of gill-rakers.

The large specimen described by Fowler from Chile as *P. kingi* has fewer dorsal (66) and anal (53) rays than any of the species of *Paralichthys* from the Pacific coast of South America. This may prove to be a *Hippoglossina*.

14. PARALICHTHYS OLIVACEUS (Temminck and Schlegel).

Hippoglossus olivaceus, Temminck and Schlegel, 1846, in Siebold, F. Japon. (Pisces), p. 184, pl. xciv, fig. 91.

Rhombus wolffi, Bleeker, 1854, Nat. Tijdschr. Ned. Ind., vi, p. 421; Bleeker, 1854, 7, Verh. Batav. Gen., xxvi, Japan, p. 122; Bleeker, 1859, Act. Soc. Sci. Indo-Néerl., v, Japan, pl. ii, fig. 3.

Platessa percocephala, Basilevsky, 1855, Nouv. Mem. Soc. Nat. Moscou, (2) x, p. 215.

Pseudorhombus olivaceus, Günther, 1862, Cat. Fish., iv, p. 429; Otaki, 1897, J. Fish. Bur. Tokyo, vi (1), p. 5, pl. v, fig. 2.

Chaznossetta olivacea, Bleeker, 1873, Ned. Tijdschr. Dierk., iv, p. 159; Bleeker, 1879, Verh. Akad. Wet. Amsterdam, xviii, Poiss. Japon., p. 21.

Chaznossetta wolffi, Bleeker, 1879, *loc. cit.*, p. 21.

Paralichthys olivaceus, Steindachner, 1866, Ann. naturh. Mus. Wien, xi, p. 217; Otaki, Fujita and Higurashi, 1904, Fish. Japan, 1 (2); Jordan and Starks, 1906, Proc. U. S. Nat. Mus., xxxi, p. 180; Jordan, Tanaka and Snyder, 1913, J. Coll. Sci. Tokyo, xxxii (1), p. 317; Jordan and Metz, 1913, Mem. Carnegie Mus., vi, p. 59; Jordan and Hulbs, 1925, Mem. Carnegie Mus., x, p. 297; Schmidt and Landberg, 1930, Bull. Acad. Lemnigrad, p. 1148; Schmidt, 1931, Frans. Pac. Com. Acad. Sci., U. S. R., ii, p. 125; Schmidt, 1931, C. R. Acad. Sci. Russ., p. 315; Wu, 1932, Thes. Facult. Sci. Univ. Paris, A 244 (268), p. 77.

Pseudorhombus scaberrimus, Günther, 1873, Ann. Mag. Nat. Hist., (4) xii, p. 379.

Paralichthys olivaceus var. *coreanicus*, Schmidt, 1904, Pse. Mar. Orient., p. 230.

Paralichthys coreanicus, Jordan and Starks, 1906, Proc. U. S. Nat. Mus., xxxi, p. 181.

Paralichthys percocephalus, Jordan and Starks, 1906, *loc. cit.*, p. 181; Jordan and Metz, 1913, Mem. Carnegie Mus., vi, p. 59.

Depth of body $2\frac{1}{2}$ to $2\frac{3}{5}$ in the length, length of head $3\frac{1}{4}$ (young) to 4. Upper profile of head straight or a little concave. Snout (in adults) much longer than eye, diameter of which is $4\frac{1}{2}$ (young) to 8 in head and a little greater than interorbital width. eyes

separated by a flat space, the upper slightly in advance of lower. Maxillary (in adults) extending to well beyond posterior edge of eye, length about 2 in that of head; lower jaw scarcely projecting, $1\frac{1}{2}$ to $1\frac{2}{3}$ in head. Teeth strong, canines well developed. 15 to 18 gill-rakers on lower part of anterior arch. Scales ctenoid on ocular side, cycloid on blind side; 108 to 122 scales in lateral line; supplementary scales present. Dorsal (66) 68-84; commencing behind posterior nostril of blind side and just in front of or above anterior margin of eye. Anal (49) 51-63. Pectoral of ocular side with 12 or 13 rays, length about $\frac{1}{2}$ that of head. Caudal double-truncate; caudal peduncle somewhat deeper than long. Greyish or brownish, speckled and spotted with dark brown, the spots sometimes arranged in rings or half rings; body often with numerous small white spots; median fins mottled and spotted with darker; pectoral sometimes with irregular dark cross-bars.

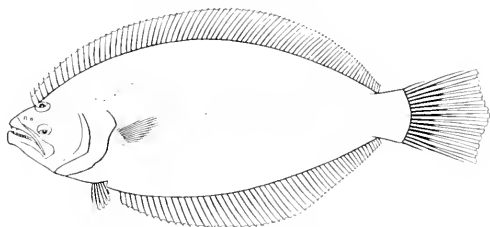


FIG. 50.—*Paralichthys olivaceus*. B.M. (N.H.) 79.5.14.70. ♂ 4.

TYPE.—Leiden Museum.

DISTRIBUTION.—Coasts of China and Japan.

SPECIMENS EXAMINED:

1 (330 mm.).	China.	Intern. Fisheries Exhib.
2 (85, 110 mm.).	Daipo, Hong Kong, China.	Chen.
1 (180 mm.).	Amoy, China.	Swinhoe.
3 (115-165 mm.).	" "	Light.
1 (250 mm.).	Coast of Shan-Tung, China.	Wu.
2 (230, 420 mm.).	Chefoo, China.	Swinhoe.
<i>P. swinhonis</i> .		
1 (375 mm.).	Inland sea of Japan.	"Challenger".
3 (78-125 mm.).	Nagasaki, Japan.	Jordan.
2 (100, 155 ,,).	Wakanoura, "	"
1 (115 mm.).	Kawatana, "	"
8 (110-340 mm.).	Hondo Is., "	"
1 (235 mm.).	Matsushima, "	"
1 (285 ,,).	Toyama, "	Tokyo Imp. Univ.
1 (370 ,,).	Bay of Mutsu, Japan.	Kishinouye.
3 (162-168 mm.).	Port Arthur.	Jordan.

Also one from Hong-Kong (Mus. Comp. Zool.).

The variation in the number of dorsal and anal rays in this species is very marked, but there appears to be no very definite increase in number from south to north as suggested by Jordan and Hubbs.¹ The following table shows the number of dorsal and anal rays in selected specimens from several localities.

¹ The number of examples counted, however, is very small.

Locality.	Dorsal	Anal.
Hong Kong	77-84	58-63
Amoy	79-84	60-63
Nagasaki	75-76	58-59
Kawatana	73	52
Chefoo	69	51-52
Shan-Tung	69	54
Hondo Is.	76-80	55-62
Port Arthur	68-69	52-55
Matsushima	75	57
Bay of Mutsu	73	58
Hakodate	72	57

An important Japanese food-fish, which attains a large size.

15. *PARALICHTHYS WOOLMANI*, Jordan and Williams; Gilbert

Paralichthys adspersus (non Steadman), Jordan and Gilbert, 1883, Proc. U.S. Nat. Mus., v, (1882), p. 370; Jordan and Bollman, 1890, Proc. U.S. Nat. Mus., xii, (1889), p. 182; Jordan and Evermann, 1898, Bull. U.S. Nat. Mus., xlvii (3), p. 2627.

Paralichthys woolmani, (Jordan and Williams) Gilbert, 1897, Proc. U.S. Nat. Mus., xix, p. 457; Jordan and Evermann, 1898, Bull. U.S. Nat. Mus., xlvii (3), p. 2628; Evermann and Radcliffe, 1917, Bull. U.S. Nat. Mus., xc v, p. 140; Meek and Hildebrand, 1928, Field Mus. Pub. Chicago, Zool. Ser., xv, No. 249, p. 974.

Paralichthys sinhalae, (Jordan and Abbott) Jordan and Evermann, 1898, Bull. U.S. Nat. Mus., xlvii (3), p. 2872.

Paralichthys woolmani, Gilbert and Starks, 1904, Mem. Calif. Acad. Sci., iv, p. 197.

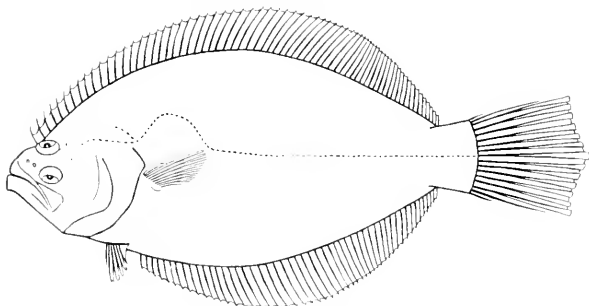


FIG. 51.—*Paralichthys woolmani*. B. M. (N. H.) 190; 5:13-257. 1/2

Depth of body $1\frac{1}{2}$ to $2\frac{1}{4}$ in the length, length of head $3\frac{1}{2}$ to $3\frac{5}{8}$. Upper profile of head a little concave. Snout as long as or longer than eye, diameter of which is $\frac{5}{8}$ to $6\frac{1}{2}$ in length of head and much greater than interorbital width, eyes separated by a flat space, the upper a little in advance of lower. Maxillary extending to below posterior edge of eye or a little beyond, length a little more than 2 in that of head;

lower jaw scarcely projecting, $1\frac{2}{3}$ to $1\frac{3}{4}$ in head. Teeth rather strong, canines large. (11) 12 to 14 gill-rakers on lower part of anterior arch. Scales all cycloid; 102 to 110 in lateral line; supplementary scales present. Dorsal 70-80; commencing a little behind posterior nostril of blind side and just in front of eye. Anal 52-64. Pectoral of ocular side with 11 or 12 rays, length about $\frac{1}{2}$ that of head. Caudal double-truncate; caudal peduncle nearly twice as deep as long. Greyish or brownish, spotted and blotched with darker and often with pearly white; on the median fins the dark blotches are more distinct, especially on the caudal, where they form two or three irregular rows; pectoral spotted with darker.

TYPE.—United States National Museum. No. 47575.

DISTRIBUTION.—Pacific coast of tropical America from Lower California to Panama; Galapagos Is.

SPECIMENS EXAMINED:

2 (150, 223 mm.).	Two of the types of <i>P. snalou</i> .	La Paz, Lower California.	Jordan (Hopkins Exped.).
2 (250, 268 mm.).		Panama.	Jordan.
1 (230 mm.).		Panama Market.	U.S. Nat. Mus.
1 (300 ").		Panama Canal Zone.	"

Also one from Galapagos (Amer. Mus. Nat. Hist.), and one from Panama (Mus. Comp. Zool.).

16. PARALICHTHYS FERNANDEZIANUS, Steindachner.

Paralichthys fernandezianus, Steindachner, 1905, Zool. Jahrb., Suppl. vi, p. 208.

Depth of body $2\frac{1}{2}$ in the total length, length of head 4. Snout longer than eye, diameter of which is $7\frac{2}{3}$ in length of head. Maxillary extending to beyond posterior edge of eye, length $2\frac{1}{2}$ in that of head. There are 5 large canine teeth on ocular side of lower jaw and 10 smaller ones on the blind side. 11 gill-rakers on lower part of anterior arch. Scales ctenoid on ocular side, cycloid on blind side; about 140 in lateral line; supplementary scales present. Dorsal 78; commencing a little in front of eye. Anal 60. Pectoral of ocular side with 11 rays, length a little more than $2\frac{1}{2}$ in that of head. Brownish, sprinkled with fine darker dots; blind side of dorsal fin with large irregular brown spots.

TYPE.—Not traced.

DISTRIBUTION.—Juan Fernandez Is., Chile.

The type was 510 mm. in total length.

17. PARALICHTHYS HILGENDORFI, Steindachner.

Paralichthys hilgendorfi, Steindachner, 1905, Zool. Jahrb., Suppl. vi, p. 209.

Depth of body twice in the total length, length of head $3\frac{1}{6}$. Snout a little longer than eye, diameter of which is $5\frac{1}{2}$ in length of head and much greater than inter-orbital width. Maxillary extending to below posterior edge of eye, length less than $2\frac{1}{2}$ in that of head. 8 or 9 teeth on each side of lower jaw, those in front stronger, but scarcely larger than anterior teeth in upper jaw. 9 gill-rakers on lower part of anterior arch. Scales ctenoid on ocular side, cycloid on blind side; about 04 in lateral line. Dorsal 75; commencing above anterior edge of eye. Anal 61. Pectoral of ocular side with 11 rays, length 2 in that of head. Greyish brown, with numerous fine darker dots.

TYPE.—Not traced.

DISTRIBUTION.—Juan Fernandez Is., Chile.

The type was 273 mm. in total length.

18. PARALICHTHYS MICROPS (Gunther).

Hippoglossina microps, Gunther, 1881, *Proc. Zool. Soc.*, p. 21; Delnn, 1901, *Rev. Chil. Hist. Nat.* iv, (1900), p. 103.

? *Paralichthys jordanii*, Steindachner, 1868, *Zool. Jahrb., Suppl.* iv, p. 325; Delnn, 1901, *l. cit.*, p. 104.

Depth of body $2\frac{1}{2}$ to $2\frac{3}{4}$ in the length, length of head $3\frac{1}{6}$ to $3\frac{1}{4}$. Upper profile of head a little concave. Snout about as long as eye, diameter of which is $4\frac{1}{2}$ to $5\frac{1}{4}$ in length of head, and much greater than interorbital width; eyes separated by a flat space, the upper a little in advance of lower. Maxillary extending nearly to below posterior edge of eye, length about $2\frac{1}{2}$ in that of head, lower jaw not projecting, $1\frac{3}{4}$ to nearly 2 in head. Teeth rather strong, canines of moderate size. 18 to 21 gill-rakers on lower part of anterior arch. Scales ctenoid on ocular side, cycloid on blind side; about 80 in lateral line; supplementary scales present. Dorsal 72-73, commencing behind posterior nostril of blind side and above anterior half of eye.

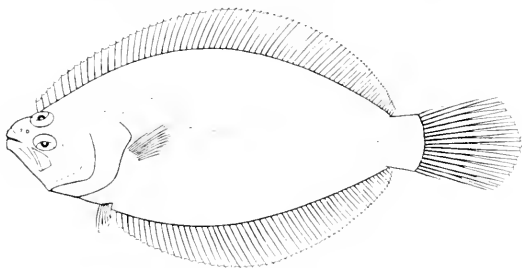


FIG. 52.—*Paralichthys microps*. B.M. (N.H.) 80.7.28.6. 1.

Anal 56. Pectoral of ocular side with 11 or 12 rays, length about $\frac{1}{2}$ that of head. Caudal rounded or double-truncate; caudal peduncle about $1\frac{1}{2}$ times as deep as long. Greyish or brownish, spotted and mottled with darker.

TYPE—British Museum (Nat. Hist.) Reg. No. 80.7.28.6.

DISTRIBUTION—Coast of Chile.

SPECIMENS EXAMINED:

1 (180 mm.)	Coast of Chile	Delnn.
1 (107 ")	West coast of Patagonia	Coppinger ("Alert")

In the position of the origin of the dorsal fin *P. microps* approaches some of the species of *Hippoglossina*, but the form of the teeth and the absence of an anal spine suggest that it belongs to this genus.

19. PARALICHTHYS CÆRULEOSTICTA, Steindachner.

Paralichthys cæruleosticta, Steindachner, 1868, *Zool. Jahrb., Suppl.* iv, p. 327; Delnn, 1901, *Rev. Chil. Hist. Nat.*, iv, (1900), p. 104.

Depth of body less than $2\frac{1}{4}$ in the length, length of head more than $4\frac{1}{2}$. Snout shorter than eye, diameter of which is 3 in length of head and more than 3 times the interorbital width. Length of maxillary 3 in that of head. Teeth slender, pointed,

somewhat enlarged anteriorly. 20 gill-rakers on lower part of anterior arch. Scales ctenoid on ocular side, cycloid on blind side; 75 in lateral line. Dorsal 87; commencing in front of eye. Anal 70. Pectoral of ocular side $1\frac{2}{3}$ in length of head. Brownish, with numerous small blue dots margined with darker scattered over the head and body, between many larger, mostly very diffuse dark brown spots; the latter are much clearer in the centre than at the margin, and form a regular series parallel with and at a short distance from the base of the dorsal fin; in the lower half of the body these markings appear to be mostly wanting.

TYPE.—Not traced.

DISTRIBUTION.—Juan Fernandez Is., Chile.

The type was 73 mm. in total length.

Genus 6. PSEUDORHOMBUS

- Pseudorhombus*, Bleeker, 1862, Versl. Akad. Wet. Amsterdam, xiii, p. 426 [*Rhombus polyspilus*, Bleeker]; Day, 1877, Fish. India, p. 422; Regan, 1920, Ann. Durban Mus., ii, p. 207; Weber and Beaufort, 1929, Fish. Indo-Austral. Arch., v, p. 99; Norman, 1931, Ann. Mag. Nat. Hist., (10) viii, p. 597; Wu, 1932, Thés. Facult. Sci. Univ. Paris, A. 244 (268), p. 79.
- ? *Neorhombus*, Castelnau, 1875, Research. Fish. Austral. (Vict. Offic. Rec. Philad. Exhib.), p. 45 [*Neorhombus unicolor*, Castelnau].¹
- Teratorhombus*, Macleay, 1882, Proc. Linn. Soc. N.S.W., vi, p. 126 [*Teratorhombus excisiceps*, Macleay].
- Rhombiscus*, Jordan and Snyder, 1901, Proc. U.S. Nat. Mus., xxiii, p. 379 [*Rhombus cinnamomeus*, Temminck and Schlegel].
- Spinorhombus*, Oshima, 1927, Japan. J. Zool., Trans. Abstr., i (5), p. 187 [*Spinorhombus ctenosquamis*, Oshima].
- Istorhombus*, Whitley, 1931, Aust. Zool., vi, p. 322 [*Pseudorhombus spinosus*, McCulloch].

Very close to *Paralichthys*, which it replaces in the Indo-Pacific region, but with a supratemporal branch of the lateral line running upwards towards the anterior part of the dorsal fin. Eyes separated by a bony ridge. 58 to 100 scales in lateral line. Generally the body is less elongate than in *Paralichthys*, the mouth smaller, and the teeth rather less strong. In general, the species are of smaller size.

A number of species from the Indo-Pacific.

SYNOPSIS OF THE SPECIES.

- I. Gill-rakers palmate (short, strongly spinulate), as broad as long; 3 or more distinct ocelli or double ocelli on body.
 - A. Origin of dorsal well in front of nostrils of blind side, a line connecting base of first ray and posterior nostril, if continued, passes above hinder end of maxillary; upper profile of head evenly convex 1. *spinosus*.
 - B. Origin of dorsal above or just behind nostrils of blind side, a line connecting base of first ray and posterior nostril, if continued, crosses maxillary; upper profile of head notched.
 1. Depth $2\frac{2}{3}$ to $2\frac{3}{4}$ in length; maxillary to below posterior edge of eye or beyond, 2 to $2\frac{1}{4}$ in head; canines strong; 4 to 8 teeth on blind side of lower jaw 2. *diplospilus*.
 2. Depth $2\frac{1}{10}$ to $2\frac{2}{5}$ in length; maxillary to below middle of eye or beyond, $2\frac{1}{4}$ to $2\frac{1}{2}$ in head; canines moderate or small; 13 to 22 teeth on blind side of lower jaw 3. *dupliciocellatus*.

¹ It is impossible to identify this fish with certainty from Castelnau's brief description. The type of *N. unicolor* was from Fremantle, Western Australia.

11. Gill-rakers pointed, longer than broad

- a. Scales all cycloid, canines very small 4 *tenuicostium*.
- b. Scales of ocular side more or less ctenoid, at least anteriorly and at edges of body
1. Anterior rays of dorsal longer than those that follow and free from membrane; 23 to 25 gill-rakers on lower part of anterior arch, depth $1\frac{1}{2}$ to $1\frac{2}{3}$ in length
- a. Scales cycloid on blind side, except anteriorly and at edges of body; 3 conspicuous ocelli on body 5 *triocellatus*
- b. Scales all ctenoid on blind side, body with dark rings but no conspicuous ocelli 6. *annulatus*.
2. Anterior rays of dorsal not prolonged, never entirely free from membrane; 5 to 18 gill-rakers on lower part of anterior arch, depth $1\frac{1}{2}$ to $2\frac{1}{3}$ in length.
- a. Scales of blind side ctenoid
- α Depth $1\frac{1}{2}$ to 2, head $3\frac{1}{2}$ to $3\frac{1}{2}$ in length; pectoral of blind side $1\frac{1}{2}$ to about 2 in head; dorsal 71-77, anal 55-61 7 *malayanus*.
- β Depth 2 to $2\frac{1}{4}$, head $3\frac{1}{2}$ to $3\frac{2}{3}$ in length; pectoral of blind side $2\frac{1}{2}$ to $2\frac{1}{2}$ in head; dorsal 78-82, anal 61-65 8. *oblongodon*.
- b. Scales of blind side cycloid
- a. Origin of dorsal above or a little in front of nostrils of blind side, well in advance of eye.
- * Teeth strong, rather widely set, canines large; 6 to 10 teeth on blind side of lower jaw
- † Dorsal 68-70, anal 52-55; tip of first interhemal spine projecting; maxillary about 2 in head; head $3\frac{1}{4}$ in length; caudal peduncle about twice as deep as long 9. *quinquocellatus*
- †† Dorsal 78, anal 50; tip of first interhemal spine projecting, maxillary about $1\frac{1}{2}$ in head; head more than $4\frac{1}{2}$ in length 10. *ctenosquamis*
- ††† Dorsal 72-80, anal 54-62; tip of first interhemal spine feeble, not projecting; maxillary $2\frac{1}{2}$ to $2\frac{2}{3}$ in head, head $3\frac{1}{2}$ to $3\frac{1}{2}$ in length, caudal peduncle $2\frac{1}{4}$ to $3\frac{1}{2}$ times as deep as long 11. *arcticus*.
- ** Teeth smaller, more close-set, not much enlarged anteriorly, usually more than 20 teeth on blind side of lower jaw
- \dagger Origin of nostril above posterior nostril or above space between nostrils, a line connecting base of first ray and posterior nostril, if continued, crosses the maxillary
- \ddagger Maxillary not reaching middle of eye, $2\frac{1}{2}$ to nearly 3 in head; head $3\frac{1}{2}$ to $3\frac{2}{3}$ in length; 11 to 13 gill-rakers on lower part of anterior arch
- \S 58 scales in lateral line; eye $3\frac{1}{2}$, maxillary $2\frac{1}{2}$ in head, body with conspicuous darker rings more or less regularly arranged 12. *natalensis*
- \parallel 95 or more scales in lateral line; eye 4 or more, maxillary $2\frac{1}{2}$ to nearly 3 in head, body without rings, but with 3 or 4 ocelli 13. *micrognathus*.
- ††† Maxillary extending to below middle of eye or beyond, 2 to $2\frac{1}{2}$ in head; head $3\frac{1}{4}$ to $3\frac{2}{3}$ in length, (15) 17 or 18 gill-rakers on lower part of anterior arch 14. *pentophthalmus*.

- †† Origin of dorsal above or a little in advance of anterior nostril, a line connecting base of first ray and posterior nostril, if continued, passes above hinder end of maxillary or crosses its most posterior part.
- ‡ Dorsal 67-76, anal 51-58.
- § Depth $1\frac{2}{3}$ to 2, head $3\frac{1}{2}$ to nearly $3\frac{1}{2}$ in length; scales all ctenoid on ocular side; upper profile of head notched 15. *elevatus*.
- §§ Depth $2\frac{1}{10}$ to $2\frac{1}{2}$, head $3\frac{1}{2}$ to 4 in length; scales of ocular side more or less ctenoid anteriorly, mostly cycloid posteriorly; a strip of ctenoid scales at edges of body; upper profile of head scarcely notched, usually evenly curved 16. *javanicus*.
- ‡‡ Dorsal (78) 80-89, anal (59) 63-69.
- § 11 or 12 gill-rakers on lower part of anterior arch; scales all ctenoid on ocular side 17. *cinnamomeus*.
- §§ 8 (or 9) gill-rakers on lower part of anterior arch; scales cycloid on ocular side except for a strip of ctenoid scales at edges of body 18. *levisquamis*.
- β Origin of dorsal immediately behind (occasionally above) posterior nostril of blind side, above or very little in advance of anterior part of eye.
- * (12) 14 to 16 gill-rakers on lower part of anterior arch; eye 4 to $4\frac{1}{2}$ in head; upper profile of head with distinct notch 19. *argus*.
- ** (6) 8 to 10 gill-rakers on lower part of anterior arch; eye (4) $4\frac{1}{2}$ to $6\frac{1}{2}$ in head; upper profile of head usually with a more or less distinct notch 20. *jenyntsi*.
- *** 9 to 11 (12) gill-rakers on lower part of anterior arch; eye $3\frac{3}{4}$ to $4\frac{1}{2}$ in head; upper profile of head straight or with rather shallow notch 21. *neglectus*.

DOUBTFUL SPECIES.

22. *nauphala*
23. *guttulatus*.
24. *moorei*.

The arrangement of the laminae in the nasal organs is somewhat variable among the species of this genus, but I have been unable to make use of this character to divide the group further. As a general rule, the arrangement is more or less similar to that found in *Paralichthys*, the laminae being arranged transversely to a fairly elongate rachis, but in certain species this rachis is reduced and the laminae have a radiating arrangement. In *P. trocellatus* and *P. annulatus* the laminae are rather broader and more numerous than in other species.

1. PSEUDORHOMBUS SPINOSUS, McCulloch.

- Pseudorhombus spinosus*, McCulloch, 1914, Biol. Res. "Endeavour", ii, p. 126, pl. xxv; Norman, 1926, Biol. Res. "Endeavour", v, p. 224; McCulloch, 1929, Mem. Aust. Mus., v, p. 279.
- Istiorkombus spinosus*, Whitley, 1931, Aust. Zool., vi, p. 322.
- Istiorkombus spinosus normani*, Whitley, 1931, *tom. cit.*, p. 322.

Depth of body $2\frac{1}{2}$ to $2\frac{1}{2}$ in the length, length of head $3\frac{3}{4}$ to $3\frac{1}{2}$. Upper profile of head evenly convex, not notched in front of eyes. Snout longer than eye, diameter of which is $4\frac{1}{2}$ to 5 in length of head; lower eye scarcely in advance of upper, which is separated from edge of head by a space equal to $\frac{2}{3}$ its diameter. Maxillary extending

to below posterior $\frac{1}{3}$ or $\frac{1}{4}$ of eye, length about twice in that of head, lower jaw not projecting, $1\frac{2}{3}$ to $1\frac{1}{2}$ in head. Teeth of upper jaw rather small laterally, not close-set, enlarged anteriorly; teeth of lower jaw stronger, a single pair of enlarged teeth anteriorly. Gill-rakers "palmate" (short, the margins strongly spinulate), as broad as long, 16 on lower part of anterior arch. Scales cycloid or feebly ctenoid on ocular side, often more or less embedded in the skin, cycloid on blind side; 75 to 83 scales in lateral line. Supratemporal branch of lateral line short, not reaching base of dorsal fin. Dorsal 72-76; commencing well in front of nostrils of blind side, and at a distance in front of eye equal to or greater than its diameter, a line connecting base of first ray and posterior nostril, if continued, passes above hinder end of maxillary. Anal 57; tip of first interanal spine generally projecting. Pectoral of ocular side with 10 to 12 rays, length $1\frac{1}{2}$ to 2 in that of head. Caudal obtusely pointed, caudal

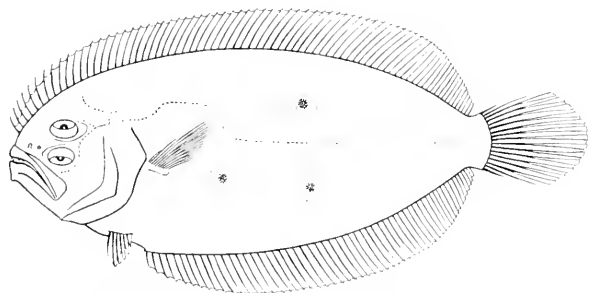


FIG. 83.—*Pseudorhombus spinosus*. B.M. (N.H.) 1925.7.227. $\times \frac{1}{2}$.

peduncle $2\frac{1}{2}$ to $2\frac{2}{3}$ times as deep as long. Pale brownish or greyish, with darker spots and rings, and with 3 large, conspicuous ocelli arranged thus . . .; median fins generally spotted and blotched with brown.

TYPE.—Australian Museum No. 17237.

DISTRIBUTION.—Western Australia, southern Queensland.

SPECIMENS EXAMINED.

1 (190 mm.)	25 miles off Bustard Head Light,	Austr. Mus. ("Endeavour")
	Queensland, 20 fms.	
2 (190, 242 mm.)	10 to 7 miles N.W. of Hervey Bay,	" "
	Queensland, 9-11 fms.	

Also 8 from southern Queensland (Austr. Mus. "Endeavour").

Whitley (1931) remarks that the Queensland examples differ from the types from Western Australia "in details of squamation", and separates them as a distinct subspecies (*normani*). He makes this species the type of a new genus (*Istorhombus*), distinguished by the convex dorsal profile of head, palmate gill-rakers, cycloid scales, origin of dorsal fin in front of nostrils, and strong preanal spine.

2. PSEUDORHOMBUS DIPLOSPILUS, Norman.

[TWIN-SPOT FLOUNDER.]

Pseudorhombus sp., Ogilby, 1912, Mem. Qd. Mus., i, p. 44.*Pseudorhombus diplospilus*, Norman, 1926, Biol. Res. "Endeavour", v, p. 226, fig. 1; McCulloch, 1929, Mem. Aust. Mus., v, p. 280.*Pseudorhombus condorensis*, Chabanaud, 1929, Bull. Mus. Hist. nat. Paris, (2) i, p. 370.

Depth of body ($2\frac{1}{2}$) $2\frac{2}{3}$ to $2\frac{3}{4}$ in the length, length of head $3\frac{2}{3}$ to $3\frac{3}{4}$. Upper profile of head with a distinct notch in front of eyes. Snout (in adults) a little longer than eye, diameter of which is $4\frac{1}{2}$ (young) to $5\frac{3}{4}$ in length of head; upper eye a little in advance of lower, separated from edge of head by a space equal to $\frac{1}{2}$ to $\frac{1}{3}$ its diameter. Maxillary (in adults) extending to below posterior edge or hinder part of eye or beyond, length 2 to $2\frac{1}{2}$ in that of head; lower jaw scarcely projecting, a strong knob at the symphysis, $1\frac{2}{3}$ to $1\frac{3}{4}$ in head. Teeth of upper jaw small and rather close-set laterally, one or two

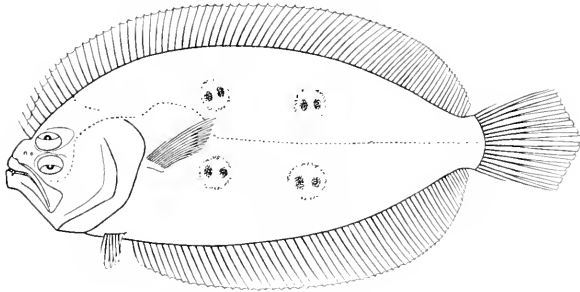


FIG. 54.—*Pseudorhombus diplospilus*. B.M. (N.H.) 1925.7.22.15. $\frac{1}{2}$.

pairs of strong canines anteriorly, which are clearly visible when the mouth is closed; lateral teeth of lower jaw much stronger and wider apart than those of upper jaw; 4 to 8 teeth on blind side of jaw; one or two pairs of strong canines anteriorly. Gill-rakers "palmate" (short, the margins strongly spinulate), as broad as long; 8 to 10 on lower part of anterior arch. Scales cycloid or feebly ctenoid on ocular side, cycloid on blind side; 89 to 95 in lateral line. Supratemporal branch of lateral line reaching base of ninth or tenth ray of dorsal fin. Dorsal 75-79; commencing just behind posterior nostril of blind side, and at a distance in front of eye equal to $\frac{1}{4}$ or $\frac{1}{3}$ its diameter. Anal 61-64; tip of first interhæmal spine not projecting. Pectoral of ocular side with 11 or 12 rays, length about twice in that of head. Caudal pointed or double-truncate; caudal peduncle $2\frac{2}{3}$ to $2\frac{3}{4}$ times as deep as long. Brownish, with some faint darker spots and markings, and with four large conspicuous double ocelli arranged thus, : : ; median fins with small brown spots; a series of rings on dorsal and anal.

TYPE.—Australian Museum. No. E.6678.

DISTRIBUTION.—Indo-China; east coast of Queensland.

SPECIMENS EXAMINED :

2 (225, 232 mm.). Paratypes. 3 to 7 miles N.W. of Hervey Bay, Queensland, 9-11 fms. Austr. Mus. ("Endeavour").

Also 5 from Queensland (Austr. Mus. "Endeavour"), and a co-type of *P. condorensis* from Poulo-Condore, French Indo-China (Paris Mus.)

The co-type (240 mm.) of *P. condorensis* has the head and anterior part of the body somewhat distorted, making direct comparison with the paratypes of *P. diplospilus* difficult. However, I have little hesitation in uniting the two species.

3. PSEUDORHOMBUS DUPLICIOCELLATUS, Regan

Pseudorhombus dupliciocellatus, Regan, 1905, Ann. Mag. Nat. Hist., (7) xv, p. 25; Jordan and Starks, 1906, Proc. U.S. Nat. Mus., xxxi, p. 177; Jordan, Tanaka and Snyder, 1913, J. Coll. Sci. Tokyo, xxxiii (1), p. 310; Norman, 1926, Biol. Res. "Endeavour", v, p. 228, fig. 2; Norman, 1927, Rec. Ind. Mus., xxix, p. 10; McCulloch, 1929, Mem. Aust. Mus., v, p. 278; Weber and Beaufort, 1929, Fish. Indo-Austral. Arch., v, p. 102; Schmidt, 1931, Trans. Pac. Com. Acad. Sci., U.S.S.R., II, p. 124.

Platophrys palad, Evermann and Sacle, 1907, Bull. U.S. Bur. Fish., xxxvi, (1909), p. 105, fig. 21.

Pseudorhombus cotia, rights, Ogilby, 1912, Mem. Qd. Mus., I, p. 47.

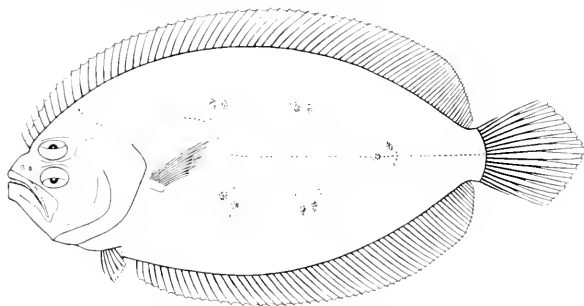


FIG. 55.—*Pseudorhombus duplicioellatus*. B.M. (N.H.) 1925.7.22.9. $\frac{1}{4}$.

Depth of body $2\frac{1}{10}$ to $2\frac{2}{5}$ in the length, length of head $3\frac{1}{2}$ to 4. Upper profile of head more or less strongly notched in front of eyes. Snout as long as or a little longer than eye, diameter of which is $4\frac{1}{2}$ to $6\frac{1}{2}$ in length of head; upper eye generally a little in advance of lower, separated from edge of head by a space equal to $\frac{1}{3}$ or $\frac{1}{2}$ its diameter. Maxillary extending to below middle of eye or beyond, length $2\frac{1}{2}$ to $2\frac{3}{4}$ in that of head; lower jaw not projecting, a rather obtuse knob at the symphysis, $1\frac{1}{2}$ to 2 in head. Teeth of upper jaw rather small and close-set laterally, somewhat larger and wider apart anteriorly, those of lower jaw stronger, 13 to 22 on blind side of jaw. Gill-rakers "palmate" (short, the margins strongly spinulate), as broad as long, 8 or 9 on lower part of anterior arch. Scales ctenoid on ocular side, cycloid on blind side, 73 to 84 in lateral line. Supratemporal branch of lateral line generally reaching base of eighth or ninth ray of dorsal fin. Dorsal 74-78; commencing above or immediately behind posterior nostril of blind side, and at a distance in front of eye equal to $\frac{1}{3}$ to $\frac{1}{2}$ its diameter. Anal 59-63, tip of first interhaemal spine not projecting. Pectoral of ocular side with 10 to 12 rays, length $1\frac{1}{2}$ to $2\frac{1}{2}$ in that of head. Caudal pointed, caudal peduncle $2\frac{1}{2}$ to $2\frac{3}{4}$ times as deep as long. Brownish, with a number of darker spots and rings, and with 3 or 4 large double ocelli arranged thus, $\cdot\cdot$ or $\cdot\cdot$, which are not usually so prominent as those of *P. diplospilus*, the two dark spots forming each

ocellus, as well as the ocellus itself, may be margined with small white spots; fins with small brown spots; generally a series of rings on dorsal and anal, and sometimes a pair on base of caudal.

TYPE.—British Museum (Nat. Hist.). Reg. No. 1905.6.6.243.

DISTRIBUTION.—From the Nicobar Islands through the Malay Archipelago to north-eastern Australia and Japan.

SPECIMENS EXAMINED:

1 (97 mm.).	Nankauri Harbour, Nicobar Is.	Ind. Mus.
2 (200, 222 mm.).	Java Sea, 15½–20 fms.	Amsterdam Mus.
1 (165 mm.).	Java Sea (7°14' S., 114° E.).	Hardenberg.
1 (220 ").	Queensland (?).	Austr. Mus. (" Endeavour ").
2 (260, 282 mm.).	25 miles S.E. from Double Island Point, Queensland, 33 fms.	" " "
5 (165–227 ").	Northern New South Wales.	" " "
1 (385 mm.).	Holotype. Inland Sea of Japan.	Smith.

Also several from Queensland and New South Wales (Austr. Mus. " Endeavour "), and one from the Nicobars (Ind. Mus.).

4. PSEUDORHOMBUS TENUIRASTRUM (Waite).

[DEEP-WATER FLOUNDER; SLENDER FLOUNDER.]

Paralichthys tenuirastrum, Waite, 1899, Mem. Aust. Mus., iv, p. 121, pl. xxviii, text-fig. 10.

Pseudorhombus tenuirastrum, Ogilby, 1912, Mem. Qd. Mus., 1, pp. 43, 45; McCulloch, 1914, Biol. Res. " Endeavour ", ii, p. 130; Norman, 1926, Biol. Res. " Endeavour ", v, p. 225; McCulloch, 1929, Mem. Aust. Mus., v, p. 279.

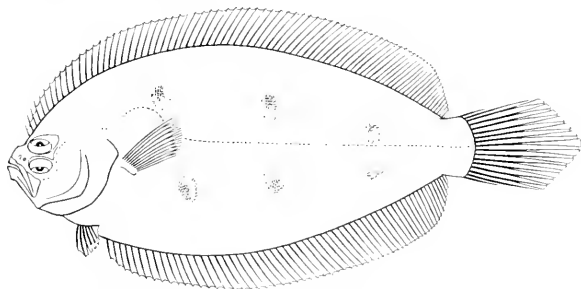


FIG. 56.—*Pseudorhombus tenuirastrum*. B.M. (N.H.) 1925.7.22.8. · ½.

Depth of body $2\frac{1}{2}$ to $2\frac{1}{2}$ in the length, length of head $\frac{1}{4}$ to $\frac{1}{4}$. Upper profile of head notched in front of eyes. Snout shorter than eye, diameter of which is $\frac{1}{4}$ to $\frac{1}{4}$ in length of head; upper eye generally a little in advance of lower, and close to upper edge of head. Maxillary extending about to below middle of eye, length $2\frac{1}{2}$ to 3 in that of head; lower jaw a little projecting, 2 to $2\frac{1}{2}$ in head. Teeth all small, rather close-set, little enlarged anteriorly. Gill-rakers rather long and slender; 11 to 13 on lower part of anterior arch. Scales cycloid on both sides of body, those on the ocular side frequently with a rough or spiny patch well within the hinder margin of the scale; 71 to 80 scales in lateral line. Supratemporal branch of lateral line reaching

base of eighth or ninth ray of dorsal fin. Dorsal 74-80; commencing just behind posterior nostril of blind side, above or a little in front of anterior margin of eye. Anal 58 or (63); tip of first interhaemal spine not projecting. Pectoral of ocular side with 11 to 13 rays, length $1\frac{1}{2}$ to $1\frac{3}{4}$ in that of head. Caudal pointed or double-truncate; caudal peduncle more than twice as deep as long. Brownish, with a number of darker spots and markings, of which 6 ocelli arranged thus, : : : , and a series of 5 or 6 smaller ones at edges of body, are generally most prominent; fins with numerous dark brown spots and markings; dorsal and anal each with a series of 7 to 6 prominent spots near basal parts of fins; a pair of dark blotches at base of caudal fin.

TYPE.—Australian Museum, No. I. 3080.

DISTRIBUTION.—Coasts of south-eastern Australia, northwards to southern Queensland.

SPECIMENS EXAMINED:

3 (102-220 mm.).	Northern New South Wales.	Austr. Mus. ("Endeavour").
4 (210-235 ").	8 miles E. of Sandon Bluff, N.S. Wales, 35-40 fms.	" "
1 (133 mm.).	Port Jackson, N.S. Wales.	Austr. Mus.

Also several from New South Wales and southern Queensland (Austr. Mus. "Endeavour").

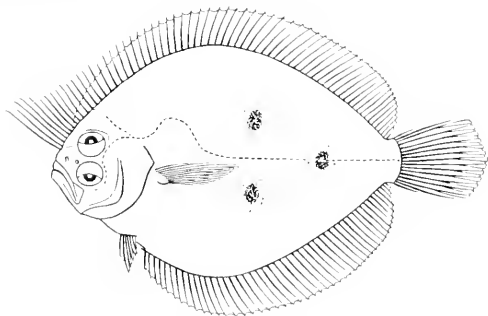
5. PSEUDORHOMBUS TRIOCELLATUS (Schneider).

Pleuronectes trioceellatus, Schneider 1801, in Bloch, Syst. Ichth., p. 145.

Rhombus trioceellatus, Bleeker, 1853, Nat. Tijdschr. Ned. Ind., v, p. 528.

Pseudorhombus trioceellatus, Günther, 1862, Cat. Fish., iv, p. 428; Kner, 1869, Reise "Novara", Zool. 1, 5, Fische, p. 284; Bleeker, 1869-72, Atl. Ichth., vi, p. 9, Pleuron., pl. xii, fig. 1; Day, 1877, Fish. India, p. 421, pl. xcii, fig. 1; Norman, 1927, Rec. Ind. Mus., xxix, p. 11; Fowler, 1928, Mem. B.P. Bishop Mus., x, p. 93; Weber and Beaufort, 1929, Fish Indo-Austral. Arch., v, p. 108.

Panalichthys trioceellatus, Fowler, 1904, J. Acad. Nat. Sci. Philad. (2) xii, p. 555.



110. 57. *Pseudorhombus trioceellatus*. B.M. (N.H.) 1927.1.0.1. 3.

Depth of body $1\frac{1}{2}$ to $1\frac{3}{4}$ in the length, length of head $3\frac{1}{3}$ to $3\frac{1}{2}$. Upper profile of head sometimes a little notched in front of eyes. Snout about as long as eye, diameter of which is $3\frac{1}{3}$ to 4 in length of head; anterior margins of eyes level, or lower a little in advance of upper, which is separated from edge of head by a space equal to

$\frac{1}{4}$ or $\frac{1}{3}$ its diameter. Maxillary extending to below middle of eye or not quite as far, length $2\frac{1}{4}$ to $2\frac{1}{2}$ in that of head; lower jaw not projecting, nearly twice in head. Teeth minute in both jaws, scarcely enlarged anteriorly. Gill-rakers rather long, slender; about 23 on lower part of anterior arch. Scales ctenoid on ocular side, cycloid on blind side, except anteriorly and near bases of dorsal and anal fins, where they are ctenoid; 63 to 69 scales in lateral line. Supratemporal branch of lateral line extending towards tenth to thirteenth ray of dorsal fin. Dorsal 65-70; commencing above or a little in front of anterior nostril of blind side, and at a distance in front of eye equal to about $\frac{1}{3}$ its diameter; anterior rays somewhat prolonged, free from membrane, first ray nearly $\frac{2}{3}$ length of head. Anal 49-52; tip of first interhaemal spine sometimes projecting. Pectoral of ocular side with 12 or 13 rays, length $1\frac{1}{4}$ to $1\frac{1}{2}$ in that of head. Caudal rounded or double-truncate; caudal peduncle 3 to $3\frac{1}{2}$ times as deep as long. Brownish, with indistinct darker spots and markings, and sometimes with some scattered white spots and blotches; three large conspicuous dark ocelli arranged in the form of a triangle on the body; median fins with dark spots and blotches.

TYPE.—Not traced.

DISTRIBUTION.—East coast of India to the Malay Archipelago; Tahiti (?).¹

SPECIMENS EXAMINED:

2 (85, 100 mm.).	—	Zool. Soc. Coll.
1 (120 mm.).	Madras.	Day.
2 (112, 114 mm.).	"	"
7 (100-130 ").	Orissa Coast, 8 fms.	Ind. Mus.

Also several from Ceylon, Madras, Orissa coast and Burma (Ind. Mus.); 1 from Moluccas, 1 from Borneo, and 2 (Bleeker Coll.) from India (?) (Leiden Mus.); and 1 from Colombo (Mus. Comp. Zoöl.).

Attains a length of 6 or 8 inches.

6. PSEUDORHOMBUS ANNULATUS, Norman.

Pseudorhombus annulatus, Norman, 1927, Rec. Ind. Mus., xxix, p. 12, pl. 11.

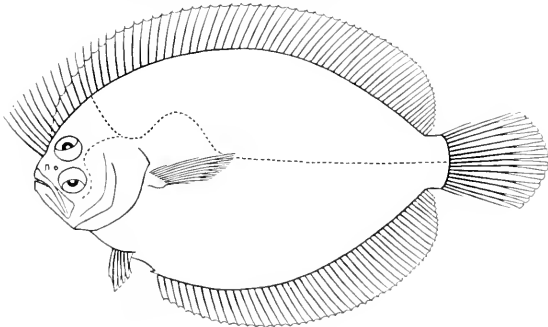


FIG. 58.—*Pseudorhombus annulatus*. B.M. (N.H.) 1904.5.25.74. 1.

¹ Recorded by Kuer (1869); locality probably incorrect.

Close to *P. trivellatus*. Depth of body $1\frac{2}{3}$ in the length, length of head $3\frac{1}{2}$ to $3\frac{2}{3}$. Snout shorter than eye, diameter of which is 3 to $3\frac{1}{2}$ in length of head. Length of maxillary a little more than twice in head. 23 to 25 gill-rakers on lower part of anterior arch. Scales all ctenoid on both sides of body; 60 to 67 in lateral line. Dorsal 67-70, anterior rays somewhat prolonged, quite free from membrane, first ray not much more than $\frac{1}{2}$ length of head. Anal 49-51; tip of first interanal spine projecting. Length of pectoral of ocular side $1\frac{1}{3}$ to $1\frac{2}{3}$ in that of head. Pale brownish, with a number of more or less distinct darker rings; median fins with brown spots and blotches.

TYPE.—British Museum (Nat. Hist.) Reg. No. 1004, 5.25.74.

DISTRIBUTION.—Muscat, Gulf of Oman.

SPECIMENS EXAMINED:

5 (60-105 mm). Types 1. Muscat, Gulf of Oman, 15. 30. fms. Townsend

7. PSEUDORHOMBUS MALAYANUS, Bleeker

Pseudorhombus russelli (part), Günther, 1862, Cat. Fish., iv, p. 424.

Pseudorhombus malayanus, Bleeker, 1866, Ned. Tijdschr. Dierk., iii, p. 45; Bleeker, 1866-72,

Atl. Ichth., vi, p. 7, Pleuron., pl. iii, fig. 2; Norman, 1927, Rec. Ind. Mus., xxix, p. 12.

Pseudorhombus arsius (part), Jenkins, 1910, Mem. Ind. Mus., iii, p. 24.

Pseudorhombus oligodon, Weber and Beaufort, 1929, Fish. Indo Austral. Arch., v, p. 101, Chabanaud, 1929, Bull. Mus. Hist. nat. Paris, (2) 1, p. 374.

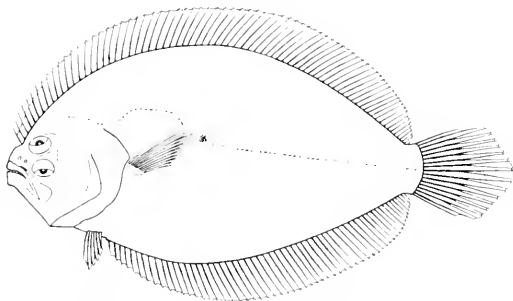


FIG. 59. *Pseudorhombus malayanus*. B.M. (N.H.) 1927.1.6.11. $\frac{1}{2}$.

Depth of body $1\frac{1}{2}$ to twice in the length, length of head $3\frac{1}{2}$ to $3\frac{2}{3}$. Upper profile of head a little notched in front of eyes. Snout as long as or a little longer than eye, diameter of which is $4\frac{1}{2}$ to nearly 6 in length of head. anterior margins of eyes level or upper a little in advance of lower, separated from edge of head by a space equal to $\frac{1}{4}$ or $\frac{1}{3}$ its diameter. Maxillary extending to below posterior edge of hinder part of eye, length $2\frac{1}{2}$ to $2\frac{3}{4}$ in that of head. lower jaw not projecting, $1\frac{1}{2}$ to $1\frac{1}{3}$ in head. Lateral teeth of upper jaw small, rather close-set, anterior teeth enlarged, teeth of lower jaw stronger and wider apart than those of upper, 7 to 11 on blind side of jaw, some of the teeth in both jaws with barbel tips. Gill-takers rather short,

¹ The largest specimen is selected as the holotype.

8 to 10 on lower part of anterior arch. Scales ctenoid on both sides of body; 70 to 78 in lateral line. Supratemporal branch of lateral line extending towards ninth to eleventh ray of dorsal fin. Dorsal 71-77; commencing above or very little in advance of posterior nostril of blind side, and at a distance in front of eye equal to $\frac{1}{4}$ or $\frac{1}{3}$ its diameter. Anal 55-61; tip of first interhæmal spine sometimes projecting. Pectoral of ocular side with 12 or 13 rays, length $1\frac{2}{3}$ to $1\frac{3}{4}$ in that of head; pectoral of blind side $1\frac{1}{2}$ to about twice in head. Caudal double-truncate; caudal peduncle 3 to 4 times as deep as long. Brownish, with or without indistinct groups of small white spots above, below, and on straight part of lateral line; generally a dark blotch at commencement of straight part of lateral line; sometimes other more irregular darker spots and markings; median fins with indistinct dark spots and rings.

TYPE.—Leiden Museum.

DISTRIBUTION.—East coast of India through the Malay Peninsula and Archipelago to the Philippines.

SPECIMENS EXAMINED:

1 (143 mm.).	Madras.	Day.
2 (185, 192 mm.).	Orissa Coast.	Ind. Mus.
2 (160, 205 ,,).	Singapore Fishmarket.	Raffles Mus.
1 (142 mm.). Paratype.	East Indian Archipelago.	Bleeker.
2 (115, 165 mm.).	Java Sea (6° 52' S., 112° 55' E.).	Hardenberg.
1 (140 mm.).	Ceram.	Pfeiffer.
2 (200, 215 mm.).	Nhatrang Bay, Indo-China.	Paris Mus.
1 (187 mm.).	Bay of Manila, Philippines.	Meyer.
1 (145 ,,).	Philippines.	Veitch.
1 (150 ,,).	Manila, Philippines.	Herre.

Also several from the east coast of India and Burma (Ind. Mus.).

Apart from the presence of ctenoid scales on the blind side of the body, this species is very similar to *P. arsius*. If specimens of more or less equal size are compared, however, the latter species may generally be recognised by the shorter lower jaw, the stronger canines in both jaws, and the shorter pectoral fin on the blind side.

8. PSEUDORHOMBUS OLIGODON (Bleeker).

Rhombus oligodon, Bleeker, 1854, Nat. Tijdschr. Ned. Ind., vi, p. 419; Bleeker, 1858-9, Art. Soc. Sci. Indo-Neerl., v, Japan, pl. iii, fig. 2.

Pseudorhombus russellii (part), Gunther, 1862, Cat. Fish., iv, p. 424.

? *Pseudorhombus cinnamomeus*, Otaki, 1897, J. Fish. Bur. Tokyo, vi (1), p. 6, pl. iii, fig. 2; Tanaka, 1913, Fish. Japan, xiv, p. 231, pl. lxx, fig. 238.

Paralichthys oligodon, Jordan and Snyder, 1901, Annot. Zool. Japon., iii, p. 121.

Pseudorhombus oligodon, Jordan and Evermann, 1902, Proc. U.S. Nat. Mus., xxv, p. 365; Jordan and Snyder, 1906, Proc. U.S. Nat. Mus., xxxi, p. 177; Snyder, 1912, Proc. U.S. Nat. Mus., xli, p. 438; Norman, 1931, Ann. Mag. Nat. Hist. (10) viii, p. 598; Wu, 1932, Thès. Facult. Sci. Univ. Paris, A. 244 (268), p. 80.

? *Pseudorhombus arsius*, Jordan and Seale, 1905, Proc. U.S. Nat. Mus., xxix, p. 529.

Pseudorhombus cinnamomeus, Jordan and Starks, 1906, Proc. U.S. Nat. Mus., xxxi, p. 174; Hubbs, 1915, Proc. U.S. Nat. Mus., xlviii, p. 462; Fowler and Bean, 1922, Proc. U.S. Nat. Mus., lxi (2), p. 66; Oshima, 1927, Japan. J. Zool., Trans. Abstr., 1 (5), p. 189.

Very close to *P. malayanus*, but depth of body 2 to $2\frac{1}{4}$ in the length, length of head $3\frac{1}{2}$ to $3\frac{3}{4}$. Maxillary not extending to below posterior edge of eye, length 2 to $2\frac{1}{2}$ in that of head; lower jaw about $1\frac{2}{3}$ in head. 7 to 9 gill-rakers on lower part of anterior arch. So to 90 scales in lateral line. Supratemporal branch of lateral line extending towards seventh to ninth ray of dorsal fin. Dorsal 78-82. Anal 61-65. Pectoral of ocular side $1\frac{2}{3}$ to $1\frac{3}{4}$ in head, that of blind side $2\frac{1}{2}$ to $2\frac{3}{4}$. Brownish, with or without darker spots or rings; a large dark spot at commencement of straight part of lateral line, which may be rounded and distinct or diffuse; median fins with irregular brown spots and markings.

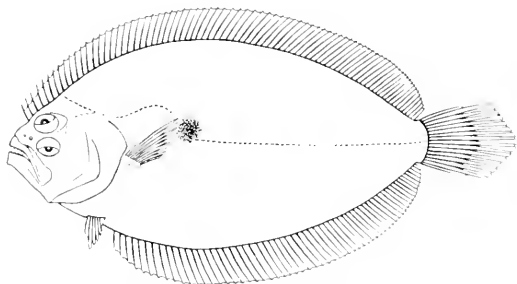


FIG. 60. — *Pseudorhombus oligodon*. B.M. (N.H.) 79-5.14.74. ♂.

TYPE — Leiden Museum.

DISTRIBUTION — China and Japan; Formosa.

SPECIMENS EXAMINED:

1 (145 mm.).	China.	Reeves.
1 (150 ").	Anov.	Fight.
1 (220 ").	Hong Kong, 7 fms.	" Challenger ".
1 (208 ").	Dai-po, Hong Kong.	Chen.

6. *PSEUDORHOMBUS QUINTUOCELLATUS*, Weber & Beaufort.

Pseudorhombus quinquocellatus, Weber and Beaufort, 1929, Fish. Indo-Austral. Arch., v, p. 104.

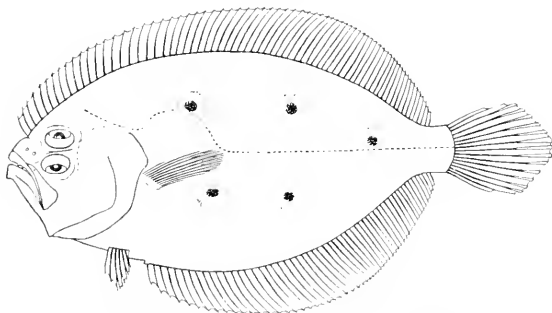


FIG. 61. — *Pseudorhombus quinquocellatus*. Co-type. ♂.

Depth of body a little more than twice in the length, length of head $3\frac{1}{2}$. Upper profile of head a little notched in front of upper eye. Snout about as long as eye, diameter of which is $4\frac{2}{3}$ in length of head; lower eye very slightly in advance of upper, which is separated from edge of head by a space equal to about $\frac{1}{3}$ its diameter. Maxillary extending to below posterior part of eye, length about $\frac{1}{2}$ that of head; lower jaw scarcely projecting, $1\frac{1}{4}$ in head. Lateral teeth of upper jaw small and rather close-set; 3 or 4 pairs of strong canines anteriorly; lateral teeth of lower jaw much stronger and wider apart than those of upper jaw; 12 to 14 teeth on blind side of jaw and one or two canines anteriorly. Gill-rakers of moderate length; 9 or 10 on lower part of anterior arch. Scales ctenoid on ocular side, cycloid on blind side; 76 to 79 in lateral line. Supratemporal branch of lateral line extending towards eighth ray of dorsal fin. Dorsal 68-70; commencing above space between nostrils of blind side, and at a distance in front of eye equal to more than $\frac{1}{2}$ its diameter. Anal 52-55; tip of first interhæmal spine strongly projecting. Pectoral of ocular side with 12 or 13 rays, length $1\frac{2}{3}$ in that of head; that of blind side more than twice in head. Caudal double-truncate (?); caudal peduncle about twice as deep as long. Reddish brown, with 5 dark blotches arranged thus :::, each being surrounded at some distance by a brown ring; indistinct dark rings scattered over body.

TYPE.—Amsterdam Museum.

DISTRIBUTION.—Indo-Australian Archipelago.

SPECIMENS EXAMINED:

2 co-types (182 and 185 mm.) from Madura Strait (7° 39' S., 114° 17'-18' E.) [Amsterdam Mus.]

10. PSEUDORHOMBUS CTENOSQUAMIS (Oshima).

Pseudorhombus ctenosquamis, Oshima, 1927, Japan. J. Zool., Trans. Abstr., i (5), p. 188.

Close to *P. arsius*. Depth of body twice in the length, length of head more than $4\frac{1}{2}$. Snout as long as eye, diameter of which is a little less than $3\frac{1}{2}$ in length of head. Maxillary extending to below middle of eye, length about $1\frac{1}{2}$ in that of head. Lower jaw of ocular side with 6 widely set canine teeth, that of blind side with 16 pointed teeth. Gill-rakers long, slender, pointed; 10 on lower part of anterior arch. 85 scales in lateral line. Dorsal 78, commencing on blind side opposite notch in upper profile of head. Anal 59; tip of first interhæmal spine projecting. Length of pectoral of ocular side about $1\frac{1}{2}$ in that of head. Caudal double truncate. Greyish brown, with a round dark blotch encircled by minute white spots at angle of lateral line; round dark spots with pale centres scattered irregularly over body; median fins fuscous.

TYPE.—Not traced.

DISTRIBUTION.—Formosa

The single type-specimen was 140 mm. in length, and was taken at Anping, near Tainan.

Wu [1932, Thés. Facult. Sci. Univ. Paris, A 244 (208), p. 85] includes this species in the synonymy of *P. cinnamomeus*, but does not state whether he has examined the type.

11 PSEUDORHOMBUS ARSIUS (Hamilton).

[LARGE-TOOTHED FLOUNDER.]

Pleuronectes arsius, Hamilton, 1822, Fish. Ganges, p. 128; Hora, 1929, Mem. Ind. Mus., ix, p. 80, pl. xvii, figs. 1, 2.

? *Pleuronectes maculosus*, Cuvier, 1829, R. Ann., ed. 2, ii, p. 341.

Platessa russelli, Gray, 1834, Illust. Indian Zool., ii, pl. xciv, fig. 2; Cantor, 1859, J. Asiat. Soc. Beng., xviii (2), p. 1190.

Rhombus lentiginosus, Richardson, 1813, Ann. Mag. Nat. Hist., xi, p. 495; Bleeker, 1852, Verh. Batav. Gen., xxiv, Pleuron., p. 15.

- Platessa bilineata*, Richardson, 1846, 15 Rept. Brit. Assoc., (Camba. 1845), p. 278.
- Rhombus arsius*, Bleeker, 1865, Verh. Batav. Gen., xxv, Bengal, p. 76.
- Rhombus polyspilus*, Bleeker, 1865, Nat. Tijdschr. Ned. Ind., iv, p. 503.
- Pseudorhombus russelli* (part), Günther, 1862, Cat. Fish., iv, p. 124; Barnard, 1928, Ann. S. Afr. Mus., xvi, p. 388.
- Pseudorhombus lentiginosus*, Bleeker, 1865, Ned. Tijdschr. Dierk., ii, p. 184.
- ? *Pseudorhombus russelli*, Kner, 1869, Reise "Novara", Zool., 1, 5, Fische, p. 283.
- Pseudorhombus russelli*, Day, 1865, Fish. Malabar, p. 172; Bleeker, 1866, 72, Atl. Ichth., vi, p. 6, Pleuron., pl. II, fig. 2; Macleay, 1878, Proc. Linn. Soc. N.S.W., ii, p. 302; Sauvage, 1891, Hist. Nat. Madagascar, xvi, Poiss., p. 473; Gilchrist and Thompson, 1917, Ann. Durban Mus., ii, p. 399; Regan, 1920, Ann. Durban Mus., ii, p. 268, fig. 1; Von Bonde, 1922, Rep. Fish. Mar. Biol. Surv. S. Afr., ii, (1921), Spec. Rep. 1, p. 13; Fowler, 1926, Proc. Acad. Nat. Sci. Philad., lxxvii, (1925), p. 204; Oshima, 1927, Japan. J. Zool., Trans. Abstr., 1 (5), p. 183.
- Pseudorhombus arsius*, Günther, 1862, Cat. Fish., iv, p. 126; Day, 1877, Fish. India, p. 423, pl. x0, fig. 5; Jordan and Seale, 1907, Bull. U.S. Bur. Fish., xxvi, (1906), p. 45; Snyder, 1912, Proc. U.S. Nat. Mus., xli, p. 179; Hora, 1923, Mem. Ind. Mus., v, p. 758; Norman, 1926, Biol. Res. "Indoayan", v, p. 231; Norman, 1927, Rec. Ind. Mus., xxix, p. 13; Fowler, 1928, Mem. B. P. Bishop Mus., x, p. 93; Weber and Beaufort, 1929, Fish. Indo Austral. Arch., v, p. 108; McCulloch, 1929, Mem. Aust. Mus., v, p. 279; Wu, 1932, Thes. Facult. Sci. Univ. Paris, A, 243 (268), p. 86.
- Pseudorhombus polyspilus*, Bleeker, 1862, Versl. Akad. Wet. Amsterdam, xiii, p. 426; Bleeker, 1866-72, Atl. Ichth., vi, p. 7, Pleuron. pl. vi, fig. 3; Jordan and Seale, 1907, Bull. U.S. Bur. Fish., xxvi, (1906), p. 45; Weber and Beaufort, 1929, Fish. Indo Austral. Arch., v, p. 106, fig. 20; Schmidt, 1930, Trans. Pacif. Comm. Acad. Sci. U.S.S.R., 1, p. 112.
- Leurohombus cincticeps*, Macleay, 1882, Proc. Linn. Soc. N.S.W., vi, p. 126.
- Pleuronectes mortoniensis*, De Vis, 1883, Proc. Linn. Soc. N.S.W., vii, p. 370.
- Pseudorhombus multumaculatus*, Meyer, 1885, Anal. Soc. Esp. Hist. Nat., xiv, p. 49.
- Neorhombus ocellatus*, De Vis, 1886, Ann. Rept. Q'ld. Mus.¹
- Paralichthys arsius*, Rutter, 1897, Proc. Acad. Nat. Sci. Philad., p. 87; Waite, 1899, Mem. Aust. Mus., iv, p. 120, fig. 8; Stead, 1906, Fish. Austral., p. 178; Stead, 1908, Edible Fish. N.S. Wales, p. 103.
- Paralichthys polyspilus*, Fowler, 1904, J. Acad. Nat. Sci. Philad., (2) xii, p. 555.
- Pseudorhombus andersoni*, Gilchrist, 1905, Mar. Invest. S. Afr., iii, p. 9, pl. xxvi.
- Platophrys russelli*, Evermann and Seale, 1907, Bull. U.S. Bur. Fish., xxvi, (1906), p. 105.
- Pseudorhombus arsius* (part), Jenkins, 1910, Mem. Ind. Mus., iii, p. 24.

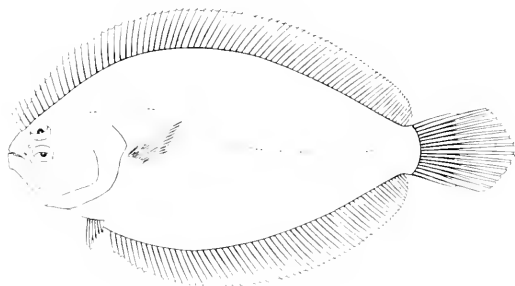


FIG. 62. *Pseudorhombus arsius*. B.M. (N.H.) 89, 2-1, 1906. 1/3.

¹ See A. R. McCulloch.

Depth of body $1\frac{1}{2}$ to $2\frac{1}{4}$ in the length, length of head $3\frac{1}{2}$ to $3\frac{3}{4}$. Upper profile of head straight or a little notched in front of eyes. Snout (in adults) longer than eye, diameter of which is $\frac{4}{5}$ to $\frac{7}{10}$ in length of head; anterior margins of eyes level or upper a little in advance of lower; upper eye separated from edge of head by a space equal to $\frac{1}{3}$ to $\frac{2}{5}$ its diameter. Maxillary extending to below posterior edge or hinder part of eye (middle of eye in young), length $2\frac{1}{2}$ to $2\frac{3}{4}$ in that of head; lower jaw not projecting, $1\frac{1}{2}$ to 2 in head. Lateral teeth of upper jaw small, and rather close-set; 2 to 4 pairs of rather large canines anteriorly; lateral teeth of lower jaw much stronger and wider apart than those of upper jaw; 6 to 13 teeth on blind side of jaw, and one or two pairs of strong canines anteriorly; none of the teeth with barbed tips. Gill-rakers of moderate length or rather short; 8 to 15 on lower part of anterior arch. Scales ctenoid on ocular side, cycloid on blind side; 69 to 80 in lateral line. Supratemporal branch of lateral line reaching eighth to twelfth ray of dorsal fin. Dorsal 72-80; commencing above or a little in advance of nostrils of blind side, and at a distance in front of eye equal to $\frac{1}{2}$ to $\frac{2}{3}$ its diameter. Anal 54-62; tip of first interhamal spine feeble, not projecting. Pectoral of ocular side with 11 to 13 rays, length $1\frac{1}{2}$ to 2 in that of head; that of blind side 2 to $2\frac{1}{2}$ in head. Caudal double-truncate; caudal peduncle $2\frac{1}{4}$ to $3\frac{1}{2}$ times as deep as long. Brownish or greyish, generally with some darker spots and rings; usually a dark spot, sometimes surrounded by a ring of white dots, at junction of straight and curved parts of lateral line, either small and distinct or larger and more diffuse; frequently one or two smaller spots on straight portion of lateral line; head and body sometimes with numerous scattered small dark spots, with or without bluish-white margins (*polyspilus*); median fins with brown spots and rings.

TYPE.—None.¹

DISTRIBUTION.—From the East coast of Africa through the Indian Ocean and Archipelago to the Pacific.

SPECIMENS EXAMINED:

1 (200 mm.), skin.	Near Mouth of Umbilo R., Port Natal.	—
2 (200, 232 mm.).	Port Natal.	Ayres.
3 (168-202 ,,).	Durban Bay, Natal.	Warren.
1 (255 mm.), skin.	Zanzibar.	Playfair.
1 (222 ,,).	"	"
2 (319, 320 mm.).	Muscat.	Jayakar.
5 (42-58 ,,).	Persian Gulf.	Fownsend.
1 (114 mm.).	Karachi.	Townsend.
1 (190 ,,).	"	"
2 (152, 205 mm.).	S. Canara.	Dav.
5 (180-235 ,,).	Sind.	"
3 (138-162 ,,).	Madras.	"
2 (145, 155 ,,).	Puri Beach, Orissa.	Ind. Mus.
1 (215 mm.).	Balasure Bay, Orissa.	"
		(" Golden Crown ").
1 (155 ,,).	Chilka Lake.	Ind. Mus.
1 (160 ,,).	Calcutta.	Day.
2 (35, 45 mm.).	"	"
2 (130, 205 ,,).	Bengal.	Waterhouse.
2 (140, 175 ,,), skins.	"	"
1 (87 mm.).	Andaman Is.	Day.
1 (135 ,,).	"	"
1 (95 ,,).	"	"
1 (164 ,,).	"	"
1 (160 ,,).	"	Ind. Mus.

¹ According to Hora (1929, Mem. Ind. Mus., ix, p. 175), no zoological collections were ever kept by Hamilton (formerly Buchanan). Apart from the original description, therefore, the only indications of his species are the manuscript drawings, many of which (including that of *P. asiaticus*) are preserved.

1 (148 mm)	Akyab, Burma.	Dav
2 (90, 92 mm.)	" "	" "
2 (139, 210 "	Siam.	Chunpon.
1 (305 mm.), Stuffed	East Indies (?)	Whitely
1 (175 "), Paratype of <i>P. polyspilus</i>	I. Indian Archipelago.	Bleeker
2 (128, 220 mm.), skins	Penang.	Cantor
1 (200, 245 ")	Singapore Fishmarket	Raffles Mus.
1 (75 " mm.)	Buntal, Sarawak.	Brooke.
1 (200 " ")	Borneo.	—
1 (245 " ")	N. Celebes.	Meyer.
1 (96 " ")	Kota Radja, Sumatra	Hardenberg.
1 (103 " ")	Near Cheribon, Java Sea.	Amsterdam Mus.
1 (143 " ")	Eastern part of Java Sea.	" "
1 (185 " ")	Batavia Fishmarket.	Hardenberg.
1 (125 " ")	Zamboanga.	" Challenger."
1 (285 " "), skin	China.	Warwick.
1 (310 " "), stuffed. Type of <i>P. russelli</i>	" "	Reeves.
1 (12, 148 mm.)	Santiao, China.	Light.
1 (92 mm.),	Amoy, China.	" "
1 (160 " "),	Port Malle, Queensland.	Coppinger ("Alert")
2 (215, 220 mm.),	4 to 20 miles N.E. of Gloucester Head, Queensland, 19-35 fms.	Anstr. Mus.
	3 to 7 miles N.W. of Hervey Bay, Queensland, 9-11 fms.	("Endeavour").
1 (200 mm.)	" "	" "
1 (192 " "),	Mouth of Wide Bay, Queensland.	" "
1 (265 " "),	New South Wales.	Austr. Mus.
1 (210 " "),	" "	" "
1 (220 " "),	" "	Stead.
4 (139-325 mm.)	Port Jackson, N.S.W.	Imp. Inst.
1 (235 mm.), skeleton	" "	" "
1 (235 " "), skin. Type of <i>P. lentiginosus</i>	Port Essington, N.S.W.	" "
1 (125 " "),	St. Vincent Gulf, S. Australia.	S. Austr. Mus.
1 (225 " ")	Australia.	Kent
2 (85, 87 mm.)	—	—

Also numerous examples from the coasts of India and Burma, Andaman Is. and Mergui Archipelago (Ind. Mus.), several from the coasts of Queensland and New South Wales (Austr. Mus. "Endeavour"), 6 from Java, Sumatra, Borneo and New Guinea (Leiden Mus.), and several from the Malay Peninsula and Archipelago (Mus. Comp. Zool.)

Pleioneictes maculosus, Cuvier, is based on the figure of "Noorce Nalaka A" in Russell's "Descr. Fish Vizag", i, p. 58, pl. lxxx (1803), which may represent this species. *Teratohombus exsticeps*, Macleay, and *Pseudohombus andersoni*, Gilchrist, were ambicolorate examples. The identity of *P. asiaticus* and *P. russelli* seems fairly certain, but the former is based on a drawing of a young specimen, and the latter on a poorly stuffed skin. *P. polyspilus* should perhaps rank as a distinct variety or subspecies.

This species is abundant in the Indo-Pacific region, and attains a length of about 15 to 18 inches.

12. PSEUDORHOMBUS NATALENSIS, Gilchrist

- Pseudohombus natalensis*, Gilchrist, 1913, Mar. Invest. S. Afr., iii, p. 8, pl. xxv; Gilchrist and Thompson, 1917, Ann. Durban Mus., i, p. 399; Regan, 1920, Ann. Durban Mus., ii, p. 299; Von Bonde, 1923, Trans. Roy. Soc. S. Afr., xii, p. 299; Fowler, 1926, Proc. Acad. Nat. Sci. Philad., lxxxv, (1925), p. 291; Norman, 1934, Ann. Mag. Nat. Hist., (10) viii, p. 508.
- Pseudohombus russelli* (part), Barnard, 1938, Ann. S. Afr. Mus., xvi, p. 388, pl. xvii, fig. 2.

Close to *P. arsius*. Depth of body twice in the length, length of head $3\frac{1}{2}$. Snout shorter than eye, diameter of which is $3\frac{1}{2}$ in length of head; lower eye a little in advance of upper, which is separated from edge of head by a space equal to about $\frac{1}{4}$ its diameter. Maxillary extending to below anterior $\frac{1}{4}$ of eye, length $2\frac{1}{2}$ in that of head; lower jaw not projecting, $1\frac{1}{2}$ in head. Teeth small and close-set, scarcely enlarged anteriorly. Gill-rakers rather short, 11 on lower part of anterior arch 58 scales in the lateral line. Dorsal 70; commencing above posterior nostril of blind side and at a distance in front of eye equal to $\frac{1}{4}$ its diameter. Anal 52; tip of first interhæmal spine feeble, just projecting. Pectoral of ocular side with 11 rays, length about $1\frac{1}{2}$ in that of head. Caudal double-truncate; caudal peduncle more than twice as deep as long. Brownish, with a number of distinct dark rings arranged symmetrically on body; a series of conspicuous brown spots on dorsal and anal fins; tip of pelvic of ocular side with a dark spot.

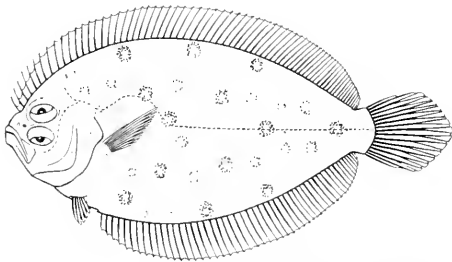


FIG. 63.—*Pseudorhombus natalensis*. B.M. (N.H.) 1901, 12, 31, 1. 1.

TYPE.—South African Museum.

DISTRIBUTION.—Natal.

SPECIMEN EXAMINED:

1 (135 mm.). Co-type (?).

$6\frac{1}{2}$ miles W. by N. of C. Natal, 54 fms.

Gilchrist.

13. PSEUDORHOMBUS MICROGNATHUS, Norman.

Pseudorhombus javanicus (part), Day, 1877, Fish. India, p. 424; Jenkins, 1910, Mem. Ind. Mus., III, p. 24.

Pseudorhombus micrognathus, Norman, 1927, Rec. Ind. Mus., XXIX, p. 10, pl. III.

Close to *P. elevatus*, but length of head $3\frac{1}{2}$ to $3\frac{2}{3}$ in that of fish (without caudal). Diameter of eye 4 to $4\frac{1}{3}$ in length of head. Maxillary scarcely reaching middle of eye, length $2\frac{3}{4}$ to nearly 3 in that of head; lower jaw more than twice in head; teeth minute. Gill-rakers shorter, 13 on lower part of anterior arch. 65 or more scales in lateral line. Supratemporal branch of lateral line reaching seventh or eighth ray of dorsal fin. Dorsal 60; origin above space between nostrils and at a distance in front of eye equal to about $\frac{1}{4}$ its diameter; anterior rays nearly free. Anal 50; tip of first interhæmal spine feeble, scarcely projecting. Brownish, with numerous small dark spots; 3 or 4 fairly prominent ocelli, one above and one below anterior third of straight part of lateral line, a third below junction of straight and curved portions,

and sometimes an inconspicuous fourth ocellus above the curved portion, sometimes a faint blotch at junction of straight and curved parts of lateral line, median fins with small brown spots.

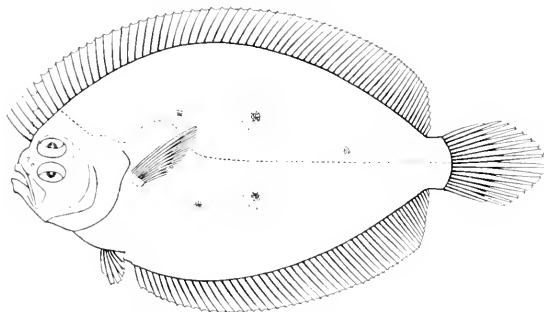


FIG. 64. *Pseudorhombus micrognathus*. Ind. Mus. F. 3441 I. ♂

TYPE: Indian Museum, No. F. 3441 I.

DISTRIBUTION:—Coast of Orissa, India.

SPECIMENS EXAMINED:

1 (115 mm) Paratype. Puri Beach, Orissa. Ind. Mus.

Also the holotype (165 mm) and one other specimen from Orissa (Ind. Mus.).

14. PSEUDORHOMBUS PENTOPHTHALMUS, Gunther.

Pseudorhombus pentopthalmus, Gunther, 1862, Cat. Fish., iv, p. 428; Gunther, 1860, Shore Fishes, "Challenger", p. 69; Jordan and Starks, 1904, Bull. U. S. Bur. Fish., xxii, (1902), p. 626; Fowler and Bean, 1922, Proc. U. S. Nat. Mus., lxxii (2), p. 106; Weber and Beaufort, 1929, Fish Indo Austral. Arch., v, p. 114; Norman, 1931, Ann. Mag. Nat. Hist. (6), viii, p. 599; Wu, 1932, Thes. Facult. Sci. Univ. Paris, A, 244 (268), p. 88.

Pseudorhombus russelli, Otake, 1897, J. Fish. Bur. Tokyo, p. 6.

Pseudorhombus ocellifer, Regan, 1908, Ann. Mag. Nat. Hist., (7) xv, p. 25; Jordan and Starks, 1906, Proc. U. S. Nat. Mus., xxxi, p. 178; Hubbs, 1915, Proc. U. S. Nat. Mus., xlviii, p. 103; Jordan and Hubbs, 1925, Mem. Carnegie Mus., vi, p. 297; Oshima, 1927, Japan. J. Zool., Trans. Abstr., v (5), p. 189; Schmidt and Landberg, 1930, Bull. Acad. Leningrad, p. 1147.

? *Pseudorhombus annamensis*, Chabanand, 1929, Bull. Mus. Hist. nat. Paris, (2) 1, p. 174.

Arneoglossus wakivai, Schmidt, 1931, U. R. Acad. Leningrad, p. 313, fig. 1.

Depth of body 2 to 2½ in length, length of head 3¼ to 3½. Upper profile of head notched in front of eyes. Snout as long as or shorter than eye, diameter of which is 3⅓ to 4¼ in length of head, anterior margins of eyes level, the upper eye rather close to edge of head. Maxillary extending to below middle of eye or beyond, length 2 to 2½ in that of head, lower jaw not projecting, 1½ to 1⅔ in head. Teeth all rather small and close-set, somewhat enlarged anteriorly; more than 20 on blind side of lower jaw. Gill-rakers rather long and slender, (15) 17 or 18 on lower part of anterior arch. Scales ctenoid on ocular side, cycloid on blind side, 62 to

73 in lateral line. Supratemporal branch of lateral line extending towards seventh to ninth ray of dorsal fin. Dorsal 68-73; commencing above space between nostrils of blind side, and at a distance in front of eye equal to $\frac{1}{3}$ or $\frac{1}{2}$ its diameter. Anal 53-57; tip of first interhæmal spine projecting. Pectoral of ocular side with 11 or 12 rays, length $1\frac{1}{3}$ to $1\frac{1}{2}$ in that of head; that of blind side 2 to $2\frac{1}{4}$ in head. Caudal pointed or double-truncate; caudal peduncle 2 to 3 times as deep as long. Brownish, with darker spots and markings, of which five ocelli arranged thus, :::, are most prominent; median fins with small, dark spots.

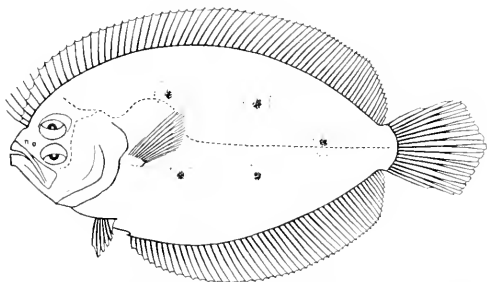


FIG. 65.—*Pseudorhombus pentophthalmus*. B.M. (N.H.) 48.3.10.207. 1.

TYPE.—British Museum (Nat. Hist.). Reg. No. 48.3.10.207.

DISTRIBUTION.—Java Sea; Indo-China; Formosa; China and Japan; Corea.

SPECIMENS EXAMINED:

1 (90 mm.).	Holotype.	China.	Belcher.
3 (110-125 mm.).	Types of <i>P. ocellifer</i> .	Inland Sea of Japan.	Smith.
2 (113, 120 ").	" "	" " "	" Challenger."
1 (122 mm.).	" "	Wakanoura, Japan.	Jordan.
1 (48 ").	" "	Mororan, "	" "

Also 8 from Fukuura, Japan (Zool. Samml., Munich); and a co-type of *P. annamensis* (Paris Mus.).

Apart from a supposed difference in the size of the eye, *P. ocellifer* is very close to *P. pentophthalmus*, and as the eye appears to be very variable in size I am unable to recognise this as a distinct species. *Arnoglossus wakiyai*, Schmidt, from Fusan (Corea), is almost certainly this species, and, in view of the fact that the pelvic fins are described as "attached nearly symmetrically and . . . of the same length", it is difficult to understand why it was placed in the genus *Arnoglossus*. I have examined a co-type (120 mm.) of *P. annamensis*, from the Bay of Nhatrang, French Indo-China, and regard this species as probably identical with *P. pentophthalmus*, which has been recorded from the Java Sea by Weber and Beaufort. The body is very slightly deeper, the anterior profile a little more elevated, and the third and fourth rays of the dorsal fin longer than those that follow, but in other respects it agrees very closely with examples of *P. pentophthalmus* of equal size.

This is a small species, rarely exceeding a length of 5 or 6 inches.

15. PSEUDORHOMBUS ELEVATUS, Ogilby

(DEEP FLOUNDER)

Pseudorhombus javanicus (part), Day, 1877, Fish. India, p. 124, pl. xxi, fig. 2; Jenkins, 1910, Mem. Ind. Mus., iii, p. 24.

Pseudorhombus elevatus, Ogilby, 1912, Mem. Qd. Mus., i, p. 45; Norman, 1920, Biol. Res. "Endeavour", v, p. 234, fig. 3; Norman, 1927, Res. Ind. Mus., xxix, p. 15; McCulloch, 1929, Mem. Aust. Mus., v, p. 279.

Pseudorhombus affinis, Weber, 1911, "Siboga"-Exped., Fische, p. 420, pl. xi, fig. 1; Weber and Beaufort, 1929, Fish. Indo Austral. Arch., v, p. 110, fig. 25.

? *Pseudorhombus oligodon*, Schmidt and Lindberg, 1930, Bull. Acad. Leningrad, p. 1147.

Depth of body $1\frac{1}{2}$ to twice in the length, length of head $3\frac{1}{2}$ to nearly $3\frac{1}{2}$. Upper profile of head somewhat notched in front of eyes. Snout about as long as eye, diameter of which is $3\frac{1}{2}$ to $4\frac{1}{2}$ in length of head; anterior margins of eyes level, or lower very slightly in advance of upper, which is separated from edge of head by a

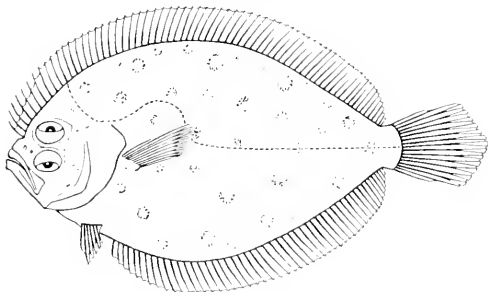


FIG. 16. *Pseudorhombus elevatus*. B.M. (N.H.) 1904.5.25.199. 3

space equal to $\frac{1}{3}$ or $\frac{1}{2}$ its diameter. Maxillary extending to below middle of eye or a little beyond, length $2\frac{1}{2}$ to $2\frac{1}{2}$ in that of head; lower jaw scarcely projecting, $1\frac{2}{3}$ to nearly twice in head. Teeth all small in both jaws, scarcely enlarged anteriorly, 23 to 32 teeth on blind side of lower jaw. Gill-rakers rather long, slender; 11 to 15 on lower part of anterior arch. Scales all ctenoid on ocular side, cycloid on blind side, 65 to 74 in lateral line. Supratemporal branch of lateral line nearly reaching base of ninth to eleventh ray of dorsal fin. Dorsal 67-74, commencing above anterior nostril of blind side, and at a distance in front of eye equal to about $\frac{1}{2}$ its diameter, a line connecting base of first ray and posterior nostril, if continued, passes above the hinder end of the maxillary or crosses its most posterior part. Anal 52-58, tip of first interhaemal spine, if projecting, comes out on the blind side, behind the vent and above first or second ray of anal fin. Pectoral of ocular side with 11 or 12 rays, length $1\frac{1}{2}$ to $1\frac{2}{3}$ in that of head. Caudal double-truncate; caudal peduncle $2\frac{1}{2}$ to $2\frac{3}{4}$ times as deep as long. Pale brownish, with 5 rows of inconspicuous darker rings; generally a dark blotch, with or without a margin of small white spots, at junction of curved and straight parts of lateral line, and one or two smaller ones on the straight portion, sometimes similar blotches above and below lateral line, median fins with brown spots and markings.

TYPE.—Queensland Museum

DISTRIBUTION.—Persian Gulf, through the Indian Ocean and Archipelago to Australia

SPECIMENS EXAMINED :

2 (135, 140 mm.).	Persian Gulf, 10-20 fms.	Townsend.
3 (105-134 ,,).	Orissa Coast, 7-11 fms.	Ind. Mus.
1 (133 mm.).	Puri Beach, Orissa.	"
1 (115 ,,).	Sandheads, R. Hughli.	"
2 (120, 130 mm.).	Mouth of R. Hughli.	"
1 (115 mm.).	Gulf of Cambay, 25-30 fms.	"
2 (37, 50 mm.).	Gulf of Martaban.	Oates.
2 (147, 150 mm.).	Nahrang Bay, Indo-China.	Paris Mus.
5 (80-130 ,,).	Bah Strait, 109 fms.	Hardenberg.
2 (95-105 ,,).	Malacca Strait (3° 43' N., 99° 10' E.).	"
1 (133 mm.).	3 to 7 miles N.W. of Hervey Bay, Queensland, 9-11 fms.	Austr. Mus. (" Endeavour ")
4 (118-146 mm.).	12 miles N.E. of Bowen, Queensland, 19-25 fms.	"

Also a number from the Persian Gulf, coasts of India and Burma (Ind. Mus.); from the east coast of Queensland (Austr. Mus. " Endeavour "); and 2 from Malacca Strait (Laborat. Onderzoek Zee, Batavia).

16. PSEUDORHOMBUS JAVANICUS (Bleeker).

Rhombus javanicus, Bleeker, 1853, Nat. Tijdschr. Ned. Ind., iv, p. 502.

Pseudorhombus javanicus, Gunther, 1862, Cat. Fish., iv, p. 427; Bleeker, 1866-72, Atl. Ichth., vi, p. 8, Plenron. pl. 1, fig. 3; Weber, 1913, " Siboga " Exped., Fische, p. 424; Norman, 1927, Rec. Ind. Mus., xxix, p. 16; Weber and Beaufort, 1929, Fish. Indo-Austral. Arch., v, p. 109; Norman, 1931, Ann. Mag. Nat. Hist., (10) viii, p. 598; Wu, 1932, Thès. Facult. Sci. Univ. Paris, A. 244 (268), p. 82.

Platophrys javanicus, Evermann and Seale, 1907, Bull. U.S. Bur. Fish., xxvi, (1906), p. 105.

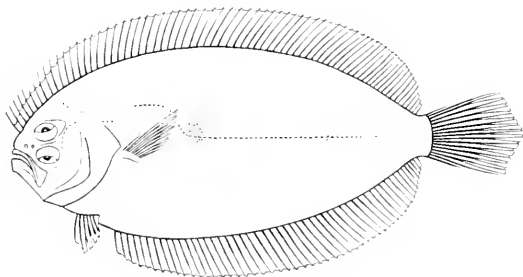


FIG. 67.—*Pseudorhombus javanicus*. B.M. (N.H.) 62.6.1.1; 1.

Depth of body $2\frac{1}{10}$ to $2\frac{1}{3}$ in the length, length of head $3\frac{1}{2}$ to 4. Upper profile of head evenly convex or very slightly notched in front of eyes. Snout as long as or a little longer than eye, diameter of which is 4 to 5 in length of head; anterior margins

of eyes about level, the upper separated from edge of head by a space equal to $\frac{1}{2}$ to $\frac{3}{4}$ its diameter. Maxillary extending to below middle of eye or a little beyond, length $2\frac{1}{2}$ to $2\frac{7}{8}$ in that of head, lower jaw not projecting, twice or nearly twice in head. Teeth all small in both jaws, a little enlarged anteriorly, 15 to 25 teeth on blind side of lower jaw. Gill-rakers pointed, rather short, 12 to 15 on lower part of anterior arch. Scales of ocular side more or less ctenoid anteriorly, mostly cycloid on posterior part of body, a narrow strip of distinctly ctenoid scales at bases of dorsal and anal fins, scales of blind side cycloid, 67 to 74 scales in lateral line. Supratemporal branch of lateral line nearly reaching base of ninth to eleventh ray of dorsal fin. Dorsal 60-70; commencing in advance of anterior nostril of blind side, and at a distance in front of eye equal to $\frac{2}{3}$ to $\frac{1}{2}$ its diameter; a line connecting base of first ray and posterior nostril, if continued, passes above hinder end of maxillary. Anal 51-50, tip of first interhemal spine feeble, sometimes projecting. Pectoral of ocular side with 11 or 12 rays, length $1\frac{1}{2}$ to $1\frac{3}{8}$ in that of head. Caudal double-truncate, caudal peduncle $2\frac{1}{4}$ to nearly 3 times as deep as long. Brownish or greyish, with darker spots and blotches, often a number of pale spots and ocelli, which are scattered irregularly over the body and extend on to the median fins; a round black blotch, sometimes surrounded by white dots, at the junction of the straight and curved parts of the lateral line, and usually another smaller blotch on middle of straight portion, median fins with small brown spots.

TYPE.—Leiden Museum.

DISTRIBUTION.—East coast of India through the Malay Peninsula and Archipelago to southern China.

SPECIMENS EXAMINED:

5 (155-185 mm.)	Singapore Fishmarket	Raffles Mus.
1 (200 mm.), Paratype	F. Indian Archipelago.	Bleeker.
1 (170 ")	Menam, R. Siam.	Roy. Siamese Mus.
1 (185 ")	Nhatrang Bay, Indo-China	Paris Mus.
1 (220 ")	Daipo, Hong Kong.	Chen.
1 (167 ")	Lankou, Haunan	"

17. PSEUDORHOMBUS CINNAMONEUS (Temminck and Schlegel)

Pleuromectes chrysopterus, Schneider, 1801, in Bloch, Syst. Ichth., p. 151.

Platessa chrysoptera, Richardson, 1846, 15 Rept. Brit. Assoc. (Camb. 1845), p. 278.

Rhombus cinnamomeus, Temminck and Schlegel, 1846, in Siebold, F. Japon. (Pisces), p. 180, pl. xviii.

Richardson, 1846, *loc. cit.*, p. 279; Bleeker, 1858, Act. Soc. Sci. Indo-Néerl., iii, Japan, p. 25.

Pseudorhombus cinnamomeus, Günther, 1862, Cat. Fish., iv, p. 127; Snyder, 1912, Proc. U.S. Nat.

Mus., xlii, p. 438; Schmidt, 1931, Trans. Pac. Com. Acad. Sci. U.S.S.R., ii, p. 124; Schmidt,

1931, C. R. Acad. Leningrad, p. 315; Norman, 1931, Ann. Mag. Nat. Hist., (10) viii, p. 509;

Wu, 1932, Thés. Facult. Sci. Univ. Paris, A, 244 (268), p. 85.

Rhombus cinnamomeus, Jordan and Snyder, 1901, Proc. U.S. Nat. Mus., xxiii, p. 379.

Pseudorhombus misakius, Jordan and Starks, 1906, Proc. U.S. Nat. Mus., xxxi, p. 175, figs. 4, 5.

Jordan, Tanaka and Snyder, 1913, J. Coll. Sci. Tokyo, xxxiii (1), p. 310, fig. 204; Jordan and

Thompson, 1914, Mem. Carnegie Mus., vi, p. 306, fig. 79; Hulbés, 1915, Proc. U.S. Nat. Mus.,

xlviii, p. 463; Schmidt and Lundberg, 1930, Bull. Acad. Leningrad, p. 1147.

? *Pseudorhombus cinnamomeus*, Tanaka, 1913, Fish. Japan, xiv, p. 231, pl. lxx, fig. 238.

Pseudorhombus formosanus, Oshima, 1927, Japan. J. Zool., Trans. Abstr., 1 (5), p. 182.

Spirorhombus latianus, Oshima, 1927, *loc. cit.*, p. 180.

Depth of body about twice in the length, length of head $3\frac{2}{3}$ to nearly 4. Upper profile of head distinctly convex above eyes, notched in front of upper eye. Snout (in adults) longer than eye, diameter of which is 4 to 5 in length of head, anterior margin of eyes about level, the upper separated from edge of head by a space equal to about $\frac{1}{2}$ its diameter. Maxillary extending to a little beyond middle of eye, length $2\frac{1}{2}$ to $2\frac{1}{2}$ in that of head; lower jaw scarcely projecting, nearly twice in head. Teeth all rather small, scarcely enlarged anteriorly (at least in lower jaw), 20 to 25 teeth on blind side of lower jaw. Gill-rakers of moderate length, rather slender, margins

feebly spinulate; 11 or 12 on lower part of anterior arch. Scales all ctenoid on ocular side, cycloid on blind side; 75 to 82 in lateral line. Supratemporal branch of lateral line branched, nearly reaching dorsal fin between bases of ninth and tenth rays. Dorsal 80-89; commencing about above anterior nostril of blind side, and at a distance in front of eye equal to nearly $\frac{1}{2}$ its diameter; a line connecting base of first ray and posterior nostril, if continued, passes above the hinder end of the maxillary or crosses its posterior part. Anal 63-69; tip of first interhemal spine rather feeble, sometimes projecting. Pectoral of ocular side with 13 rays, length about $1\frac{2}{3}$ in that of head. Caudal pointed or double-truncate; caudal peduncle 3 times as deep as long. Brownish, with a number of darker rings more or less regularly arranged, those near edges of body most prominent; a dark spot or diffuse blotch, generally with a white margin, at junction of curved and straight portions of lateral line, and generally one or two similar spots on the straight part, median fins with numerous small brown spots; sometimes flecked with white.

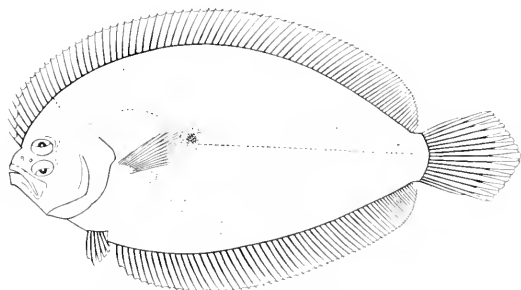


FIG. 68.—*Pseudorhombus cinnamomeus*. B.M. (N.H.) 1905.6.9.234. $\frac{1}{2}$.

TYPE.—Leiden Museum.

DISTRIBUTION.—China and Japan; Formosa

SPECIMENS EXAMINED:

4 (70-140 mm.).	Amoy, China.	Light.
1 (113 mm.).	Shanghai, China.	Swinhoe.
2 (100, 210 mm.).	Coast of Shan-Tung, China.	Wu.
2 (235, 305 ").	Inland Sea of Japan.	Smith.

Also 1 from Japan (Leiden Mus., Bleeker Coll.), and 1 from Japan (Zool. Samml., Munich).

Platessa chrysoptera, Richardson, which is doubtfully identical with *Pleuronectes chrysopterus*, Schneider, is based on a figure in the collection of water-colour drawings made by Mr. J. Reeves (plate 44, number 104), which may represent this species.

18. PSEUDORHOMBUS LEVISQUAMIS (Oshima).

Pseudorhombus levisquamis, Oshima, 1927, Japan. J. Zool., Trans. Abstr., 1 (5), p. 189

Pseudorhombus levisquamis, Wu, 1932, Thes. Facult. Sci. Univ. Paris, A. 244 (268), p. 83.

Very close to *P. cinnamomeus*. Depth of body twice in the length, length of head nearly $3\frac{1}{2}$. Snout nearly as long as eye, diameter of which is $4\frac{1}{2}$ in length of head.

Maxillary extending to a little beyond middle of eye, length $2\frac{1}{4}$ in that of head. About 20 teeth on blind side of lower jaw. Gill-rakers rather short and stout, margins strongly spinulate, 8 (9) on lower part of anterior arch. Scales mostly cycloid on ocular side, except at edges of body, where there is a narrow strip of ctenoid scales; scales of blind side all cycloid; about 75 scales in lateral line. Dorsal (78) 85 (86). Anal (50) 63 (64). Pectoral of ocular side with 12 or 13 rays, length $1\frac{2}{3}$ in that of head. Caudal peduncle $2\frac{1}{4}$ times as deep as long. Brownish, with traces of darker spots, and with a series of dark rings near upper and lower edges of body; a diffuse black blotch at junction of curved and straight parts of lateral line.

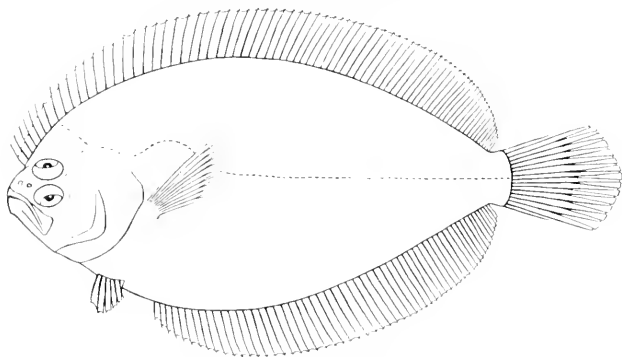


FIG. 66.—*Pseudohombus levisquamis*. M.C.Z. 11201. $\times \frac{1}{2}$.

TYPE --Not traced

DISTRIBUTION --Formosa; China.

SPECIMEN EXAMINED:

1 (250 mm) from China (Mus. Comp. Zool., No. 11201).

10. PSEUDORHOMBUS ARGUS, Weber.

Pseudohombus argus, Weber, 1911, "Siboga"-Exped., Fische, p. 425, pl. xi, fig. 9; Norman, 1926, Biol. Res. "Endeavour", v, p. 236; Weber and Beaufort, 1929, Fish. Indo-Austral. Arch., v, p. 113, fig. 27; McCulloch, 1929, Mem. Aust. Mus., v, p. 278.

Depth of body about twice in the length, length of head $3\frac{2}{3}$ to $3\frac{3}{4}$. Upper profile of head notched in front of eyes. Snout a little shorter than eye, diameter of which is 4 to $4\frac{1}{2}$ in length of head. anterior margins of eyes level or upper slightly in advance of lower; upper eye separated from edge of head by a space equal to $\frac{1}{5}$ its diameter. Maxillary extending to below middle of eye or a little beyond, length (2) $2\frac{3}{4}$ to $2\frac{5}{8}$ in that of head. lower jaw scarcely projecting, $1\frac{5}{8}$ to 2 in head. Teeth all small and rather close-set, scarcely enlarged anteriorly; 15 to 19 teeth on blind side of lower jaw. Gill-rakers slender, of moderate length; (12) 14 to 16 on lower part of anterior arch. Scales ctenoid on ocular side, cycloid on blind side, 70 to 77 in lateral line.

Supratemporal branch of lateral line extending towards base of seventh to ninth ray of dorsal fin. Dorsal 68-69; commencing just behind posterior nostril of blind side, and immediately in front of eye or above its anterior edge. Anal 51-54; tip of first interhæmal spine feeble, not projecting. Pectoral of ocular side with 10 or 11 rays, length $1\frac{2}{3}$ to $1\frac{1}{2}$ in that of head. Caudal double-truncate; caudal peduncle about 3 times as deep as long. Brownish, with darker spots and rings, and with 5 more or less conspicuous ocelli arranged thus, ::•:; median fins with brown spots; a series of rings on dorsal and anal.

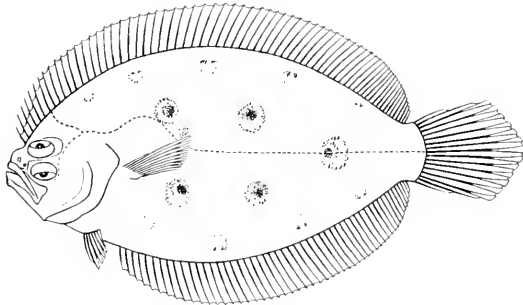


FIG. 70.—*Pseudorhombus argus*. B.M. (N.H.) 1925.7.22.34. $\times \frac{3}{2}$.

TYPE.—Amsterdam Museum.

DISTRIBUTION —Aru Islands; southern Queensland.

SPECIMENS EXAMINED:

1 (175 mm.)	3 to 7 miles N.W. of Hervey Bay, Queensland 9-11 fms.	Austr. Mus. ("Endeavour").
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Also 2 from southern Queensland (Austr. Mus. "Endeavour").

This species is very closely related to *P. jenynsii* (Bleeker), but may be distinguished by the more numerous gill-rakers.

20. PSEUDORHOMBUS JENYNSII (Bleeker).

[SMALL-TOOTHED FLOUNDER.]

Platessa —?, Jenyns, 1842, Zool. Voy. "Beagle", iv, Fish, p. 138.

Platessa jenynsii, Bleeker, 1855, Verh. Akad. Wet. Amsterdam, 11, Viss. Van Diemen, p. 15, sp. 265.

Pseudorhombus multimaculatus, Gunther, 1862, Cat. Fish., iv, p. 427; Steindachner, 1867, Sitzber.

Akad. Wiss. Wien, lvi (1), p. 318; Macleay, 1882, Proc. Linn. Soc. N.S.W., vi, p. 125; Ogilby,

1893, Edible Fish. Crust. N.S.Wales, p. 157, pl. xxxviii; McCulloch, 1914, Biol. Res.

"Endeavour", 11, p. 131, pl. xxiv; Norman, 1926, Biol. Res. "Endeavour", v, p. 237;

McCulloch, 1929, Mem. Aust. Mus., v, p. 278.

Pseudorhombus multiradiatus, Macleay, 1883, Proc. Linn. Soc. N.S.W., vii, p. 13.

- Paralichthys norae-cambriae*, Ogilby, 1898, Proc. Linn. Soc. N.S.W., XLIII, p. 290; Wate, 1899, Mem. Aust. Mus., iv, p. 120, fig. 9; Stead, 1906, Fish. Austral., p. 179, fig. 65.
Pseudorhombus norae-cambriae, Ogilby, 1908, Proc. Roy. Soc. Queensl., XXI, p. 25; Ogilby, 1912, Mem. Qd. Mus., I, pp. 43, 45.
 ? *Pseudorhombus anomalus*, Ogilby, 1912, *loc. cit.*, p. 48; Norman, 1920, Biol. Res. "Endeavour", v, p. 239; Whitley, 1931, Aust. Zool., vi, p. 322, pl. XXV.
Pseudorhombus jenynsii, Whitley, 1931, Aust. Zool., vi, p. 313.

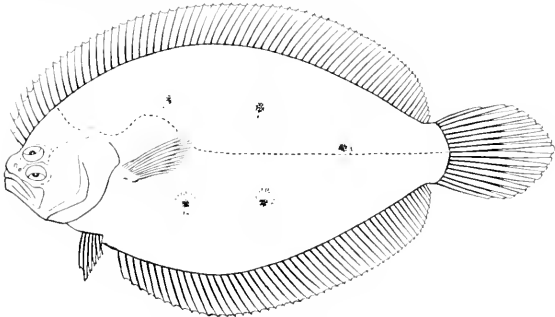


FIG. 71.—*Pseudorhombus jenynsii*. B.M. (N.H.) 90.9.23.202 $\times \frac{1}{2}$.

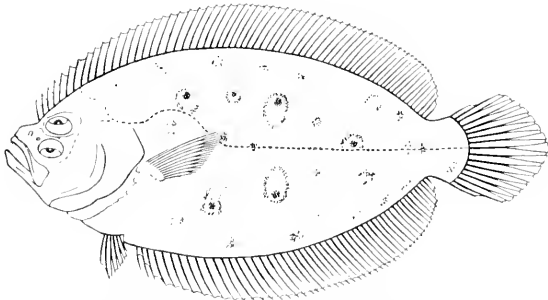


FIG. 72.—*Pseudorhombus jenynsii* var. *anomalus*. [After Whitley] $\times \frac{1}{2}$.

Depth of body $1\frac{1}{2}$ to $2\frac{1}{2}$ in the length, length of head $3\frac{2}{3}$ to nearly 4. Upper profile of head more or less distinctly notched in front of eyes. Snout as long as or a little longer than eye, diameter of which is (4) $4\frac{1}{2}$ to $6\frac{1}{2}$ in length of head, upper eye a very little in advance of lower, separated from edge of head by a space equal to about $\frac{1}{2}$ its diameter. Maxillary extending to just beyond middle of eye or to below its

posterior edge, length $2\frac{1}{2}$ to $2\frac{3}{4}$ in that of head; lower jaw scarcely projecting, $1\frac{1}{2}$ to 2 in head. Teeth of upper jaw small and rather close-set laterally, becoming somewhat larger and wider apart anteriorly; teeth of lower jaw a little stronger; no prominent canines in either jaw. Gill-rakers pointed, generally rather short and broad, sometimes more elongate; (6) 8 to 10 on lower part of anterior arch. Scales ctenoid on ocular side, cycloid on blind side; 68 to 75 in lateral line. Supratemporal branch of lateral line extending to base of sixth or seventh (occasionally eighth) ray of dorsal fin. Dorsal 67-74; commencing just behind posterior nostril of blind side and above or a little in advance of anterior edge of eye. Anal 51-60; tip of first interhæmal spine feeble, not projecting. Pectoral of ocular side with 11 or 12 rays, length $1\frac{1}{2}$ to $1\frac{3}{4}$ in that of head. Caudal pointed; caudal peduncle about 3 times as deep as long. Brownish or greyish, with darker spots and markings, of which 5 ocelli arranged thus, : : • are most prominent; these ocelli usually provided with a number of small white dots and surrounded by a dark ring; median fins with brown spots; a series of larger and more distinct dark spots on basal parts of dorsal and anal fins.

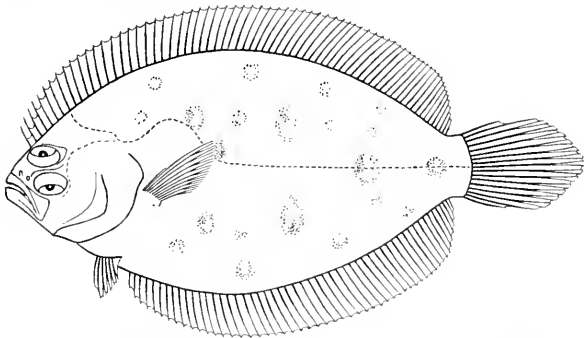


FIG. 73.—*Pseudorhombus jenynsis* var. *dubius*. B.M. (N.H.) 1925.7.22.35. $\times \frac{3}{2}$.

TYPE.—British Museum (Nat. Hist.). Reg. No. 1933.2.28.5.

DISTRIBUTION.—Coasts of Australia, from Fremantle, Western Australia, to southern Queensland.

SPECIMENS EXAMINED :

3 (170-220 mm.).	Types of <i>P. multimaculatus</i> .	—	Haslar Coll.
1 (165 mm.), skin.	Holotype of the species.	King George Sound, W. Australia.	"Beagle."
1 (270 ").		St. Vincent Gulf, S. Australia.	S. Austr. Mus.
1 (215 ").		New South Wales.	Austr. Mus.
3 (218-340 mm.).		Port Jackson, N.S.Wales.	Imp. Inst.
1 (260 mm.), skeleton.		" "	"
1 (140 ").	{Var. <i>anomalus</i> .}	" "	"
1 (220 ").		Port Hacking, N.S.Wales.	Austr. Mus.
1 (155 ").		Port Bowen, Queensland.	Godeffroy.
1 (183 ").		3 to 7 miles N.W. of Hervey Bay, Queensland, 9-11 fms.	Austr. Mus.
1 (184 ").	{Var. <i>dubius</i> .}	" "	("Endeavour").

Also 4 from Queensland (Austr. Mus. "Endeavour"), and 1 from St Vincent Gulf, S. Australia (S. Austr. Mus.).

It seems probable that more than one form is included within this widely distributed and apparently variable species, but the material in the British Museum is quite inadequate to settle this matter. I have compared examples representing Ogilby's *P. nova-cambriae* with the types of *P. multimaculatus*, and believe them to be identical, but the latter are in a poor state of preservation, and the type locality is unknown. The type of *P. jenynsii* (Bleeker) is a dried skin, but appears to be the same species¹. Whitley has recently given an excellent figure of Ogilby's *P. anomalus*, the type of which is in the Queensland Museum (Reg. No. I 13 1568), and I am indebted to him for several notes on this specimen. It differs from typical examples of *P. jenynsii* only in the rather more slender body and in the somewhat longer and slightly more numerous gill-rakers. Among specimens from Port Jackson in the British Museum is one (140 mm) which agrees well in general appearance with the figure of *P. anomalus*, and also exhibits the longer gill-rakers, which are 10 in number. This form is, perhaps, best to be regarded as a variety of *jenynsii* — *anomalus*, Ogilby, and a copy of Whitley's figure is given here. Among the material collected by the "Endeavour" is one specimen (E 6680), previously identified by me as *P. multimaculatus* (= *jenynsii*), which differs from that species in the following characters: The length of the head is a little less than $3\frac{3}{4}$ in that of fish (without caudal); the upper profile of head is nearly straight; the diameter of the eye is 4, the length of the maxillary a little more than $2\frac{3}{4}$ in that of head, there are 5 or 6 very short, stout gill-rakers on the lower part of the anterior arch. I am not inclined to describe this as a new species on the basis of a single specimen, but it may well be regarded, for the present, as another variety of *jenynsii*, for which I propose the name *dubius* (var. n.). A figure of this fish (B.M. Reg. No. 1625.7.22.35) is also included here.

21. PSEUDORHOMBUS NEGLECTUS, Bleeker.

Pseudorhombus neglectus, Bleeker, 1866, Ned. Tijdschr. Dierk., iii, p. 44; Bleeker, 1866-72, Atl. Ichth., vi, p. 8, Pleuron. pl. iii, fig. 1; Weber, 1913, "Siloga" Exped., Fische, p. 424; Weber and Beaufort, 1929, Fish. Indo-Austral. Arch., v, p. 111.
Platophys neglectus, Evermann and Seale, 1907, Bull. U.S. Bur. Fish., xxvi, (1906), p. 105.

Depth of body $1\frac{3}{5}$ to $2\frac{1}{4}$ in the length, length of head $3\frac{3}{4}$ to $3\frac{3}{4}$. Upper profile of head straight or a little notched in front of eyes. Snout shorter than eye, diameter of which is $3\frac{3}{4}$ to $4\frac{1}{4}$ in length of head; upper eye a little in advance of lower, and very close to edge of head. Maxillary extending to below middle of eye or a little beyond, length $2\frac{1}{2}$ to $2\frac{1}{4}$ in that of head, lower jaw not projecting, $1\frac{1}{2}$ in head. Teeth all rather small, scarcely enlarged anteriorly. Gill-rakers rather short, compressed, 9 to 11 (12) on lower part of anterior arch. Scales ctenoid on ocular side, the spinules sometimes confined to a patch in the centre of the posterior edge of each scale, cycloid on blind side, about 77 scales in lateral line. Supratemporal branch of lateral line extending towards space between seventh and eighth rays of dorsal fin. Dorsal (68) 72-75; commencing just behind posterior nostril of blind side, and above anterior margin of eye. Anal (53) 50-59, tip of first interhaemal spine not projecting. Pectoral of ocular side with 12 or 13 rays, length $1\frac{1}{3}$ to $1\frac{1}{2}$ in that of head. Caudal bluntly pointed, caudal peduncle nearly 3 times as deep as long. Pale brownish, with or without numerous small dark dots; a dark blotch, often encircled with white, at junction of curved and straight portions of lateral line, and a second on middle of straight part; median fins with brown spots and markings.

TYPE — Leiden Museum.

DISTRIBUTION — Indo-Australian Archipelago, Philippines, southern Chinese Sea.

¹ The new names proposed by Bleeker in this list (1855), one of the first check-lists of Australasian fishes, had been generally overlooked until they were noticed by Whitley (1921).

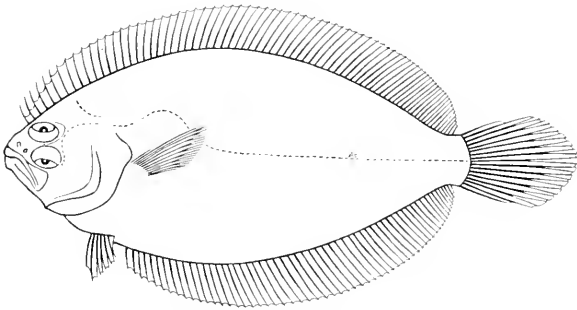


FIG. 74.—*Pseudorhombus neglectus*. B.M. (N.H.) 1924.9.30.3. ♂.

SPECIMENS EXAMINED :

3 (145–205 mm.).	Singapore Fishmarket.	Raffles Mus.
1 (172 mm.).	S. Chinese Sea.	Amsterdam Mus.
1 (155 „).	Malacca Strait (3° 40' N., 99° 10' E.).	Hardenberg.
2 (165, 187 mm.).	Cap Saint Jacques, French Indo-China.	Paris Mus.

DOUBTFUL SPECIES.

22. *PSEUDORHOMBUS* [?] *NAUPHALA* (Hamilton).

Pleuronectes nauphala, Hamilton, 1822, Fish. Ganges, p. 126.

“ The fish is narrow in proportion to its length, being shaped like the iron of a lance, while its greatest width is before the middle In each jaw is a single row of sharp, awl-shaped large teeth, nearly equal in size, and placed at equal distances from each other The scales adhere firmly; those on the upper side are finely indented on the edge, those below are smooth. . . . The lateral lines run straight along the middle of the sides, but, in their fore part, send off a branch, which, forming an arch forward, is then bent up to the back. . . . There are seven distinct fins. That of the back is slightly arched, and contains seventy-three undivided flexible rays The fin behind the vent is slightly arched, and contains fifty-five undivided flexible rays. . . . The fin of the tail is undivided and sharp-pointed, and contains seventeen rays, of which two on each side are undivided, and the others are branched. . . . Its upper or left side is rough, and of a greenish-brown colour, on which are scattered some black spots ”.

TYPE.—None.

DISTRIBUTION.—Estuaries of the Ganges.

Said to grow to a length of about 8 inches.

There is no manuscript drawing of this species in existence, but, judging from the very inadequate description, it is probably a *Pseudorhombus*, and may be near *P. arsius* (Hamilton) or *P. elevatus*, Ogilby.

23. PSEUDORHOMBUS GUTTULATUS, Macleay.

Pseudorhombus guttulus, Macleay, 1883, Proc. Linn. Soc. N.S.W., viii, p. 276; Fowler, 1928, Mem. B. P. Bishop Mus., x, p. 93; Weber and Beaufort, 1929, Fish. Indo-Austral. Arch., v, p. 115.

The depth of the body is nearly $\frac{1}{2}$ the total length. Eyes large, separated by a narrow ridge. Teeth acute, sloping backwards. Dorsal 75; commencing in front of eyes. Anal 63. Uniform grey, fins lighter, the whole covered with minute brown dots.

TYPE.—Australian Museum. No. 19180.

DISTRIBUTION.—Hood Bay, New Guinea.

The type is 100 mm. in length.

Apparently close to *P. arsius* (Hamilton).

24. PSEUDORHOMBUS MOOREI, Thominot.

Pseudorhombus moorei, Thominot, 1880, Bull. Soc. philom. Paris, (7) iv, p. 175; McCulloch, 1929, Mem. Aust. Mus., v, p. 280.

Depth of body twice in the length, length of head 3 $\frac{1}{2}$. Snout as long as eye; eyes separated by a sharp ridge. Teeth strong. Scales ctenoid; 75 to 80 in lateral line. Dorsal 65. Anal 52-55. Pectoral with 10 rays. Caudal rounded. Greenish, with 23 spots or ocelli on body; dorsal and anal fins spotted; a black spot on pectoral fin.

TYPE.—No longer exists.

DISTRIBUTION.—Melbourne, Western Australia.

Apparently nearest to *P. jenyssii* (Bleeker).

Genus 7. TARPHOPS.

Tarphops, Jordan and Thompson, 1914, Mem. Carnegie Mus., vi, p. 307 [*Rhombus oligolepis*, Bleeker].

Perhaps identical with *Pseudorhombus*, but the scales larger, there being less than 50 in the lateral line. The single species grows to a very much smaller size than any *Pseudorhombus*, an example of 74 mm. in total length having been recorded with ripe ova.

A single species from Formosa and Japan

1 TARPHOPS OLIGOLEPIS (Bleeker).

Rhombus oligolepis, Bleeker, 1858-9, Art. Soc. Sci. Indo-Néerl., v, Japan, p. 8, pl. ii, fig. 2.

Pseudorhombus oligolepis, Gunther, 1862, Cat. Fish., iv, p. 430; Jordan and Starks, 1906, Proc. U.S. Nat. Mus., xxxi, p. 179; Jordan, Tanaka and Snyder, 1913, J. Coll. Sci. Tokyo, xxxii (1), p. 316; Schmidt, 1931, Trans. Pac. Com. Acad. Sci. U.S.S.R., ii, p. 124.

Tarphops oligolepis, Jordan and Thompson, 1914, Mem. Carnegie Mus., vi, p. 307, pl. xxxix; Hubbs, 1915, Proc. U.S. Nat. Mus., xlviii, p. 402; Wu, 1932, Illés. Facult. Sci. Univ. Paris, A 244 (268), p. 88.

Spiriorhombus oligolepis, Oshima, 1927, Japan. J. Zool., Trans. Abstr., 1 (5), p. 191.

Depth of body $1\frac{1}{5}$ to $2\frac{1}{3}$ in the length, length of head $3\frac{1}{2}$ to $3\frac{1}{4}$. Upper profile of head evenly curved or very slightly notched in front of eyes. Snout shorter than eye, diameter of which is 3 to 4 in length of head; anterior margins of eyes nearly level, the upper close to edge of head. Maxillary not reaching middle of eye, length a little more than twice in head; lower jaw not projecting, $1\frac{2}{3}$ to $1\frac{1}{2}$ in head. Teeth very small in both jaws, scarcely enlarged anteriorly. Gill-rakers long, slender, close-set, about 16 on lower part of anterior arch. Scales ctenoid on both sides of body,

42 to 48 in lateral line. Dorsal 62-66; commencing above posterior nostril of blind side and just in front of eye. Anal 48-52; tip of first interhæmal spine projecting. Pectoral of ocular side with 10 rays, length $1\frac{1}{2}$ to $1\frac{3}{4}$ in that of head. Caudal rounded or double-truncate. Brownish, with irregular darker spots and markings.

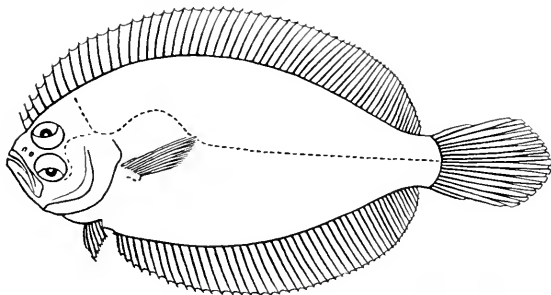


FIG. 75.—*Tarphops oligolepis*. B.M. (N.H.) 1905.6.6.237. 2.

TYPE.—Leiden Museum.

DISTRIBUTION.—Formosa; Japan.

SPECIMENS EXAMINED:

6 (55-60 mm.).

1 (67 mm.).

Inland Sea of Japan.

Senzaki, Nagato Prov., Japan.

Smith.

Tokyo Imp. Univ.

Genus 8. XYSTREURYS.

Xystreurus, Jordan and Gilbert, 1881, Proc. U.S. Nat. Mus., iii, (1880), p. 34 [*Xystreurus isolepis*, Jordan and Gilbert].

Percundum, Jordan, 1890, Proc. U.S. Nat. Mus., xiii, p. 330 [*Percundum rasile*, Jordan].

Body ovate or rather deep, compressed. Eyes normally on the left side,¹ separated by a narrow ridge. Olfactory laminae arranged transversely to or radiating from a fairly lengthy central raxis. Mouth of moderate size, the length of the maxillary more than $\frac{1}{2}$ that of head; jaws about equally developed on both sides, but dentition more developed on the blind side; teeth rather small, blunt, conical, without distinct canines anteriorly, uniserial in both jaws; vomer toothless. Gill-rakers short or of moderate length; lower pharyngeals each with 3 or 4 rows of strong, bluntly pointed teeth. Dorsal fin commencing well behind posterior nostril of blind side and above the eye; the rays simple or bifid at their tips, scaled on both sides. Tip of first interhæmal spine not projecting in front of anal fin. Pectoral fins unequal, that of ocular side prolonged, much longer than that of blind side; middle rays branched. Pelvic fins short-based, subequal and subsymmetrical. Scales small, all cycloid; some minute supplementary scales present, particularly in region of pectoral arch. Lateral line equally developed on both sides of body, with a distinct curve above the pectoral fin; no distinct supratemporal branch. Vent nearly on median line, just in front of anal fin. Vertebrae 37 (12 + 25).

Two species from the coasts of California and Brazil.

¹ *X. isolepis* is indifferently sinistral or dextral.

SYNOPSIS OF THE SPECIES.

- I Depth nearly twice in length; eye $4\frac{1}{2}$ to nearly 5 in head, 6 or 7 short, thick gill-rakers on lower part of anterior arch; about 120 scales in lateral line, many dorsal and anal rays bifid; caudal double-truncate 1 *holepis*.
- II Depth $2\frac{1}{2}$ in length; eye $2\frac{5}{8}$ to $3\frac{3}{8}$ in head; 10 or 11 gill-rakers of moderate length on lower part of anterior arch; 82 to 86 scales in lateral line, only the last few dorsal and anal rays bifid, caudal pointed 2 *rasile*.

1. *XYSTREURYS LIOLEPIS*, Jordan and Gilbert

Xystreurus liolepis, Jordan and Gilbert, 1881, Proc. U.S. Nat. Mus., III, (1886) p. 34; Jordan and Goss, 1889, Rep. U.S. Com. Fish., XIV (1886), p. 243; Jordan and Evermann, 1898, Bull. U.S. Nat. Mus., XLVII (3), p. 2623; Starks and Morris, 1907, Univ. Calif. Pub. Zool., III (11), p. 242; Starks, 1918, Calif. Fish Game, IV (4), p. 8, fig. 88.
Paralichthys liolepis, Jordan and Gilbert, 1883, Bull. U.S. Nat. Mus., XVI, p. 825.

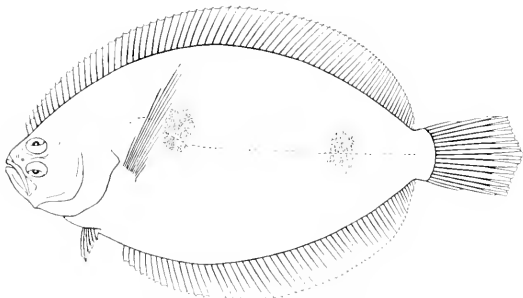


FIG. 76. *Xystreurus liolepis*. B.M. (N.H.) 1015, 1915, 1/2.

Depth of body nearly twice in the length, length of head $3\frac{1}{2}$ to 4. Upper profile of head very little notched above eyes. Snout as long as or a little shorter than eye, diameter of which is $4\frac{1}{2}$ to nearly 5 in length of head; anterior margins of eyes about level, the upper close to edge of head. Maxillary extending to below middle of eye, length $2\frac{1}{4}$ to $2\frac{1}{2}$ in that of head, lower jaw 2 to $2\frac{1}{2}$ in head. Gill-rakers short, thick, 6 or 7 on lower part of anterior arch. About 120 scales in lateral line, supplementary scales numerous. Dorsal 74-78. Anal 50-62. Rays of posterior halves of dorsal and anal fins bifid at their tips. Pectoral of ocular side with 13 rays, falcate, length variable, equal to or much longer than that of head. Caudal double-truncate, length of middle rays $1\frac{1}{4}$ to $1\frac{1}{3}$ in that of head, caudal peduncle more than twice as deep as long. Brownish, mottled with darker, sometimes with distinct round black blotches,¹ median fins blotched with darker, pectoral fin with oblique cross-bars.

TYPE—United States National Museum (?).

DISTRIBUTION—Southern California.

¹ Usually one at junction of straight and curved portions of lateral line and another on the straight part.

SPECIMENS EXAMINED :

1 (200 mm.).	San Diego Bay.	Eigenmann
2 (260, 262 mm.).	California.	"

This species, in which the coloration and length of the pectoral fin on the ocular side is subject to considerable variation, is indifferently sinistral or dextral. It grows to a length of about 15 inches.

2. NYSTREURYS RASILE (Jordan).

- Verecundum rasile*, Jordan, 1890, Proc. U.S. Nat. Mus., xiii, p. 330.
Hypoglossina notata, Berg, 1895, An. Mus. nac. B. Aires, iv, p. 75.
Xystreurus notatus, Ribeiro, 1904, Lavoura (Bol. Soc. nac. Agricult.), 4-7 (1903), p. 162; Ribeiro, 1915, Arch. Mus. nac. Rio de J., xvii, Heterosomata, p. 11.
Xystreurus brasiliensis, Regan, 1914, Ann. Mag. Nat. Hist., (8) xiii, p. 17; Regan, 1914, Rep. Brit. Antarct. ("Terra Nova") Exped., 1910, Zool., I, 1, p. 23, pl. x, fig. 1.

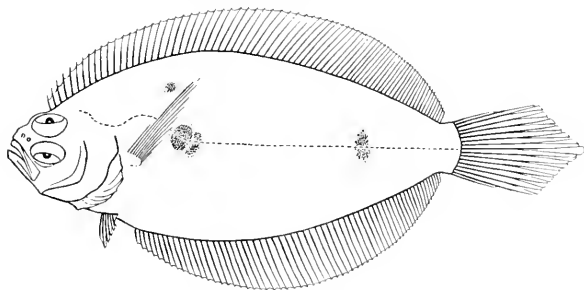


FIG. 77.—*Xystreurus rasile*. B.M. (N.H.) 1913.12.4.257. · ½

Depth of body $2\frac{1}{2}$ in the length, length of head about 4. Upper profile of head not notched above eyes. Snout shorter than eye, diameter of which is $2\frac{1}{2}$ to $3\frac{1}{2}$ in length of head; anterior margins of eyes about level, the upper entering dorsal profile of head. Maxillary extending to a little beyond anterior third of eye, length about $2\frac{1}{2}$ in that of head, lower jaw 2 in head. Gill-rakers of moderate length; 10 or 11 on lower part of anterior arch. 82-86 scales in lateral line; supplementary scales not very numerous. Dorsal 78-83. Anal 64-67. Most of the rays of dorsal and anal fins simple, only the last 3 or 4 branched. Pectoral of ocular side with 10 rays, a little falcate, nearly as long as or a little longer than head. Caudal pointed, middle rays a little longer than head; caudal peduncle more than twice as deep as long. Pale brownish; a large double ocellus at junction of curved and straight parts of lateral line, and a small ocellus between this and the dorsal fin, a black spot posteriorly on lateral line; traces of another pair of spots above and below its straight part.

TYPE.—United States National Museum, No. 43430.

DISTRIBUTION.—Coasts of Brazil, Uruguay and the Argentine Republic.

SPECIMENS EXAMINED :

2 (98, 170 mm.).	Types of <i>X. brasiliensis</i> .	C. Frio, Brazil, 40 fms.	"Terra Nova."
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I am indebted to the Director of the Museo Nacional de Historia Natural, Buenos Aires, for a photograph of the type-specimen of *Hippoglossina notata*, preserved in that institution. This is in very poor condition, but appears to be identical with the specimens described above.

Genus 9. TENIOPSETTA.

Teniopsetta, Gilbert, 1905, Bull. U.S. Com. Fish., xxiii (2), (1903), p. 680 [*Teniopsetta radula*, Gilbert].

Body rather deep, greatly compressed. Eyes on the left side, separated by a ridge. Olfactory laminae reduced to 5 or 6, slightly radiating, without central rachis. Mouth rather small, the length of the maxillary less than $\frac{1}{4}$ that of head; jaws and dentition about equally developed on both sides; teeth small, conical, without canines anteriorly, uniserial in both jaws; vomer toothless. Gill-rakers rather short and broad; lower pharyngeals each with a row of sharp-pointed teeth on outer edge and one or two irregular teeth inside them. Dorsal fin commencing just above posterior nostril of blind side, and well in front of eye; all the rays simple, scaled on both sides. Tip of first interlamal spine not projecting in front of anal fin. Some of the rays of the dorsal and anal fins prolonged. Pectoral fins unequal, that of ocular side larger; all the rays simple. Pelvic fins short-based, subequal and subsymmetrical. Scales very small, cycloid or feebly ctenoid on ocular side, all cycloid on blind side. Lateral line developed only on ocular side of body, with a strong curve above the pectoral fin; no supratemporal branch. Vent on blind side, above first ray of anal fin; urino-genital papilla occupying a similar position on ocular side.

Two species from deep water in the Indian Ocean and Pacific.

SYNOPSIS OF THE SPECIES.

- I Depth $1\frac{1}{2}$ to a little more than twice in length; scales all cycloid, about 105 in lateral line; some of the dorsal and anal rays prolonged only in the male 1 *ocellata*
- II Depth about $1\frac{3}{4}$ in length; scales ctenoid on ocular side, cycloid on blind side, about 140 in lateral line; some of the dorsal and anal rays prolonged in both sexes 2 *radula*.

The sexual differences in this genus are discussed on p. 33.

1. TENIOPSETTA OCELLATA (Günther).

Pseudorhombus ocellatus, Günther, 1880, Shore Fishes "Challenger", p. 50, pl. xxiv, figs A, B; Regan, 1908, Trans. Linn. Soc. London, Zool., xii, p. 232.
Teniopsetta ocellata, Norman, 1927, Rec. Ind. Mus., xxix, p. 17.

Depth of body $1\frac{1}{2}$ to a little more than twice in the length, length of head $3\frac{1}{2}$ to 4. Anterior profile of head steep, a little concave in front of eyes. Snout shorter than eye, diameter of which is about 3 in length of head, lower eye in advance of upper, which is close to edge of head. A strong spine in front of each eye in the male, but only a blunt spine in front of lower eye in the female; a spine on the snout above the maxillary in both sexes, and sometimes one or two spinous processes on the interorbital ridge. Maxillary extending to below anterior part of eye, length $3\frac{1}{2}$ to $3\frac{1}{3}$ in that of head; lower jaw scarcely projecting, $2\frac{1}{4}$ to $2\frac{1}{2}$ in head. 5 gill-rakers on lower part of anterior arch. Scales all cycloid, about 105 in lateral line. Dorsal 88-93; first ray with a broad membranous flap; in the male the rays increase more or less regularly in height to the twelfth, the next six or seven rays being prolonged and more or less free from the membrane of the fin, the highest much longer than head. Anal 74-78, the first six or seven rays prolonged in the male, the first ray

being shorter than the others and with a membranous flap. None of the rays of the dorsal and anal fins prolonged in the female. Pectoral of ocular side with 13 or 14 rays, length $\frac{1}{2}$ to nearly $\frac{2}{3}$ that of head. A strong spine between the pelvic fins. Caudal rounded; caudal peduncle very short. Pale brownish, speckled and spotted with darker, and with a number of rings or U-shaped markings, of which the series of large ones at edges of body are most prominent; median fins with irregular spots and streaks of dark brown; sometimes a deep black blotch at bases of anterior rays of anal fin; distal part of pectoral dusky. Blind side of body dusky in its posterior half, yellowish white anteriorly.

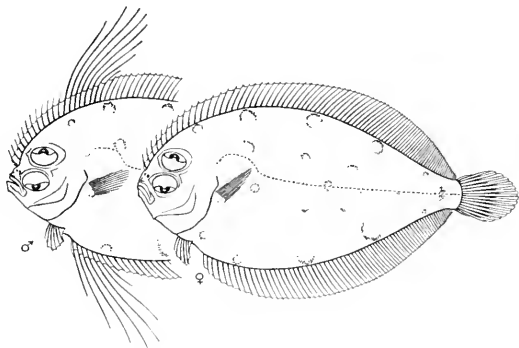


FIG. 78.—*Taniopsetta ocellata*. B.M. (N.H.) 79.5.14.76, 77. $\times \frac{1}{2}$.

TYPE.—British Museum (Nat. Hist.). Reg. No. 1879.5.14.76.

DISTRIBUTION.—Saya de Malha Bank, Indian Ocean; Admiralty Islands.

SPECIMENS EXAMINED:

3 (♂, 150, 155; ♀, 148 mm.).	Saya de Malha Bank, 123 fms.	Gardiner.
2 (♂, 135; ♀, 142 mm.).	Types. ¹ Nares Harbour, Admiralty Is., 152 fms.	"Challenger"

2. *TANIOPSETTA RADULA*, Gilbert.

Taniopsetta radula, Gilbert, 1905. Bull. U.S. Com. Fish., xxiii (2), (1903), p. 680, fig. 266; Norman, 1931, Ann. Mag. Nat. Hist., (10) viii, p. 599.

Taniopsetta ocellatus, Fowler, 1928, Mem. B.P. Bishop Mus., x, p. 90.

Close to *T. ocellata*, but depth of body about $1\frac{1}{2}$ in the length. Scales ctenoid on ocular side, cycloid on blind side; about 140 in lateral line. Dorsal 88–93; 10th or 12th to 15th or 18th rays prolonged in the male, 10th to 13th or 14th in the female. Anal 72–75; first 4 or 5 rays prolonged in the male, first 3 or 4 in the female. All these rays are rather shorter in the female. Membranous flap of first ray of dorsal with a black spot narrowly bordered with white; a jet black spot margined with white on anterior rays of anal; blind side of body without pigment.

¹ The male is selected as the holotype.

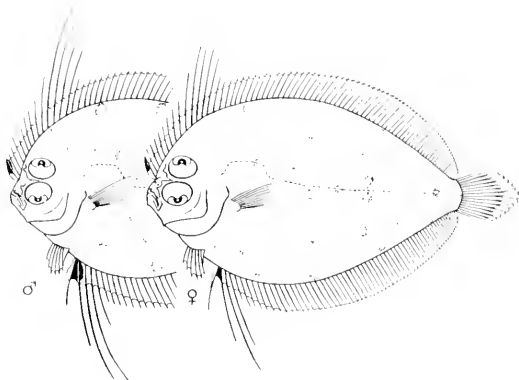


FIG. 79. *Ancylosetta radula*. B.M. (N.H.) 1931.8.19.1, 2. ♂, ♀.

TYPE — United States National Museum No 51639

DISTRIBUTION — Hawaiian Islands.

SPECIMENS EXAMINED :

2. (♂, 92 ; ♀, 116 mm) Paratypes Hawaiian Is. U.S. Nat. Mus.

Genus 10. ANCYLOPSETTA.

Ancylosetta, Gill, 1864, Proc. Acad. Nat. Sci. Philad., p. 224 [*Ancylosetta quadricellata*, Gill].

Notosema, Goode and Bean, 1883, Bull. Mus. Comp. Zool., x, p. 192 [*Notosema dilecta*, Goode and Bean].

Ramularia, Jordan and Evermann, 1898, Bull. U.S. Nat. Mus., XLVII (3), p. 2033 [*Ancylosetta dendritica*, Gilbert].

Body oblong or ovate, compressed. Eyes on the left side, separated by a ridge or flattish, scaled space. Olfactory laminae not numerous, arranged transversely to or radiating from a central rachis of moderate length. Mouth rather small, oblique, the length of the maxillary more than $\frac{1}{3}$ that of head, jaws and dentition about equally developed on both sides; teeth rather small, conical, pointed, somewhat enlarged anteriorly, but without distinct canines, uniserial in both jaws, vomer toothless. Gill-rakers short and broad, lower pharyngeals each with numerous rows of minute pointed teeth, and with two or three larger teeth on posterior part of inner margin. Dorsal commencing above or a little behind nostrils of blind side, and above anterior edge or anterior part of eye, most of the rays simple, more or less scaled on both sides. Tip of first interanal spine not projecting in front of anal fin. Pectoral fins unequal, that of ocular side larger, middle rays branched. Pelvic fins short-based and subsymmetrical, that of ocular side with the rays longer than those of pelvic of blind side. Scales small, strongly ctenoid on both sides of body, no supplementary scales. Lateral line equally developed on both sides of

body, with a distinct curve above the pectoral fin; a supratemporal branch present. Vent on blind side, in advance of or above first ray of anal fin. Vertebræ 35 (9 + 26).

Three species from both coasts of North America.

SYNOPSIS OF THE SPECIES.

- I Pelvic of ocular side about as long as or longer than head, twice or more than twice as long as that of blind side; depth about twice in length.
- A. Anterior dorsal rays not prolonged; tubules of lateral line much branched; gill-rakers rounded, as broad as long; anal 63-66
1. *dendritica*.
- B. Some of the anterior dorsal rays prolonged, forming a distinct lobe; tubules of lateral line simple; gill-rakers pointed, longer than broad; anal 54-56
2. *dilecta*.
- II Pelvic of ocular side (in adults) less than $\frac{1}{2}$ as long as head, not much longer than that of blind side: depth $1\frac{2}{3}$ to $1\frac{1}{3}$ in length
3. *quadrocellata*.

1. ANCYLOPSETTA DENDRITICA, Gilbert.

Ancyplosetta dendritica, Gilbert, 1891, Proc. U.S. Nat. Mus., xiii, (1890), p. 121; Gilbert and Starks, 1904, Mem. Calif. Acad. Sci., iv, p. 199, pl. xxxiii, fig. 62.

Kamularia dendritica, Jordan and Evermann, 1898, Bull. U.S. Nat. Mus., xlvii (3), p. 2633.

Hippoglossina sabanensis, Boulenger, 1899, Boll. Mus. Zool. Anat. Torino, xiv, No. 340, p. 4.

Pseudorhombus dendritica, Meek and Hildebrand, 1928, Field Mus. Pub. Chicago, Zool. Ser., xv, No. 249, p. 972.

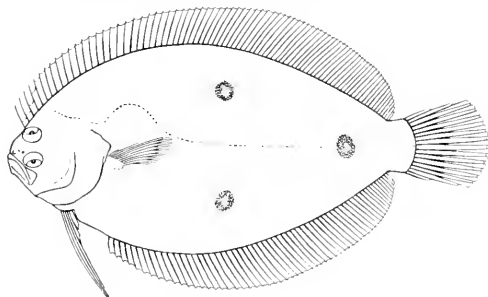


FIG. 80.—*Ancyplosetta dendritica*. B.M. (N.H.) 1923.11.21.25. $\frac{1}{4}$.

Depth of body about twice in the length, length of head nearly 4. Upper profile of head very slightly notched in front of eyes. Snout with a blunt bony knob on ocular side, shorter than eye, diameter of which is 5 to $5\frac{1}{2}$ in length of head, and more than twice the interorbital width; eyes separated by a flat scaled space, anterior margins about level, the upper close to edge of head. Maxillary extending to below posterior part of eye, length $2\frac{1}{2}$ to $2\frac{3}{4}$ in that of head; lower jaw a little more than twice in head. Teeth directed obliquely inward. Gill-rakers rounded, as broad as long; 5 or 6 on lower part of anterior arch. 86 to 88 scales in lateral line. Tubules of lateral lines (in adults) much branched; supratemporal branch well developed. Dorsal (76) 80-82 (84); commencing just behind posterior nostril of blind side and

above anterior part of eye; first few rays more or less free from membrane, but scarcely prolonged. Anal 63-66. Pectoral of ocular side with 11 rays, length $1\frac{1}{4}$ to $1\frac{1}{2}$ in that of head. Pelvic fin of ocular side about as long as or longer than head, more than twice as long as that of blind side. Caudal rounded; caudal peduncle twice or more than twice as deep as long. Greyish or brownish, with 3 large, round, dark ocellated spots, with pale centres and bluish-white margins, the two anterior ones above and below lateral line in middle of body, and the third on posterior part of lateral line; median fins nearly uniform.

TYPE.—United States National Museum No. 47201.

DISTRIBUTION.—Gulf of California to Panama Bay.

SPECIMENS EXAMINED:

1 (215 mm.).	Panama	Jordan.
1 (270 ").	Panama Canal Zone	U.S. Nat. Mus.

The type, 13 inches in length, was taken by the "Albatross" at Station 3022 (Gulf of California), in 11 fathoms.

2. ANCYLOPSETTA DILECTA (Goode and Bean).

Notosema dilecta, Goode and Bean, 1883, Bull. Mus. Comp. Zool., x, p. 193; Goode and Bean, 1895, Ocean. Ichth., p. 437, figs. 302, 305; Jordan and Evermann, 1898, Bull. U.S. Nat. Mus., xlvii (3), p. 2635.

Paralichthys stigmatias, Goode, 1884, Nat. Hist. Aquat. Annu. (Fisheries Fish. Indust. U.S., 1), p. 182.

Ancylpsetta dilecta, Jordan, 1885, Cat. Fish. N. Amer., p. 134; Jordan and Goss, 1889, Rep. U.S. Com. Fish., xiv, (1886), p. 250.

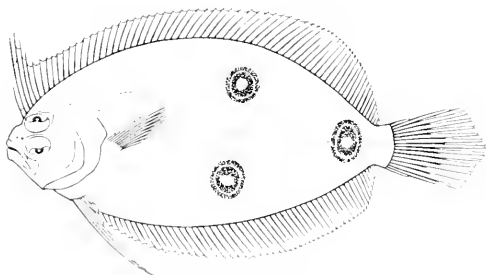


FIG. 81.—*Ancylpsetta dilecta*. B.M. (N.H.) 96.2.10.73. $\times \frac{1}{2}$.

Depth of body twice in the length, length of head $\frac{1}{4}$. Upper profile of head a little notched in front of eyes. Snout shorter than eye, diameter of which is about $\frac{1}{4}$ in length of head; eyes separated by a narrow ridge, their anterior margins about level, the upper close to edge of head. Maxillary extending to below middle of eye, length $2\frac{1}{2}$ in that of head; lower jaw $1\frac{3}{4}$ in head. Teeth only slightly directed inward. Gill-rakers pointed, longer than broad; 7 on lower part of anterior arch. About 80 scales in lateral line. Tubules of lateral line short, simple; supratemporal branch feebly developed. Dorsal 68, commencing a little behind posterior nostril of blind

side, and above anterior margin of eye; second to fifth or sixth rays prolonged, forming a distinct lobe, highest rays $\frac{3}{4}$ length of head. Anal 54-56. Pectoral of ocular side with 11 rays, length $1\frac{1}{2}$ in that of head. Pelvic fin of ocular side longer than head, nearly 3 times as long as that of blind side. Caudal double-truncate; caudal peduncle twice as deep as long. Brownish, speckled with darker; 3 large, round, dark ocelli of complicated pattern, with pale margins, the two anterior ones above and below lateral line in middle of body, and the third on posterior part of lateral line; median fins blotched with dark brown.

TYPE.—Museum of Comparative Zoology. No. 25783.

DISTRIBUTION.—Off the coast of Carolina, United States.

SPECIMEN EXAMINED :

1 (192 mm.).

N. Atlantic (Gulf Stream).

U.S. Nat. Mus.

3. ANCYLOPSETTA QUADROCELLATA, Gill.

Ancyplosetta quadrocellata, Gill, 1864, Proc. Acad. Nat. Sci. Philad., p. 224; Jordan and Goss, 1889, Rep. U.S. Com. Fish., xiv, (1886), p. 250; Jordan and Evermann, 1895, Bull. U.S. Nat. Mus., xlvii (3), p. 2634, pl. cclxxv, fig. 925.

Pseudorhombus quadrocellatus, Jordan and Gilbert, 1879, Proc. U.S. Nat. Mus., i, (1878), p. 370.

Paralichthys onmatus, Jordan and Gilbert, 1883, Proc. U.S. Nat. Mus., v, (1882), p. 616; Jordan and Gilbert, 1883, Bull. U.S. Nat. Mus., xvi, p. 824.

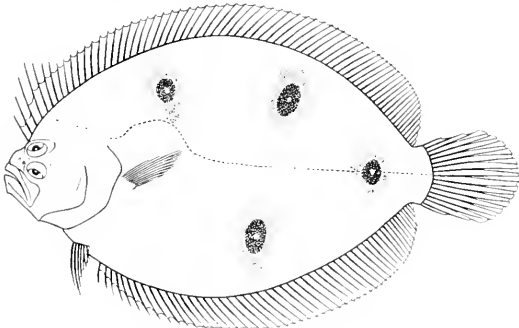


FIG. 82.—*Ancyplosetta quadrocellata*. B.M. (N.H.) 1913.12.8.4. $\times \frac{1}{2}$.

Depth of body $1\frac{2}{3}$ to $1\frac{1}{2}$ in the length, length of head $3\frac{1}{2}$ to $3\frac{3}{4}$. Upper profile of head a little notched in front of eyes. Snout about as long as eye, diameter of which is 5 to $5\frac{1}{2}$ in length of head; eyes separated by a narrow ridge, their anterior margins about level, the upper close to edge of head. Maxillary extending to below middle of eye or beyond, length about $2\frac{1}{2}$ in that of head; lower jaw twice in head. Teeth only slightly directed inward. Gill-rakers short, broad, bluntly pointed, 7 on lower part of anterior arch. About 80 scales in lateral line. Tubules of lateral line short, simple; supratemporal branch well developed. Dorsal 70-75 (76); commencing just behind posterior nostril of blind side and above anterior margin or anterior part of eye; some of the anterior rays more or less free from membrane, a little prolonged, forming a low lobe. Anal 56-58 (59). Pectoral of ocular side with

11 rays, length $1\frac{1}{2}$ to $1\frac{3}{4}$ in that of head. Pelvic fin of ocular side (in adults) a little less than $\frac{1}{2}$ length of head (nearly $\frac{2}{3}$ or more in young), not much longer than that of blind side. Caudal rounded; caudal peduncle more than 3 times as deep as long. Brownish, with 4 conspicuous oblong ocellated spots, a smallish one above curve of lateral line, a pair of large ones above and below lateral line in middle of body, and a fourth large one on posterior part of lateral line; often some scattered white spots on body and median fins; a series of small indistinct dark spots on dorsal and anal.

TYPE.—United States National Museum No 8081.

DISTRIBUTION.—Atlantic and Gulf coasts of the United States.

SPECIMENS EXAMINED:

1 (202 mm.).	Morehead, N. Carolina.	Coles.
1 (1108 ").	C. Lookout, N. Carolina	Amer. Mus. Nat. Hist.
1 (210 ")	Off Charleston Harbour, S. Carolina.	Charleston Mus.
10 (80-200 mm.).	Off Horn. Isd., Mississippi.	Caribb. Biol. Lab.

Regan 1910, Rep. Brit. Antart. ("Terra Nova") Exped., 1910, Zool., i, 4, p. 149, pl. 18, figs. 3, 4, has described some post-larvæ, said to be of *Ancylopsetta*, from Rio de Janeiro. The locality at which these were taken, however, suggests that they do not belong to this genus, but probably to a species of *Paralichthys*.

Genus II. GASTROPSETTA.

Gastropsetta, Bean, 1895, Proc. U.S. Nat. Mus., xvii, (1894), p. 633 [*Gastropsetta frontalis*, Bean]; Jordan and Evermann, 1898, Bull. U.S. Nat. Mus., xlvii (3), p. 2639.

Close to *Ancylopsetta*. Teeth small. Dorsal fin commencing in advance of eye, its anterior rays free and somewhat prolonged. Pelvic fin of ocular side with the rays prolonged. Scales all cycloid, embedded in the skin.

A single species from off the coast of Florida.

1. GASTROPSETTA FRONTALIS, Bean.

Gastropsetta frontalis, Bean, 1895, Proc. U.S. Nat. Mus., xvii, (1894), p. 633, fig. 1; Jordan and Evermann, 1898, Bull. U.S. Nat. Mus., xlvii (3), p. 2639.

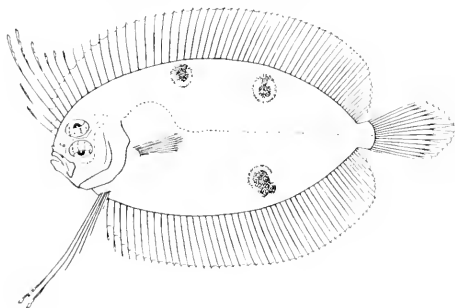


FIG. 83.—*Gastropsetta frontalis*. U.S.N.M. 37668. $\times \frac{1}{4}$.

Depth of body about twice in the length, length of head 4 to $4\frac{1}{2}$. A blunt rostral spine. Eye large, diameter 3 to $3\frac{1}{2}$ in length of head; eyes separated by a narrow ridge. Maxillary extending nearly to below middle of eye, length $2\frac{1}{2}$ in that of head. Gill-rakers very short, as broad as long; 7 on lower part of anterior arch. Scales small. Dorsal 60-62; anterior rays with membranous distal processes, the third and fourth highest, as long as or longer than head. Anal 48-52; none of the rays much prolonged. Pectoral of ocular side with 9 or 10 rays, length about $1\frac{1}{2}$ in that of head; that of blind side very little shorter. Caudal pointed. Brownish, spotted with darker; 3 large, conspicuous dark ocelli on body, two along the back and one near base of anal fin; head and upper surfaces of eye-balls with vertical dark stripes; fins with dusky blotches.

TYPE.—United States National Museum. No. 37668.

DISTRIBUTION.—Off the coast of Florida

SPECIMEN EXAMINED:

1 (148 mm.).

Dry Tortugas.

Longley.

Two examples of this species were collected by the "Albatross" at Station 2317, near Key West ($24^{\circ}25' N.$, $81^{\circ}46' W.$), in 45 fathoms, of which the smaller (160 mm) is figured here. A third specimen was taken at Station 2373, near Apalachicola.

Genus 12. SYACIUM.

Syacium, Ranzani, 1840, De Nov. Pisc., (2) [N. Comm. Ac. Sci. Inst. Bonon., v], p. 18 [*Syacium*

micrurum, Ranzani]; Jordan and Evermann, 1898, Bull. U.S. Nat. Mus., xlvii (3), p. 2670.

Hemirhombus, Bleeker, 1862, Versl. Akad. Wet. Amsterdam, xii, p. 425 [*Hemirhombus guineensis*, Bleeker].

Aramaca, (Jordan and Goss) Jordan, 1885, Cat. Fish. N. Amer., p. 133 [*Hemirhombus pactulus* (Beau Jordan and Gilbert)].

Body ovate or rather elongate, compressed. Eyes on the left side, separated by a concave space (in adults), which is narrow in the female and more or less broad in the male; no spines on the head in either sex. Olfactory laminae in moderate number, arranged transversely to or radiating from a fairly lengthy central racibus. Mouth of moderate size, the length of the maxillary more than $\frac{1}{2}$ that of head; lower jaw slightly included; jaws and dentition about equally developed on both sides; teeth conical, curved; teeth of upper jaw biserial, those of the outer series stronger and enlarged anteriorly; teeth of lower jaw uniserial; vomer toothless. Gill-rakers short or of moderate length, few in number; lower pharyngeals each with an inner row of long, slender teeth and an outer row of smaller teeth. Dorsal fin commencing on blind side of head, above posterior nostril and well in front of eye, all the rays simple, scaled on both sides. Tip of first interhæmal spine not projecting in front of anal fin. Pectoral fins unequal, that of ocular side with the upper rays prolonged in the male; middle rays branched. Pelvic fins short-based, subequal, that of ocular side on median line. Scales of moderate size or rather small, ctenoid on ocular side, cycloid on blind side; small supplementary scales generally present, particularly in region of lateral line. Lateral line equally developed on both sides of body, without a distinct curve above the pectoral fin; no supratemporal branch. Vent on blind side, above first rays of anal fin. Vertebrae 35 or 36 (10-11 + 25).

Four species from both sides of the Atlantic and from the Pacific coast of tropical America.

SYNOPSIS OF THE SPECIES.

1. Anterior teeth of upper jaw forming distinct canines [Atlantic species].
 - A. Interorbital width equal to or greater than eye (mature ♂), or about $\frac{2}{3}$ eye (♀); 46 to 56 scales in lateral line.
 1. Depth $2\frac{1}{2}$ to $2\frac{2}{3}$ in length; 50 to 56 scales in lateral line; dorsal 82-91, anal 65-70 1. *papillosum*.

- 2 Depth twice or less than twice in length, 46 to 48 scales in lateral line, dorsal 74-82, anal 66-65 2. *gunteri*
 B Interorbital width $\frac{1}{2}$ to $\frac{1}{3}$ eye (immature $\frac{5}{8}$), or much narrower ($\frac{2}{3}$): 54 to 65 scales in lateral line 3. *micrurum*
 II Anterior teeth of upper jaw more or less enlarged, but not forming distinct canines. Pacific species 4. *ovale*

The three Atlantic coast species of this genus are not easily differentiated. A further revision, based on adequate material, is required.

1 SYACIUM PAPILLOSUM (Linnæus).

- Pleuronectes papillosus*, Linnæus, 1758, Syst. Nat., ed. x, p. 274; 1790, ed. xii, p. 159.
Pleuronectes aramacia, Walbaum, 1792, Arted. Ichth., (3), pl. 2, p. 121; Cuvier, 1829, R. Anim., ed. 2, ii, p. 341.
Platessa papillosa, Cloquet, 1826, Diet. Sci. Nat., xli, p. 195.
 ? *Rhombus soleiformis*, (Cuvier) Agassiz, 1831, in Spix, Pisc. Brasil., p. 89, pl. xlvii.
Hippoglossus intermedius, Ranzi, 1840, De Nov. Pisc., (2) N. Comm. Ac. Sci. Inst. Bonon., v, p. 14, pl. iv.
Hemirhombus (?) *soleiformis*, Günther, 1862, Cat. Fish., iv, p. 123.
Hemirhombus patulus, (Bean) Jordan and Gilbert, 1883, Proc. U.S. Nat. Mus., v, (1882), p. 391; Goode and Bean, 1883, Proc. U.S. Nat. Mus., v, (1882), p. 114.
Citharichthys aramacia, Jordan and Gilbert, 1883, Bull. U.S. Nat. Mus., xvi, p. 816.
Citharichthys patulus, Jordan and Gilbert, 1883, *loc. cit.*, p. 964; Goode and Bean, 1895, Ocean. Ichth., p. 148, fig. 373.
Aramacia papillosa, Jordan, 1887, Proc. U.S. Nat. Mus., ix, (1886), p. 602.
Aramacia soleiformis, Jordan, 1887, *loc. cit.*, p. 602.
Syacium papillosum, Jordan and Goss, 1886, Rep. U.S. Com. Fish., xiv, (1886), p. 269; Jordan and Evermann, 1898, Bull. U.S. Nat. Mus., xlvii (3), p. 2971, pl. cccxxxiii, fig. 911; Ribeiro, 1915, Arch. Mus. nac. Rio de J., xvii, Heterosomata, p. 9; Ribeiro, 1918, Arch. Mus. nac. Rio de J., xxi, p. 169; Meek and Hildebrand, 1925, Field Mus. Pub. Chicago, Zool. Ser., xv, No. 249, p. 953; Chabanaud, 1930, Bull. Mus. Hist. nat. Paris, (2) ii, p. 628.
Syacium micrurum, Gilbert, 1900, Proc. Washington Acad. Sci., ii, p. 182.

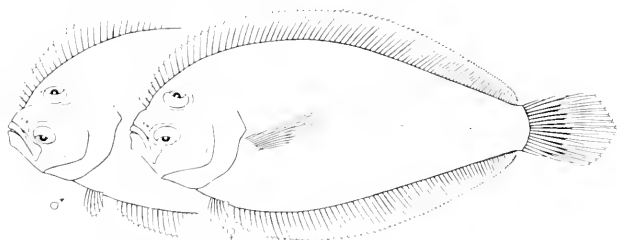


FIG. 54.—*Syacium papillosum*. ♂ B.M. (N.H.) 1929, 42, 23; 1971; ♀ B.M. (N.H.) 18, 42, 14. ♂ $\frac{1}{2}$

Depth of body $2\frac{1}{2}$ to $2\frac{3}{5}$ in the length, length of head $3\frac{1}{2}$ to nearly 4. Upper profile of head with a shallow notch in front of eyes. Snout about as long as eye, diameter of which is $\frac{1}{4}$ to $\frac{1}{5}$ in length of head, interorbital width greater than diameter of eye in mature $\frac{5}{8}$,¹ about $\frac{2}{3}$ eye (\pm), lower eye distinctly in advance of upper, which is well

¹ Narrower in miniature individuals.

separated from edge of head. Maxillary extending to below middle of eye or not quite as far, length $2\frac{2}{3}$ to $2\frac{3}{4}$ in that of head; lower jaw about twice in head. Some of the anterior teeth in the outer series of upper jaw forming fairly strong canines. 8 gill-rakers on lower part of anterior arch. 50-56 scales in lateral line; supplementary scales numerous. Dorsal 82-91. Anal 65-70. Pectoral of ocular side with 11 rays, the upper rays prolonged and filamentous (at least in the male). Caudal double-truncate. Uniformly brownish, or dotted and mottled with darker; median fins generally mottled with dark brown; pectoral with obscure and irregular cross-bars; blind side of body sometimes wholly or partly dusky.

TYPE.—Not traced.

DISTRIBUTION.—Atlantic coast of America from South Carolina to Rio de Janeiro.

SPECIMENS EXAMINED:

1 (♂, 290 mm.).	Bermudas.	Jones.
1 (♀, 222 ,,).	Pensacola, Florida.	U.S. Nat. Mus.
12 (♂, ♀, 150-280 mm.).	Dry Tortugas, Florida.	Longley.
1 (♂, 205 mm.).	Florida.	U.S. Nat. Mus.
2 (♀, 123; ♂, 150 mm.).	Eschschalbe Bay, S. of Tortugas.	Guppy."
8 (7 ♂, 150-210; 1 ♀, 158 mm.).	Tobago.	Göldi.
2 (♂, 195, 210 mm.).	Rio de Janeiro.	

Pleuronectes papillosus, Linnæus, and *P. aramaca*, Walbaum, were based on the "Aramaca" of Marcgrave (1648, 'Hist. Brasil.', p. 181, fig.), which, judging from the brief description and crude figure, appears to be this species. The specimens from Rio de Janeiro included in the above description agree closely with the figure of *Rhombus soleæformis*, Agassiz, except that that species is depicted as having a dark blotch on the shoulder. The otherwise uniform coloration and the wide interorbital space shown in the figure suggest that Agassiz could not have had an example of *Syacium micrurum* before him when describing his *Rhombus soleæformis*, although a diffuse dark blotch on the anterior part of the lateral line is sometimes found in that species.

2. SYACIUM GUNTERI, Ginsburg.

Syacium gunteri, Ginsburg, 1933, Proc. U.S. Nat. Mus., lxxxii (20), p. 7.

Syacium longleyi, Norman, 1933, Ann. Mag. Nat. Hist., (10) xii, p. 201.

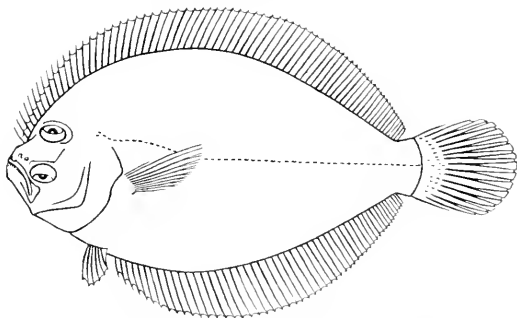


FIG. 85.—*Syacium gunteri*. B.M. (N.H.) 1931.11.5.23. 7.

Close to the preceding species, but depth of body twice or less than twice in the length. Interorbital width (\bar{J}) nearly equal to diameter of eye. Gill-rakers a little shorter and stouter, 7 on lower part of anterior arch. 49 to 48 scales in lateral line; supplementary scales rather less numerous. Dorsal (7 p.) 79-81 (82). Anal 60-63 (65). Length of pectoral of ocular side equal to or less than that of head, upper ray sometimes a little prolonged.

TYPE: United States National Museum. No. 92860.

DISTRIBUTION.—Coasts of Florida and Louisiana.

SPECIMENS EXAMINED:

1 ♀, 132 mm l.	Off Breton Is., Louisiana.	Caribb. Biol. Lab.
1 ♀, 58-100 mm l.	Key West, Florida.	Amer. Mus. Nat. Hist.
1 ♀, 119 mm l.	Dry Tortugas, Florida.	Longley.

3. SYACIUM MICRURUM, Ranzani

Syacium micrurum, Ranzani, 1819, De Nov. Pisc., (2), N. Comu. Ac. Sci. Inst. Bonon., v, p. 18, pl. v.; Jordan and Gooss, 1889, Rep. U.S. Com. Fish., xv, (1886), p. 269; Jordan and Evermann, 1898, Bull. U.S. Nat. Mus., xlvii (3), p. 2672; Evermann and Marsh, 1902, Bull. U.S. Com. Fish., xx, (1900), p. 224; Ribeiro, 1915, Arch. Mus. nac. Rio de J., xvii, Heterosomata, p. 9; Ribeiro, 1917, Arch. Mus. nac. Rio de J., xxi, p. 101; Meek and Hildebrand, 1928, Field Mus. Pub. Chicago, Zool. Ser., xv, No. 219, p. 981.

Hippoglossus ocellatus, Poey, 1850-58, Mem. Inst. nat. Cuba, ii, p. 314.

Hemihombus ayamaea, Gauthier, 1862, Cat. Fish., iv, p. 122; Garman, 1896, Bull. Lab. Nat. Sci. Univ. Iowa, p. 91.

Hemihombus guineensis, (Bleeker) Gauthier, 1862, Cat. Fish., iv, p. 123; Bleeker, 1863, Nat. Verh. Holl. Maatsch. Wet., (2) xviii, p. 25, pl. iii; Steindachner, 1882, Denkschr. Akad. Wiss. Wien, xlv, p. 13; Steindachner, 1894, Notes Leyden Mus., xvi, p. 51; Pellegin, 1905, Act. Soc. Lum. Bordeaux, (6) x (lx), p. 31, fig. 2; Pellegin, 1911, Ann. Inst. oceanogr. Paris, vi (4), p. 73; Metzelaar, 1919, Trop. Atlant. Vissch., p. 277; Chabanand and Monod, 1927, Bull. Com. Etud. Hist. Sci. Afric. Occ. Fr., (1926), p. 289.

Hemihombus ocellatus, Poey, 1868, Repertorio Cuba, ii, p. 407; Poey, 1875, Enum. Pisc. Cubens., p. 138.

Catharichthys ocellatus, Jordan and Gilbert, 1883, Bull. U.S. Nat. Mus., xvi, p. 994.

Catharichthys athalion, Jordan, 1887, Proc. U.S. Nat. Mus., ix, (1886), p. 52.

Hemihombus athalion, Jordan, 1887, *loc. cit.*, p. 602.

Syacium guineensis, Fowler, 1919, Proc. U.S. Nat. Mus., lvi, p. 268.

Hemihombus micrurus, Metzelaar, 1919, Trop. Atlant. Vissch., p. 131.

Syacium orale, Fomca, 1939, Ann. Nat. Mus. Wien, p. 37.

Depth of body $2\frac{1}{4}$ to $2\frac{3}{4}$ in the length, length of head $3\frac{1}{2}$ to nearly 4. Upper profile of head with a shallow notch in front of eyes. Snout as long as or shorter than eye, diameter of which is 4 to nearly 5 in length of head; interorbital width $\frac{1}{4}$ to $\frac{1}{2}$ diameter of eye (mature \bar{J}), or much narrower ($\bar{2}$), reduced to a narrow bony ridge in the young; lower eye a little in advance of upper or anterior margins of eyes about level. Maxillary extending to below middle of eye or not quite as far, length $2\frac{1}{2}$ to $2\frac{3}{4}$ in that of head; lower jaw 2 to $2\frac{1}{2}$ in head. Teeth as in *S. papillosum*; 7 or 8 gill-rakers on lower part of anterior arch; 54 to 65 scales in lateral line; supplementary scales present, less numerous than in *S. papillosum*. Dorsal 85-91. Anal 68-73. Pectoral of ocular side with 11 rays, the upper rays prolonged and filamentous (at least in the male). Caudal double-truncate. Brownish, with or without irregular darker markings; generally numerous spots and rings of pale grey and blackish, some of the dark rings with a black central spot (at least in American examples); sometimes a diffuse dark blotch on lateral line above pectoral fin and another near base of caudal peduncle; median fins spotted and speckled with dark brown; pectoral with irregular dusky cross-bars.

TYPE: Instituto di Zoologia, Università di Bologna.

DISTRIBUTION.—Atlantic coast of tropical America from Florida to Rio de Janeiro, tropical West Africa.

SPECIMENS EXAMINED:

1 (♀, 140 mm.).	America.	—
1 (♀, 90 ,,).	West Indies.	Leiden Mus.
2 (♀, 110, 116 mm.).	Tetron Bay, Trinidad.	Totton.
1 (♀, 144 mm.).	Porto Rico.	Amer. Mus. Nat. Hist.
7 (♂, ♀, 100-200 mm.), skins.	Jamaica.	Parnell Coll.
1 (♂, 180 mm.).	Cuba.	Zool. Soc. Coll.
2 (♀, 135, 173 mm.).	"	Mus. Comp. Zoöl.
2 (♂, 230; ♀, 235 mm.).	Río de Janeiro.	"
5 (♂, ♀, 90-270 mm.).	C. Verde Is.	Lowe.
1 (♂, 210 mm.).	Lagos.	Cadman.
4 (♂, 115-155 mm.).	Sierra Leone.	Lowe.
1 (♀ (?), 51 mm.).	Banana, Congo.	Brussels Mus.

Also 13 (♂, ♀) from the West Indies, 1 (♀) from Brazil, and 2 (♀) from Liberia (Leiden Mus.).

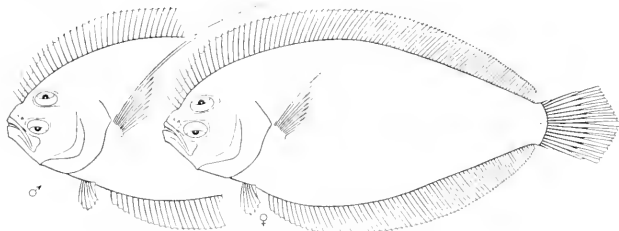


FIG. 86.—*Syacium micrurum*. B.M. (N.H.) 1930.9.4.6, 7. $\times \frac{1}{2}$.

The examples from C Verde Islands and from the coast of West Africa are very similar to those from the western Atlantic, and I have hesitated to regard them as a distinct species. In 9 specimens from Brazil and the West Indies I count 58 to 65 scales in the lateral line, but the supplementary scales are numerous in this region, making an exact count difficult. In 12 specimens from C. Verde Islands and West Africa there are 54 to 60 scales in the lateral line and the supplementaries appear to be usually less numerous. When specimens of equal size and of the same sex are compared, the interorbital width seems to be a very little narrower in West African examples, but I am unable to detect any other differences. If the form from the eastern Atlantic be regarded as a distinct subspecies it will stand as *Syacium micrurum guineensis* (Bleeker).

4. SYACIUM OVALE (Günther).

- Hemirhombus ovalis*, Günther, 1864, Proc. Zool. Soc., p. 154; Günther, 1868, Trans. Zool. Soc., vi, p. 472, pl. lxxx, fig. 1
Citharichthys latifrons, Jordan and Gilbert, 1882, Bull. U.S. Com. Fish., 1, (1881), p. 334
Citharichthys ovalis, Jordan, 1886, Proc. U.S. Nat. Mus., viii, (1885), p. 301.
Syacium ovale, Jordan and Goss, 1889, Rep. U.S. Com. Fish., xiv, (1886), p. 271; Jordan and Evermann, 1898, Bull. U.S. Nat. Mus., xivii (3), p. 2674; Gilbert and Starks, 1904, Mem. Calif. Acad. Sci., iv, p. 199; Meek and Hildebrand, 1928, Field Mus. Pub. Chicago, Zool. Ser., xv, No. 249, p. 982.
Syacium latifrons, Jordan and Goss, 1889, Rep. U.S. Com. Fish., xiv, (1886), p. 271; Jordan and Evermann, 1898, Bull. U.S. Nat. Mus., xivii (3), p. 2673; Meek and Hildebrand, 1928, Field Mus. Pub. Chicago, Zool. Ser., xv, No. 249, p. 984.

Depth of body $2\frac{1}{2}$ to $2\frac{1}{4}$ in the length, length of head nearly 4. Upper profile of head straight or with a very shallow notch in front of upper eye. Snout about as long as eye, diameter of which is 4 to nearly 5 in length of head; interorbital width greater than diameter of eye (mature ♂), much narrower and about equal to pupil (♀); anterior margins of eyes about level ($\frac{1}{4}$) or lower in advance of upper ($\frac{3}{4}$) upper eye close to edge of head. Maxillary extending to below middle of eye, length $2\frac{1}{2}$ to $2\frac{3}{4}$ in that of head; lower jaw about twice in head. Anterior teeth in upper jaw more or less enlarged, but not forming distinct canines. 7 or 8 gill-rakers on lower part of anterior arch. 52 to 57 scales in lateral line; supplementary scales not numerous. Dorsal 80-88. Anal 63-68. Pectoral of ocular side with 12 rays, the two upper rays prolonged and filamentous in the male. Caudal double-truncate. Brownish, with or without indefinite darker spots and blotches; dorsal and anal fins with dark dots and with a row of brown spots; caudal fin with large irregular dark spots; pectoral (♂) with dusky cross-bars.

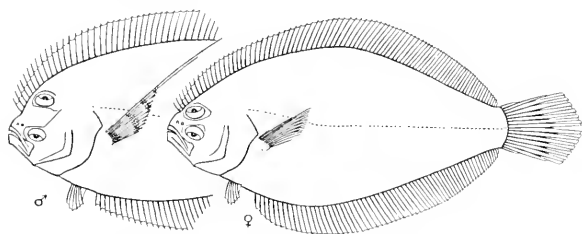


FIG. 57.—*Syacium ovale*. ♂ U.S.N.M. 583; ♀ B.M. (N.H.) 64.1.20.348. $\frac{1}{2}$.

TYPE.—British Museum (Nat. Hist.) Reg. No. 64.1.20.348

DISTRIBUTION.—Pacific coast of tropical America

SPECIMENS EXAMINED.

1 (♀, 125 mm.).	Gulf of California.	U.S. Nat. Mus.
1 (♂, 165 "). Holotype	Pacific coast of Panama.	Salvin.
2 (♀, 158, 170 mm.).	Panama.	Jordan.
3 (♀, 95-150 ").	Mazatlan	"
1 (130 mm.), skeleton.	"	"

Col. Tenison has examined the type of *Syacium latifrons*, and informs me that this is without any doubt the male of the species described by Gunther as *ovale*. Apart from the form of the teeth, *S. ovale* is very close indeed to *S. papillosum* of the Atlantic coast.

Genus 13. CYCLOPSETTA.

Cyclopsetta, Gull, 1880, Proc. U.S. Nat. Mus., XI, (1888), p. 601 (*Hemirhombus fimbriatus*, Goode and Bean).

Azeta, (Jordan) Jordan and Goss, 1880, Rep. U.S. Com. Fish., XIV, (1886), p. 271 [*Citharichthys panamensis*, Steadmanner].

Close to *Syacium*. Eyes separated by a flat space, which is narrow or of moderate width and similar in both sexes. Mouth large, the length of the maxillary $\frac{1}{2}$ or nearly $\frac{1}{2}$ that of head; lower jaw included. Teeth uniserial in both jaws; lateral teeth of upper jaw of moderate size, a pair of canines anteriorly; teeth of lower jaw all strong,

widely separated, largest at the sides. Gill-rakers very short, broad, strongly spinulate, few in number; lower pharyngeals each with a single row of slender, somewhat curved, pointed teeth. Dorsal fin commencing above or in advance of nostrils of blind side. None of the rays of pectoral fin prolonged. Scales small, ctenoid or cycloid; sometimes a few supplementary scales in region of lateral line. Lateral line with a short, irregular suprtemporal branch. Vertebrae 33.

Four species from both coasts of tropical North and Central America.

SYNOPSIS OF THE SPECIES.

I. Scales of ocular side cycloid [CYCLOPSETTA].

- A. Dorsal 89-93, anal 70-74; lateral line tubules much branched; 92 to 98 scales in lateral line; upper eye in advance of lower 1. *querna*.
 B. Dorsal 80-85, anal 60-68; lateral line tubules not much branched; 70 to 88 scales in lateral line; anterior margins of eyes about level.
 1. Scales firm, 83 to 88 in lateral line; hinder margin of left pectoral oblique 2. *chittendeni*.
 2. Scales deciduous, about 70 in lateral line; hinder margin of left pectoral subtruncate 3. *fimbriata*.

II. Scales of ocular side ctenoid [AZEVIA].

- A. Dorsal 90-99, anal 70-78; eye $4\frac{3}{4}$ to $5\frac{1}{4}$ in head 4. *panamensis*
 B. Dorsal 85, anal 65-67; eye nearly 4 in head 5. *maculifera*.

I. CYCLOPSETTA QUERNA (Jordan and Bollman).

Azevia querna, Jordan and Bollman, 1890, Proc. U.S. Nat. Mus., xii, (1889), p. 174.

Cyclopsetta querna, Jordan and Evermann, 1898, Bull. U.S. Nat. Mus., xlvii (3), p. 2675; Gilbert and Starks, 1904, Mem. Calif. Acad. Sci., iv, p. 200; Meek and Hildebrand, 1928, Field Mus. Pub. Chicago, Zool. Ser., xv, No. 249, p. 991.

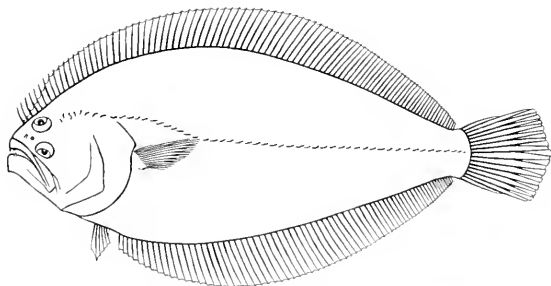


FIG. 88.—*Cyclopsetta querna*. B.M. (N.H.) 1903.5.15.240. $\times \frac{2}{3}$.

Depth of body $2\frac{1}{2}$ to $2\frac{1}{4}$ in the length, length of head $3\frac{3}{8}$ to nearly 4. Upper profile of head slightly and evenly convex. Snout longer than eye, diameter of which is 6 to $6\frac{1}{2}$ in length of head, and about twice interorbital width; upper eye in advance of lower and fairly close to edge of head. Maxillary extending to well beyond eye, length $1\frac{1}{2}$ to nearly 2 in that of head; lower jaw $1\frac{3}{8}$ to $1\frac{3}{4}$ in head. 8 or 9 gill-rakers on lower part of anterior arch. Scales all cycloid, 92 to 98 in lateral line. Tubules

of lateral line profusely branched, a network of similar tubules on postocular part of head, but no distinct supratemporal branch. Dorsal 80-93; commencing just in advance of posterior nostril of blind side, and at a distance in front of eye equal to $\frac{1}{2}$ its diameter. Anal 70-74. Pectoral of ocular side with 14 to 16 rays, length about $\frac{1}{2}$ that of head. Caudal double truncate, caudal peduncle nearly 3 times as deep as long. Uniformly brownish.

TYPE.—United States National Museum. No. 41150.

DISTRIBUTION.—Pacific coast of Panama and Colombia.

SPECIMENS EXAMINED:

♂, 258, 270 mm Panama. Jordan.

2. *CYCLOPSETTA CHITTENDENI*, Bean

Cyclopsetta chittendeni, Bean, 1895, Proc. U.S. Nat. Mus., xvii, (1894), p. 638, fig. 3. Jordan and Evermann, 1898, Bull. U.S. Nat. Mus., xlvii (3), p. 2676.

Depth of body $2\frac{1}{4}$ to $2\frac{1}{2}$ in the length, length of head $3\frac{1}{2}$ to $3\frac{3}{4}$. Upper profile slightly and evenly convex. Snout longer than eye, diameter of which is about $5\frac{1}{2}$

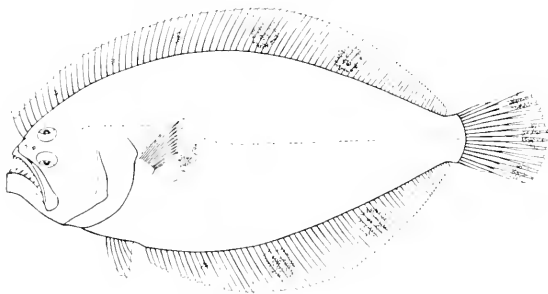


FIG. 80.—*Cyclopsetta chittendeni*. (B.M.N.H., 12, 1, 12, 14.) $\frac{1}{2}$.

in length of head, and more than twice interorbital width; anterior margins of eyes about level, the upper well separated from edge of head. Maxillary extending to a little beyond posterior edge of eye, length $1\frac{1}{2}$ to $1\frac{1}{4}$ in that of head; lower jaw $1\frac{1}{2}$ to $1\frac{1}{4}$ in head. 8 gill-rakers on lower part of anterior arch. Scales all cycloid, fin, 83 to 88 in lateral line. Tubules of lateral line not much branched; a short irregular supratemporal branch. Dorsal 82-85, commencing in advance of posterior nostril of blind side, and at a distance in front of eye equal to $\frac{2}{3}$ or $\frac{3}{4}$ its diameter. Anal 63-68. Pectoral of ocular side with 15 or 16 rays, length $1\frac{1}{2}$ in head; hinder margin of fin oblique. Caudal rounded (1), caudal peduncle more than twice as deep as long. Brownish, a large dark blotch with some white spots in its centre below anterior part of lateral line, two or three similar but more distinct rounded spots on dorsal and anal fins, dorsal fin with three smaller and less definite spots anteriorly, pelvic of ocular side dusky, caudal with three large black spots at its extremity.

TYPE.—United States National Museum. No. 41100.

DISTRIBUTION.—Tinned.

SPECIMENS EXAMINED :

1 (205 mm.).	Trinidad.	Chittenden.
1 (207 ,,).	Gulf of Paria.	"
1 (230 ,,).	"	Guppy.
1 (210 ,,).	Port of Spain.	Rodger.

3. *CYCLOPSETTA FIMBRIATA* (Goode and Bean).

Hemirhombus fimbriatus, Goode and Bean, 1886, Proc. U.S. Nat. Mus., viii, (1885), p. 591.
Arnoglossus (?) fimbriatus, Jordan and Goss, 1889, Rep. U.S. Com. Fish., xiv, (1886), p. 262.
Cyclopsetta fimbriata, Bean, 1895, Proc. U.S. Nat. Mus., xvii, (1894), p. 635, fig. 2; Goode and Bean, 1895, Ocean. Ichth., p. 451, fig. 368; Jordan and Evermann, 1898, Bull. U.S. Nat. Mus., xlvii (3), p. 2670.

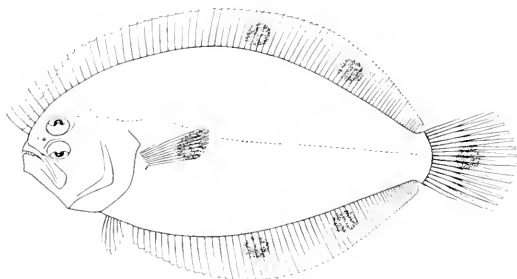


FIG. 90.—*Cyclopsetta fimbriata*. U.S.N.M. 37330. 7.

Very close to *C. chittendeni*, but the teeth apparently smaller; the scales larger and more deciduous, 70 in lateral line; dorsal 80, anterior rays of fin a very little prolonged; anal 60-61; hinder margin of pectoral sinuate; spots on dorsal and anal fins prominent; a similar spot on middle of caudal fin and another on distal part of pectoral.

TYPE—United States National Museum. No. 37330.

DISTRIBUTION—Deep water in the Gulf of Mexico.

The type is 213 mm. in length, and was taken by the "Albatross" between the Mississippi Delta and Cedar Keys.

4. *CYCLOPSETTA PANAMENSIS* (Steindachner)

Citharichthys panamensis, Steindachner, 1875, SitzBer. Akad. Wiss. Wien, LXXII (1), p. 92.
Azevia panamensis, Jordan and Goss, 1889, Rep. U.S. Com. Fish., xiv, (1886), p. 272; Jordan and Evermann, 1898, Bull. U.S. Nat. Mus., xlvii (3), p. 2677, pl. cccxxxiv, fig. 942; Gilbert and Starks, 1904, Mem. Calif. Acad. Sci., iv, p. 200; Meek and Hildebrand, 1928, Field Mus. Pub. Chicago, Zool. Ser., xvi, No. 249, p. 090.

Depth of body $2\frac{1}{2}$ to $2\frac{3}{4}$ in the length, length of head nearly 4. Upper profile of head evenly convex. Snout longer than eye, diameter of which is $4\frac{2}{3}$ to $5\frac{1}{4}$ in length of head, and 4 or 5 times interorbital width; anterior margins of eyes level, the upper well separated from edge of head. Maxillary scarcely extending to beyond posterior edge of eye, length twice in that of head; lower jaw $1\frac{1}{2}$ in head. 8 or 9 gill-rakers on

lower part of anterior arch. Scales ctenoid on ocular side, cycloid on blind side, about 75 in lateral line. Tubules of lateral line not much branched; traces of a short supratemporal branch. Dorsal (60) 93-95 (99); commencing in advance of anterior nostril of blind side, and at a distance in front of eye equal to more than $\frac{1}{2}$ its diameter. Anal 70-78. Pectoral of ocular side with 15 rays, length $1\frac{2}{3}$ in that of head. Caudal double-truncate; caudal peduncle more than 3 times as deep as long. Brownish, with indefinite darker blotches, which are more distinct on the median fins.

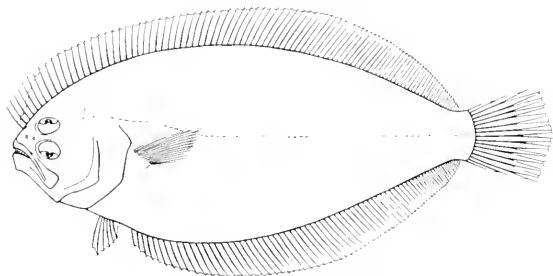


FIG. 91.—*Cyclopsetta panamensis*. B. M. (N.H.) 95.5.27.219. $\frac{1}{4}$.

TYPE.—Vienna Museum.

DISTRIBUTION.—Pacific coast of America from Lower California to Panama.

SPECIMENS EXAMINED:

1 (220 mm).	Panama.	Jordan.
2 (205, 215 mm).	Mazatlan.	"
1 (152 mm).	"	Stanford Univ.

5. CYCLOPSETTA MACULIFERA (Garman).

Citharichthys maculifer, Garman, 1899, Mem. Mus. Comp. Zool., xxiv, p. 224.

Depth of body about $2\frac{1}{2}$ in the length, length of head $3\frac{1}{4}$. Upper profile of head with a very slight indentation in front of eyes. Snout shorter than eye, diameter of which is nearly $\frac{1}{4}$ in length of head and about $\frac{1}{4}$ times interorbital width; lower eye a very little in advance of upper, which is well separated from edge of head. Maxillary extending nearly to below middle of eye, length $2\frac{1}{2}$ in that of head. Lower jaw a little more than twice in head. 7 gill-rakers on lower part of anterior arch. Scales ctenoid on ocular side, cycloid on blind side; 57 to 59 in lateral line. Dorsal 85; commencing near posterior nostril of blind side and at a distance in front of eye equal to about $\frac{2}{3}$ its diameter. Anal 65-67. Pectoral of ocular side with 11 or 12 rays, length $1\frac{1}{3}$ in that of head. Caudal blunt or rounded; caudal peduncle about $2\frac{1}{2}$ times as deep as long. Greyish brown, with numerous ocellate spots of bluish and of brownish on body and fins; caudal with brown spots forming irregular transverse series; pectoral with two brownish cross-bars.

TYPE.—Museum of Comparative Zoology. No. 28546.

DISTRIBUTION.—Pacific coast of Panama, 66 fathoms.

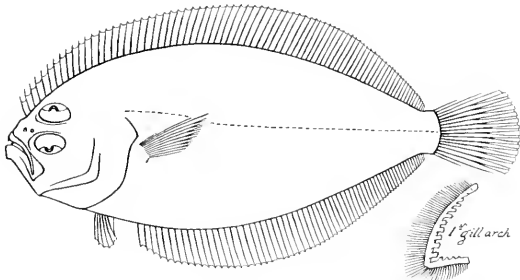


FIG. 92.—*Cyclopssetta maculifera*. M.C.Z. 28546. ♂, ♀.

Known from 2 specimens, 127 and 200 mm. in total length, both collected by the "Albatross" at Station 3368 ($5^{\circ} 32' 45''$ N., $86^{\circ} 54' 30''$ W.).

I am indebted to Mr. N. A. Borodin for sending me the gill-arch of one of these specimens. This confirms my opinion that this species should be placed in the genus *Cyclopssetta*.

Genus 14. CITHARICHTHYS.

Citharichthys, Bleeker, 1862, Versl. Akad. Wet. Amsterdam, xiii, p. 427 [*Citharichthys cayennensis*, Bleeker]; Jordan and Evermann, 1898, Bull. U.S. Nat. Mus., xlvii (3), p. 2678.
Orthopssetta, Gill, 1862, Proc. Acad. Nat. Sci. Philad., p. 330 [*Psittichthys sordidus*, Girard].
Metoponops, Gill, 1864, Proc. Acad. Nat. Sci. Philad., p. 198 [*Metoponops cooperi*, Gill].

Close to *Syacium*. Body ovate or rather deep. Eyes separated by a bony ridge or concave space, which may be similar in both sexes or broader in the male. Olfactory laminae in moderate number or rather numerous arranged transversely to or radiating from a central rachis which is generally short or of moderate length. Mouth of moderate size, the length of the maxillary 2 to $3\frac{1}{2}$ in that of head. Gill-rakers short or of moderate length, rather slender. Dorsal fin commencing on blind side of head, above or just behind nostrils. Pectoral fins unequal, that of ocular side larger; upper rays usually not prolonged. Scales cycloid or feebly ctenoid. Vertebrae 33 to 40.

Fourteen species from both coasts of America and from tropical West Africa.

SYNOPSIS OF THE SPECIES.

- I. Vertebrae 37 to 40; interorbital ridge sharply elevated; head not greatly compressed [species of the North Pacific—*ORTHOPSETTA*].
 - A. Interorbital space concave, scaled (at least posteriorly).
 1. 15 to 18 gill-rakers on lower part of anterior arch.
 - a. 15 or 16 gill-rakers; maxillary $2\frac{3}{4}$ to nearly 3 in head; 61 to 67 scales in lateral line; dorsal 90-98, anal 72-80 1. *sordidus*.
 - b. 18 gill-rakers; maxillary $2\frac{3}{4}$ in head; about 50 scales in lateral line; dorsal (83-87) 88, anal (67) 60 (70) 2. *fragilis*.
 2. 10 or 11 gill-rakers on lower part of anterior arch; maxillary about 3 in head 3. *xanthostigma*.
 - B. Eyes separated by a sharp, nearly naked ridge; 9 gill-rakers on lower part of anterior arch; dorsal 83-92, anal 67-72 4. *stigmaeus*.

II. Vertebrae 33 to 36, eyes separated by a low ridge or concave space; head closely compressed species of the Atlantic and tropical Pacific - CITHARICHTHYS

V. Maxillary $2\frac{1}{2}$ to $3\frac{1}{2}$ in head; interorbital space similar in both sexes¹

1. Eye 3 to $4\frac{1}{2}$ in head.

a. Head 3 to $3\frac{1}{2}$ in length

α Interorbital width less than $\frac{1}{2}$ eye; 2 rostral spines, dorsal 61, anal 73 5. *dinoceros*.

β Interorbital width about $\frac{1}{2}$ eye, no rostral spines, dorsal 78, anal 62 6. *platophrys*.

b. Head $3\frac{1}{2}$ to $4\frac{1}{2}$ in length

α Depth $2\frac{1}{2}$ to $2\frac{2}{3}$ in length; maxillary $3\frac{1}{2}$ ($3\frac{1}{2}$) in head 7. *actifrons*

β Depth 2 to $2\frac{1}{2}$ in length; maxillary $2\frac{2}{3}$ in head
* Dorsal 80-82, anal 50-62; 41 to 44 scales in lateral line

. 8. *macrops*

** Dorsal 68, anal 52; 52 to 55 scales in lateral line 9. *uhleri*

2. Eye $4\frac{1}{2}$ to nearly 8 in head

a. Depth a little less than twice in length, dorsal (68) 75, anal (48) 55, 50 scales in lateral line 10. *arenaceus*

b. Depth 2 to $2\frac{1}{2}$ in length, dorsal 77-87, anal 58-65, 40 to 48 scales in lateral line.

α 43 to 47 scales in lateral line, 10 to 13 gill-rakers on lower part of anterior arch; maxillary to below hinder part or posterior edge of eye, $2\frac{1}{2}$ to $2\frac{1}{2}$ in head, head $3\frac{2}{3}$ to $3\frac{2}{3}$ in length

. 11. *spilopterus*.

β 46 to 48 scales in lateral line, 14 to 17 gill-rakers on lower part of anterior arch, maxillary to below middle or posterior $\frac{1}{2}$ of eye, $2\frac{1}{2}$ to $2\frac{2}{3}$ in head, head $3\frac{2}{3}$ to $3\frac{2}{3}$ in length

. 12. *stampfli*

γ 40 to 43 scales in lateral line, 12 to 14 gill-rakers on lower part of anterior arch, maxillary to below middle or posterior part of eye, $2\frac{2}{3}$ to $2\frac{2}{3}$ in head; head $3\frac{1}{3}$ to $3\frac{2}{3}$ in length 13. *gilberti*

3. Maxillary scarcely more than twice in head, interorbital space broader in male; male with prominent rostral spines; eye $2\frac{1}{2}$ to 3 in head

. 14. *connatus*

This genus forms a very heterogeneous group, but I am unable to find valid reasons for its subdivision. *C. actifrons* has a greater number of olfactory laminae in the nasal organ, with a longer median rachis, than any other species examined by me, but, as I have seen no examples of *dinoceros*, *platophrys* and *uhleri*, I have hesitated to remove it on this account. *C. connatus* shows marked secondary sexual differences, but otherwise appears to be a typical *Citharichthys*.

Parr (1931, Bull. Bingham Ocean Coll., iv (1), p. 2) unites *Etiopus* with *Citharichthys*, but, since the species of the former genus appear to form a natural group, characterised by the smaller mouth and feeble dentition, with the teeth nearly confined to the blind side of the jaws, it is more convenient to retain the two genera, at any rate for the present.

1. CITHARICHTHYS SORDIDUS (Girard).

SOFT FLOUNDER

Psettichthys sordidus, Girard, 1856, Proc. Acad. Nat. Sci. Philad., vii, (1854), p. 142. Girard, 1858, U.S. Pacif. R.R. Survey, 8. Fishes, p. 155.

Orthopsetta sordida, Gill, 1862, Proc. Acad. Nat. Sci. Philad., p. 370.

Metopomus coeparii, Gill, 1864, Proc. Acad. Nat. Sci. Philad., p. 198.

¹ *C. dinoceros* and *platophrys*.

Citharichthys sordidus, Gunther, 1862, Cat. Fish., iv, p. 421; Lockington, 1880, Proc. U.S. Nat. Mus., II, (1879), p. 83; Jordan and Gilbert, 1883, Bull. U.S. Nat. Mus., XVI, p. 817; Jordan and Goss, 1889, Rep. U.S. Com. Fish., XIV, (1886), p. 274; Jordan and Evermann, 1898, Bull. U.S. Nat. Mus., XLVII (3), p. 2679, pl. cccxxxiv, fig. 943; Starks and Morris, 1907, Univ. Calif. Pub. Zool., III (11), p. 216; Evermann and Goldsborough, 1907, Bull. U.S. Bur. Fish., XXVI, (1906), p. 358, fig. 144; Starks, 1918, Calif. Fish Game, IV (4), p. 17, fig. 101.

Depth of body $2\frac{1}{2}$ to $2\frac{2}{3}$ in the length, length of head $3\frac{2}{5}$ to $3\frac{3}{5}$. Head not closely compressed, its upper profile straight or slightly concave above eyes. Snout shorter than eye, diameter of which is $3\frac{1}{2}$ to $4\frac{2}{5}$ in length of head; interorbital space narrow, concave anteriorly, crossed by an oblique ridge posteriorly, width (in adults) nearly $\frac{1}{2}$ diameter of eye; ridge above lower eye sharply elevated; anterior margins of eyes about level, the upper touching or entering dorsal profile of head. Maxillary extending to below middle of eye or not quite as far, length $2\frac{1}{2}$ to nearly 3 in that of head; lower jaw a little more than twice in head. Teeth somewhat enlarged anteriorly, but not forming distinct canines. Gill-rakers rather long and slender; 15 or 16 on lower part

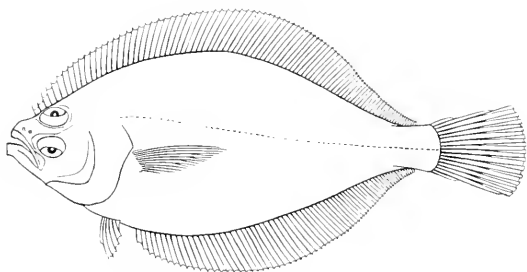


FIG. 93.—*Citharichthys sordidus*. B.M. (N.H.) 90.11.15.258. ?.

of anterior arch. Scales cycloid or feebly ctenoid; 61 to 67 in lateral line; supplementary scales generally numerous. Dorsal 90-98; commencing just behind posterior nostril of blind side, and a little in front of eye. Anal 72-86. Pectoral of ocular side with 12 rays, length $1\frac{1}{2}$ to $1\frac{2}{3}$ in that of head. Caudal rounded; caudal peduncle nearly twice as deep as long. Vertebrae 39 or 40 (11 + 28-29). Brownish; male with dull orange spots and blotches; each scale with a darker edge; dorsal and anal fins in the male blackish, with dull orange blotches, and edged anteriorly with yellowish, female paler, the fins nearly plain.

TYPE.—Not traced.

DISTRIBUTION.—Pacific coast of North America from British Columbia to Lower California.

SPECIMENS EXAMINED:

1 (310 mm.).	Nanaimo, B.C.	
2 (255, 275 mm.).	Port Reyes, California.	Clemens.
1 (250 mm.), skeleton.	" "	Eigenmann.
1 (210 ").	" "	" "
1 (225 ").	Coast of California.	Avres.
1 (129 ").	Monterey, California.	U.S. Nat. Mus.
1 (150 ").	N. Pacific, off California.	" "
	" "	" "

Although much larger in size than any other species of the genus, *C. sordidus* is said rarely to exceed 2 pounds in weight.

2. CITHARICHTHYS FRAGILIS, Gilbert

Citharichthys fragilis, Gilbert, 1891, Proc. U.S. Nat. Mus., xii, (1890), p. 120; Jordan and Evermann, 1898, Bull. U.S. Nat. Mus., xlvii (3), p. 2680; Starks and Morris, 1911, Univ. Calif. Pub. Zool., viii (2), p. 18.

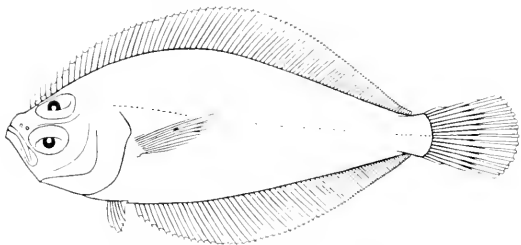


FIG. 94. — *Citharichthys fragilis*. B.M. (N.H.) 1000.9.20.252. $\times \frac{1}{4}$.

Close to *C. sordidus*, but length of maxillary $2\frac{3}{4}$ in that of head. 18 gill-rakers on lower part of anterior arch. About 50 scales in lateral line. Dorsal (83-87) 88. Anal (67) 69 (70). Vertebrae 37 (10 + 27). Brownish.

TYPE—United States National Museum No. 44409.

DISTRIBUTION—Gulf of California.

SPECIMEN EXAMINED:

1 (140 mm.)

Gulf of California.

Jordan.

3. CITHARICHTHYS XANTHOSTIGMA, Gilbert.

Citharichthys xanthostigma, Gilbert, 1890, Proc. U.S. Nat. Mus., xii, p. 120; Jordan and Evermann, 1898, Bull. U.S. Nat. Mus., xlvii (3), p. 2680.

Depth of body a little more than twice in the length, length of head $3\frac{1}{2}$ to $3\frac{1}{2}$. Head not closely compressed, its upper profile with a shallow notch in front of eyes. Snout shorter than eye, diameter of which is $3\frac{2}{3}$ to $3\frac{1}{3}$ in length of head; interorbital space narrow, concave anteriorly, crossed by an oblique ridge posteriorly, width (in adults) less than $\frac{1}{2}$ diameter of eye; ridge above lower eye sharply elevated; anterior margins of eyes about level, the upper nearly reaching dorsal profile of head. Maxillary extending nearly to below middle of eye, length about 3 in that of head, lower jaw a little more than twice in head. Teeth somewhat enlarged anteriorly, but not forming distinct canines. Gill-rakers long, slender, 10 or 11 on lower part of anterior arch. Scales mostly cycloid, a few feebly ctenoid, about 50 in lateral line, very few supplementary scales in region of lateral line. Dorsal (81) 83-88; commencing just behind posterior nostril of blind side and a little in front of eye. Anal 63-67. Pectoral of ocular side with 10 rays, longer than head. Caudal rounded or double-truncate, caudal peduncle about $2\frac{1}{2}$ times as deep as long. Vertebrae 37 (11 + 26). Pale brownish, irregularly spotted with paler and darker, a number of bright yellow spots ocellated.

with brownish black, of which a series on the lateral line and 2 or 3 pairs between this and the edges of the body are most prominent: fins faintly marked with brownish. pectoral sometimes with faint, broad, dusky cross-bars.

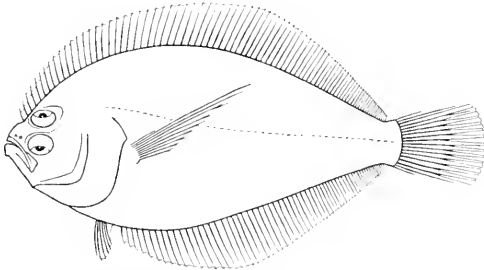


FIG. 95.—*Citharichthys xanthostigma*. U.S.N.M. 44408. $\times \frac{1}{2}$.

TYPE.—United States National Museum. No. 44408.

DISTRIBUTION.—Both coasts of Lower California.

SPECIMENS EXAMINED:

2 (102, 160 mm.). Paratypes. $26^{\circ} 16' 15''$ N., $113^{\circ} 42' 15''$ W. U.S. Nat. Mus.

4. CITHARICHTHYS STIGMÆUS, Jordan and Gilbert.

Citharichthys stigmæus, Jordan and Gilbert, 1883, Proc. U.S. Nat. Mus., v, (1882), p. 411; Jordan and Gilbert, 1883, Bull. U.S. Nat. Mus., xvi, p. 965; Jordan and Goss, 1889, Rep. U.S. Com. Fish., xiv, (1886), p. 274; Gilbert, 1895, Rep. U.S. Com. Fish., xix, (1893), p. 473; Jordan and Evermann, 1898, Bull. U.S. Nat. Mus., xlvii (3), p. 2681; Starks and Morris, 1907, Univ. Calif. Pub. Zool., iii (11), p. 246; Starks, 1918, Calif. Fish. Game, iv (4), p. 18.

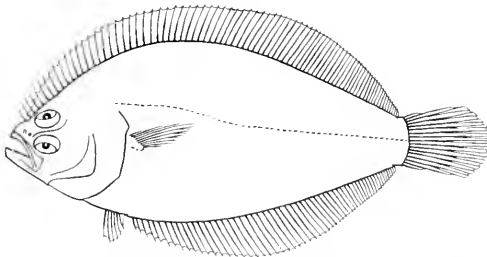


FIG. 96.—*Citharichthys stigmæus*. B.M. (N.H.) 90.11.15.261. $\times \frac{1}{2}$.

Depth of body $2\frac{1}{2}$ to $2\frac{1}{2}$ in the length, length of head $3\frac{1}{2}$ to $3\frac{1}{2}$. Head not closely compressed, its upper profile straight or a little notched in front of upper eye. Snout shorter than eye, diameter of which is $3\frac{1}{2}$ to $4\frac{1}{2}$ in length of head; eyes separated by a sharp, nearly naked ridge, their anterior margins level; upper eye very close to edge of head. Maxillary scarcely extending to below middle of eye, length $2\frac{1}{2}$ in that of head; lower jaw about twice in head. Teeth somewhat stronger than in *C. sordidus*. Gill-rakers of moderate length, 9 on lower part of anterior arch; 53 to 58 scales in lateral line; supplementary scales present in lateral line region. Dorsal 83-92, commencing immediately behind posterior nostril of blind side and a little in front of eye. Anal 67-72. Pectoral of ocular side with 12 rays, length $1\frac{1}{2}$ to $1\frac{1}{2}$ in that of head. Caudal rounded; caudal peduncle more than 3 times as deep as long. Brownish; edges of scales sometimes darker; fins dusky; dorsal and anal each with a row of small dark spots.

TYPE.—United States National Museum. No. 31699.

DISTRIBUTION.—Pacific coast of North America from Oregon to San Diego.

SPECIMENS EXAMINED:

1 (22, 130 mm.)	Pt. Reyes, California.	Eigemann
1 (68, 400 "	Pt. Pinos, California.	U. S. Nat. Mus.
1 (80 mm.)	Gulf of California (Stn. 3037)	"
1 (88 ")	Off Central California (Stn. 3130)	"
2 (63, 88 mm.)	N. Pacific.	"

This species is very close to *C. sordidus*, but may be distinguished by the inter-orbital ridge and smaller number of gill-rakers. Further, if specimens of equal size are compared, the head is larger, the eye smaller, and the caudal peduncle shorter than in *C. sordidus*. It rarely exceeds a length of 5 or 6 inches.

5. CHIHARICHTHYS BINOCEROS, Goode and Bean

Chiharichthys binoceros, Goode and Bean, 1880, Bull. Mus. Comp. Zool., xii, p. 157; Jordan and Goss, 1880, Rep. U. S. Com. Fish., xiv, (1886), p. 275; Goode and Bean, 1895, Ocean Ichth., p. 117; Jordan and Evermann, 1898, Bull. U. S. Nat. Mus., xlvii (3), p. 2682; Parr, 1931, Bull. Bingham Ocean Coll., iv (1), p. 8.

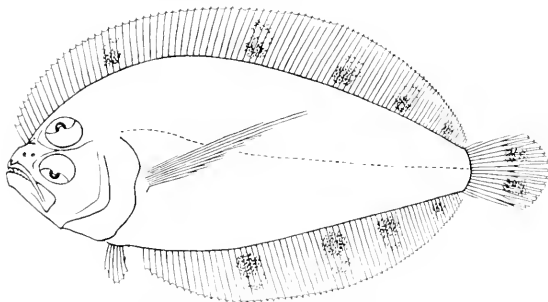


FIG. 97.—*Chiharichthys binoceros*.—M. C. Z., 2796, p. 157.

Depth of body $2\frac{1}{2}$ in the length, length of head $3\frac{1}{2}$. Head closely compressed, its upper profile with a shallow notch in front of eyes. Snout shorter than eye, diameter

of which is about $3\frac{1}{2}$ in length of head and more than 5 times interorbital width; eyes separated by a narrow, rather prominent, sharp ridge, the lower a little in advance of upper, which is close to edge of head. A strong rostral spine overhanging the upper lip and a shorter spine in front of upper eye. Maxillary extending to below middle of eye, length a little more than twice in that of head. Anterior teeth enlarged. Gill-rakers rather long and slender; 8 on lower part of anterior arch. Scales thin, deciduous, all cycloid; 48 in lateral line. Dorsal 61; commencing well in advance of eye. Anal 73. Pectoral of ocular side with 10 rays, length about $1\frac{1}{2}$ times that of head. Caudal bluntly pointed; caudal peduncle very short. Vertebræ 33 to 36. Greyish brown; median fins with large blackish blotches.

TYPE.—Museum of Comparative Zoology. No. 27963.

DISTRIBUTION.—West Indies, in deep water (175 to 1000 fathoms).

The holotype is 92 mm long to base of caudal fin, and was taken by the "Blake" from off Guadeloupe, in 175 fathoms. Other examples were obtained from off Ste. Lucie and Barbados.

6. CITHARICHTHYS PLATOPHRYS, Gilbert.

Citharichthys platophrys, Gilbert, 1891, Proc. U.S. Nat. Mus., xii, (1890), p. 454; Jordan and Evermann, 1898, Bull. U.S. Nat. Mus., xlvii (3), p. 2683.

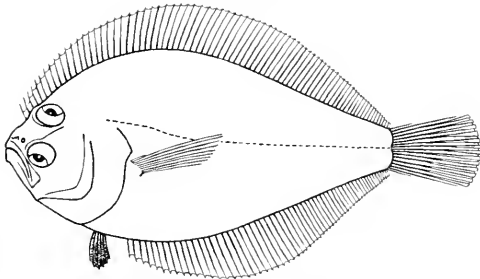


FIG. 98.—*Citharichthys platophrys*. U.S.N.M. 43415. 1.

Depth of body twice in length, length of head 3. Head closely compressed, its upper profile very slightly notched in front of eyes. Snout a little shorter than eye, diameter of which is 4 in length of head and about twice interorbital width; eyes separated by a concave space divided by an oblique ridge, the lower a little in advance of upper, which touches dorsal profile of head. No rostral spines. Maxillary extending to below middle of eye, length $2\frac{1}{2}$ in that of head. Anterior teeth somewhat enlarged, but not forming distinct canines. Gill-rakers short, wide-set, very slender; 9 on lower part of anterior arch. Scales on blind side very feebly ctenoid; 43 scales in lateral line. Dorsal 78; commencing behind nostrils of blind side and in advance of eye. Anal 62. Pectoral of ocular side with 11 rays, length about $1\frac{1}{2}$ in that of head. Caudal rounded; caudal peduncle very short. Pale brownish; fins somewhat dusky; pelvic fin of ocular side black, that of blind side blackish on distal portion of inner rays.

TYPE—United States National Museum. No. 43415.

DISTRIBUTION—Bay of Panama, in deep water.

Only the holotype, 95 mm in total length, known. This was taken by the "Albatross" at Station 2790 (8° 44' N., 76° 09' W.), in 20½ fathoms.

7. CITHARICHTHYS ARCTIFRONS, Goode.

Citharichthys arctifrons, Goode, 1881, Proc. U.S. Nat. Mus., iii, (1880), pp. 311, 172.; Goode and Bean, 1883, Bull. Mus. Comp. Zool., x, p. 194.; Jordan and Gilbert, 1883, Bull. U.S. Nat. Mus., xvi, p. 818.; Jordan and Goss, 1889, Rep. U.S. Com. Fish., xiv, (1886), p. 275.; Goode and Bean, 1895, Ocean. Ichth., p. 442, fig. 366.; Jordan and Evermann, 1898, Bull. U.S. Nat. Mus., xlvii (3), p. 2683.; Bigelow and Welsh, Bull. U.S. Bur. Fish., xl (1), (1924), p. 524, fig. 271.; Breder, 1927, Bull. Bingham Ocean. Coll., i (1), p. 88.; Parr, 1931, Bull. Bingham Ocean. Coll., iv (1), p. 8.

Depth of body $2\frac{3}{5}$ to $2\frac{2}{3}$ in the length, length of head 4 to $4\frac{1}{2}$. Head closely compressed, its upper profile very slightly notched in front of eyes. Snout shorter than

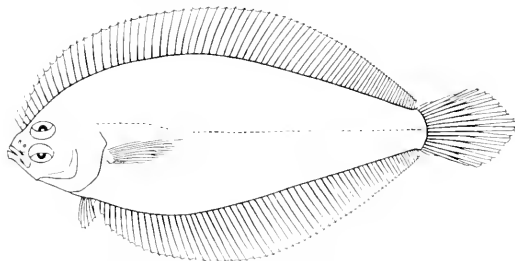


FIG. 99.—*Citharichthys arctifrons*. B.M. (N.H.) 99.2 16 77. — 4

eye, diameter of which is $3\frac{2}{3}$ in length of head. Eyes separated by a narrow ridge, the lower very little in advance of upper, which is very close to edge of head, a blunt, bony protuberance projecting forward in front of lower eye and above upper lip. Maxillary extending to below anterior part of eye, length $3\frac{1}{2}$ ($3\frac{1}{2}$) in that of head, lower jaw a little more than twice in head. Anterior teeth not enlarged. Gill-rakers short, 7 on lower part of anterior arch. Scales cycloid or very feebly ctenoid, about 40 in lateral line. Dorsal 78-83, commencing above posterior nostril of blind side and a little in front of eye. Anal (61) 64-67. Pectoral of ocular side with 9 or 10 rays, length about $\frac{1}{2}$ that of head. Caudal double-truncate (?), caudal peduncle very short. Uniformly pale brownish.

TYPE—United States National Museum. No. 25008.

DISTRIBUTION—Deep waters of the Gulf Stream.¹

SPECIMENS EXAMINED:

1 (150 mm).	Off Chesapeake Bay.	U. S. Nat. Mus.
1 (82 " ")	N. Atlantic.	Mus. Comp. Zool.

Also 1 from 40° 02' N., 70° 37' 30" W., 101 fathoms (Mus. Comp. Zool.).

¹ According to Parr, this species is quite abundant on the continental shelf between Cape Cod and Cape Hatteras (40 to 200 fathoms).

8. CITHARICHTHYS MACROPS, Dresel.

Citharichthys macrops, Dresel, 1885, Proc. U.S. Nat. Mus., vii, (1884), p. 539; Jordan and Goss, 1889, Rep. U.S. Com. Fish., xiv (1886), p. 275; Jordan and Evermann, 1898, Bull. U.S. Nat. Mus., xlvii (3), p. 2684, pl. cclxxxv, fig. 944; Parr, 1931, Bull. Bingham Ocean. Coll., iv (1), p. 20.

Depth of body 2 to $2\frac{1}{2}$ in the length, length of head $3\frac{1}{2}$ to 4. Head closely compressed, its upper profile slightly notched in front of eyes. Snout shorter than eye, diameter of which is about $\frac{1}{4}$ in length of head; eyes separated by a low, narrow, more or less concave ridge, their anterior margins about level; upper eye close to edge of head. Maxillary extending nearly to below middle of eye, length $2\frac{3}{8}$ in that

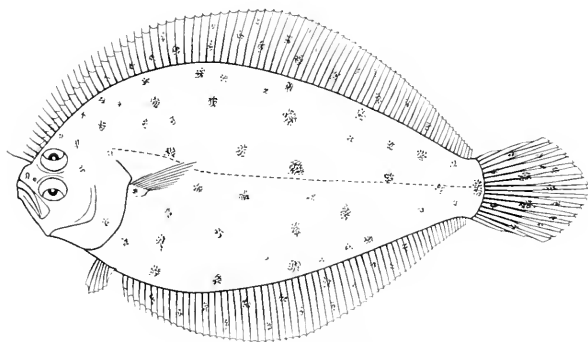


FIG. 100.—*Citharichthys macrops*. B.M. (N.H.) 1923.6.8.3. $\times 1$.

of head; lower jaw $1\frac{5}{8}$ in head. Teeth minute. Gill-rakers rather slender; 14 on lower part of anterior arch. Scales firm, cycloid or very feeble ctenoid; 41 to 44 in lateral line. Dorsal 80-82; commencing above space between nostrils on blind side and in front of eye; anterior rays more or less free from membrane, first longer than those which follow. Anal 59-62. Pectoral of ocular side with 10 rays, length $1\frac{1}{2}$ in that of head. Caudal pointed (?); caudal peduncle very short. Vertebrae 34 (9+25) Brownish, with a number of more or less regularly arranged round dark brown spots on body and median fins, the largest nearly as large as eye.

TYPE.—United States National Museum. No. 21500.

DISTRIBUTION.—South Atlantic and Gulf Coasts of the United States.

SPECIMENS EXAMINED:

1 (117 mm.).	Cape Lookout, N. Carolina.	Amer. Mus. Nat. Hist.
2 (95, 97 mm.).	Off Charleston Harbour, S. Carolina.	Charleston Mus.
3 (65-82 ,,).	Caximbas, Florida.	,,

9. *CITHARICHTHYS UHLERI*, Jordan—Jordan and Goss.

Citharichthys uhleri, (Jordan) Jordan and Goss, 1889, Rep. U. S. Com. Fish., XIV, (1889), p. 275.
 Jordan and Evermann, 1895, Bull. U. S. Nat. Mus., XLV (3), p. 2684; Parr, 1931, Bull. Bingham Ocean Coll., IV, (1), p. 23.

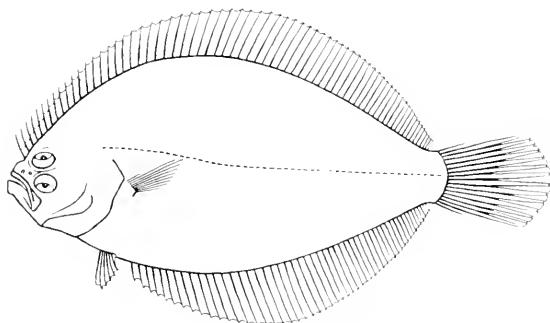


FIG. 101.—*Citharichthys uhleri*. M. C. Z. 11102. 1.

Close to *C. macrops*, but diameter of eye $1\frac{1}{2}$ in length of head; orbital scales coalescent. Gill-rakers short, very slender; 12 on lower part of anterior arch. Scales finely ctenoid; 52 to 55 in lateral line. Dorsal 68. Anal 52. Dark brown, with whitish blotches; fins mottled.

TYPE—Museum of Comparative Zoology. No. 11102.

DISTRIBUTION—Haiti, West Indies.

Only the holotype, 108 mm. in total length, known.

10. *CITHARICHTHYS ARENACEUS*, Evermann and Marsh.

Citharichthys arenaceus, Evermann and Marsh, 1902, Bull. U. S. Com. Fish., XX, (1902), p. 326, fig. 106; Norman, 1917, Ann. Mag. Nat. Hist., (10) VIII, p. 508; Parr, 1931, Bull. Bingham Ocean Coll., IV (1), p. 22.

Citharichthys rathboni, Ribeiro, 1915, Arch. Mus. nac. Rio de J., XVII, Heterosomata, p. 10.
Citharichthys evermanni, Meek and Hildebrand, 1928, Field Mus. Pub. Chicago, Zool. Ser., XV, No. 249, p. 989, pl. c.

Depth of body a little less than twice in the length, length of head nearly 4. Head closely compressed, its upper profile very slightly notched in front of eyes. Snout as long as or a little longer than eye, diameter of which is about 6 in length of head; interorbital space narrow, a little concave; upper eye a little in advance of lower and rather close to edge of head. Maxillary nearly reaching posterior edge of eye, length $2\frac{1}{2}$ in that of head; lower jaw about twice in head. Gill-rakers of moderate length, slender; 13 on lower part of anterior arch. Scales feebly ctenoid on ocular side, cycloid on blind side; about 50 in lateral line; supplementary scales usually

present in lateral line region. Dorsal (68) 75; commencing above anterior nostril of blind side and in front of eye. Anal (48) 55. Pectoral of ocular side with 10 rays, length $1\frac{1}{2}$ in that of head. Caudal pointed (?); caudal peduncle more than twice as deep as long. Pale brownish, speckled and spotted with darker; median fins spotted with dark brown.

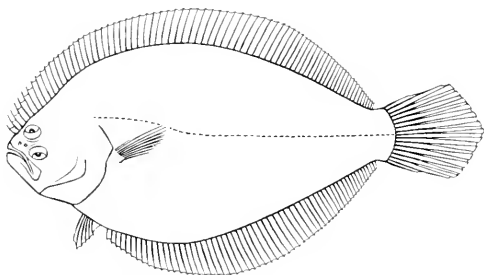


FIG. 102.—*Citharichthys arenaceus*. B.M. (N.H.) 91.5.12.54. $\times \frac{1}{2}$.

TYPE.—United States National Museum. No. 49536.

DISTRIBUTION.—West Indies, southwards to Bahia, Brazil.

SPECIMEN EXAMINED:

1 (142 mm.).

St. Vincent.

Godman.

11. CITHARICHTHYS SPILOPTERUS, Gunther.

Citharichthys spilopterus (part), Gunther, 1862, Cat. Fish., iv, p. 421.

Citharichthys cayennensis, Bleeker, 1862, Versl. Akad. Wet. Amsterdam, xii, p. 427.

Citharichthys guatemalensis, Bleeker, 1863, Versl. Akad. Wet. Amsterdam, xv, p. 452; Bleeker, 1865, Ned. Tijdschr. Dierk., ii, p. 73.

Hemirhombus fuscus, Poey, 1868, Repertorio Cuba, ii, p. 406; Poey, 1875, Enum. Pisc. Cubens., p. 138.

Citharichthys spilopterus, Jordan and Gilbert, 1883, Proc. U.S. Nat. Mus., v, (1882), p. 618; Jordan and Gilbert, 1883, Bull. U.S. Nat. Mus., xvi, p. 817; Jordan and Goss, 1889, Rep. U.S. Com. Fish., xiv, (1886), p. 276; Jordan and Evermann, 1898, Bull. U.S. Nat. Mus., xivii (3), p. 2685; Evermann and Marsh, 1902, Bull. U.S. Com. Fish., xx, (1900), p. 320; Jordan and Dickerson, 1908, Proc. U.S. Nat. Mus., xxxiv, p. 22; Ribeiro, 1915, Arch. Mus. nac. Rio de J., xvii, Heterosomata, p. 15; Ribeiro, 1918, Arch. Mus. nac. Rio de J., xxi, p. 162; Metzelaar, 1919, Trop. Atlant. Vissch., p. 133; Parr, 1931, Bull. Bingham Ocean. Coll., iv (1), p. 21.

Depth of body 2 to $2\frac{1}{2}$ in the length, length of head $3\frac{2}{3}$ to $3\frac{3}{4}$. Head closely compressed, its upper profile distinctly concave. Snout (in adults) longer than eye, diameter of which is $5\frac{1}{2}$ to nearly 8 in length of head; interorbital space narrow, a little concave (in adults); upper eye very little in advance of lower, close to edge of head. Maxillary extending to below posterior edge or hinder part of eye, length $2\frac{1}{2}$ to $2\frac{3}{4}$ in that of head, lower jaw about twice in head. Gill-rakers of moderate length, rather stout; 10 to 13 on lower part of anterior arch. Scales feebly ctenoid on

ocular side, cycloid on blind side; 43 to 47 in lateral line; very few supplementary scales. Dorsal 77-84, commencing above or a little in advance of posterior nostril of blind side, and a little in front of eye. Anal 58-63. Pectoral of ocular side with 9 or 10 rays, length $1\frac{1}{2}$ to $1\frac{3}{4}$ in that of head. Caudal rounded; caudal peduncle short. Brownish, with or without darker spots and blotches; fins spotted or speckled with dark brown.

TYPE.—British Museum (Nat. Hist.). Reg. No. 52.8.10.23

DISTRIBUTION.—Atlantic coast of America, from New Jersey to Brazil.

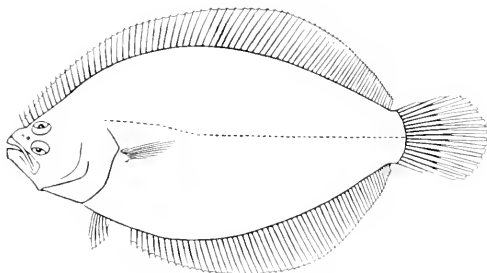


FIG. 103.—*Utharichthys spilopterus*. B.M. (N.H.) 1923.7.30.333. ♂.

SPECIMENS EXAMINED:

1 (147 mm.). Holotype.	New Orleans.	Cuning.
1 (112-123 mm.).	Off Charleston Harbour, S. Carolina.	Charleston Mus.
10 (75-145 ..).	Off Breton Isd., Louisiana.	Caribb. Biol. Lab.
1 (135 mm.).	Grenada.	Crawford.
2 (125, 140 mm.).	St. Croix.	Stevens.
14 (105-135 mm.).	Antigua.	Hay.
2 (124, 130 mm.).	Barbados.	Beckford.
8 (115-150 mm.), skins. Paratypes.	Jamaica.	Parnell Coll.
3 (95-168 mm.). Paratypes.	Santo Domingo.	Cuning.
1 (142 mm.).	Trinidad.	Guppy.
1 (112 ..).	"	Rodger.
1 (65 ..).	Gulf of Paria, Trinidad.	Sci. Exped. Research Assoc. ("St. George").
10 (14-95 mm.).	Oyapok R., French Guiana.	Ternetz.
1 (105 mm.).	Pernambuco.	Mus. Comp. Zool.
2 (135, 175 mm.). Paratypes.	Bahia.	Wucherer.
2 (97, 142 mm.).	Rio de Janeiro.	Ternetz.

Also 1 from Guatemala, 1 from Cayenne and 2 from Surinam (Leiden Mus.); and 2 from the coast of Texas (Mus. Comp. Zool.).

This species rarely exceeds 5 inches in length.

12. CITHARICHTHYS STAMPFLII (Steindachner).

Citharichthys spilopterus (part), Gunther, 1862, Cat. Fish., iv., p. 421.

Citharichthys spilopterus (non Gunther), Steindachner, 1870, SitzBer. Akad. Wiss. Wien, lx (1), p. 975; Boulenger, 1916, Cat. Afr. F.W. Fish., iv, p. 5, fig. 2; Metzelaar, 1919, Trop. Atlant. Vissch., p. 276; Monod, 1927, Faune Colon. Franç., i, p. 720.

Hemirhombus stampflii, Steindachner, 1894, Notes Leyden Mus., xvi, p. 52, pl. iii, fig. 3; Pellegrin, 1914, Ann. Inst. océanogr. Paris, vi (4), p. 73.

Closely related to *C. spilopterus*, but length of head $3\frac{2}{3}$ to $3\frac{3}{4}$ in that of fish (without caudal); anterior edge of head more blunt and its upper profile less distinctly concave. Diameter of eye $4\frac{1}{2}$ to 6 in length of head. Maxillary extending to below middle or posterior half of eye, length $2\frac{1}{3}$ to $2\frac{2}{3}$ in that of head. 14 to 17 gill-rakers on lower part of anterior arch. 46 to 48 scales in lateral line. Dorsal 82-87; commencing

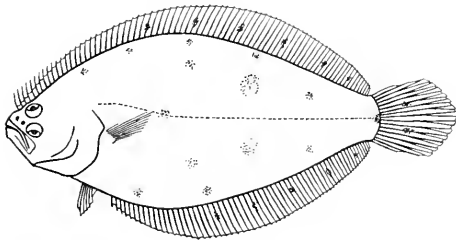


FIG. 104.—*Citharichthys stampflii*. B.M. (N.H.) 1915.3.9.8. ♂ 3.

above space between nostrils on blind side. Anal 62-65. Caudal pointed. Brownish, with darker spots and blotches, and often with a series of conspicuous spots along upper and lower edges of body; a dark blotch at base of caudal fin; dorsal and anal fins each with a row of small dark spots, and a pair of similar spots on middle of caudal.

TYPE.—Vienna Museum.

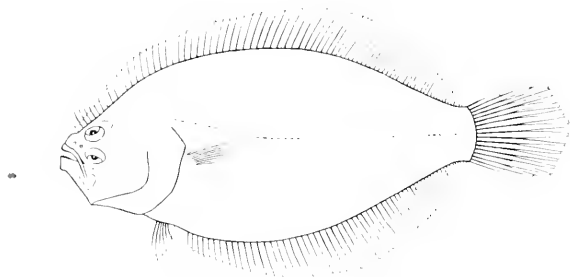
DISTRIBUTION.—West Africa, from Senegambia to Angola; entering fresh water.

SPECIMENS EXAMINED:

2 (107, 109 mm.).	Paratypes of <i>C. spilopterus</i> .	—	Zool. Soc. Coll.
2 (105, 125 ,,).	"	—	Haslar Coll.
2 (120, 132 ,,).	"	Benito R., Spanish Guinea.	Bates.
7 (65-130 ,,).	"	Sierra Leone.	Lowe.
2 (90, 117 ,,).	"	Lagos Lagoon.	Bruce.
2 (105, 135 ,,).	Paratypes of <i>C. spilopterus</i> .	Niger.	Fraser.
4 (85-120 ,,).	"	Degama, Lower Niger.	Ansonge.
2 (88, 107 ,,).	"	Banana, Congo.	Derscheid.
2 (95, 103 ,,).	"	Chiloango Town.	Ansonge.
2 (125, 130 ,,).	"	Bengo R., Quifangondo, Angola.	"

13. CATHARICHTHYS GILBERTI, Jenkins and Evermann

- Catharichthys spilopterus* (non Gunther, 1862), Gunther, 1869, Trans. Zool. Soc., vi, p. 471, pl. lxxx fig. 2; Jordan and Gilbert, 1883, Bull. U.S. Com. Fish., ii, (1882), pp. 108, 111.
Catharichthys gilberti, Jenkins and Evermann, 1889, Proc. U.S. Nat. Mus., xi, (1888), p. 157; Gilbert, 1891, Proc. U.S. Nat. Mus., xiii, (1890), p. 151; Jordan and Evermann, 1898, Bull. U.S. Nat. Mus., xlvii (3), p. 2682; Gilbert and Starks, 1904, Mem. Calif. Acad. Sci., iv, p. 200; Starks, 1906, Proc. U.S. Nat. Mus., xxx, p. 800; Regan, 1906-8, Biol. Centr. Amer., Pisc., p. 2; Evermann and Radcliffe, 1917, Bull. U.S. Nat. Mus., xcv, p. 141; Meek and Hildebrand, 1928, Field Mus., Pub. Chicago, Zool. Ser., xv, No. 249, p. 987.
Catharichthys sumichrasti, Jordan and Goss, 1880, Rep. U.S. Com. Fish., xiv, (1886), p. 270.

FIG. 103.—*Catharichthys gilberti*. F. M. (N. H.) 64:1:29:285. 3/4

Very closely related to *C. spilopterus*. Depth of body 2 to 2½ in length, length of head 3¼ to 3½. Diameter of eye 4½ to nearly 6 in length of head. Maxillary extending to below middle or hinder part of eye, length 2½ to 2¾ in that of head. Gill-rakers of moderate length, a little longer and rather more slender than in *C. spilopterus*, 12 to 14 on lower part of anterior arch; 40 to 43 scales in lateral line. Dorsal 77-85 (80). Anal 58-64 (68). Pale brownish, spotted or mottled with darker.

TYPE.—United States National Museum, No. 39627.

DISTRIBUTION.—Pacific coast of tropical America, from Lower California to Peru, entering fresh water.

SPECIMENS EXAMINED:

2 (105, 160 mm.)	Chiapas, Mexico.	Salvin.
1 (104 mm.)	Rio de Mascota, Mexico.	Fuller.
1 (142 " ")	Mazatlan, Mexico.	Jordan.
2 (98, 117 mm.)	Panama.	" "
1 (100 mm.)	N. Rioño.	U.S. Nat. Mus.
1 (12 " ")	Rio Sapayo, Ecuador.	Rosenberg.

14 CITHARICHTHYS CORNUTUS (Günther).

Rhomboidichthys cornutus, Günther, 1880, Shore Fishes "Challenger", p. 7, pl. 11 fig. B.
Citharichthys unicomis, Goode, 1881, Proc. U.S. Nat. Mus., 11, (1880), p. 342; Jordan and Gilbert, 1883, Bull. U.S. Nat. Mus., xvi, p. 818; Jordan and Goss, 1889, Rep. U.S. Com. Fish., xiv, (1886), p. 275; Goode and Bean, 1895, Ocean. Ichth., p. 444, fig. 309; Jordan and Evermann, 1898, Bull. U.S. Nat. Mus., xlvii (3), p. 2683; Evermann and Marsh, 1902, Bull. U.S. Com. Fish., xx, (1900), p. 325; Metzelaar, 1919, Trop. Atlant. Vissch., p. 132; Parr, 1931, Bull. Bingham Ocean. Coll., iv (1), p. 17, fig. 7.
Syacium cornutum, Jordan and Goss, 1889, Rep. U.S. Com. Fish., xiv, (1886), p. 269.

Depth of body 2 to 2½ in the length, length of head 3¼ to 3½. Head closely compressed, its upper profile evenly convex. Snout shorter than eye, diameter of which is 2½ to 3 in length of head; interorbital width (in adults) about ½ (♂) or less than ½ (♀) diameter of eye¹; lower eye in advance of upper, which is very close to edge of head.

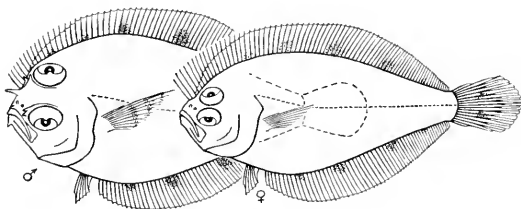


FIG. 106.—*Citharichthys cornutus*. B.M. (N.H.) ♂ 79.5.14.53; ♀ 1932.12.31.11. 1.

Male with a strong spine projecting forward from the profile of the snout in front of the eyes, two smaller spines in front of upper eye, one or two in front of lower eye, and a short spine in advance of the nostrils and above the upper lip; in the female and in young males² these spines are represented by slight prominences. Maxillary extending to below anterior part of eye, length a little more than twice in that of head; lower jaw 1½ to nearly twice in head. Teeth small, somewhat enlarged anteriorly. Gill-rakers of moderate length, rather slender; 14 or 15 on lower part of anterior arch. Scales feebly ctenoid on ocular side, cycloid on blind side; 40 to 45 in lateral line. Dorsal (74) 76-80; commencing above posterior nostril of blind side and well in front of eye. Anal (60) 62-66. Pectoral of ocular side with 11 rays, length nearly equal to that of head. Caudal rounded; caudal peduncle very short. Brownish, with traces of irregular darker markings; a series of large dark spots on basal parts of dorsal and anal fins, more distinct in the male; similar spots on caudal; pectoral with dusky cross-bars.

TYPE.—British Museum (Nat. Hist.). Reg. No. 79.5.14.53.

DISTRIBUTION.—Deep waters of the Gulf Stream; off the coast of Brazil.

¹ In juvenile examples the eyes are nearly contiguous or separated by a very narrow ridge.

² The sexual differences and growth changes in *C. cornutus* have been described in detail by Parr (1931).

SPECIMENS EXAMINED:

2 (♂, 84, 87 mm sl.) Types.	Off the coast of Brazil, 20 or 350 fms.	"Challenger."
1 (♂, 47, 82 " " ")	N. Atlantic, "	" "
1 (♂, 70 mm sl.)	" "	U. S. Nat. Mus.
2 (♂, 79, ♀, 58 mm sl.)	28° 36' N., 85° 33' W.	" "

The marked sexual differences characteristic of this species have not been described in any other species of *Citharichthys*.

Genus 15. ETROPUS.

Etropus, Jordan and Gilbert, 1882, Proc. U. S. Nat. Mus., iv, (1881), p. 394 (*Etropus crossotus*, Jordan and Gilbert); Jordan and Evermann, 1898, Bull. U. S. Nat. Mus., xlvii (13), p. 2687; *Citharichthys* (part), Parr, 1931, Bull. Bingham Ocean. Coll., iv (1), p. 2.

Very close to *Citharichthys*, but eyes always separated by a narrow, bony ridge, mouth small, the length of the maxillary $3\frac{1}{2}$ to $4\frac{1}{2}$ in that of head; dentition generally more feeble, the teeth mostly on blind side of jaws; none of the teeth enlarged. Gill-rakers short or of moderate length, few in number. Vertebrae 34 (10 + 24).

Six species from both coasts of America.

SYNOPSIS OF THE SPECIES.

- I Depth more than twice in length; upper profile of head straight or a little concave; back not much elevated
 - A Pectoral 4 to $5\frac{1}{2}$ in length of fish (without caudal)
 - 1 Dorsal 88-93, anal 72-78; snout without scales; 9 gill-rakers on lower part of anterior arch; 50 to 54 scales in lateral line; no supplementary scales 1. *ectenus*
 - 2 Dorsal 67-81, anal 50-60; snout partially scaled; 5 (occasionally 6 or 7) gill-rakers on lower part of anterior arch; 30 to 45 scales in lateral line; supplementary scales present, not very numerous 2. *microstomus*
 - B Pectoral 3 to $3\frac{3}{4}$ in length of fish (without caudal); dorsal 79-85, anal 60-73; snout without scales; 6 or 7 gill-rakers on lower part of anterior arch; no supplementary scales 3. *longimanus*
- II Depth about twice in length; upper profile of head nearly straight; back moderately elevated; pectoral about 6 in length of fish (without caudal); no supplementary scales 4. *intermedius*
- III Depth less than twice in length; upper profile of head more or less concave (at least in adults); back distinctly elevated
 - A Snout entirely covered with coarse ctenoid scales; supplementary scales present on body, numerous; about 5 gill-rakers on lower part of anterior arch; interorbital ridge high 5. *rimosus*
 - B Snout without scales; no supplementary scales on body; 6 to 9 (usually 7 or 8) gill-rakers on lower part of anterior arch; interorbital ridge rather low 6. *crossotus*

The species of this genus are difficult to distinguish and have been frequently confused. For this reason it has proved impossible adequately to disentangle the synonymies of some of the species.

¹ The larger is selected as the holotype.

1. ETROPUS ECTENES, [Jordan] Jordan and Goss.

Etropus ectenes, (Jordan) Jordan and Goss, 1889, Rep. U.S. Com. Fish., xiv, (1886), p. 277.

Depth of body $2\frac{1}{4}$ to $2\frac{3}{8}$ in the length, length of head a little more than 4. Upper profile of head a little concave; back not much elevated. Snout shorter than eye, diameter of which is $4\frac{1}{4}$ to $4\frac{1}{2}$ in length of head; interorbital ridge only slightly elevated; anterior margins of eye nearly level, upper entering dorsal profile of head. Snout without scales. Maxillary extending to below anterior part of eye, length nearly 4 in that of head. Gill-rakers short, stout; 9 on lower part of anterior arch. Scales feebly ctenoid on ocular side, cycloid on blind side; 50 to 54 in lateral line, no supplementary scales. Dorsal 88-93. Anal 72-78. Pectoral of ocular side with 10 rays, length 5 to $5\frac{1}{2}$ in that of fish (without caudal). Yellowish brown, with indistinct darker spots and blotches; median fins spotted with brown; pectoral with irregular cross-bars.

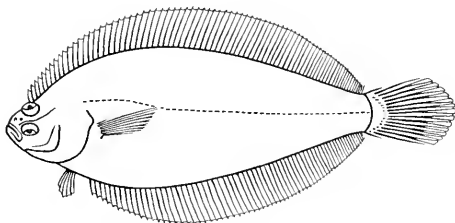


FIG. 107.—*Etropus ectenes*. M.C.Z. 11145. $\times 1$.

TYPE.—Museum of Comparative Zoology. No. 11605.

DISTRIBUTION.—Pacific coast of South America.

SPECIMENS EXAMINED:

2 (75, 90 mm.).

Paraca Bay, Peru.

Mus. Comp. Zool.

2. ETROPUS MICROSTOMUS (Gill).

Citharichthys microstomus, Gill, 1864, Proc. Acad. Nat. Sci. Philad., p. 223; Goode and Bean, 1895, Ocean. Ichth., p. 446; Parr, 1931, Bull. Bingham Ocean. Coll., iv (1), p. 11, figs. 4-5.

Etropus microstomus, Jordan and Goss, 1889, Rep. U.S. Com. Fish., xiv, (1886), p. 278; Bean, 1902, Ann. Rep. Forest Fish Game Comm. N.Y., vi, (1901), p. 474; Nichols and Breder, 1927, Zoologica, ix, p. 182, fig.; Hildebrand and Schroeder, 1928, Bull. U.S. Bur. Fish., xliii (1), (1927), p. 173.

? *Etropus microstomus*, Jordan and Evermann, 1868, Bull. U.S. Nat. Mus., xlvii (3), p. 2687.

Citharichthys micros, Fowler, 1911, Proc. Acad. Nat. Sci. Philad., lxxiii, p. 200, fig.

Depth of body $2\frac{1}{2}$ to $2\frac{1}{4}$ (to $2\frac{1}{2}$) in the length, length of head $3\frac{3}{8}$ to 4 (to $4\frac{1}{4}$). Upper profile of head nearly straight, a shallow notch in front of eye; back not much elevated. Snout shorter than eye, diameter of which is about 4 in length of head; interorbital ridge moderately elevated; lower eye a very little in advance of upper, which is very close to edge of head. Snout with ctenoid scales in front of eyes, but only partly covered farther forward. Maxillary extending to below anterior part of eye, length about $3\frac{1}{2}$ in that of head. Gill-rakers short, stout; 5 (rarely 6 or 7) on lower part of

anterior arch. Scales very finely ctenoid; 39 to 45 in lateral line; supplementary scales present, 2 to 7 (usually about 5) covering anterior part of free portion of each primary scale. Dorsal 67-81. Anal 50-60. Pectoral of ocular side with 10 rays, length 4 to 5 in that of fish (without caudal). Uniformly brownish.

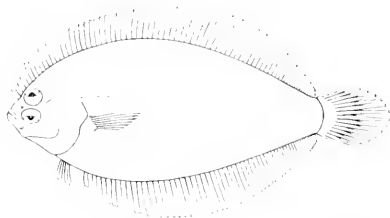


FIG. 108—*Etropus microstomus*. U.S.N.M. 68145. $\times 1$.

TYPE—Not traced.

DISTRIBUTION—Atlantic coast of North America, from the New England coast to Florida.

SPECIMENS EXAMINED:

6 (55-94 mm.).

Delaware Bay

Farr.

1 (95 mm.).

Off Charleston Harbour, S. Carolina,

Charleston Mus.

3. *ETROPUS LONGIMANUS*, Norman.

Etropus microstomus (non Galli, Regan, 1914, Rep. Brit. Antarct. ("Terra Nova") Exped. 1910, Zool., 1, 1, p. 23).

Etropus longimanus, Norman, 1933, Ann. Mag. Nat. Hist., (10) XI, p. 202.

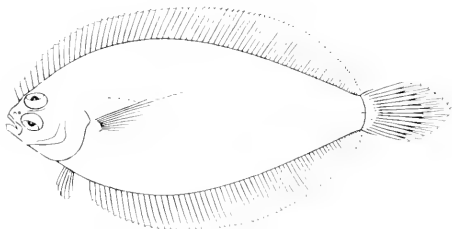


FIG. 109—*Etropus longimanus*. B.M. (N.H.) 1917. 12.4.311. $\times \frac{1}{2}$.

Depth of body $2\frac{1}{4}$ to $2\frac{1}{2}$ in the length, length of head 4 to $4\frac{2}{5}$. Upper profile of head nearly straight, back not much elevated. Snout shorter than eye, diameter of which is $3\frac{2}{5}$ to $3\frac{1}{4}$ in length of head, interorbital ridge moderately elevated, lower eye a little in advance of upper, which is very close to edge of head. Snout apparently without scales. Maxillary extending to below anterior edge of eye or a little

beyond, length $3\frac{3}{4}$ to 4 in that of head. Gill-rakers short, rather stout; 6 or 7 on lower part of anterior arch. Scales finely ctenoid on ocular side, cycloid on blind side; 43 to 47 in lateral line; no supplementary scales. Dorsal 79-85. Anal 60-73. Pectoral of ocular side with 9 rays, length 3 to $3\frac{3}{8}$ in that of fish (without caudal). Uniformly brownish; dorsal and anal fins each with a row of small, brown spots; pectoral with irregular brown cross-bars.

TYPE.—British Museum (Nat. Hist.). Reg. No. 1913.12.4.311.

DISTRIBUTION.—Coasts of Brazil and Argentina.

SPECIMENS EXAMINED:

16 (35-115 mm.).	Types. ¹	C. Frio, Brazil; 40 fms.	"Terra Nova."
2 (82, 88 mm.).		Argentina.	Stanford Univ.

4 ETROPUS INTERMEDIUS, Norman.

? *Etropus crossotus* (non Jordan and Gilbert), Ribeiro, 1915, Arch. Mus. nac. Rio de J., xvii, Heterosomata, p. 7.

Etropus intermedius, Norman, 1933, Ann. Mag. Nat. Hist., (10) xii, p. 203.

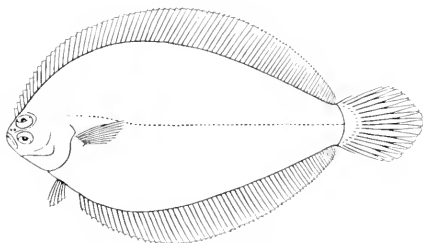


FIG. 110.—*Etropus intermedius*. B.M. (N.H.) 1932.5.9.19. $\times \frac{3}{4}$.

Depth of body about twice in the length, length of head $4\frac{1}{2}$ to 5. Upper profile of head nearly straight; back moderately elevated. Snout much shorter than eye, diameter of which is about 4 in length of head; interorbital ridge moderately elevated; lower eye scarcely in advance of upper, which touches dorsal profile of head. Snout and greater part of interorbital ridge without scales. Maxillary extending to below anterior part of eye, length about 4 in that of head. Gill-rakers short; 8 or 9 on lower part of anterior arch. Scales finely ctenoid on ocular side, cycloid on blind side; about 45 in lateral line; no supplementary scales. Dorsal 80-84. Anal 65-67. Pectoral of ocular side with 10 rays, length about 6 in that of fish (without caudal). Brownish, finely sprinkled with very small dusky spots; scales mostly with dark edges; median fins with small, brown spots.

TYPE.—British Museum (Nat. Hist.). Reg. No. 1932.5.9.19.

DISTRIBUTION.—Atlantic coast of South America, from Trinidad to Rio de Janeiro.

SPECIMENS EXAMINED:

1 (122 mm.).	Holotype.	Port of Spain, Trinidad.	Rogers.
1 (90 ").	Paratype.	Victoria, Brazil.	Mus. Comp. Zool.
1 (105 ").	"	Rio de Janeiro, Brazil.	Ternetz.

¹ A female, 115 mm. in length, has been selected as the holotype.

5. *ETROPUS RIMOSUS*, Goode and Bean.

Etropus rimosus, Goode and Bean, 1886, Proc. U. S. Nat. Mus., viii, (1885), p. 593; Goode and Bean, 1895, Ocean. Ichth., p. 450, figs. 360, 361; Jordan and Evermann, 1898, Bull. U. S. Nat. Mus., xlvii (1), p. 2688, pl. cclxxxv, fig. 945.

Citharichthys rimosus, Parr, 1931, Bull. Bingham Ocean. Coll., iv (1), p. 9, figs. 2, 3.

Depth of body $1\frac{1}{2}$ to nearly twice in the length, length of head $4\frac{1}{2}$ to $4\frac{3}{4}$. Upper profile of head straight or a little concave; back distinctly elevated. Snout shorter than eye, diameter of which is $3\frac{1}{2}$ to $3\frac{3}{4}$ in length of head; interorbital ridge strongly elevated, lower eye a very little in advance of upper, which is very close to edge of head. Snout and interorbital ridge densely covered with coarsely ctenoid scales, their free portions characteristically thickened and modified; dorsal surface of each eye-ball with a small patch of scales. Maxillary extending to below anterior edge of eye, length $3\frac{1}{2}$ to 4 in that of head. Gill-rakers rather short; 5 on lower part of

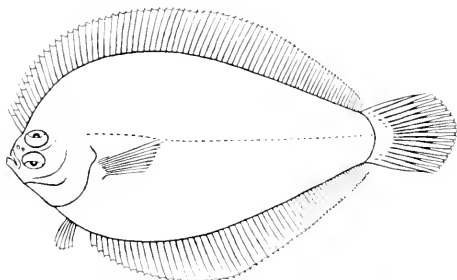


FIG. 111.—*Etropus rimosus*. U. S. N. M. 37332. ♂

anterior arch. Scales mostly very finely ctenoid or cycloid, 40 to 41 in lateral line, free portion of each primary scale nearly completely covered by a number of smaller supplementary scales. Dorsal 77. Anal 61. Pectoral of ocular side with 10 rays, length $4\frac{1}{2}$ to $4\frac{3}{4}$ in that of fish (without caudal). Greyish, with a few irregularly placed, indistinct brownish blotches.

TYPE.—United States National Museum. No. 37332.

DISTRIBUTION.—Off the coasts of South Carolina and Florida.

The type is 100 mm in length, and was collected by the "Albatross" at Station 2468, between Pensacola and Cedar Keys, Florida, at a depth of 21 fathoms.

6. *ETROPUS CROSSOTUS*, Jordan and Gilbert

Etropus crossotus, Jordan and Gilbert, 1882, Proc. U. S. Nat. Mus., iv, (1881), p. 364; Jordan and Gilbert, 1885, Proc. U. S. Nat. Mus., v, (1882), pp. 308, 618; Jordan and Gilbert, 1883, Bull. U. S. Nat. Mus., xvi, p. 859; Jordan and Swain, 1885, Proc. U. S. Nat. Mus., vii, (1884), p. 234; Jordan and Goss, 1886, Rep. U. S. Com. Fish., xiv, (1886), p. 278; Jordan and Evermann, 1895, Bull. U. S. Nat. Mus., xlvii (1), p. 2686, pl. cclxxxvi, fig. 946; Evermann and Marsh, 1902, Bull. U. S. Com. Fish., xx, (1900), p. 328, fig. 107; Meek and Hildebrand, 1928, Field Mus. Pub. Chicago, Zool. Ser., xv, No. 249, p. 99; Hildebrand and Schroeder, 1928, Bull. U. S. Bur. Fish., xliii (1), 01927, p. 173, fig. 58.

Citharichthys crossotus, Parr, 1931, Bull. Bingham Ocean. Coll., iv (1), p. 13.

Citharichthys crossotus atlanticus, Parr, 1931, *tom. cit.*, p. 16.

Citharichthys crossotus crossotus, Parr, 1931, *tom. cit.*, p. 16.

Depth of body $1\frac{3}{4}$ to nearly twice in the length, length of head $3\frac{3}{4}$ to $4\frac{1}{2}$. Upper profile of head (in adults) distinctly concave, nearly straight in the young; back distinctly elevated. Snout shorter than eye, diameter of which is 4 to $4\frac{1}{2}$ in length of head; interorbital ridge slightly elevated; lower eye a little in advance of upper, which is very close to or enters dorsal profile of head. Snout without scales. Maxillary extending to below anterior edge or anterior part of eye, length 4 to $4\frac{1}{2}$ in that of head. Gill-rakers of moderate length; 6 to 9 (usually 7 or 8) on lower part of anterior arch. Scales very finely ctenoid or cycloid; 41 to 47 in lateral line; no supplementary scales. Dorsal (75) 77-87. Anal (58) 60-65 (68). Pectoral of ocular side with 10 rays, length 5 to $5\frac{1}{2}$ in that of fish (without caudal). Brownish, with or

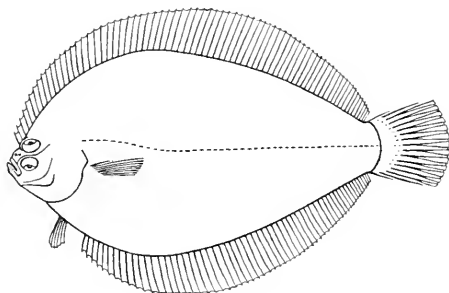


FIG. 112.—*Etropus crossotus*. U.S.N.M. 51935. $\times \frac{3}{4}$.

without darker blotches, which may form irregular cross-bars; median fins finely spotted and mottled with black and grey; often a row of larger spots on dorsal and anal; other fins more or less spotted.

TYPE.—United States National Museum. No. 28124.

DISTRIBUTION.—Both coasts of America, from Chesapeake Bay to the West Indies (? and beyond), and from Lower California to Panama.

SPECIMENS EXAMINED:

1 (115 mm.).	Beaufort, N. Carolina.	Jordan.
1 (83 ,,).	S. Carolina.	Stanford Univ.
4 (98-140 mm.).	Off Charleston Harbour, S. Carolina.	Charleston Mus.
1 (92 mm.).	St. John's R., Florida.	U.S. Nat. Mus.
2 (78, 81 mm.).	Florida.	Amer. Mus. Nat. Hist.
12 (95-140 mm.).	Off Breton Isd., Louisiana.	Caribb. Biol. Lab.
10 (86-125 ,,).	" "	" "
2 (88, 100 ,,).	Cerros Isd., California.	Jordan.
2 (79, 84 mm.).	Lower California.	Amer. Mus. Nat. Hist.
2 (115, 135 mm.).	San Bartholomé, Mexico.	" "
5 (65-125 ,,).	Mazatlan, Mexico.	Jordan.
2 (53, 75 mm.).	Panama.	U.S. Nat. Mus.
1 (92 mm.).	Pacific.	" "

Jordan and Evermann (1898) were unable to find any constant distinctions between examples of this variable species from the Atlantic and Pacific coasts respectively of tropical America. Parr (1931) found himself unable to differentiate the fully grown specimens of the two regions, but noted that "there is a considerable and significant difference in the ontogenetic development of the body width". On the basis of this difference he distinguished an Atlantic (*atlanticus*) and Pacific (*crossotus*) subspecies. He further suggested the possibility of two separate forms still being confused in the Pacific *E. crossotus crossotus*, again distinguished by differences in body width at certain stages of development. The type of *E. crossotus*, about 125 mm. in total length, came from Mazatlan. On the Atlantic coast the species appears to grow to about 140 mm. in length, and on the Pacific coast to more than 100 mm.

Genus 16. TRICHOPSETTA.

Trichopsetta, Gill, 1889, Proc. U. S. Nat. Mus., XI, (1888), p. 601. *Citharichthys ventralis*, Goode and Bean; Jordan and Evermann, 1898, Bull. U. S. Nat. Mus., XLVI (3), p. 2609.

Body ovate, much compressed. Eyes on the left side, separated by a narrow ridge, with a median groove, at least anteriorly. Posterior nostril of blind side small, without membranous valve, olfactory lamellae few, nearly parallel with each other and with the main axis of the body; no central rachis. Mouth of moderate size, the length of the maxillary more than $\frac{1}{3}$ that of head; jaws and dentition more or less equally developed on both sides; teeth very small, pointed, somewhat enlarged and curved anteriorly, uniserial in both jaws; vomer toothless. Gill-rakers rather long, slender. Dorsal fin commencing above posterior nostril of blind side, and well in front of eye; all the rays simple, more or less scaled on both sides. Tip of first interhaemal spine not projecting in front of anal fin. Pectoral fins unequal, that of blind side usually larger; all the rays simple. Pelvic fins short-based, that of ocular side with somewhat longer base and placed on median line, that of blind side with the rays much prolonged. Scales small, ctenoid on ocular side, cycloid on blind side. Lateral line developed only on ocular side of body, with a strong curve above the pectoral fin; no supra-temporal branch. Vent on blind side, above first ray of anal fin.

A single species from the Gulf of Mexico.

1. TRICHOPSETTA VENTRALIS (Goode and Bean).

Citharichthys ventralis, Goode and Bean, 1886, Proc. U. S. Nat. Mus., VIII, (1885), p. 592.
Arroglossus (?) ventralis, Jordan and Gosse, 1889, Rep. U. S. Com. Fish., XIV, (1889), p. 202.
Trichopsetta ventralis, Gill, 1889, Proc. U. S. Nat. Mus., XI, (1888), p. 601; Goode and Bean, 1895, Ocean Ichth., p. 419, fig. 372; Jordan and Evermann, 1898, Bull. U. S. Nat. Mus., XLVI (3), p. 2609, pl. cccxxxiii, fig. 949.

Depth of body 2 to $2\frac{1}{2}$ in the length, length of head $3\frac{1}{4}$ to 4. Upper profile of head notched in front of eyes. Snout shorter than eye, diameter of which is about $\frac{1}{4}$ in length of head, lower eye in advance of upper, which is separated from edge of head by a space equal to about $\frac{1}{4}$ its diameter. Maxillary extending to below middle of eye, length $2\frac{1}{2}$ to $2\frac{3}{4}$ in that of head; lower jaw $1\frac{1}{2}$ in head. 9 or 10 gill-rakers on lower part of anterior arch. About 65 scales in lateral line. Dorsal 91-94. Anal 71-74. Pectoral of ocular side with 12 or 13 rays, length about $1\frac{1}{2}$ in that of head, that of blind side with 9 rays, as long as or shorter than head. Caudal pointed, caudal peduncle very short. Pale brownish, some obscure dark markings at junction of straight and curved portions of lateral line, a dark blotch on anterior rays of anal fin.

TYPE.—United States National Museum. No. 37343.

DISTRIBUTION.—Deep water in the Gulf of Mexico.

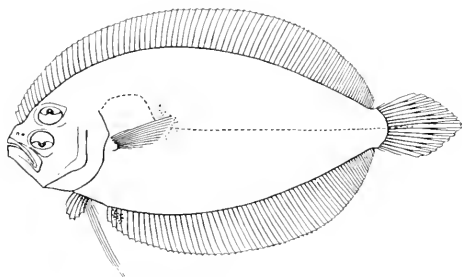


FIG. 113.—*Trichopssetta ventralis*. B.M. (N.H.) 96.2.19.74. ♂ ♀.

SPECIMENS EXAMINED:

1 (130 mm.).

29° 14' 30" N., 88° 09' 30" W.

U.S. Nat. Mus.

3 (132-146 mm.).

Dry Tortugas, Florida.

Longley.

Genus 17. ENGYOPHRYS.

Engyophrys, Jordan and Bollman, 1890, Proc. U.S. Nat. Mus., xii (1889), p. 176 [*Engyophrys sancti-laurentis*, Jordan and Bollman]; Jordan and Evermann, Bull. U.S. Nat. Mus., xlvii (3), p. 2668.

Body ovate, compressed. Eyes on the left side, separated by a narrow ridge, armed with one or more backwardly directed spines. Posterior nostril of blind side small, without membranous valve; olfactory laminae few, nearly parallel with each other and with the main axis of the body; no central rachis. Mouth small, the length of the maxillary less than $\frac{1}{2}$ that of head; jaws equally developed, but dentition almost entirely confined to blind side; teeth small, pointed, scarcely enlarged anteriorly, uniserial in both jaws; vomer toothless. Gill-rakers very short, few in number. Dorsal fin commencing above posterior nostril of blind side and just in front of eye; all the rays simple, scaled on ocular side. Tip of first interhæmal spine not projecting in front of anal fin. Pectoral fins unequal, that of ocular side larger; all the rays simple. Pelvic fins short-based, that of ocular side with somewhat longer base and placed on median line; rays of pelvic of blind side not prolonged. Scales of moderate size, ctenoid on ocular side, cycloid on blind side. Lateral line developed only on ocular side of body, with a strong curve above the pectoral fin; a short bifurcated supratemporal branch. Vent on blind side above first ray of anal fin.

Two species from both coasts of tropical America.¹

¹ Ginsberg has recently described a second species of this genus, but his paper was received too late for inclusion in this monograph:

Engyophrys sentus, Ginsburg, 1933, Proc. U.S. Nat. Mus., lxxxii (20), p. 6. Described from a single example (U.S.N.M., No. 91402), 83 mm. in total length, from off Dry Tortugas, Florida (24° 23'-25' N., 82° 57'-58' W.), 50 fms. Said to differ from the Pacific species in having four spines on the interorbital ridge, spinous processes on the "ocular shelves", less numerous scales, and differently shaped body. The blind side is devoid of pigment.

1. *ENGYOPHYRYS SANCTI-LAURENTII*, Jordan and Bollman.

Engyophrys sancti-laurentii, Jordan and Bollman, 1890, Proc. U.S. Nat. Mus., XII, (1889), p. 170; Jordan and Evermann, 1898, Bull. U.S. Nat. Mus., XLVI (3), p. 2968; Garman, 1899, Mem. Mus. Comp. Zool., XXIV, p. 222; Meek and Hildebrand, 1928, Field Mus. Pub. Chicago, Zool. Ser., XV, No. 249, p. 976.

Depth of body about twice in the length, length of head $3\frac{1}{2}$ to $3\frac{1}{2}$. Upper profile of head notched in front of eyes. Snout shorter than eye, diameter of which is $3\frac{1}{2}$ to 4 in length of head. Lower eye a little in advance of upper, which enters dorsal profile of head. Maxillary extending to below anterior part of eye, length $3\frac{1}{2}$ to nearly 4 in that of head. Lower jaw $2\frac{1}{2}$ in head. 6 gill-rakers on lower part of anterior arch. 64 to 68 scales in lateral line. Dorsal 85-86. Anal 66-71. Pectoral of ocular side with 10 or 11 rays, length about $\frac{1}{2}$ that of head. Caudal rounded or obtusely pointed, caudal peduncle very short. Brownish, with scattered paler and darker spots; some

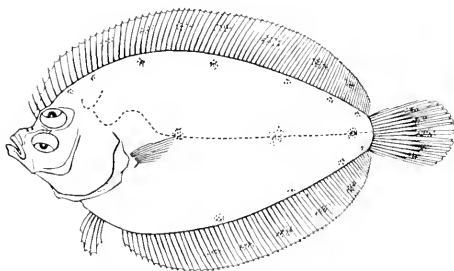


FIG. 111.—*Engyophrys sancti-laurentii*. B.M. (N.H.) 1900.9.29.253. 1/2.

more distinct blackish spots at edges of body, and 3 dark blotches on straight part of lateral line. dorsal and anal fins with scattered black and white spots, caudal with 5 dark spots forming a curved cross-band; in life there are 5 or 6 curved, parallel, dusky bands on blind side of head and anterior half of body.

TYPE.—United States National Museum. No. 41155.

DISTRIBUTION.—On the coast of Colombia, south-west of Panama.

SPECIMENS EXAMINED:

1 (125 mm.)	Paratype	Off coast of Colombia, 51 fms.	Jordan
1 (115 "	"	"	Stanford Univ.
1 (48 "	"	Gorgona Is., Colombia, 30 fms.	Sci. Exped. Research Assoc. ("St. George").

Genus 18. PERISSIAS.

Perissias, Jordan and Evermann, 1898, Bull. U.S. Nat. Mus., XLVI (3), p. 2967. *Platophrys tenuipinna*, Gilbert).

Apparently related to *Engyophrys* and *Trichopsetta*. Eyes separated by a concave space of varying width, broader in the male. Male with spines on the snout and on orbital margins. Mouth small, the length of the maxillary about $3\frac{1}{2}$ in that of head, teeth small, pointed, a little enlarged anteriorly, uniserial (or biserial?) in both jaws.

vomer toothless. Gill-rakers few in number, short. Dorsal fin commencing well in advance of eye; second ray in both sexes produced into a flat, ribbon-shaped filament; all the rays simple, scaled on ocular side. Tip of first interhamal spine not projecting in front of anal fin. Pectoral fins unequal, that of blind side rudimentary, shorter than eye. Pelvic fins rather short-based, subequal, that of ocular side on median line, two anterior rays in the male produced to form flat filaments. Scales of moderate size, ctenoid on ocular side, cycloid on blind side. Lateral line developed only on ocular side, with a distinct curve above the pectoral fin; a short supratemporal branch; straight part of lateral line with several broad cutaneous flaps.

A single species from the coast of California.

1 PERISSIAS TÆNIOPTERUS (Gilbert).

Platophrys tæniopterus, Gilbert, 1890, Proc. U.S. Nat. Mus., xiii, p. 118.

Perissias tæniopterus, Jordan and Evermann, 1898, Bull. U.S. Nat. Mus., xlvii (3), p. 2667.

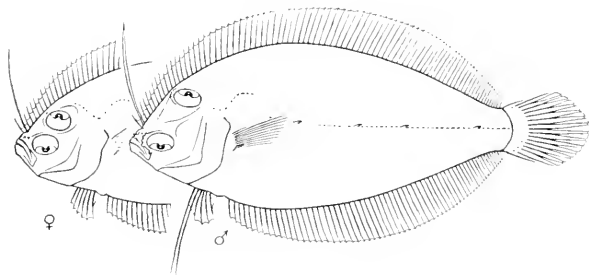


FIG. 115.—*Perissias tæniopterus*. U.S.N.M. 43095. $\times 1$.

Depth of body $2\frac{1}{2}$ in the length, length of head $3\frac{3}{5}$. Diameter of eye $3\frac{1}{2}$ in length of head; interorbital space in the female and in very young males a narrow concave groove, equal to or greater than diameter of eye in larger males ($3\frac{1}{2}$ inches); lower eye well in advance of upper. Supraorbital ridge of lower eye serrated, the spines being less marked in the females; anterior edge of upper orbit similarly but less strongly marked; a strong double spine on maxillary in front of nostril, and a spine near end of maxillary in the male. Maxillary not reaching front of pupil, length about $3\frac{1}{2}$ in that of head. 8 gill-rakers on lower part of anterior arch. 60 to 65 scales in lateral line. Dorsal 86-88; second ray as long as head. Anal 67-70. Pectoral of ocular side a little more than $\frac{1}{2}$ as long as head, that of blind side about $\frac{1}{2}$ as long as orbit. Two anterior rays of left pelvic as long as head in male. Olive brown, with numerous small irregular spots of pale grey, each with a darker border; 3 or 4 dark blotches along lateral line; about 5 pairs of pale spots, broadly ocellated with blackish, along upper and lower edges of body; male with a bright blue spot on anterior profile at base of each of first 10 or 12 dorsal rays, and one on end of snout; male with a broad, oblique, dark brown bar on blind side, from the upper anterior part of which a number of narrow parallel streaks run forward towards the head. filamentous rays of dorsal and left pelvic white. fins all speckled; a small black spot at base of median caudal rays.

TYPE.—United States National Museum No. 43095.

DISTRIBUTION.—Deep water off the coast of California.

The type (about 90 mm) was taken in the Gulf of California, north of La Paz (24° 51' N., 110° 39' W.), in 40 fathoms.

Genus 10. MONOLENE.

Monolene, Goode, 1881, Proc. U. S. Nat. Mus., III, (1880), p. 338 [*Monolene sessilicauda*, Goode &

Jordan and Evermann, 1895, Bull. U. S. Nat. Mus., XLVI (3), p. 2600.

Thyris, Goode, 1881, *ibid.*, cit., p. 344. *Thyris pellucidus*, Goode.

Delothyris, Goode, 1884, Proc. U. S. Nat. Mus., VI (1883), p. 100. *Thyris pellucidus*, Goode.¹

Body ovate or rather elongate, much compressed. Eyes on the left side, separated by a ridge or very narrow space. Posterior nostril of blind side small, without membranous valve; olfactory laminae few, parallel to each other and to the main axis of the body; no central rachis. Mouth rather small, the length of the maxillary less than $\frac{1}{2}$ that of head; jaws and dentition more or less equally developed on both sides; teeth minute, scarcely enlarged anteriorly; uniserial in both jaws; vomer toothless. Gill-rakers rather short. Dorsal fin commencing above nostrils of blind side and well in front of eye; all the rays simple, more or less scaled on both sides. Tip of first interhamal spine not projecting in front of anal fin. Pectoral fin (in adults) developed only on ocular side; all the rays simple. Pelvic fins with bases of moderate length, that of ocular side on median line, but scarcely in advance of that of blind side; none of the rays prolonged. Scales rather small, ctenoid on ocular side, cycloid on blind side. Lateral line feebly developed on blind side; a strong curve above the pectoral fin; no distinct supratemporal branch. Vent on blind side, above first ray of anal fin. Vertebrae 43.

Five species from both coasts of tropical America.

SYNOPSIS OF THE SPECIES.

- I. Depth about $2\frac{1}{2}$ in length; eye $5\frac{1}{2}$ in head; dorsal 82, anal 93. 1. *dubiosa*.
- II. Depth $2\frac{1}{2}$ to $3\frac{1}{2}$ in length; eye $2\frac{2}{3}$ to $3\frac{1}{3}$ in head.
- A. Dorsal 69–109, anal 76–88.
1. Depth nearly 3, head 5 in length; eye $3\frac{1}{2}$ in head; 93 scales in lateral line 2. *sessilicauda*.
2. Depth 3 to $3\frac{1}{2}$, head $4\frac{1}{2}$ to $4\frac{1}{2}$ in length; eye $3\frac{1}{2}$ to $3\frac{1}{2}$ in head; 87 to 88 scales in lateral line 3. *antillarum*.
3. Depth $3\frac{1}{2}$ to $3\frac{1}{2}$, head $3\frac{2}{3}$ to $3\frac{1}{2}$ in length; eye $3\frac{1}{2}$ to $3\frac{2}{3}$ in head; 104 to 108 scales in lateral line 4. *maculipinna*.
- B. Dorsal 124, anal 100; eye $2\frac{2}{3}$ in head 5. *atrimana*.

1. MONOLENE DUBIOSA, Garman

Monolene dubiosa, Garman, 1899, Mem. Mus. Comp. Zool., XXV, p. 227.

Depth of body about $2\frac{1}{2}$ in the length, length of head $3\frac{1}{2}$. Upper profile of head with a small notch in front of eye. Snout shorter than eye, diameter of which is $5\frac{1}{2}$ in length of head; interorbital ridge low; upper eye a little in advance of lower, close to edge of head. Maxillary extending to below anterior part of eye, length about 4 in that of head; lower jaw 3 in head. 83 scales in lateral line. Dorsal 82. Anal 93. Pectoral with 12 rays, length $2\frac{1}{2}$ in that of head. Caudal pointed (?), caudal peduncle very short. Brownish; edges of scales darker; dorsal and anal fins brown, with paler spots; caudal pale with blackish dots; posterior half of pectoral black.

¹ Substitute for *Thyris* (preoccupied).

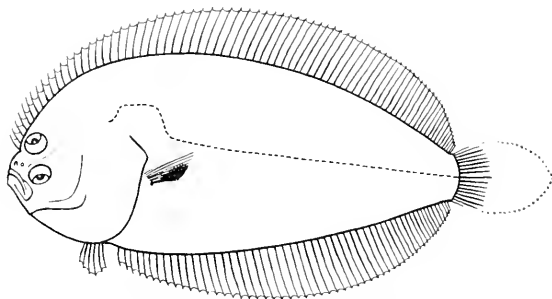


FIG. 116.—*Monolene dubiosa*. M.C.Z. 28538. $\times 1\frac{1}{2}$.

TYPE.—Museum of Comparative Zoology. No. 28538.

DISTRIBUTION.—Off the Pacific coast of Central America; in deep water.

Known only from the type, 70 mm. in total length, taken by the "Albatross" at Station 3422 ($10^{\circ} 47' 30''$ N., $99^{\circ} 59' 30''$ W.), at a depth of 141 fathoms.

2. MONOLENE SESSILICAUDA, Goode

Monolene sessilicauda, Goode, 1881, Proc. U.S. Nat. Mus., iii, (1880), pp. 338, 472; Jordan and Gilbert, 1883, Bull. U.S. Nat. Mus., xvi, p. 841; Jordan and Goss, 1880, Rep. U.S. Com. Fish., xiv, (1886), p. 280.

Thyrus pellucidus, Goode, 1881, Proc. U.S. Nat. Mus., iii, (1880), p. 344.

Delothyrus pellucidus, Goode, 1884, Proc. U.S. Nat. Mus., vi, (1883), p. 109.

Monolene sessilicauda (part), Goode and Bean, 1895, Ocean. Ichth., p. 452, fig. 357; Jordan and Evermann, 1898, Bull. U.S. Nat. Mus., xlvii (3), p. 2691.

Monolene atrimana, Goode and Bean, 1895, Ocean. Ichth., pl. cui, fig. 359.

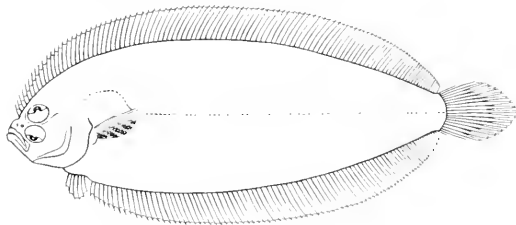


FIG. 117.—*Monolene sessilicauda*. B.M. (N.H.) 96.2.10.72. $\times \frac{1}{2}$.

Depth of body nearly 3 in the length, length of head 5. Upper profile of head with a small notch in front of eyes. Snout shorter than eye, diameter of which is

$3\frac{1}{2}$ in length of head, interorbital ridge low, lower eye in advance of upper, which is separated from edge of head by a narrow space. Maxillary extending to below anterior part of eye, length a little more than 3 in that of head, lower jaw a little more than twice in head. 10 gill-rakers on lower part of anterior arch. 93 scales in lateral line. Dorsal (96-103) 104. Anal (76-81) 85. Pectoral with 13 or 14 rays, length nearly $\frac{2}{3}$ that of head. Caudal pointed, caudal peduncle very short. Brownish, with numerous more or less distinct darker spots, lower part of pectoral fin with blackish spots and blotches, which tend to unite to form irregular cross-bars.

TYPE.—United States National Museum. No. 26004.

DISTRIBUTION.—Off the coast of southern New England; in deep water.

SPECIMENS EXAMINED:

1 (137 mm.). Paratype. Off Newport, Rhode Is. U. S. Nat. Mus.

The post-larval form described by Goode as *Debothyrus pellucidus* is the young of this species. The type is 72 mm. in length.

3. MONOLENE ANTILLARUM, Norman.

Monolene sessilicauda (part), Goode and Bean, 1895, Ocean, Ichth., p. 452; Jordan and Evermann, 1898, Bull. U. S. Nat. Mus., XLVI (3), p. 2694.

Monolene sessilicauda, Garman, 1896, Bull. Lab. Nat. Sci. Univ. Iowa, p. 91.

Monolene antillarum, Norman, 1933, Ann. Mag. Nat. Hist., (10) XI, p. 294.

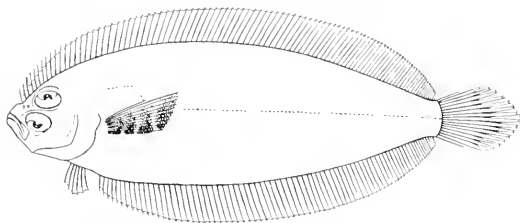


FIG. 118.—*Monolene antillarum*. B.M. (N.H.) 1932.12.31.15. 1/4

Closely related to *M. sessilicauda*, but depth of body 3 to $3\frac{1}{2}$ in the length, length of head $4\frac{1}{4}$ to $4\frac{1}{2}$; upper profile of head less elevated above and behind eyes, diameter of eye $3\frac{1}{4}$ to $3\frac{1}{2}$ in length of head, lower jaw a little longer and rather more vertical. 8 or 9 gill-rakers on lower part of anterior arch. 87 to 88 scales in lateral line. Dorsal 102-109. Anal 86-88. Pectoral with 12 to 14 rays, length $\frac{2}{3}$ to $\frac{1}{2}$ that of head. Brownish, with indistinct darker markings, of which those near edges of body are most prominent; pectoral with irregular blackish cross-bars, which are more distinct in its lower part.

TYPE.—British Museum (Nat. Hist.). Reg. No. 1932.12.31.15.

DISTRIBUTION.—Off the coast of Florida and the West Indies, in shallow or deep water.

SPECIMENS EXAMINED:

2 (129, 125 mm.) ¹ . Types.	South of Tortugas.	U. S. Nat. Mus.
1 (74, 129 mm.).	Dry Tortugas.	Longley.
1 (155 mm.). Type.	Off Barbados.	Mus. Comp. Zool.

¹ The larger has been selected as the holotype.

4 *MONOLENE MACULIPINNA*, Garman.

Monolene maculipinna, Garman, 1899, Mem. Mus. Comp. Zool., xxiv, p. 226, pl. li, figs. 1, 2.

Depth of body $3\frac{1}{2}$ to $3\frac{1}{4}$ in the length, length of head $3\frac{2}{3}$ to $3\frac{1}{5}$. Upper profile of head notched in front of eyes. Snout shorter than eye, diameter of which is $3\frac{1}{4}$ to $3\frac{2}{3}$ in length of head; interorbital ridge rather low; lower eye well in advance of upper, which is very close to edge of head. Maxillary extending to below anterior part of eye, length a little more than 3 in that of head; lower jaw more than twice in head. 8 or 9 gill-rakers on lower part of anterior arch. 104 to 108 scales in lateral line. Dorsal 98-100 (102). Anal 78-80 (85). Pectoral with 15 or 16 rays, length $1\frac{1}{2}$ to twice in that of head. Caudal obtusely pointed; caudal peduncle very short. Brownish, irregularly clouded with darker; posterior part of caudal fin blackish; pectoral black,

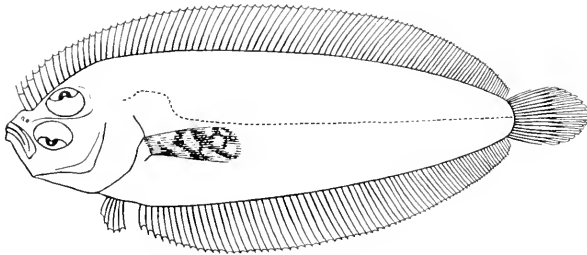


FIG. 119.—*Monolene maculipinna*. B.M. (N.H.) 1930.9.4.13. ♀.

except for its anterior third, with some elongate white spots, which tend to form one or two irregular cross-bars.

TYPE.—Museum of Comparative Zoology. No. 28541-2.

DISTRIBUTION.—Off the Pacific coast of Panama and Colombia; in deep water.

SPECIMENS EXAMINED:

2 (125, 150 mm.). Paratypes. 7 40' N., 79 17' W., 127 fms. Mus. Comp. Zool.
(“Albatross”).

5 *MONOLENE ATRIMANA*, Goode and Bean.

Monolene atrimana, Goode and Bean, 1886, Bull. Mus. Comp. Zool., xii, p. 155; Jordan and Goss, 1889, Rep. U.S. Com. Fish., xiv, (1886), p. 280; Goode and Bean, 1895, Ocean. Ichth., p. 455, fig. 358; Jordan and Evermann, 1898, Bull. U.S. Nat. Mus., xlviii (3), p. 2692.

Depth of body more than $3\frac{1}{4}$ in the length, length of head $4\frac{1}{4}$ to $4\frac{1}{2}$. Upper profile of head notched in front of eyes. Snout shorter than eye, diameter of which is $2\frac{2}{3}$ in length of head; lower eye well in advance of upper, which is very close to edge of head. Maxillary extending to a little beyond anterior edge of eye, length $3\frac{2}{3}$ in that of head. 105 scales in lateral line. Dorsal 124. Anal 100. Pectoral with 11 or 12 rays, about as long as or longer than head. Caudal pointed; caudal peduncle very short. Pale brownish grey; median fins dusky; pectoral black.

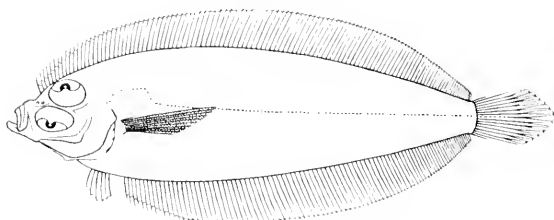


FIG. 120.—*Monolepis atromanni*. U.S.N.M. 17659. $\frac{1}{2}$

TYPE.—Museum of Comparative Zoology. No. 27952

DISTRIBUTION.—Off Barbados, in deep water

The type, 114 mm. in length, was taken by the "Blake" in 288 fathoms.

Genus 20. EUCITHARUS.

Citharus, (Rose), 1793, in Walbaum, *Arted. Ichth.*, 13, p. 416.¹

Citharus (non Reinhardt), Bleeker, 1862, *Versl. Akad. Wet. Amsterdam*, XIII, p. 424 [*Pleuronectes citharus*, Spinola]

Eucitharus, Gill, 1880, *Proc. U.S. Nat. Mus.*, XI, (1888), p. 600 [*Pleuronectes linguatula*, Linnaeus.²

Chopon-psetta, Whitley, 1931, *Aust. Zool.*, VI, p. 322 [*Pleuronectes linguatula*, Linnaeus.³

Body rather elongate, compressed. Eyes on the left side, separated by a low, bony ridge. Olfactory laminae rather numerous, arranged transversely to a long central rachis. Mouth large, the maxillary about $\frac{1}{2}$ as long as head; lower jaw strongly projecting, each mandible with a strong emargination near its anterior end, jaws and dentition about equally developed on both sides, teeth of moderate size, with well-developed canines anteriorly, uniserial (except at front of upper jaw), vomer toothed. Gill-rakers of moderate length, rather slender, lower pharyngeals each with two irregular rows of pointed teeth, those of the inner row much larger. Dorsal fin commencing immediately behind lower part of posterior nostril of blind side, which has the form of a large opening covered by a membranous valve extending downwards towards the mouth, origin of fin just in front of eye, nearly all the rays branched, not scaled; hinder rays of fin highest, slightly deflected on to blind side of caudal peduncle. Tip of first interhamal spine not projecting in front of anal fin. Pectoral fins unequal, that of ocular side larger, middle rays branched. Pelvic fins short-based, subequal, that of ocular side on median line. Scales large, rather deciduous, more or less ctenoid on both sides of body. Lateral line equally developed on both sides of body, continued posteriorly to margin of caudal fin, a distinct curve above the pectoral fin, no supratermporal branch, tubules simple. Vent on ocular side, above first ray of anal fin. Vertebrae 35 (10 + 25).

A single species from the Mediterranean and West Africa.

¹ The generic names attributed by Jordan and Evermann (1917, *Genera Fish.*, 1, p. 81) to A. J. Rose, listed in the appendix included in part IV of Walbaum's "*Arted. Ichthologica*" (1793), pp. 416-418, do not appear to be admissible, being accompanied by descriptions *Citharus*, Bleeker (1862), is preoccupied by *Citharus*, Reinhardt (1838), a synonym of *Hippoglossoides*.

² Substitute for *Citharus*, Bleeker, preoccupied.

³ An unnecessary substitute for *Eucitharus*, Gill, which, according to the rules (Art. 56), is not invalidated by its similarity to *Eucitharus*, Fischer (1883), a molluscan genus.

I. EUCITHARUS LINGUATULA (Linnæus).

- Pleuronectes linguatula*, Linnæus, 1758, Syst. Nat., ed. 10, p. 270; Schneider, 1801, in Bloch, Syst. Ichth., p. 151.
- Pleuronectes macrolepidotus*, Bloch, 1787, Nat. Ausl. Fische, iii, p. 34, pl. cxc; Delaroche, 1809, Ann. Mus. H. N. (Paris), xiii, p. 353; Bonaparte, 1841, Icon. F. Ital., (4), Indice (2) and (22), fig.; Canestrini, 1862, Arch. Zool. Anat. Fisiol. Genova, i, p. 16, pl. ii, fig. 1.
- Pleuronectes citharus*, Spinola, 1807, Ann. Mus. H. N. Paris, x (58-59), p. 374; Bonaparte, 1840, Cat. metod. Pesci Europ., p. 47; Moreau, 1881, Hist. Nat. Poiss. France, iii, p. 334, fig. 186.
- ? *Solea limanda*, Rafinesque, 1810, Ind. itt. Sicil., p. 14.
- Solea cithara*, Rafinesque, 1810, *tom. cit.*, pp. 14, 52.
- Hippoglossus* (?) *macrolepidotus*, Cuvier, 1817, R. Anim., ed. i, ii, p. 221; Cuvier, 1829, R. Anim., ed. 2, ii, p. 340.
- Hippoglossus citharus*, Risso, 1826, H. N. Europe, iii, p. 246; Costa, 1847, Faun. R. Napoli, ii, fasc. 55-8, p. 27.
- Pleuronectes pataarchia*, Nardo (ex Chierighi MS.), 1847, Sin. med. spec. Lag. Veneto, p. 121.
- ? *Pleuronectes citharus*, Nardo, 1847, *tom. cit.*, p. 121.
- Citharus macrolepidotus*, Bleeker, 1862, Versl. Akad. Wet. Amsterdam, xiii, p. 424.
- Citharus linguatula*, Gunther, 1862, Cat. Fish., iv, p. 418; Steindachner, 1868, Sitzber. Akad. Wiss. Wien, lvi (1), p. 717; Jordan and Goss, 1880, Rep. U.S. Com. Fish., xiv, (1886), p. 253; Buen, 1926, Cat. ictiol. Medit. Españ. Marruecos, p. 95; Chabanaud, 1931, Bull. Mus. Hist. nat. Paris, (2) ii, p. 627; Chabanaud, 1931, Riviera Sci., Suppl. Mem. ii, p. 17; Chabanaud, 1931, Bull. Soc. zool. Fr., lvi, p. 393; Chabanaud, 1933, Mem. Soc. Sci. Nat. Maroc, xxxv, p. 6, pl. 1, figs. 1-3, text-figs.¹
- Eucitharus linguatula*, Gill, 1889, Proc. U.S. Nat. Mus., xi, (1888), p. 599; Carus, 1889-93, Prodr. Faun. Medit., ii, p. 588; Buen, 1919, Bol. Pesc. Madrid, iv, p. 302; Norman, 1939, "Discovery" Reports, ii, p. 359.

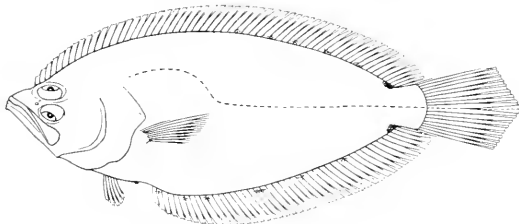


FIG. 121.—*Eucitharus linguatula*. B.M. (N.H.) 1930.5.0.27. $\frac{1}{2}$

Depth of body $2\frac{1}{2}$ to $2\frac{3}{4}$ in the length, length of head 3 to $3\frac{1}{4}$. Upper profile of head distinctly concave. Snout a little longer than eye, diameter of which is 5 to $5\frac{1}{2}$ in length of head; upper eye a little in advance of lower, which is very close to edge of head. Maxillary extending to below posterior edge of eye or not quite as far, length about $\frac{1}{2}$ that of head; lower jaw $1\frac{1}{2}$ to $1\frac{3}{4}$ in head. Premaxillary with an outer series of rather strong teeth, inside which are one or two strong canines; maxillary with a single series of smaller teeth; mandibular teeth uniserial, somewhat enlarged anteriorly; two or three strong teeth on the vomer. 11 or 12 gill-rakers on lower part of anterior arch. 35 to 39 scales in lateral line. Dorsal 64-72. Anal

¹ This paper, which contains a number of valuable observations on the osteology, etc., of *Eucitharus*, *Arnoglossus*, *Bothus*, and other Flatfishes, was unfortunately received too late for inclusion in the present monograph.

44-48. Pectoral of ocular side with 10 rays, length a little more than $\frac{1}{2}$ that of head. Caudal pointed or double-truncate; caudal peduncle about $1\frac{2}{3}$ times as deep as long. Yellowish or greyish brown, a black spot at base of last rays of dorsal fin and a similar spot above end of anal fin; a row of round black spots on dorsal and anal fins.

TYPE.—Not traced.

DISTRIBUTION.—Mediterranean and adjacent parts of Atlantic; West Africa.

SPECIMENS EXAMINED:

1 (215 mm l.)	Mediterranean.	Wolfenden.
6 (140-195 mm l.)	Naples.	Kyle.
1 (135 mm l.), skeleton.	"	"
1 (175 " " l.)	Famagusta, Cyprus.	Carmichael.
1 (149, 173 mm l.)	Off C. Lopez, French Congo, 32-27 fms.	" Discovery "
1 (200, 215 " " l.)	Off Elephant Bay, Angola, 40-53 fms.	"
1 (170, 80 mm l.)	Off St. Paul de Loanda, Angola, 35-36 fms.	"

Also 3 from the Mediterranean (Leiden Mus.).

The type of *Pleuronectes macrolepidotus* was said to have come from Brazil, but there can be no doubt that Bloch had an example of this species and that the locality was incorrect.

Genus 21. CITHAROIDES.

Citharus ides, Hubbs, 1915, Proc. U.S. Nat. Mus., XLVIII, p. 457. *Citharoides macrolepidotus*, Hubbs & Paracitharus, Regan, 1920, Ann. Durban Mus., 11, p. 209. *Arroglossus macrolepis*, Gilchrist.]

Closely related to *Eucitharus*, but teeth all small, pointed, in bands in the jaws (at least in adults); vomer toothless; anterior end of each mandible flat or with a very shallow emargination; dorsal fin commencing immediately above posterior nostril of blind side; tip of first interhemal spine feeble, just projecting in front of anal fin; tubules of lateral line forked, Y- or T-shaped.

A single species from South Africa and Japan.

1. CITHAROIDES MACROLEPIS (Gilchrist).

[LARGE-SCALED FLOUNDER]

Arroglossus macrolepis, Gilchrist, 1905, Mar. Invest. S. Afr., 10, p. 12, pl. XXX; Von Bonde, 1925, Trans. R. Soc. S. Afr., XL, p. 288.
Citharoides macrolepidotus, Hubbs, 1915, Proc. U.S. Nat. Mus., XLVIII, p. 453, pl. XXV, fig. 1.
Paracitharus macrolepis, Regan, 1920, Ann. Durban Mus., 11, p. 210, fig. 2; Barnard, 1925, Ann. S. Afr. Mus., XVI, p. 350; Fowler, 1926, Proc. Acad. Nat. Sci. Philad., LXVII, (1925), p. 203.

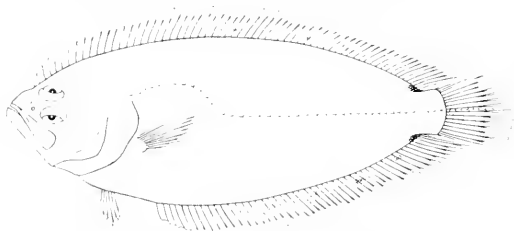


FIG. 122.—*Citharoides macrolepis*. B.M. (N.H.) 1905, 9, 2, 5. (1/2).

Depth of body $2\frac{1}{2}$ to $2\frac{3}{4}$ in the length, length of head $3\frac{1}{4}$ to nearly $3\frac{1}{2}$. Upper profile of head a little concave in front of eyes. Snout as long as or shorter than eye, diameter of which is $3\frac{1}{4}$ (young) to nearly 5 in length of head; upper eye a little in advance of lower and close to edge of head. Maxillary extending to below posterior part of eye, length twice or a little more than twice in head; lower jaw $1\frac{3}{8}$ to $1\frac{1}{4}$ in head. 9 to 11 gill-rakers on lower part of anterior arch. 40 to 46 scales in lateral line. Dorsal 66-72. Anal 43-50. Pectoral of ocular side with 10 rays, length a little more than $\frac{1}{2}$ that of head. Caudal rounded or double-truncate; caudal peduncle (in adults) about twice as deep as long. Pale brownish; a dark spot at base of last rays of dorsal fin and a similar spot above end of anal; a row of round, black or brown spots on dorsal and anal.

TYPE.—South African Museum.

DISTRIBUTION.—South Africa, from Zululand to Delagoa Bay; Korean Strait, Japan.

SPECIMENS EXAMINED:

1 (198 mm.).	Paratype.	22 miles N. of mouth of R. Tugela, Natal, 63-73 fms.	Gilchrist.
1 (245 ").		Natal.	"
1 (182 ").		Sea of Japan, off Nagato Prov.	Tokyo Imp. Univ.

The type of *C. macrolepidotus*, taken by the "Albatross" in the Korean Strait, in 66 fathoms, is only 59 mm. in total length. The teeth were described as uniserial in the upper jaw, with several large teeth irregularly placed, and uniserial posteriorly in the lower jaw, becoming biserial further forward and forming a narrow band at the symphysis. Col. Tenison has examined the type in the United States National Museum (No. 75670), and assures me that it is a young example of *C. macrolepis*. An adult example from Japan received after the completion of this work confirms this view.¹

Subfamily 2. BOTHINÆ.

Pelvic fin of blind side short-based; that of ocular side elongate, extending forward to the urohyal, supported by a cartilaginous plate placed in advance of the cleithra, its anterior ray well in advance of first ray of that of blind side; caudal vertebræ with well-developed apophyses.

Thirteen genera, mostly from tropical and temperate seas.

SYNOPSIS OF THE GENERA.

- I Dentition more or less developed on both sides of jaws; mouth a little protractile.
- A. Mouth small or of moderate size, maxillary $\frac{1}{2}$ or less than $\frac{1}{2}$ head; lower jaw not very prominent.
1. Both pectorals developed.
- a. Lateral line absent or feebly developed on blind side.
- a. Eyes separated by a bony ridge or narrow concave space; inter-orbital region similar in both sexes.
- * Male without rostral spines or tubercles.
- † Scales of ocular side cycloid or rather feebly ctenoid; maxillary 2 to $3\frac{1}{4}$ in head 22. ARNGLOSSUS.
- †† Scales of ocular side strongly ctenoid; maxillary $2\frac{1}{4}$ to $3\frac{1}{4}$ in head 23. PSETTINA.
- ** Male with bony tubercles on snout and at mandibular symphysis, which are feebly developed or absent in female; maxillary $3\frac{1}{2}$ to nearly 4 in head; anterior dorsal rays prolonged in male 24. LOPHONECTES.

¹ Unfortunately the lateral line scales are all missing in this specimen.

- β. Eyes separated by a more or less concave space (except in very young), which is usually broad in the mature male; male generally with one or more rostral spines.
- Less than 65 scales in lateral line; gill-opening extending to lateral line, or ending a short distance above pectoral fin, in which case scaling of head and body is continuous below lateral line.
 - † Scales of ocular side rather feebly ctenoid; maxillary $2\frac{1}{2}$ to $3\frac{1}{2}$ in head 25 ENGYPROSEPON
 - †† Scales of ocular side strongly ctenoid, maxillary $3\frac{2}{3}$ to nearly 4 in head 26 CROSSORHOMBUS.
 - ** More than 74 scales in lateral line; upper angle of gill-opening a short distance above pectoral fin or close to lateral line, membrane joining operculum to pectoral arch scaleless or partly scaled.
 - † Eyes generally separated by a broad interspace (at least in male), the lower well in advance of the upper; male nearly always with rostral and orbital spines; teeth in jaws in two or more series (at least anteriorly)¹, membrane joining operculum to pectoral arch scaleless 27. BÖTHUS
 - †† Eyes separated by a narrow or moderately wide space in both sexes, the lower only a little in advance of the upper, male without distinct rostral or orbital spines; teeth uniserial in both jaws, membrane joining operculum to pectoral arch partly scaled 28 PARABÖTHUS
 - b Lateral line equally developed on both sides of body; interorbital region narrow, concave, similar in both sexes; scales small 29 GRAMMATOBÖTHUS
2. No pectoral fins.
- a Scales small, ctenoid, the spinules directed horizontally, body normal 30. MANGOPSETTA
 - b Scales very small, ctenoid, the spinules directed vertically, giving the skin a pilose appearance, body with a thick, muscular central portion, continued above and below as a thin, semi-transparent region 31. ACHIROPSETTA
1. Mouth very large, maxillary more than $\frac{1}{2}$ head, lower jaw very prominent, body elongate
- 1 Mandibular membranes not forming a pouch; only the tip of lower jaw projecting 32. CHASCANOPSETTA
 - 2 Mandibular membranes forming a gular pouch, about $\frac{1}{4}$ of length of lower jaw projecting 33. PELECANOTHYUS
- II Dentition nearly entirely confined to blind side of jaws; mouth small, protratile, maxillary $3\frac{2}{3}$ to $4\frac{2}{3}$ in head 34. LEFOPS

The subdivision into genera of the subfamily Bothinae, and particularly of those related to *Anglossus*, *Engyprosepon*, *Bothus*, etc., presents some difficulty.² The form of the gill-openings, although a useful character, proves to be of less importance than it was believed to be, and the form of the interorbital region, dentition, and the scaling are all very variable features. The arrangement of the olfactory laminae in the nasal organs provides a character which is somewhat more reliable, but this requires further investigation with well-preserved material.³ Weber and Beaufort,¹ working on Indo-Australian Heterosomata only, would unite the genera *Anglossus*,

¹ Sometimes uniserial in *B. mancus*.

² See Jordan and Hubbs, 1917, Ann. Carnegie Mus., XI, p. 168.

³ This character has not been used in the synopsis of the genera above.

⁴ 1929, Fish. Indo-Austral. Arch., 5, p. 117.

Psettina, *Engyprosopon*, *Crossorhombus*, *Bothus*, *Parabothus* and *Grammatobothus*, into a single genus (*Bothus*). When dealing with all the Indo-Pacific species, however, together with those from Europe and America, such a genus would assume very clumsy proportions. Practically all the species fall readily into one or other of the genera defined in the above synopsis, and it is only some 3 or 4 species, most of them known from only a single example or from specimens of one sex only, whose systematic position is more difficult to determine.

Genus 22. ARNOGLOSSUS.

- ? *Peloria*, Cocco, 1844, in Krohn, Giorn. Gabin. Messina, Ann. iii, v (xxv), p. 21¹ [*Peloria heckeli*, Cocco].
Arnoglossus, Bleeker, 1862, Versl. Akad. Wet. Amsterdam, xiii, p. 427 [*Pleuronectes arnoglossus*, Schneider]; Norman, 1931, Ann. Mag. Nat. Hist., (10) viii, p. 599.
Bascanus, Schiodte, 1868, Natur. Tidsskrift, (3) v, p. 275 [*Bascanus tædifer*, Schiödte].
Anticitharus, Günther, 1880, Shore Fishes "Challenger", p. 47 [*Anticitharus polyspilus*, Günther].
Charybdis, Facciola, 1885, Nat. Sicil., iv, p. 265 [*Peloria rueppellii*, Cocco].
Caulopsetta, Gill, 1893, Mem. Nat. Acad. Sci. Washington, vi, p. 124 [*Pleuronectes scaphus* (Forster) Schneider].
Kyleia, Chabanaud, 1931, Bull. Soc. zool. Fr., lvi, p. 393; Chabanaud, 1933, Mem. Soc. Sci. Nat. Maroc, xxxv, p. 49 [*Arnoglossus thori*, Kyle].
Dullfusina, Chabanaud, 1933, Mem. Soc. Sci. Nat. Maroc, xxxv, pp. 31, 44 [*Peloria rueppellii*, Cocco].

Body ovate or rather elongate, compressed. Eyes on the left side, separated by a bony ridge or narrow concave space, the interorbital region similar in both sexes. No rostral or orbital spines. Olfactory laminae few or in moderate number, arranged transversely to or radiating from a central rachis of varying length. Mouth of moderate size or rather small, the length of the maxillary 2 to 3½ in that of head; jaws and dentition about equally developed on both sides; teeth small or of moderate size, slender, sharply pointed, sometimes enlarged and canine-like anteriorly, uniserial in both jaws; vomer toothless. Gill-rakers comparatively few in number, generally rather slender and of moderate length; lower pharyngeals each with a single series of sharply-pointed teeth. Dorsal fin commencing above nostrils of blind side and well in front of eye; all the rays simple, generally scaled (at least on ocular side). Tip of first interhemal spine not projecting in front of anal fin. Pectoral fins unequal, that of ocular side larger; all the rays simple. Tip of pelvic bone projecting downwards and backwards between the pelvic fins. Scales small or of moderate size, feebly ctenoid or cycloid on ocular side, generally cycloid on blind side; no supplementary scales. Lateral line developed only on ocular side of body, with a distinct curve above the pectoral fin; no supratemporal branch. Vent on blind side, above anterior ray of anal fin.

About twenty-four species from the Atlantic coasts of Europe and Africa, the Mediterranean, and the Indo-Pacific.

SYNOPSIS OF THE SPECIES.

European and African Species.

- I. Dorsal 73-80, anal 51-57.
 A. About 50 scales in lateral line; second ray of dorsal prolonged; eye about 3½ in head 1. *grohmanni*.
 B. 38 to 40 scales in lateral line; second ray of dorsal not prolonged; eye about 4½ in head 2. *kessleri*.
 II. Dorsal 81-106, anal 62-82.
 A. Dorsal 81-93 (98), anal 62-74; eye 3¾ to 5½ in head.
 1. Second ray of dorsal prolonged in both sexes; maxillary 2¾ to about 3, lower jaw about 2 in head 3. *thori*.

¹ *Teste* Facciola, 1885.

- 2 None of the rays of dorsal prolonged
 a Head $3\frac{1}{6}$ to 4 in length, maxillary $2\frac{1}{6}$ to $2\frac{1}{3}$, lower jaw $1\frac{1}{2}$ to 2 in head
 b Head $3\frac{1}{6}$ to $3\frac{2}{3}$ in length, maxillary $2\frac{1}{6}$ to $2\frac{1}{3}$, lower jaw about $1\frac{1}{4}$ in head
- III Dorsal 95-106, anal 74-82, eye $2\frac{1}{2}$ to 4 in head; anterior rays of dorsal more or less prolonged
- 1 Depth $2\frac{1}{2}$ to $2\frac{3}{4}$ in length, eyes (in adults) separated by a bony ridge
 2 Depth $2\frac{1}{2}$ to $2\frac{3}{4}$ in length, eyes (in adults) separated by a narrow concave space
- III Dorsal 110-116 (118), anal 86-94, depth 3 to $3\frac{1}{2}$ in length, eye about 3 in head

Indo-Pacific Species.

- I Anterior teeth of upper jaw scarcely enlarged, teeth of lower jaw small, rather close-set, similar to those of upper jaw, eyes separated by a bony ridge
- A Anterior rays of dorsal greatly prolonged in the male, a little longer than those which follow in the female, eye 3 to $3\frac{1}{2}$ in head
- B Anterior rays of dorsal not or a little prolonged.
- 1 Eye $3\frac{1}{2}$ to 5 in head, depth $1\frac{1}{2}$ to $2\frac{1}{2}$, head 4 to $4\frac{1}{2}$ in length
 a Eye $4\frac{1}{2}$ to 5 in head; depth $1\frac{1}{2}$ to $2\frac{1}{6}$ in length, dorsal and anal rays not scaled
 b Eye $3\frac{1}{2}$ to $4\frac{1}{2}$ in head, depth $2\frac{1}{4}$ to $2\frac{3}{4}$ in length, dorsal and anal rays scaled
- a Dorsal 80-84, anal 61-64
 β Dorsal 93-103, anal 70-82
 * Depth $2\frac{1}{2}$ to $2\frac{3}{4}$ in length, dorsal 93-98, anal 70-74
 ** Depth $2\frac{1}{2}$ to $2\frac{1}{2}$ in length; dorsal 94-103, anal 70-82
- 2 Eye about 3 in head; depth 3 or nearly 3, head $3\frac{1}{2}$ to $3\frac{3}{4}$ in length
- II Anterior teeth of upper jaw larger than those at sides, teeth of lower jaw stronger and more wide-set than lateral teeth of upper jaw.
- A Eyes separated by a bony ridge or very narrow space; gill-rakers pointed, longer than broad
- 1 Less than 100 scales in lateral line, width of curve of lateral line $1\frac{1}{2}$ to $2\frac{1}{2}$ in head; upper profile of head moderately convex above and behind eyes
- a Dorsal 90-100, anal 72-84
 a Maxillary to below anterior part or middle of eye, $2\frac{1}{2}$ to 3 in head
 * 63 to 75 scales in lateral line
 † Scales feebly ctenoid on ocular side, 68 to 75 in lateral line, maxillary to below anterior part of eye, $2\frac{1}{2}$ to 3 in head
 ‡ Depth $2\frac{1}{2}$ to $2\frac{1}{2}$, head $3\frac{1}{2}$ to $3\frac{1}{2}$ in length; eye $3\frac{1}{2}$ to $1\frac{1}{2}$ in head, dorsal 103-106, anal 81-84
 †† Depth $2\frac{1}{2}$ to $2\frac{1}{2}$, head 4 to $4\frac{1}{2}$ in length, eye 4 to 5 in head, dorsal 90-97, anal 72-75
 ††† Scales cycloid on ocular side, 93 to 94 in lateral line, maxillary to below middle of eye, a little more than twice in head
 †††† 87 to 92 scales in lateral line, scales cycloid on ocular side, dorsal 98-99, anal 77-78
 β Maxillary to below posterior $\frac{1}{2}$ of eye, about twice in head, 70 scales in lateral line

- b. Dorsal 112-119, anal 88-96.
- a. Scales cycloid on ocular side, 94 to 98 in lateral line . . . 20. *debilis*.
- β. Scales feebly ctenoid on ocular side, 80 to 89 in lateral line.
- * Maxillary to below anterior part or middle of eye, $2\frac{1}{2}$ to $2\frac{3}{4}$ in head; lower limb of præoperculum $\frac{1}{2}$ or less than $\frac{1}{2}$ as long as head . . . 21. *scapha*
- ** Maxillary nearly to below middle of eye (in an example of 156 mm.), $2\frac{1}{2}$ in head; lower limb of præoperculum rather more than $\frac{1}{2}$ as long as head . . . 22. *boops*.
2. About 110 scales in lateral line; width of curve of lateral line $2\frac{1}{2}$ in head; upper profile of head markedly convex above and behind eyes; dorsal 106, anal 84 . . . 23. *microphthalmus*.
- B. Eyes separated by a concave space, its width $\frac{1}{2}$ to $\frac{1}{3}$ eye; gill-rakers palmate (short, strongly spinulate), about as broad as long; 45 to 50 scales in lateral line . . . 24. *intermedius*.

The genus *Arnoglossus* still remains a somewhat heterogeneous group, but I am unable to find any valid reasons for its further subdivision. Apart from the two species placed at the end of the genus, *microphthalmus* and *intermedius*, which might perhaps be regarded as representing distinct genera, the species seem to form a natural group. Those species with canine teeth anteriorly in the jaws should perhaps rank as a subgenus, for which the name *Anticitharus* is available.

1. ARNOGLOSSUS GROHMANNI (Bonaparte).

? *Bothus tappa*, Rafinesque, 1810, Car. n. gen., p. 23.

Pleuronectes grohmanni, Bonaparte, 1837, Icon. Faun. Ital., (19), fig.

? *Arnoglossus grohmanni*, Buen, 1926, Cat. ictiol. Medit. Españ. Marruecos, p. 95; Chabanaud, 1930, Riviera Sci., Suppl. Mem. ii, p. 18.

LARVÆ AND POST-LARVÆ.

Kyle, 1913, Rep. Danish Ocean. Exped. 1908-1910, ii, A. 1, p. 51, pl. 1, figs. 1-4, text-fig. 51.

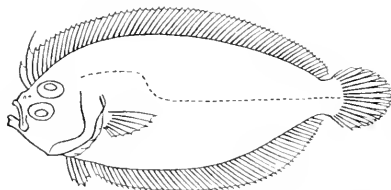


FIG. 123.—*Arnoglossus grohmanni*. [After Bonaparte.] $\times \frac{1}{2}$.

Depth of body $2\frac{1}{2}$ in the length, length of head about $3\frac{3}{4}$. Snout shorter than eye, diameter of which is about $3\frac{1}{2}$ in length of head; eyes separated by a narrow ridge, the lower in advance of the upper. Maxillary scarcely extending to below middle of eye, length about 3 in that of head. Teeth all minute, not enlarged anteriorly. About 50 scales in lateral line. Dorsal 80 (73-80); second ray somewhat thickened, about twice as long as those which follow. Anal 52 (51-57). Pectoral a little more than $\frac{1}{2}$ length of head. Caudal rounded. Vertebrae 10 + 23 = 24. Pale brown or yellowish

grey, with darker markings on the body, particularly towards the edges, head, body and fins covered with small black dots.

TYPE.—Not traced.

DISTRIBUTION.—Mediterranean, Black Sea (?).

Although no adult specimens have been recognised since the time of Bonaparte, Kyle has given good reasons for regarding this as a species distinct from that identified as *gobmanni* by most other authors (*l. e. thori*). There seems to be no adequate reason for assuming that the number of dorsal and anal fin-rays given in Bonaparte's description is incorrect, and the larval forms ascribed by Kyle to this species may be readily distinguished from those of *A. thori* or of any other European species. It is possible, however, that some of the larvæ described by Kyle (*e. g.* those from the Black Sea) may have belonged to *A. kessleri*.

2. ARNOGLOSSUS KESSLERI, Schmidt

Arnoglossus kessleri, Schmidt, 1915, Ann. Mag. Nat. Hist. (8) xvi, p. 108.

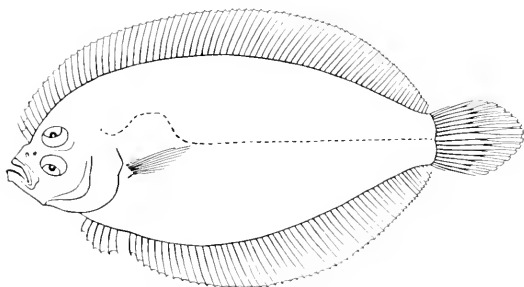


FIG. 124.—*Arnoglossus kessleri*. B.M. (N.H.) 1930.5.19.1. 2.

Depth of body about $2\frac{1}{4}$ in the length, length of head $3\frac{2}{3}$ to $3\frac{3}{4}$. Snout about as long as eye, diameter of which is $4\frac{1}{2}$ in length of head; eyes separated by a bony ridge, the lower in advance of upper. Maxillary extending to below anterior edge of eye, length 3 in that of head, lower jaw a little more than twice in head. Teeth all minute, not enlarged anteriorly. 7 or 8 gill-rakers on lower part of anterior arch. Scales feebly ctenoid, 38 to 40 in lateral line. Dorsal 74-76, tips of first two rays free from membrane, but none of the rays prolonged. Anal 53-57. Pectoral of ocular side with 10 rays, length about $\frac{2}{3}$ that of head. Caudal rounded (?). Vertebrae 10-23. Brownish, with or without dark spots or black dots.

TYPE.—Zoological Museum, Leningrad. No. 18861.2.

DISTRIBUTION.—Black Sea.

SPECIMENS EXAMINED:

1. 32 mm.

1. 62, 64 mm.

Sebastopol.

Feodosia, Crimea.

Popov.

Berg.

According to Schmidt, specimens of 47 mm. are "full-grown and ripe". The largest example described was 60 mm.

3 ARNOGLOSSUS THORI, Kyle.

- Pleuronectes grohmanni* (non Bonaparte), Canestrini, 1862, Arch. Zool. Anat. Fisiol. Genova, i, p. 12, pl. 1, fig. 3; Moreau, 1881, Hist. Nat. Poiss. France, iii, p. 326, fig. 185.
- Arnoglossus grohmanni*, Gunther, 1862, Cat. Fish., iv, p. 417; Steindachner, 1868, SitzBer. Akad. Wiss. Wien, lvii (1), p. 716; Vinciguerra, 1883, Ann. Mus. Stor. nat. Genova, xviii, p. 570; Jordan and Goss, 1889, Rep. U.S. Com. Fish. xiv, (1886), p. 261; Carus, 1889-93, Prodr. Faun. Medit., ii, p. 587; Gunther, 1890, Proc. Zool. Soc., p. 42, pl. iii, fig. A; Cunningham, 1890, Proc. Zool. Soc., p. 544, fig.; Holt and Calderwood, 1895, Sci. Trans. R. Dublin Soc., (2) v, p. 505; Danois, 1913, Ann. Inst. océanogr. Paris, v (5), p. 96, fig.
- Arnoglossus thori*, Kyle, 1913, Rep. Danish Ocean. Exped. 1908-1910, ii, A. 1, p. 55, text-fig. 8; Bowman, 1923, Fish. Scotland Sci. Invest., 1922, ii, p. 17; Buen, 1926, Cat. ictiol. Medit. Españ. Marruecos, p. 95; Chabanaud and Monod, 1927, Bull. Com. Étud. Hist. Sci. Afriq. Occ. Fr., (1926), p. 280; Bertin, 1929, in Joubin, Faune Ichth. Atlant. Nord, iii, fig.; Bertin, 1929, in Faun. Flore Medit., ix, fig.; Chabanaud, 1930, Riviera Sci., Suppl. Mem. ii, p. 18; Bertin, 1932, Bull. Soc. zool. Fr., lvii, p. 240.
- Kyleia thori*, Chabanaud, 1931, Bull. Soc. zool. Fr., lvi, p. 393; Chabanaud, 1933, Mém. Soc. Sci. Nat. Maroc, xxxv, p. 49, pl. 1, fig. 6, text-figs.

EGGS, LARVÆ AND POST-LARVÆ.

- Raffaele, 1888, Mitt. Zool. Stat. Neapel, viii, p. 50, pls. i, iii; Graeffe, 1888, Arb. Zool. Inst. Univ. Wien u. Zool. Stat. Triest, vii (3), p. 455; Holt, 1897, J. Mar. Biol. Ass., n.s., v, p. 50; Holt, 1897, Ann. Mus. Hist. nat. Marseille, Zool., v (1), p. 32, spec. iv; Holt, 1899, Ann. Mus. Hist. nat. Marseille, v (2), p. 81, pl. viii, figs. 81-84; Petersen, 1909, Medd. Komm. Havundersog. Kjøb., Ser. Fisk., iii (1), p. 8, pl. ii, figs. 32-34; Fage, 1910, Ann. Inst. océanogr. Paris, i (7), p. 35; Kyle, 1913, *tom. cit.*, p. 55, pl. 1, figs. 5-10, pl. iii, figs. 32-33.

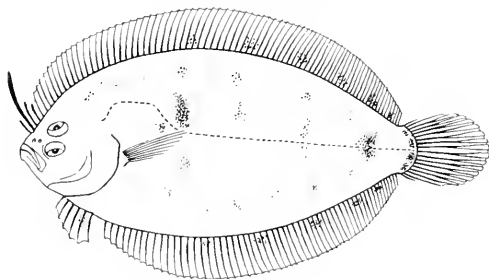


FIG. 125.—*Arnoglossus thori*. B.M. (N.H.) 1905.4.8.33. $\times \frac{1}{2}$.

Depth of body $2\frac{1}{10}$ to $2\frac{1}{2}$ in the length, length of head $3\frac{1}{2}$ to $4\frac{1}{8}$. Snout about as long as eye, diameter of which is $3\frac{1}{4}$ to $4\frac{1}{2}$ in length of head; eyes separated by a narrow concave space (a bony ridge in the young), the lower a little in advance of upper. Maxillary extending to below anterior edge or anterior $\frac{1}{3}$ of eye, length $2\frac{1}{4}$ to about 3 in that of head; lower jaw about twice in head. Teeth all small, not enlarged anteriorly. 7 to 9 rather short gill-rakers on lower part of anterior arch. Scales feebly ctenoid on ocular side, cycloid on blind side; 49 to 56 in lateral line. Dorsal 81-91 (93); second ray prolonged, varying (in adults) from $\frac{2}{3}$ to a little more than length of head; ray fringed by a broad membrane, which gives it a pinnate appearance; first, third and fourth rays sometimes a little prolonged in mature specimens. Anal (61)

62-97 (60) Pectoral of ocular side with 0 to 11 rays, length $1\frac{1}{4}$ to $1\frac{3}{4}$ in that of head. Caudal rounded. Vertebrae 10 - 27-30. Brownish or greyish, with darker spots and blotches, of which a patch just behind curve of lateral line and another on hinder end of straight part are most prominent; generally a narrow dark bar at base of caudal fin; all the fins sprinkled with small dark spots; often a dark spot distally on fourth to sixth rays of pelvic fin of ocular side; first three or four dorsal rays generally blackish in adults, but only the second ray is dark in immature specimens.

TYPE - British Museum (Nat. Hist.). Reg. No. 90.3.20.1 (lectotype).

DISTRIBUTION - Mediterranean and Atlantic coasts of Europe, northwards to the British Isles; coasts of north-west Africa.

SPECIMENS EXAMINED:

1 (150 mm.), Lectotype.	Kenmare R., Co. Kerry, 10 fms.	Green
2 (97, 138 mm.).	Inishinn, Co. Galway.	Holt.
6 (97-155 ..).	West coast of Ireland.	"
1 (140 mm.), skeleton.	"	"
8 (120-170 mm.)	Plymouth.	Mar. Biol. Assoc.
3 (120-155 ..)	"	Clark.
4 (75-100 ..)	Nice.	Bellotti.
14 (95-195 ..)	Spalato, Dalmatia.	Kolombatovic.
1 (102 mm.).	Dalmatia.	Doria.

In all the Mediterranean examples examined the second dorsal ray appears to be much less broad and pinnate than in those from more northerly localities, but this may be accounted for by the fact that the Mediterranean specimens have all been preserved in alcohol, the others mainly in formalin. Kyle has pointed out that this ray is very liable to damage, and its length is consequently very variable.

In a letter dated January, 1933, the late Professor Johannes Schmidt points out that Kyle has informed him that no type specimens were selected to represent this and other new species and subspecies described in the report on the collections made by the "Thor". I have, therefore, chosen a well-preserved specimen in the British Museum collection which will serve as a lectotype.

Chabanaud (1931, 1933) has erected a new genus (*Kyleta*) for this species, distinguished from *Arnoglossus* by having the two interorbital ridges distinct and separated instead of united. As Bertin (1932) has recently pointed out, this genus cannot be maintained.

4. ARNOGLOSSUS LATERNA (Walbaum)

[SCALD-FISH.]

Pleuronectes laterna, Walbaum, 1792, Arted. Ichth., (3), 69, 2, p. 121.

Pleuronectes arnoglossus, Schneider, 1801, in Bloch, Syst. Ichth., p. 175.

Pleuronectes diaphanus, Shaw, 1803, Gen. Zool., IV (2), p. 309.

Pleuronectes leonardi, Risso, 1810, Ichth. Nice, p. 318.

Solea arnoglossa, Kalmesque, 1810, Ind. It. Sicil., pp. 11, 52.

² *Pleuronectes castoreus*, Pennant (ex Hammer MS.), 1812, Brit. Zool., new ed., III, p. 325, pl. III.

Rhombus nudus, Cuvier, 1817, K. Anim., II, p. 222; Risso, 1820, H. N. Europe, III, p. 251.

¹ *Rhombus candidissimus*, Risso, 1820, Journ. de Physique, 81, p. 247.

Pleuronectes pellucidus, Nardo, 1824, Giorn. di Fisica etc., (2) III, p. 257; Nardo, 1827, Prodr. Adriat. Ichth., p. 15, No. 134.

Rhombus arnoglossus, Yarrell, 1841, Hist. Brit. Fish., ed. 2, II, p. 345, fig.

Hippoglossus arnoglossus, Costa, 1847, Lam. R. Napoli, Pesca, I. Pleuron., p. 32.

Pleuronectes conspersus, Caestrini, 1862, Arch. Zool. Anat. Fistol. Genova, 1, p. 19, pl. 1, fig. 2; Moreau, 1881, Hist. Nat. Poiss. France, III, p. 329.

Arnoglossus laterna, Günther, 1862, Cat. Fish., IV, p. 415; Steindachner, 1865, Sitzber. Akad. Wiss. Wien, LVII (1), p. 719; Collett, 1880, Vid.-Selsk. Forh., (1879), p. 77; Day, 1880-84, Fish. Britan., II, p. 22, pl. 801x, fig. 2; Collett, 1884, Nvt. Mag. Naturv. Christiania, XXIX, p. 101; Jordan and Goss, 1889, Rep. U.S. Com. Fish., XIV, (1889), p. 261; Carns, 1889-93, Prodr. Linn. Medit., II, p. 896; Lilljeborg, 1891, Sverig. Norg. Fiskar., II, p. 329; Collett, 1903, Vid.-Selsk. Forh., (1902), p. 93; Danos, 1913, Ann. Inst. oceanogr. Paris, V (5), p. 66, fig. 167; Jordan and Hubbs, 1917, Ann. Carnegie Mus., XI, p. 467; Bonn, 1919, Bol. Pes. Madrid, IV,

- p. 302; Bowman, 1923, Fish. Scotland Sci. Invest., 1922, ii, p. 15; Schnakenbeck, 1925, Tier. Nord Ostsee, L. 11, xii (1), p. 11, fig. 13; Buen, 1926, Cat. ictiol. Medit. Españ. Marruecos, p. 96; Bertin, 1929, in Joubin, Faune Ichtn. Atlant. Nord, iii, fig.; Bertin, 1929, in Faun. Flore Medit., ix, fig.; Chabanaud, 1931, Bull. Soc. zool. Fr., lvi, p. 391.
- Arnoglossus conspersus*, Gunther, 1862, Cat. Fish., iv, p. 416; Steindachner, 1868, SitzBer. Akad. Wiss. Wien, lvii (1), p. 716; Vinciguerra, 1883, Ann. Mus. Stor. nat. Genova, xviii, p. 568; Jordan and Goss, 1889, Rep. U.S. Com. Fish., xiv, (1886), p. 261.
- Rhombus soleiformis*, Malin, 1865, Forh. Skand. Naturf. Stockholm, (1863), p. 413.
- Arnoglossus soleiformis*, Malm, 1877, Göteborgs Bohus. Faun., p. 519; Malin, 1882, Göteborg. Mus. Årsskr., (1881), p. 24.
- Arnoglossus laterna* (part), Cunningham, 1890, Proc. Zool. Soc., p. 540; Holt and Calderwood, 1895, Sci. Trans. R. Dublin Soc., (2) v, p. 488; Chabanaud, 1930, Riviera Sci., Suppl. Mem. ii, p. 19.
- Platophrys* (*Arnoglossus*) *laterna*, Smitt, 1893, Scand. Fish., i, p. 428, pl. xix, fig. 4.
- Arnoglossus laterna microstoma*, Kyle, 1913, Rep. Danish Ocean. Exped. 1908-1910, ii, A. 1, p. 64, figs.
- Arnoglossus laterna microstoma* form. *communis*, *biscayensis*, Kyle, 1913, *loc. cit.*, p. 69.
- Arnoglossus laterna conspersus*, Buen, 1919, Bol. Pesc. Madrid, iv, p. 302.
- Arnoglossus* (*Arnoglossus*) *laterna*, Chabanaud, 1933, Mém. Soc. Sci. Nat. Maroc. xxxv, p. 31, pl. 1, figs. 4, 5, text-figs.

EGGS, LARVÆ AND YOUNG.

- Petersen, 1894, Rep. Danish Biol. Stat., iv, (1893), p. 44; Cunningham, 1896, N. H. Market. Mar. Fish., p. 274, fig. 128; Ehrenbaum, 1897, Wiss. Meeresuntersuch., Abt. Helgoland, N.F., ii (1), p. 298, pl. v, figs. 25-29; McIntosh and Masterman, 1897, Brit. Mar. Food-fish., p. 355; Holt, 1897, J. Mar. Biol. Ass., N.S., v, pp. 48, 135; Holt, 1897, Ann. Mus. Hist. nat. Marseille, v (1), p. 32, sp. iv; Holt, 1899, Ann. Mus. Hist. nat. Marseille, v (2), p. 78, pl. viii, figs. 77-80; Ehrenbaum, 1905, in Brandt and Apstein, Nordisches Plankton, I. Eier Larv. Fisch. (1), p. 189, figs.; Petersen, 1909, Medd. Komm. Havundersøg. Kjøb., Ser. Fisk., ii (1), p. 8, figs.; Kyle, 1913, *loc. cit.*, p. 94, pl. ii, figs. 13-21; Clark, 1920, J. Mar. Biol. Ass., N.S., xii, p. 189.

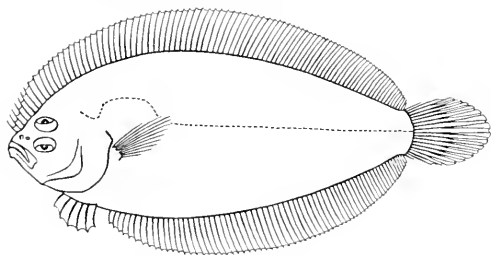


FIG. 126.—*Arnoglossus laterna*. B.M. (N.H.) 98.2.20.30. 3.

Depth of body $2\frac{1}{2}$ to $2\frac{2}{3}$ in the length, length of head $3\frac{1}{2}$ to 4. Snout as long as or longer than eye, diameter of which is $4\frac{1}{2}$ to $5\frac{1}{2}$ in length of head. Eyes separated by a very narrow space or bony ridge, the lower a little in advance of upper. Maxillary extending to below anterior part of eye, but scarcely reaching its centre, length $2\frac{1}{2}$ to $2\frac{3}{4}$ in that of head; lower jaw $1\frac{1}{2}$ to 2 in head. Teeth all small, not enlarged anteriorly. 8 or 9 gill-rakers of moderate length on lower part of anterior arch. Scales feebly ctenoid on ocular side, cycloid on blind side; 51 to 56 in lateral line. Dorsal (82) 87-93 (98); first 5 or 6 rays more or less free from membrane distally, not or only very slightly longer than those which follow. Anal (63) 65-74. Pectoral of ocular

side with 11 or 12 rays, length $1\frac{1}{4}$ to $1\frac{3}{4}$ in that of head. Caudal rounded. Vertebrae 10 + 27-32. Brownish or greyish, sometimes with irregular darker markings; fins often with small dark dots; pelvic fin of ocular side occasionally with a black spot.

TYPE.—Not traced.

DISTRIBUTION.—South-western Europe, from the Cattegat and Christiansfiord to the Sea of Marmora.

SPECIMENS EXAMINED:

1 (188 mm.),	Christiansfiord.	Collett.
1 (120 ..),	Kilbrennan Sound, 20 fms.	Murray.
1 (175 ..), skin.	Brixham.	—
1 (102 ..),	Dunmanus Bay.	Newburgh.
1 (104 ..),	Bigbury Bay, 6 fms.	Mar. Biol. Assoc.
20 (48-172 mm.),	Off Plymouth.	..
10 (82-134 .. ),	..	..
20 (100-150 ..),	Plymouth.	Clark.
1 (125 mm.), skin.	..	Yarrell Coll.
2 (100, 125 mm.),	6 miles S. of the Mewstone, Devon.	Mar. Biol. Assoc.
2 (128, 131 ..),	Falmouth Bay.	..
2 (130, 138 ..),	St. Anthony Bight, Cornwall.	..
6 (85-110 mm.),	Cawsand Bay, Cornwall.	..
4 (27-31 ..),	South Cornwall.	Byrne.
5 (100-175 mm.), skins.	Great Britain.	—
2 (92, 113 ..),	Off Malaga, 40 fms.	Wolfenden.
1 (108 mm.),	Cannes.	Argyll.
1 (65 ..),	..	Gunther.
1 (62 ..),	Palermo.	Day.
2 (67, 80 mm.),	Near Port Said.	Wimpenny.
1 (110 mm.), skin.	Mediterranean.	Yarrell Coll.
1 (115 .. ), ..	..	Zool. Soc. Coll.
1 (130 ..),	..	—

This is a very variable species, and it is probable that the examination of a large series of examples would lead to the recognition of two or more distinct races or subspecies¹. Apart from a slight difference in pigmentation, there are no apparent sexual differences. The species has long been confused in the Mediterranean with *A. macrostoma*, and some of the references in the above synonymy may refer to the latter form.

5 ARNOGLOSSUS MACROSTOMA, Kyle.

Pleuronectes arnoglossus (? non Schneider), Bonaparte, 1837, Icon. Faune Ital., (19), fig. ; Canestrini, 1862, Arch. Zool. Anat. Fisiol. Genova, 1, p. 14, pl. 1, fig. 4; Morean, 1881, Hist. Nat. Poiss. France, iii, p. 328.

Platophrys (*Arnoglossus*) *laterna* form *macrocephala* Smitt, 1893, Scand. Fish., 1, p. 428. *Arnoglossus laterna macrostoma*, Kyle, 1913, Rep. Danish Ocean. Exped. 1908-1910, II, A, 1, p. 64, fig. 2a.

Close to *A. laterna*. Depth of body $2\frac{2}{5}$ to $2\frac{3}{5}$ in the length, length of head $3\frac{1}{10}$ to $3\frac{3}{5}$. Snout rather longer than eye, diameter of which is ($3\frac{1}{2}$ to) about 5 in length of head; eyes separated by a bony ridge, the lower a little in advance of the upper. Maxillary extending to a little beyond middle of eye, length $2\frac{1}{10}$ to $2\frac{1}{2}$ in that of head, lower jaw about $1\frac{1}{4}$ in head. Teeth somewhat larger than in *A. laterna*, but not much enlarged anteriorly. 7 or 8 gill-rakers on lower part of anterior arch. Scales feebly ctenoid; about 50 in lateral line. Dorsal (86) 80-91. Anal 65-68 (60). Pectoral of ocular side with 13 rays, length about 2 in that of head. Caudal rounded. Vertebrae 10 + 29. More or less uniformly pale brownish; fins with traces of darker dots.

¹ See Jordan and Hilbis, 1917, Ann. Carnegie Mus., xi, p. 467. The material described by these authors may have included examples of *A. macrostoma*.

TYPE.—British Museum (Nat. Hist.). Reg. No. 93.2.28.29 (lectotype).

DISTRIBUTION.—Mediterranean

SPECIMENS EXAMINED :

2 (100, 122 mm.).

Nice.

Deakin.

2 (147, 152 ,,)¹

Zara, Dalmatia.

Spada-Novak.

Also 2 from the Mediterranean (Leiden Mus.).

Comparison of specimens of similar size leaves little doubt that the form described above is distinct from the typical *A. laterna* of the Mediterranean, and, although I have examined comparatively few examples of this large-mouthed form, I am inclined to

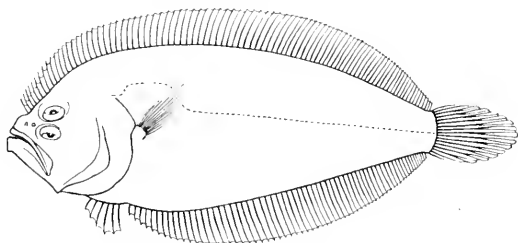


FIG. 127.—*Arnoglossus macrostoma*. B.M. (N.H.) 93.2.28.29. ∞ 3.

recognise it as a distinct species. To ascertain its correct name is more difficult, but the subspecific name *macrostoma* proposed by Kyle seems to be the first which is applicable with certainty. The *Pleuronectes arnoglossus* of Bonaparte and Canestrini was almost certainly this species, but Schneider's earlier description of an *Arnoglossus* with the same specific name is too brief to allow of a positive identification. Should this prove to have been the large-mouthed form, this species will then bear the name *Arnoglossus arnoglossus* (Schneider).

6. ARNOGLOSSUS IMPERIALIS (Rafinesque).

[SCALD-FISH.]

Bothus imperialis, Rafinesque, 1810, Car. n. gen., p. 23.

? *Pleuronectes casurus*, Pennant (ex Hammer MS.), 1812, Brit. Zool., new ed., iii, p. 325, pl. liii.

Arnoglossus lophotes, Günther, 1862, Cat. Fish., iv, p. 417; Facciola, 1886, Atti Soc. Nat. Modena, (3) iii, p. 91; Günther, 1890, Proc. Zool. Soc., p. 40; Collett, 1896, Rés. Camp. Sci. Monaco, x, p. 95, pl. iii, fig. 13.

Arnoglossus grohmanni (part), Day, 1882, Proc. Zool. Soc., p. 748, pl. liii.

Charybda rhomboidichthys, Facciola, 1885, Nat. Sicil., iv, p. 265.

Arnoglossus laterna (part), Cunningham, 1890, Proc. Zool. Soc., p. 540; Holt and Calderwood, 1895, Sci. Trans. R. Dublin Soc., (2) v, p. 488.

Arnoglossus imperialis, Kyle, 1913, Rep. Danish. Ocean. Exped. 1908-1910, II, A. 1, p. 79, figs.; Bertin, 1929, in Joubin, Faune Ichth. Atlant. Nord, iii, fig.; Bertin, 1929, in Faun. Flore Médit., ix, fig.; Chabanaud, 1930, Riviera Sci., Suppl. Mem. II, p. 19; Norman, 1930, "Discovery" Reports, II, p. 360; Chabanaud, 1931, Bull. Soc. zool. Fr., lvi, p. 392; Bertin, 1932, Bull. Soc. zool. Fr., lvii, p. 242.

¹ The larger of these is selected as the lectotype (see note on p. 178).

Arnoglossus (*Arnoglossus*) *imperialis*, Chabanud, 1933, Mem. Soc. Hist. Nat. Maroc, XXXV, p. 11, figs. 26-28.

EGGS, LARVAE AND YOUNG.

Facciola, 1888, *tom. cit.*, p. 205; Petersen, 1909, Medd. Komm. Havundersøgg. Kjøb., Ser. Fisk., III (1), p. 8, figs.; Kyle, 1913, *tom. cit.*, p. 79, pls. II, III, figs. 21-26; Bowman, 1923, Fish. Scotland Sci. Invest., 1922, II, p. 4, fig.

Depth of body $2\frac{1}{2}$ to $2\frac{3}{4}$ in the length, length of head $3\frac{1}{2}$ to $4\frac{1}{4}$. Snout shorter than eye, diameter of which is $2\frac{1}{2}$ to 4 in length of head; eyes separated by a bony ridge, the lower a little in advance of the upper. Maxillary extending to below anterior part of eye, length $2\frac{1}{2}$ to $3\frac{1}{2}$ in that of head, lower jaw $2\frac{1}{6}$ to $2\frac{1}{2}$ in head. Teeth all small, not enlarged anteriorly. 8 to 10 gill-rakers on lower part of anterior arch. Scales feebly (tenoid on ocular side, cycloid on blind side); 58 to 63 in lateral line. Dorsal (94) 95-106; second to fifth or sixth rays thickened, prolonged, and free for most of their length in the mature male, the highest ray nearly as long as head; in the mature female the second to fifth rays are somewhat thickened, a little longer than

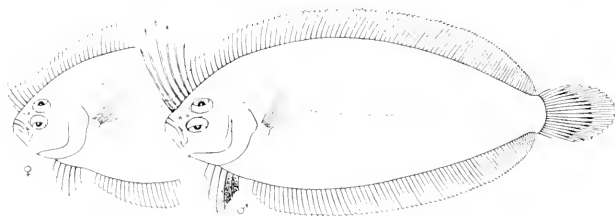


FIG. 128. *Arnoglossus imperialis*. B.M. (N.H.) ♂ 1913.11.19.14; ♀ 90.9.23.8.

those which follow. Anal 74-82. Pectoral of ocular side with 9 to 11 rays, length $1\frac{1}{4}$ to $1\frac{1}{2}$ in that of head. Rays of pelvic fin of ocular side rather longer in the male. Caudal rounded. Vertebrae 10-32-35. Greyish or brownish, generally with irregular darker patches; fins with some small dark spots; male with a conspicuous black blotch on hinder end of pelvic fin of ocular side; in the female this is greyish in colour and very indistinct.

TYPE.—Not traced.

DISTRIBUTION.—Atlantic coasts of Europe and Africa, from northern Scotland to Angola; western part of the Mediterranean.

SPECIMENS EXAMINED:

1 (215-245 mm.), skins	Types	British coast (?)	Vatrell Coll.
<i>of A. lophote.</i>			
1 (170 mm.),		Off Cardiff.	Moseley
1 (183-200 mm.),		Dummanus Bay	Newburgh
8 (145-175 ..),		Lalmoth Bay,	Mar. Biol. Assoc.
1 (170 mm.), skeleton,		"	"
2 (125-160 mm.)		Plymouth Sound,	"
1 (180-200 ..),		Plymouth,	Clark.
7 (150-200 ..),		"	"
1 (160-190 ..),		"	Cunningham.
1 (117 mm.),		Atlantic (off Morocco), 60 fms.	Paris Mus.
1 (125 ..),		Madeira.	Johnson.

1 (80 mm.).	Off Elephant Bay, Angola, 40-53 fms.	"Discovery."
1 (75 ,,).	Off St. Paul de Loanda, Angola, 35-36 fms.	,,
1 (90 ,,).	C. Lopez, French Congo, 32-37 fms.	,,
1 (136 ,,).	Palermo.	Doderlein.

7. ARNOGLOSSUS CAPE'NSIS, Boulenger.

[CAPE SCALD-FISH.]

Arnoglossus capensis, Boulenger, 1898, Mar. Invest. S. Afr., i, p. 1; Lampe, 1913, Denkschr. med.-naturw. Ges. Jena, xvii, p. 156; Barnard, 1925, Ann. S. Afr. Mus., xxi, p. 391.

EGGS AND LARVÆ.

Gilchrist, 1904, Mar. Invest. S. Afr., iii, p. 133, pl. v, fig. 36; Gilchrist, 1916, Mar. Biol. Rep. S. Afr., iii, p. 16, fig. 12.

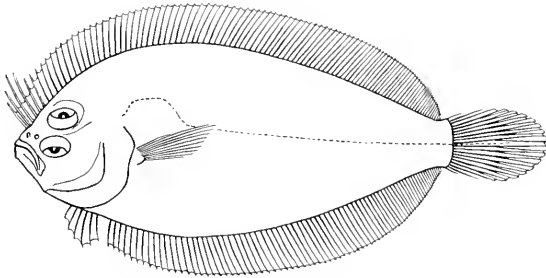


FIG. 129.—*Arnoglossus capensis*. B.M. (N.H.) 1912.12.20.27. $\times \frac{3}{4}$.

Depth of body $2\frac{1}{4}$ to $2\frac{2}{3}$ in the length, length of head $3\frac{2}{3}$ to $4\frac{1}{2}$. Snout shorter than eye, diameter of which is $3\frac{1}{3}$ to 4 in length of head; eyes separated by a concave scaled space, its width $2\frac{1}{2}$ to $3\frac{1}{2}$ in diameter of eye; lower eye a little in advance of upper. Maxillary extending to below anterior edge or anterior part of eye, length 3 to $3\frac{1}{4}$ in that of head; lower jaw $1\frac{1}{8}$ to $2\frac{1}{2}$ in head. Teeth all small, scarcely enlarged anteriorly. 10 to 13 gill-rakers of moderate length on lower part of anterior arch. Scales feebly ctenoid on ocular side, mostly cycloid on blind side; 62-66 in lateral line. Dorsal 96-100; anterior rays more or less free from membrane and somewhat prolonged in both sexes, highest ray $1\frac{2}{3}$ (σ) or more than twice (\varnothing) in head. Anal 76-80. Pectoral of ocular side with 11 or 12 rays, length $\frac{2}{3}$ to $\frac{3}{4}$ that of head. Caudal rounded. Brownish, with traces of darker markings; a series of indistinct dark spots on dorsal and anal fins.

TYPE.—British Museum (Nat. Hist.). Reg. No 97.10.18.3.

DISTRIBUTION.—South Africa.

SPECIMENS EXAMINED:

1 (160 mm.).	Holotype.	False Bay.	Gilchrist.
2 (168, 170 mm.).		Saldanha Bay.	Clark.
1 (125 mm.).		Natal.	Gilchrist.

8. ARNOGLOSSUS RUEPPELLII (Cocco).

- Peloria rueppellii*, Cocco, 1843, in Krohn, Giorn. Gabin. Messina, Ann. III, V (XXV), p. 21.¹
Bascanus luditjer, Schiodte, 1868, Naturhist. Fjeldskrift, (3) V, p. 275, pl. XI, fig. 7.
Charybdia rueppellii, Facciola, 1885, Nat. Sicil., IV, p. 295; Jordan and Goss, 1889, Rep. U. S. Com. Fish., XIV, (1889), p. 329; Collett, 1899, Res. Camp. Sci. Monaco, X, p. 99.
Arnoglossus rueppellii, Kyle, 1913, Rep. Danish Ocean. Exped. 1908-1910, II, A, 1, p. 87, fig.; Fage, 1918, Bull. Soc. zool. Fr., XLIII, p. 99, figs. 1-3; Chabanaud, 1930, Riviera Sci., Suppl. Mem. II, p. 29; Bertin, 1933, Bull. Soc. zool. Fr., LVII, p. 495, figs.
Dallfusina rueppellii, Chabanaud, 1932, in Joulan, Faune Ichth. Atlant. Nord, x, fig.
Arnoglossus (Dallfusina) rueppellii, Chabanaud, 1933, Mem. Soc. Sci. Nat. Maroc, XXX, pp. 44, 104, figs. 29-32.

LARVA AND POST-LARVA.

Kyle, 1913, *loc. cit.*, p. 87, pl. 1, fig. 12, pl. III, figs. 27-31, 34.

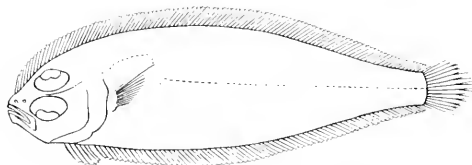


FIG. 130.—*Arnoglossus rueppellii*. ♂ After Chabanaud.

Depth of body 3 to $3\frac{1}{2}$ in the length, length of head $4\frac{1}{2}$ to 5. Snout a little shorter than eye, diameter of which is about 3 in length of head; eyes separated by a narrow bony ridge, the lower a little in advance of upper. Maxillary (in adult) extending to below anterior part of eye, length about $2\frac{1}{2}$ in that of head. Teeth rather small, a little enlarged anteriorly. 11 gill-rakers on lower part of anterior arch. Scales ctenoid (?) on ocular side, cycloid on blind side; about 75 in lateral line. Dorsal 110-116 (118), none of the rays prolonged. Anal 86-94. Pectoral of ocular side with 13 rays, length about $\frac{1}{2}$ that of head. Vertebrae 10-33-35. Brownish, with or without traces of darker markings; young with a series of incomplete dark bars across dorsal and anal fins; caudal with a dark vertical band; pectoral with dusky cross-bars.

TYPE.—Not traced.

DISTRIBUTION.—Mediterranean and adjacent parts of the Atlantic.

SPECIMENS EXAMINED.

1 (21 mm.), Post-larva.	Strait of Messina.	Bovallius.
1 (41 "), " "	" "	" "

Almost all the records of this species refer to larval or post-larval specimens. Only two adult examples have been described, one (♂) from the Atlantic coast of Morocco (Chabanaud) the other (♂) from Banyuls (Bertin). Post-larvae were taken by the "Thor" from various localities in the Mediterranean, from the coast of Spain to the Gulf of Corinth.

¹ *Leide* Facciola, 1885.

9. ARNOGLOSSUS TAPEINOSOMA (Bleeker).

- Platphrys* (*Arnoglossus*) *tapeinosoma*, Bleeker, 1866, Ned. Tijdschr. Dierk., iii, p. 49; Bleeker, 1866-72, Atl. Ichth., vi, p. 13, Pleuron. pl. iv, fig. 4.
Arnoglossus macrolophus, Alcock, 1889, J. Asiat. Soc. Beng., lviii (2), p. 280, pl. xviii, fig. 2; Alcock, 1890, Ann. Mag. Nat. Hist., (6) vi, p. 433; Alcock, 1898, Illust. Zool. "Investigator", Fishes, pl. xxiii, fig. 3; Johnstone, 1904, Ceylon Pearl Oyster Fish., Suppl. Rep., xv, p. 211; Weber, 1913, "Siboga" Exped., Fische, p. 432; Norman, 1927, Rec. Ind. Mus., xxix, p. 21, fig. 3; Fowler, 1928, Mem. B. P. Bishop Mus., x, p. 90.
Bothus (*Arnoglossus*) *tapeinosoma*, Weber and Beaufort, 1929, Fish. Indo-Austral. Arch., v, p. 127.

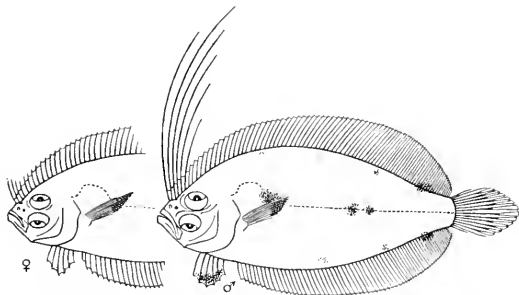


FIG. 131.—*Arnoglossus tapeinosoma*. B.M. (N.H.) 90.11.28.43.44. ♀ 1.

Depth of body $2\frac{1}{2}$ to 3 in the length, length of head 3 to nearly 4. Snout shorter than eye, diameter of which is 3 to $3\frac{1}{4}$ in length of head; eyes separated by a narrow bony ridge, their anterior margins level or lower a little in advance of upper. Maxillary extending to below anterior edge or anterior $\frac{1}{3}$ of eye, length $2\frac{3}{4}$ to $2\frac{1}{2}$ in that of head, lower jaw nearly twice in head. Teeth all small and close-set, not enlarged anteriorly. 8 to 12 slender gill-rakers on lower part of anterior arch. Scales feebly ctenoid on ocular side, cycloid on blind side; 48 to 55 in lateral line. Dorsal (83) 89-98; anterior rays greatly prolonged in the mature male, a little longer than those which follow in the female. Anal (65) 67-72. Pectoral of ocular side with 11 or 12 rays, length about $\frac{2}{3}$ that of head. Caudal pointed or double truncate. Brownish; a series of indistinct darker blotches along upper and lower edges of body; a dark blotch at junction of straight and curved parts of lateral line, and generally one or two smaller blotches on straight portion; median fins with numerous small brown spots; a large dark spot at base of posterior parts of dorsal and anal; a dark spot on distal part of pectoral; distal ends of pelvics blackish.

TYPE.—Leiden Museum.

DISTRIBUTION.—From the Persian Gulf to the Malay Peninsula and Archipelago and beyond.

SPECIMENS EXAMINED:

2 (82, 85 mm),	North end of Persian Gulf,	Ind. Mus.
1 (80 mm),	Ganjam Coast, 25-35 fms.	"
1 (57 " "),	" " "	"
2 (65, 58 mm),	" " "	"
2 (65, 72 " "),	Andaman Is., 53 fms.	"
1 (72-90 " "),	Bah Sea (8° 20' S., 114° 40' E.), 55 fms.	Hardenberg.

Also several from the Persian Gulf, India and Burma (Ind Mus.); one from off Galle, Ceylon (Liverpool Univ.); and one from the Java Sea (Amsterdam Mus.).

10. ARNOGLOSSUS FISONI, Ogilby.

Arnoglossus fisoni, Ogilby, 1898, Proc. Linn. Soc. N.S.W., xxiii, p. 295; Norman, 1926, Biol. Res. "Endeavour", v, p. 243, fig. 5; McCulloch, 1929, Mem. Aust. Mus., v, p. 277; Duncker, and Mohr, 1929, Mitt. Zool. Mus. Hamburg, xlv, p. 80.

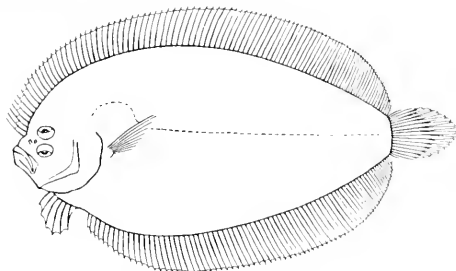


FIG. 132.—*Arnoglossus fisoni*. B.M. (N.H.) 1925.7.22.17. 3.

Depth of body $1\frac{1}{2}$ to $2\frac{1}{10}$ in the length, length of head $\frac{1}{4}$ to $\frac{1}{4}\frac{1}{2}$. Snout a little longer than eye, diameter of which is $\frac{2}{3}$ to 5 in length of head; eyes separated by a narrow bony ridge, the lower very little in advance of upper, which is well separated from edge of head. Maxillary extending to below anterior edge of eye, length $2\frac{3}{4}$ to 3 in that of head, lower jaw nearly twice in head. Teeth all small, scarcely enlarged anteriorly. 9 or 10 slender gill-rakers on lower part of anterior arch. Scales cycloid on both sides, 52 to 50 in lateral line. Dorsal 96-101; all the rays unscaled, none prolonged. Anal (74) 77-80. Pectoral of ocular side with 8 or 9 rays, the two upper rays a little prolonged in the male; length $1\frac{1}{2}$ to $1\frac{1}{2}$ in that of head. Caudal obtusely pointed. Brownish, with or without irregular dusky markings; a narrow yellowish band at upper and lower edges of body, parallel with the profile; fins with small brown spots.

TYPE.—Not traced (? Queensland Mus.).

DISTRIBUTION.—Coast of southern Queensland, Bismarck Archipelago.

SPECIMENS EXAMINED:

1 (120 mm),	7 to 10 miles N.W. of Hummocky Is., Queens-	Austr. Mus. ("Endeavour").
	land, 14-16 fms.	
1 (115 " "),	About 20 miles N.E. of Bustard Head Light,	"
	Queensland, 20-24 fms.	

Also 2 from Queensland (Austr. Mus. "Endeavour").

11. ARNOGLOSSUS ASILOS (Bleeker).

Rhombus aspihos, Bleeker, 1851, Nat. Tijdschr. Ned. Ind., i, p. 408; Bleeker, 1852, Verh. Batav. Gen., xxiv, Pleuron., p. 14.

Arnoglossus aspihos, Günther, 1862, Cat. Fish., iv, p. 417.

Platophrys (Arnoglossus) aspihos, Bleeker, 1866-72, Atl. Ichth., vi, p. 15, Pleuron. pl. vi, fig. 2.

Arnoglossus aspihos, Fowler, 1928, Mem. B. P. Bishop Mus., x, p. 89.

Bothus (Arnoglossus) aspihos, Weber and Beaufort, 1929, Fish. Indo-Austral. Arch., v, p. 132.

Depth of body $2\frac{1}{2}$ in the length, length of head 4. Diameter of eye $3\frac{1}{2}$ to nearly 4 in length of head; eyes separated by a narrow interspace, the lower a little in advance of upper. Maxillary extending to below anterior part of eye, length $2\frac{2}{3}$ in that of head; lower jaw about twice in head. Teeth minute, rather close-set, not enlarged anteriorly. 7 rather slender gill-rakers on lower part of anterior arch. Scales ctenoid

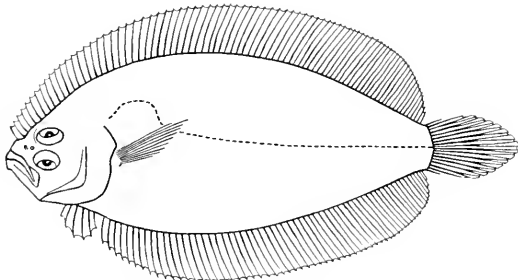


FIG. 133.—*Arnoglossus aspihos*. B.M. (N.H.) 1931.4.23.16. 1 $\frac{1}{2}$.

on ocular side, cycloid on blind side; 46 to 48 in lateral line. Dorsal 80 (84); all the rays scaled, at least on ocular side, none prolonged. Anal 61-62 (64). Pectoral of ocular side with 11 or 12 rays, length about $\frac{2}{3}$ that of head. Uniformly brownish.

TYPE.—Leiden Museum.

DISTRIBUTION.—Malay Peninsula and Archipelago.

SPECIMENS EXAMINED:

1 (75 mm.).	Paratype.	East Indies.	Bleeker Coll.
1 (72 ,,).		Cheribon, Java.	Hardenberg.
? 3 (68-72 mm.).		Off Sumatra (1° 22' S., 104° 43' E.).	„

12. ARNOGLOSSUS TENUIS, Günther.

Arnoglossus tenuis, Günther, 1860, Shore Fishes "Challenger", p. 55; Jordan and Seale, 1905, Proc. U.S. Nat. Mus., xxix, p. 528; Jordan and Hubbs, 1925, Mem. Carnegie Mus., x, p. 295; Wu, 1932, Thés. Facult. Sci. Univ. Paris, A. 244 (268), p. 89.

Depth of body $2\frac{1}{2}$ to $2\frac{2}{3}$ in the length, length of head 4 to $4\frac{1}{2}$. Snout about as long as eye, diameter of which is about $\frac{1}{4}$ in length of head; eyes separated by a bony ridge, the lower generally in advance of upper. Maxillary extending to below anterior

edge of eye, length nearly 3 in that of head; lower jaw twice in head. Teeth all small, rather close-set, not enlarged anteriorly. 8 or 9 rather slender gill-rakers on lower part of anterior arch. Scales feebly ctenoid on ocular side, cycloid on blind side, 51 to 54 in lateral line. Dorsal 93-98; all the rays more or less scaled, at least on ocular side, none prolonged. Anal 70-74. Pectoral of ocular side with 11 or 12 rays, length about $1\frac{1}{2}$ in that of head. Caudal pointed. Uniformly pale brownish, or with traces of small dark spots near bases of dorsal and anal fins.

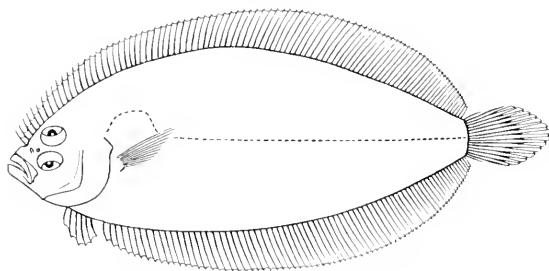


FIG. 134.—*Arnoglossus tenuis*. B.M. (N.H.) 70.5.14.95. 1.

TYPE: British Museum (Nat. Hist.). Reg. No. 70.5.14.95.

DISTRIBUTION: Coast of southern China, Japan.

SPECIMENS EXAMINED:

2 (62, 110 mm.).	Types. ¹	Hong Kong.	"Challenger."
1 (72 mm.).		"	Walker.
14 (35-93 mm.).		Santuaio	Light.

Also 4 from Hong Kong (Mus. Comp. Zool.)

13. ARNOGLOSSUS WAITEI, Norman

Arnoglossus aspilus (non Bleeker), Günther, 1880, Shore Fishes "Challenger", p. 47.

Arnoglossus waitei, Norman, 1920, Biol. Res. "Endeavour", v, p. 241, fig. 14; McCulloch, 1929, Mem. Aust. Mus., v, p. 277.

Close to *A. tenuis*. Depth of body $2\frac{1}{6}$ to $2\frac{1}{3}$ in the length, length of head $4\frac{1}{6}$ to $4\frac{1}{2}$. Diameter of eye $3\frac{1}{3}$ to $3\frac{3}{4}$ in length of head. Maxillary extending to below anterior edge of eye, length 3 to $3\frac{1}{2}$ in that of head, lower jaw $2\frac{1}{2}$ to $2\frac{1}{3}$ in head. 7 to 9 gill-rakers on lower part of anterior arch. Scales cycloid or feebly ctenoid on ocular side, all cycloid on blind side, 49 to 54 in lateral line. Dorsal 94-103. Anal 70-82. Pale brownish, with traces of darker markings on body; dorsal and anal fins with some blackish spots and blotches; a pair of dark blotches near base of caudal fin.

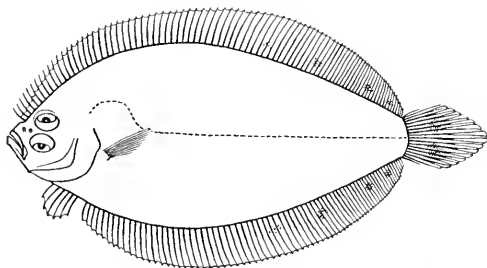
TYPE: Australian Museum. No. E. 2959.

DISTRIBUTION: Arafura Sea, east coast of Queensland.

¹ The larger specimen is selected as the holotype.

SPECIMENS EXAMINED :

1 (78 mm.).	Arafura Sea, 49 fms.	"Challenger."
2 (87, 100 mm.).	" " 30 fms.	" "
1 (92 mm.). Paratype.	11 to 14 miles N.W. of Pine Peak, Queensland,	Austr. Mus.
	24-26 fms.	("Endeavour").
1 (130 mm.). Paratype.	3 to 7 miles N.W. of Hervey Bay, Queensland,	" "
	9-11 fms.	

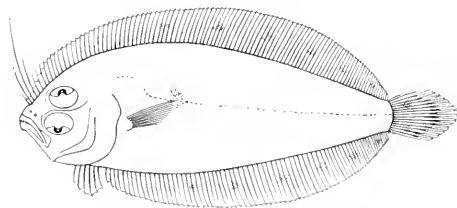
FIG. 135.—*Arnoglossus watei*. B.M. (N.H.) 1925.7.22.40. 1.

Also the holotype and one other paratype from Queensland (Austr. Mus. "Endeavour").

14. ARNOGLOSSUS ELONGATUS, Weber.

Arnoglossus elongatus, Weber, 1913, "Siboga"-Exped., Fische, p. 431, fig. 79.

Bothus (Arnoglossus) elongatus, Weber and Beaufort, 1929, Fish. Indo-Austral. Arch., v, p. 125, fig. 29.

FIG. 136.—*Arnoglossus elongatus*. B.M. (N.H.) 1930.10.16.1. 1.

Depth of body 3 or nearly 3 in the length, length of head $3\frac{1}{2}$ to $3\frac{2}{3}$. Snout shorter than eye, diameter of which is about $\frac{1}{3}$ in length of head; eyes separated by a bony ridge, the lower a little in advance of upper. Maxillary extending to below anterior

$\frac{1}{2}$ of eye, length $2\frac{1}{2}$ to $2\frac{1}{2}$ in that of head; lower jaw $1\frac{3}{4}$ to 2 in head. Teeth minute, those of upper jaw somewhat larger and wider apart anteriorly. 8 or 9 slender gill-rakers on lower part of anterior arch. Scales feebly ctenoid on ocular side, cycloid on blind side; 64 to 66 in lateral line. Dorsal 100-102, all the rays scaled, at least on ocular side, second to fourth rays somewhat prolonged (male?). Anal 78-79. Pectoral of ocular side with 12 or 13 rays, length $1\frac{1}{2}$ to $1\frac{3}{4}$ in that of head. Caudal rounded. Yellowish brown, with some indistinct darker markings, including a blotch just behind curve of lateral line; a series of dark spots on dorsal and anal fins.

TYPE.—Amsterdam Museum.

DISTRIBUTION.—Madura Sea, Indo-Australian Archipelago, in deep water.

SPECIMENS EXAMINED:

1 (59 mm).—Paratype. Madura Sea, 55 fms. Amsterdam Mus. ("Siloga").

Also 3 other paratypes from the same locality (Amsterdam Mus. "Siloga").

15. ARNOGLOSSUS POLYSPILUS (Gunther).

Anticitharus polyspilus, Gunther, 1880, Shore Fishes "Challenger", p. 48, pl. xxii, fig. v.

Arnoglossus polyspilus, Norman, 1927, Rep. Ind. Mus., xxix, p. 20.

Bothus (Anticitharus) polyspilus, Weber and Deaufort, 1929, Fish. Indo-Austral. Arch., v, p. 124.

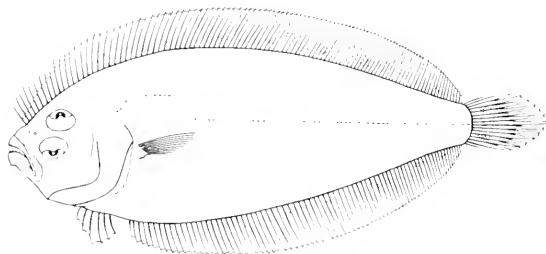


FIG. 137.—*Arnoglossus polyspilus*. B.M. (N.H.) 79.5.14.59. 1/2

Depth of body $2\frac{2}{3}$ to $2\frac{3}{4}$ in the length, length of head $3\frac{1}{2}$ to $3\frac{1}{2}$. Upper profile of head only moderately convex above and behind eyes. Snout as long as or shorter than eye, diameter of which is $3\frac{1}{2}$ to a little more than 4 in length of head, eyes separated by a low, narrow ridge, the lower a little in advance of upper. Maxillary extending to below anterior $\frac{1}{3}$ (adult) or anterior $\frac{1}{2}$ (young) of eye, length $2\frac{1}{4}$ to $2\frac{3}{8}$ in that of head, lower jaw about twice in head. Teeth of upper jaw small and rather close-set laterally, some enlarged canines anteriorly; lateral teeth of lower jaw much stronger and wider apart than those of upper, anterior teeth somewhat enlarged. 8 or 9 slender, pointed gill-rakers on lower part of anterior arch. Scales feebly ctenoid on ocular side, cycloid on blind side; 70-75 in lateral line. Width of curve of lateral line $1\frac{1}{4}$ to $2\frac{1}{4}$ in length of head. Dorsal 103-106, none of the rays prolonged. Anal 81-84. Pectoral of ocular side with 11 or 12 rays, length a little more than $\frac{1}{2}$ that of head. Caudal pointed. Pale brownish, with traces of darker markings; a series of rather large brown spots on dorsal and anal fins, and a pair of smaller spots at base of caudal.

TYPE.—British Museum (Nat. Hist.). Reg. No. 79.5.14.56.

DISTRIBUTION.—Mergui Archipelago; Kei Islands; Timor Sea: in deep water

SPECIMENS EXAMINED:

2 (180, 220 mm.). Types.¹

Kei Is., 129 fms.

"Challenger".

16. ARNOGLOSSUS MUELLERI (Klunzinger).

Pseudorhombus muelleri, Klunzinger, 1872, Arch. Naturgesch., p. 40; Klunzinger, 1880, SitzBer.

Akad. Wiss. Wien, lxxx (1), p. 407, pl. ix, fig. 2; Waite, 1905, Rec. Aust. Mus., vi, p. 73.

Arnoglossus muelleri, Norman, 1926, Biol. Res. "Endeavour", v, p. 245; McCulloch, 1929, Mem. Aust. Mus., v, p. 277.

Depth of body $2\frac{1}{2}$ to $2\frac{1}{2}$ in the length, length of head 4 to $4\frac{1}{2}$. Upper profile of head only moderately convex above and behind eyes. Snout as long as or a little longer than eye, diameter of which is 4 to 5 in length of head; eyes separated by a

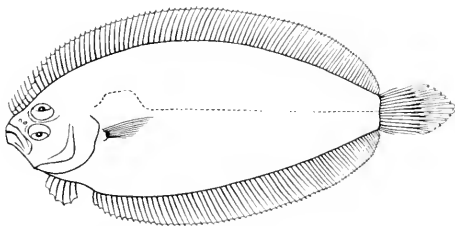


FIG. 138.—*Arnoglossus muelleri*. B.M. (N.H.) 1925.7.22.41. $\frac{2}{3}$.

narrow, bony ridge, the lower very little in advance of upper. Maxillary extending to below anterior edge or anterior $\frac{1}{4}$ of eye, length $2\frac{2}{3}$ to 3 in that of head; lower jaw about twice in head. Teeth of upper jaw rather small and close set laterally, becoming larger anteriorly; lateral teeth of lower jaw stronger and wider apart than those of upper. 8 to 10 rather short, pointed gill-rakers on lower part of anterior arch. Scales feebly ctenoid on ocular side, cycloid on blind side; 68 to 73 in lateral line. Width of curve of lateral line $1\frac{2}{3}$ to twice in length of head. Dorsal 90-97; none of the rays prolonged. Anal 72-75. Pectoral of ocular side with 10 rays, length $1\frac{1}{2}$ to $1\frac{3}{4}$ in that of head. Caudal obtusely pointed. Uniformly brownish; fins with small brown spots.

TYPE.—Württembergische Naturaliensammlung, Stuttgart

DISTRIBUTION.—Southern Australia

SPECIMENS EXAMINED:

1 (135 mm.). 42 miles S. of St. Francis Is., S. Australia, 35 fms. Austr. Mus. ("Endeavour").

1 (78 ..). Doubtful Is. Bay, east from Albany, W. Australia,

20-25 fms

Also the holotype, 180 mm in length (Stuttgart Mus.), and 5 from South and Western Australia (Austr. Mus. "Endeavour").

¹ The larger is selected as the holotype.

17. ARNOGLOSSUS JAPONICUS, Hubbs

Arnoglossus japonicus, Hubbs, 1915, Proc. U.S. Nat. Mus., XLVIII, p. 454, pl. XXV, fig. 2.

Depth of body about $2\frac{1}{2}$ in the length, length of head $3\frac{1}{2}$ to $3\frac{3}{4}$. Upper profile of head only moderately convex above and behind eyes. Snout about as long as eye, diameter of which is $3\frac{3}{8}$ in length of head; eyes separated by a low ridge, the lower very slightly in advance of upper. Maxillary extending to below middle of eye, length a little more than twice in that of head. Upper jaw with 4 canine teeth anteriorly; 8 moderate canines on each side of lower jaw. 8 short, pointed gill-rakers on lower part of anterior arch. Scales all cycloid; 63 to 64 in lateral line. Width of curve of lateral line about twice in length of head. Dorsal 97-99; second ray a little prolonged. Anal 74-79. Pectoral of ocular side with 13 rays, length $1\frac{3}{4}$ in that of head. Caudal rounded. Pale brownish, with indications of

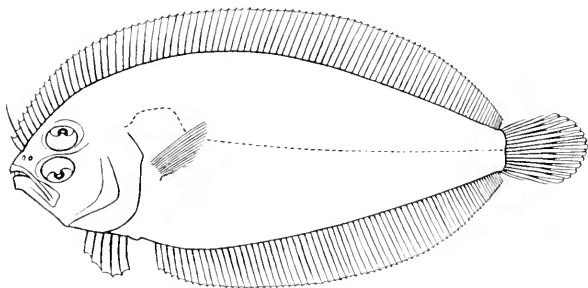


FIG. 139.—*Arnoglossus japonicus*. U.S.N.M. 75671. 1.

darker mottling; all the fins dark or with dark spots, except pectorals and pelvic of blind side.

TYPE — United States National Museum. No. 75671.

DISTRIBUTION — Japan.

Known only from the type (106 mm) from south of Kiusiu, 84 fms.; and two other specimens (41, 89 mm) from Ōhi Hondo and Suruga Gulf, 47 fms., respectively.

18. ARNOGLOSSUS BASSENSIS, Norman

Arnoglossus bassensis, Norman, 1926, Biol. Res. "Endeavour", v, p. 246, fig. 6; McCulloch, 1929, Mem. Aust. Mus., v, p. 277.

Depth of body $2\frac{1}{2}$ to $2\frac{3}{4}$ in the length, length of head $4\frac{1}{2}$ to $4\frac{3}{4}$. Upper profile of head only moderately convex above and behind eyes. Snout a little longer than eye, diameter of which is 5 to $5\frac{1}{2}$ in length of head; eyes separated by a low, narrow ridge, the lower a little in advance of upper. Maxillary extending to below anterior $\frac{1}{2}$ or $\frac{1}{3}$ of eye, length $2\frac{2}{3}$ to $2\frac{1}{2}$ in that of head; lower jaw about twice in head. Teeth of upper jaw small laterally, becoming larger anteriorly, not close-set; some of the teeth on ocular side of lower jaw movable. 7 to 9 rather short, pointed gill-rakers

on lower part of anterior arch. Scales all cycloid; 87 to 92 in lateral line. Width of curve of lateral line about $1\frac{2}{3}$ in length of head. Dorsal 98-99; none of the rays prolonged. Anal 77-78. Pectoral of ocular side with 10 rays, length $1\frac{2}{3}$ to $2\frac{1}{4}$ in that of head. Caudal obtusely pointed. Greyish brown, with some irregular dark blotches and spots on body, of which a pair of large black blotches on lateral line is most prominent.

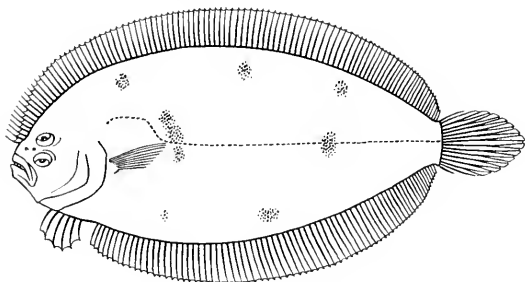


FIG. 140.—*Arnoglossus bassensis*. Austr. Mus. E.389. $\times \frac{2}{3}$.

TYPE.—Australian Museum No. E. 389.

DISTRIBUTION.—Bass Strait, south-eastern Australia.

SPECIMENS EXAMINED:

? 1 (98 mm.). Kangaroo Is., S. Australia. Austr. Mus. ("Endeavour").

Also the holotype (245 mm.) and one paratype (190 mm.) from Bass Strait (Austr. Mus. "Endeavour").

19. ARNOGLOSSUS DALGLEISHI (Von Bonde).

Trichopsetta dalgleishi, Von Bonde, 1922, Rep. Fish. Mar. Biol. Surv. S. Afr., ii, (1921), Spec. Rep. i, p. 6, pl. 1, fig. 1; Barnard, 1925, Ann. S. Afr. Mus., xxi, p. 391.

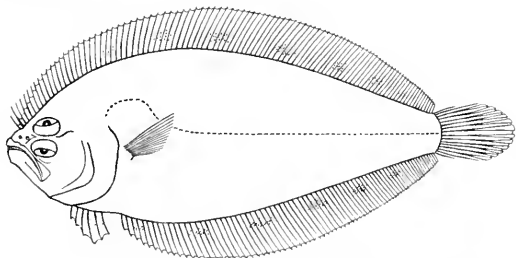


FIG. 141.—*Arnoglossus dalgleishi*. B.M. (N.H.) 1922. 3.27.16. $\times \frac{2}{3}$.

Depth of body $2\frac{1}{2}$ in the length, length of head nearly 4. Upper profile of head only moderately convex above and behind eyes. Snout about as long as eye, diameter of which is a little more than $\frac{1}{4}$ in length of head; eyes separated by a sharp ridge, the lower very little in advance of upper. Maxillary extending to below posterior $\frac{1}{2}$ of eye, length about twice in head; lower jaw $1\frac{2}{3}$ in head. Teeth of upper jaw small and rather close-set laterally, some curved canines anteriorly; lateral teeth of lower jaw stronger and wider apart than those of upper, somewhat enlarged anteriorly. Gill-rakers rather slender, pointed gill-rakers on lower part of anterior arch. Scales leebly ctenoid (?) on ocular side; apparently about 70 in lateral line. Dorsal 99, none of the rays prolonged. Anal 77. Pectoral of ocular side with 14 rays, length more than $\frac{1}{2}$ that of head. Caudal rounded (?). Greyish; dorsal and anal each with a number of dark blotches; first two rays of dorsal black.

TYPE.—Government Marine Survey of South Africa Collection.

DISTRIBUTION.—Natal.

SPECIMEN EXAMINED.

1 (155 mm.) Paratype

Natal, 29 Ins.

Gilchrist

20. ARNOGLOSSUS DEBILIS (Gilbert)

Anticitharus debilis, Gilbert, 1905, Bull. U.S. Com. Fish., xxii (2), (1903), p. 683, pl. xviii; Fowler, 1928, Mem. B. P. Bishop Mus., x, p. 90.

Arnoglossus (Anticitharus) debilis, Norman, 1931, Ann. Mag. Nat. Hist., (10) viii, p. 599.

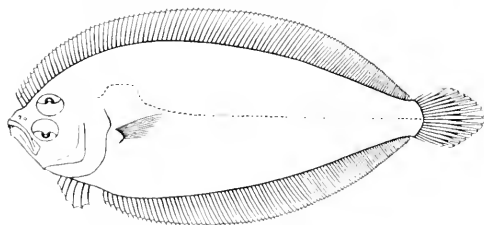


FIG. 142. *Arnoglossus debilis*. B.M. (N.H.) 1931.8.19. 3/4

Depth of body nearly $2\frac{1}{2}$ in the length, length of head about 4. Upper profile of head only moderately convex above and behind eyes. Snout a little shorter than eye, diameter of which is about $3\frac{2}{3}$ in length of head; eyes separated by a narrow ridge ($\frac{2}{3}$) or slightly wider and more evidently grooved space ($\frac{5}{8}$), the lower a little in advance of upper. Maxillary extending nearly to below middle of eye, length about $2\frac{1}{4}$ in that of head. Teeth in upper jaw rather small and close-set laterally, some moderate canines anteriorly; lateral teeth of lower jaw much stronger and wider apart than those of upper. 10 or 11 slender, pointed gill-rakers of moderate length on lower part of anterior arch. Scales all cycloid, 94 (to 98) in lateral line. Width of curve of lateral line a little more than twice in length of head. Dorsal (112) 114 (117); none of the rays prolonged. Anal (66) 93 (95). Pectoral of ocular side with 13 rays, length $\frac{1}{2}$ that of head. Caudal wedge-shaped, with rounded tip. Pale olive brown, with traces of darker markings.

TYPE.—United States National Museum. No. 51657

DISTRIBUTION.—Hawaiian Islands; in deep water.

SPECIMEN EXAMINED:

1 (142 mm.).

Hawaiian Is.

U.S. Nat. Mus.

This species was taken at depths ranging from 122 to 220 fathoms.

21. ARNOGLOSSUS SCAPHA ([Forster] Schneider).

[“MEGRIM.”]

Pleuronectes scapha, (Forster) Schneider, 1801, in Bloch, Syst. Ichth., p. 163.

Rhombus scapha, Richardson, 1843, Rept. Brit. Assoc., (Manch., 1842), p. 27.

Platessa (*Rhombus* ?) *scapha*, Gray and Richardson, 1843, in Diefenbach, Trav. N. Zealand, ii, p. 222.

Pseudorhombus scaphus, Hutton, 1872, Cat. Fish. N. Zealand, p. 51, p. ix, fig. 82.

Pseudorhombus boops (non Hector) Günther, 1880, Shore Fishes “Challenger”, p. 26; Regan, 1914, Rep. Brit. Antarct. (“Terra Nova”) Exped., 1910, Zool., i, p. 21.

Pseudorhombus hectoris, Günther, 1887, Deep-Sea Fishes “Challenger”, p. 163, fig. 4.

Caulopsetta scapha, Gill, 1893, Mem. Nat. Acad. Sci. Washington, vi, pp. 121, 124; Waite, 1911, Rec. Canterbury (N.Z.) Mus., i, p. 200, pl. xxxiv; Thomson and Anderton, 1921, Bull. N.Z. Board Sci. Art., ii, p. 82; Philipps, 1921, N.Z. J. Sci. Tech., iv, p. 121; Philipps, 1927, N.Z. Mar. Dept., Fish. Bull., i, p. 27.

Caulopsetta hectoris, Philipps, 1927, *tom. cit.*, p. 27.

EGGS, LARVÆ AND YOUNG.

Anderton, 1907, Trans. N.Z. Inst., xxxix, p. 479, pl. xix, hgs. c, c.

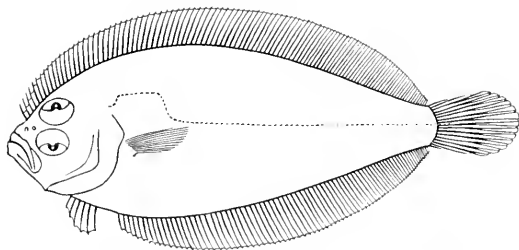


FIG. 143.—*Arnoglossus scapha*. B.M. (N.H.) 90.2.20.155. . 3.

Depth of body $2\frac{1}{2}$ to $2\frac{3}{4}$ in the length, length of head $3\frac{2}{3}$ to nearly 4. Upper profile of head only moderately convex above and behind eyes. Snout longer than eye (except in young), diameter of which is $3\frac{1}{3}$ to 5 in length of head; eyes separated by a bony ridge, the lower a little in advance of upper. Maxillary extending to below anterior part or middle of eye, length $2\frac{1}{2}$ to $2\frac{3}{5}$ in that of head; lower jaw nearly twice in head. Lower limb of preoperculum $\frac{1}{2}$ or less than $\frac{1}{2}$ as long as head. Teeth of upper jaw small and rather close-set laterally, some enlarged canines anteriorly; lateral teeth of lower jaw much stronger and wider apart from those of upper, enlarged

anteriorly 10 to 14 rather slender, pointed gill-rakers on lower part of anterior arch. Scales rather feebly ctenoid on ocular side, mostly cycloid on blind side; 80-89 in lateral line. Width of curve of lateral line $1\frac{1}{2}$ to 2 in length of head. Dorsal 112-116; none of the rays prolonged. Anal 88-96. Pectoral of ocular side with 12 to 14 rays, length $1\frac{3}{4}$ to nearly 2 in head. Caudal rounded. Pale greyish or brownish, with or without small black spots; pectoral sometimes blackish.

TYPE.—Not traced.

DISTRIBUTION.—New Zealand.

SPECIMENS EXAMINED:

1 (270-340 mm.).	Christchurch.		Canterbury Mus.
1 (155 mm.).	Stn. 107 (39° 32' S., 171° 48' E.), 150 fms.		"Challenger"
	<i>Pseudohombus hectoris</i> .		
2 (153, 154 mm.).	"	"	"
5 (88, 100 mm.).	Cape North, 70 fms.	"	"Terra Nova"
1 (232 mm.).	Dunedin		Otago Mus.

22. ARNOGLOSSUS BOOPS (Hector).

Pseudohombus boops, Hector, 1875, Trans. N.Z. Inst., vii, p. 249, pl. xi, fig. 82b; Hector, 1875, Ann. Mag. Nat. Hist., (4), xv, p. 81; Gunther, 1857, Deep-Sea Fishes "Challenger", p. 164, fig. 5.
Caulopsitta boops, Gill, 1863, Mem. Nat. Acad. Sci. Washington, vi, p. 121; Philippis, 1927, N.Z. Mar. Dept., Fish. Bull., 1, p. 27.

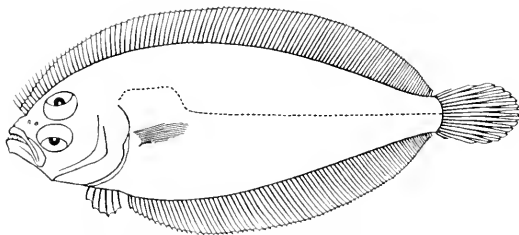


FIG. 141.—*Arnoglossus boops*. B.M. (N.H.) 85.10.15-4. 3

Perhaps identical with *A. scapha*, but depth of body $2\frac{1}{2}$ in the length, length of head $3\frac{1}{2}$. Diameter of eye a little more than 3 in length of head. Maxillary nearly reaching middle of eye, length $2\frac{1}{2}$ in that of head, lower jaw about twice in head. Lower limb of preoperculum rather more than $\frac{1}{2}$ as long as head. About 80 scales in lateral line. Width of curve of lateral line $1\frac{1}{4}$ in length of head. Dorsal 112. Anal 92. Pectoral of ocular side with 13 rays, length a little more than twice in that of head. Uniformly yellowish brown.

TYPE.—British Museum (Nat. Hist.). Reg. No. 85.10.15-4.

DISTRIBUTION.—Deep water off Cape Farewell, New Zealand.

SPECIMENS EXAMINED:

1 (156 mm.).	Holotype	200 miles off Cape Farewell, 400 fms.	"Challenger."
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23. ARNOGLOSSUS MICROPHthalmus (Von Bonde).

Læops microphthalmus, Von Bonde, 1922, Rep. Fish. Mar. Biol. Surv. S. Afr., ii, (1921), Spec. Rep. 1, p. 11, pl. iv, fig. 1; Barnard, 1925, Ann. S. Afr. Mus., xxi, p. 392.
Arnoglossus microphthalmus, Norman, 1931, Ann. Mag. Nat. Hist., (10) viii, p. 508.

Depth of body $2\frac{2}{3}$ in the length, length of head $4\frac{3}{5}$. Upper profile of head markedly convex above and behind eyes. Snout as long as eye, diameter of which is about $4\frac{3}{5}$ in length of head; eyes separated by a low ridge, the lower a very little in advance of upper. Maxillary extending to below anterior part of eye, length nearly $2\frac{1}{2}$ in that of head; lower jaw nearly twice in head. Teeth of upper jaw small and rather close-set laterally, some enlarged canines anteriorly; lateral teeth of lower jaw stronger and wider apart than those of upper. 8 or 9 rather short, pointed gill-rakers on lower part of anterior arch. Scales apparently cycloid on both sides of body, about 110 in lateral line. Width of curve of lateral line $2\frac{1}{2}$ in length of head. Dorsal

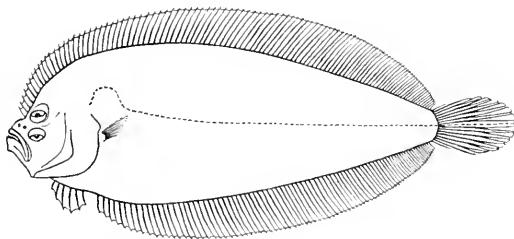


FIG. 145.—*Arnoglossus microphthalmus*. B.M.(N.H.), 1922.3.27.12. ♂.

106; none of the rays prolonged. Anal 84. Pectoral of ocular side with 14 rays, length? Caudal rounded. Pale brownish; median fins darker.

TYPE.—British Museum (Nat. Hist.). Reg. No. 1922.3.27.12.

DISTRIBUTION.—Coast of Natal; in deep water.

SPECIMEN EXAMINED:

1 (135 mm.). Holotype Off Natal, 150 fms. Gilchrist.

Apart from the somewhat smaller scales and shorter curve to the lateral line, this species agrees fairly well with some of the species of *Arnoglossus* and may be provisionally placed here. Only the type-specimen is known.

24. ARNOGLOSSUS INTERMEDIUS (Bleeker).

Platophrys (Arnoglossus) intermedius, Bleeker, 1860, Ned. Tijdschr. Dierk., iii, p. 47; Bleeker, 1866-72, Atl. Ichth., vi, p. 14, Pleuron. pl. i, fig. 1.

Rhomboidichthys intermedius, Regan, 1902, in Gardiner, Faun. Maldive Laccadive Arch., i, p. 277.
Engyprosopon intermedius, Regan, 1908, Trans. Linn. Soc. London, Zool., xii, p. 235.

Anticitharus annulatus, Weber, 1913, "Siboga"-Exped., Fische, p. 433.

Anoglossus intermedius, Norman, 1926, Biol. Res. "Endeavour", v, p. 248, Norman, 1927, Rec. Ind. Mus., xxix, p. 21, pl. iv; Fowler, 1928, Mem. B.P. Bishop Mus., v, p. 90, McCulloch, 1929, Mem. Aust. Mus., v, p. 277.
Isithus (Anoglossus) intermedius, Weber and Beaufort, 1929, Fish. Indo-Austral. Arch., v, p. 130.

Depth of body $2\frac{1}{2}$ to $2\frac{2}{3}$ in the length, length of head about $3\frac{1}{2}$. Snout longer than eye, diameter of which is $4\frac{1}{2}$ to 5 in length of head; eyes separated by a concave space, its width $\frac{1}{4}$ to $\frac{1}{3}$ diameter of eye; lower eye a little in advance of upper. Maxillary extending to below anterior edge of eye or a little beyond, length about $2\frac{1}{2}$ in head; lower jaw $1\frac{2}{3}$ to $1\frac{1}{2}$ in head. Teeth of upper jaw very small and close-set laterally, becoming stronger and wider apart anteriorly; lateral teeth of lower jaw somewhat stronger and wider apart than those of upper. Gill-rakers "palmate" (short, broad, the margins strongly spinulate); 8 or 9 on lower part of anterior arch. Scales feebly ctenoid on ocular side, cycloid on blind side; 45 to 50 in lateral line. Dorsal 77-83; first ray somewhat prolonged and expanded distally. Anal 50-62.

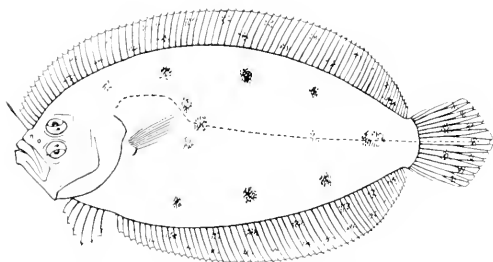


FIG. 146. *Anoglossus intermedius*. B.M. (N.H.) 1928, v, 23, 131. $\frac{1}{2}$.

Pectoral of ocular side with 9 to 11 rays, length about $\frac{1}{2}$ head. Caudal rounded or obtusely pointed. Brownish; a number of dark brown blotches and annular markings on body, of which a series near upper and lower edges of body, a pair above and below commencement of straight part of lateral line, and another pair on the straight portion, are usually most conspicuous; all the fins with numerous dark brown spots; a row of larger spots along basal parts of dorsal and anal.

TYPE.—Leiden Museum.

DISTRIBUTION.—Indian Ocean and Archipelago to Australia and the Solomon Islands.

SPECIMENS EXAMINED:

146, 85 mm.	Maldives	Garbner
2915, 127 mm.	Seychelles, 37 fms.	"
113, 105 "	Off Hervey Bay, Queensland	Aust. Mus. "Endeavour"

Also 4 from Queensland (Aust. Mus. "Endeavour").

This species is provisionally placed here, but perhaps represents a distinct genus. It may be distinguished from all species of *Anoglossus* by the form of the gill-rakers, which are similar to those of certain species of *Pseudorhombus*, and from most of them by the concave interorbital space.

Genus 23. PSETTINA.

Psettina, Hubbs, 1915, Proc. U.S. Nat. Mus., xlviii, p. 456 [*Engyprosopon ujjimæ*, Jordan and Starks].
Crossolepis, Norman, 1927, Rec. Ind. Mus., xxix, p. 22 [*Arnoglossus brevirectis*, Alcock].

Very close to *Arnoglossus*, but the scales strongly ctenoid on ocular side (cf. *Crossolepis rhombus*, p. 217¹); a blunt rostral spine, more prominent in the male; mouth somewhat smaller, the length of the maxillary $2\frac{1}{2}$ to $3\frac{1}{2}$ in that of head; teeth all small, scarcely enlarged anteriorly; gill-rakers rather short and stout.

Three species from the Indian Ocean and Archipelago and Japan.

SYNOPSIS OF THE SPECIES.

- I. Dorsal 76-82, anal 60-66; maxillary $3\frac{2}{3}$ to $3\frac{1}{2}$ in head, which is about $3\frac{1}{2}$ in length 1. *brevirectis*.
 II Dorsal 80-95, anal 69-75; maxillary about 3 in head, which is $3\frac{3}{4}$ to nearly 4 in length.
 A. Longest ray of left pelvic $2\frac{1}{2}$ to $2\frac{1}{2}$ in head; lower eye very little in advance of upper 2. *ujjimæ*.
 B. Longest ray of left pelvic $1\frac{3}{4}$ to $1\frac{3}{4}$ in head; lower eye well in advance of upper 3. *profunda*.

1. PSETTINA BREVIRECTIS (Alcock).

Arnoglossus brevirectis, Alcock, 1890, Ann. Mag. Nat. Hist., (6) vi, p. 433; Alcock, 1896, J. Asiatic Soc. Beng., lxx (2), p. 327; Alcock, 1898, Illust. Zool. "Investigator", Fishes, pl. xxii, fig. 4; Weber, 1913, "Siboga" Exped., Fische, p. 432.
Crossolepis brevirectis, Norman, 1927, Rec. Ind. Mus., xxix, p. 23, fig. 4.
Bothus (Arnoglossus) brevirectis, Weber and Beaufort, 1929, Fish. Indo-Austral. Arch., v, p. 129

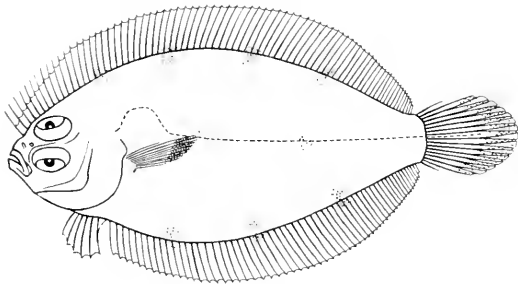


FIG. 147.—*Psettina brevirectis*. B.M. (N.H.) 1927.1.6.30. . 1.

¹ The similarity between the scales of *Psettina* and *Crossolepis* is very striking, and it is possible that the two genera should be united. In view of the marked differences in the interorbital region, it seems inadvisable to do this, particularly as the logical outcome would have to be the union of *Arnoglossus* and *Engyprosopon*.

Depth of body about twice in the length, length of head about $3\frac{1}{2}$. Upper profile of head with a slight notch in front of eyes. Snout shorter than eye, diameter of which is 3 to $3\frac{1}{4}$ in length of head, eyes separated by a narrow ridge, the lower a little in advance of upper. Maxillary extending to below anterior edge of eye or a little beyond, length $3\frac{2}{3}$ to $3\frac{1}{2}$ in that of head; lower jaw $2\frac{2}{3}$ to $2\frac{1}{2}$ in head. 7 or 8 gill-rakers on lower part of anterior arch. 47 to 52 scales in lateral line. Dorsal (70) 78-82. Anal 60-66. Pectoral of ocular side with 11 rays, length $\frac{2}{3}$ to $\frac{3}{4}$ that of head. Longest rays of left pelvic about $2\frac{2}{3}$ in length of head. Caudal rounded. Brownish, a series of rather indistinct dark blotches along upper and lower edges of body, continued on bases of dorsal and anal fins, two or three blotches on lateral line, a dark patch on distal part of pectoral, hinder part of caudal fin with a broad blackish band.

TYPE.—Indian Museum No. 13922

DISTRIBUTION.—South-eastern India, Celebes; in rather deep water.

SPECIMENS EXAMINED:

(170-77 mm.)

Madras Coast, 20 fms.

Ind. Mus.

Also 6 from Ganjam, Madras and Travancore coasts, including the types of the species (Ind. Mus.).

2. *PSETTINA HJIME* (Jordan and Starks)

Enyprosopon hjime, Jordan and Starks, 1904, Bull. U.S. Com. Fish., xxii, (1902), p. 620, pl. viii, fig. 1; Jordan and Starks, 1906, Proc. U.S. Nat. Mus., xxvi, p. 171, fig. 3; Jordan, Tanaka and Snyder, 1913, J. Coll. Sci. Tokyo, xxxiii (1), p. 313, fig. 293.

Psettina hjime, Hubbs, 1915, Proc. U.S. Nat. Mus., xlviii, p. 450.

Psettina hjime (part), Norman, 1931, Ann. Mag. Nat. Hist., (10) viii, p. 600.

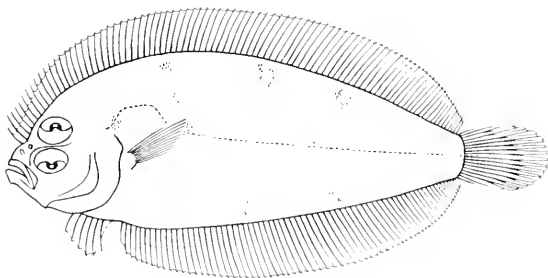


FIG. 148.—*Psettina hjime*.—B.M. (N.H.) 1913 (S. 19) 1. 1.

Depth of body $2\frac{1}{2}$ in the length, length of head nearly 4. Upper profile of head distinctly notched in front of eyes. Snout shorter than eye, diameter of which is 3 in length of head, eyes separated by a narrow bony ridge ($\frac{1}{2}$), the lower very little in advance of upper. Maxillary extending to below anterior part of eye, length about 3 in that of head, lower jaw a little more than twice in head. 6 or 7 gill-rakers

on lower part of anterior arch. 55 (?) scales in lateral line. Dorsal (80-90) 95. Anal (60-73) 75. Pectoral of ocular side with 11 rays, length about $1\frac{1}{2}$ in that of head. Longest ray of left pelvic $2\frac{1}{2}$ to $2\frac{3}{4}$ in length of head. Caudal rounded. Brownish, with a number of darker spots and rings, of which rows at upper and lower edges of body are most prominent; median fins spotted with darker.

TYPE.—United States National Museum. No. 51461.

DISTRIBUTION.—Southern Japan; in rather deep water.

SPECIMEN EXAMINED:

1 (♀, 110 mm.).

Okii Shima.

U.S. Nat. Mus.

3. *PSETTINA PROFUNDA* (Weber).

Arnoglossus profundus, Weber, 1913, "Siboga"-Exped., Fische, p. 430, pl. vi, fig. 3.

Bothus (Arnoglossus) profundus, Weber and Beaufort, 1929, Fish. Indo-Austral. Arch., v, p. 127.

Psettina iijimæ (part), Norman, 1931, Ann. Mag. Nat. Hist., (10) viii, p. 600.

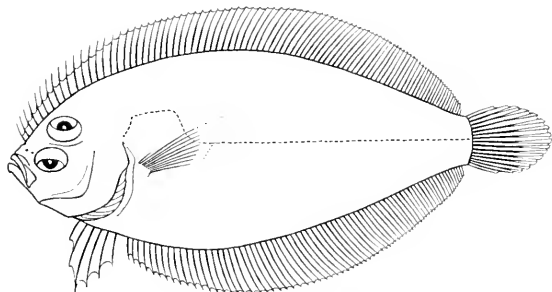


FIG. 149.—*Psettina profunda*. Paratype. $\times 1$.

Probably identical with *P. iijimæ*. Depth of body $2\frac{1}{2}$ in the length, length of head $3\frac{1}{4}$. Upper profile of head with a slight notch in front of eyes. Diameter of eye $3\frac{1}{4}$ in length of head; eyes separated by a narrow scaled space ($\frac{3}{4}$) or bony ridge ($\frac{5}{8}$), the lower well in advance of upper. (55) 60 scales in lateral line. Dorsal 90-95. Anal 70-73. Length of pectoral $1\frac{1}{2}$ in that of head. Longest ray of left pelvic about $1\frac{3}{4}$ or $1\frac{1}{2}$ in length of head. Reddish brown, clouded with darker, median fins with brown blotches.

TYPE.—Amsterdam Museum.

DISTRIBUTION.—Indo-Australian Archipelago; in deep water.

SPECIMENS EXAMINED:

1 (♂, 105 mm.).

Madura Strait (7° 40' S., 114° 21' E.).

Hardenberg.

Also 4 paratypes from Java, Madura Sea and Timor Sea, 55 to 61 fms. (Amsterdam Mus. "Siboga").

This species will probably prove to be identical with *P. iijimæ* of Japan. Unfortunately I have only seen a female of *P. iijimæ*.

Genus 24. LOPHONECTES.

Lophonectes, Gunther, 1880, Shore Fishes "Challenger", p. 20 [*Lophonectes callus*, Gunther].
Lophorhombus, Macleay, 1883, Proc. Linn. Soc. N. S. W., vii, p. 14 [*Lophorhombus cristatus*, Macleay].

Close to *Amnoglossus*, but mouth smaller, the length of the maxillary $3\frac{1}{2}$ to nearly 4 in that of head; male with bony tubercles on the snout and at symphysis of lower jaws, these being much smaller and blunter or absent altogether in the female; anterior rays of dorsal fin greatly prolonged in the male, slightly prolonged in the female.

A single species from Australia and New Zealand.

1. LOPHONECTES GALLUS, Gunther

[CRESTED FLOUNDER]

Lophonectes gallus, Gunther, 1880, Shore Fishes "Challenger", p. 29, pl. xv, fig. 6; McCulloch, 1914, Biol. Res. "Endeavour", ii, p. 128; McCulloch, 1921, Aust. Zool., ii, p. 45, pl. xiii; Waite, 1921, Rec. S. Aust. Mus., ii, p. 156, fig. 259; Norman, 1920, Biol. Res. "Endeavour", v, p. 249; McCulloch, 1920, Mem. Aust. Mus., v, p. 278.

Lophys parviceps (part), Gunther, 1880, Shore Fishes "Challenger", p. 29.

Lophorhombus cristatus, Macleay, 1883, Proc. Linn. Soc. N. S. W., vii, p. 14; Macleay, 1884, Proc. Linn. Soc. N. S. W., ix, p. 52.

Amnoglossus mongonuiensis, Regan, 1914, Ann. Mag. Nat. Hist., (8) xiii, p. 16; Regan, 1914, Rep. Brit. Antarct. ("Terra Nova") Exped., 1910, Zool., i, 1, p. 21, pl. xi, fig. 2.

Lophonectes mongonuiensis, Philipps, 1927, N. Z. Mar. Dept., Fish. Bull., i, p. 39.

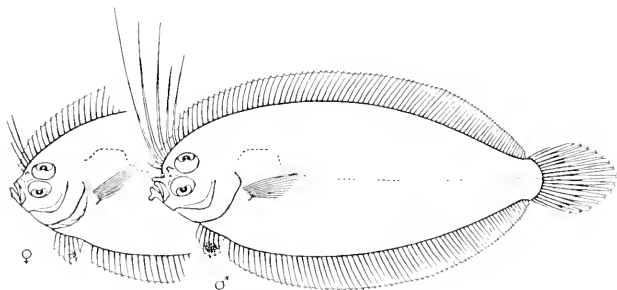


FIG. 150. — *Lophonectes gallus*. B.M. (N.H.) 90.9.24.46.47. 5.

Depth of body about $2\frac{1}{2}$ in the length, length of head $4\frac{1}{2}$ to $5\frac{1}{2}$. Snout shorter than eye, diameter of which is $3\frac{1}{2}$ to 4 in length of head; eyes separated by a narrow bony ridge, the lower very slightly in advance of upper, which is separated from edge of head by a space equal to $\frac{1}{2}$ to $\frac{1}{4}$ its diameter. Maxillary extending to below anterior edge of eye or a little beyond, length $3\frac{1}{2}$ to nearly 4 in that of head; lower jaw $2\frac{1}{2}$ to $2\frac{3}{4}$ in head. Teeth small, scarcely enlarged anteriorly. Gill-rakers short or of

moderate length, rather stout; 6 or 7 on lower part of anterior arch. Scales ctenoid on ocular side, cycloid on blind side; 62 to 70 in lateral line. Dorsal 87-93; second (occasionally first) to fifth, sixth or seventh rays much prolonged in the male (except in very young), longest rays (in adults) $1\frac{1}{2}$ to about twice length of head; only the third to fourth or fifth rays are prolonged in the female, length $\frac{1}{2}$ to $\frac{9}{10}$ that of head. Anal 71-77. Pectoral of ocular side with 11 or 12 rays, length $\frac{2}{3}$ to $\frac{3}{4}$ that of head. Caudal pointed. Brownish or greyish, with or without darker markings, the most conspicuous of which are three blotches on the lateral line; fins with dark dots; pelvic of ocular side generally blackish posteriorly, with a pale margin.

TYPE.—British Museum (Nat. Hist.). Reg. No. 79.5.14.93.

DISTRIBUTION.—South-eastern Australia; Tasmania; New Zealand.

SPECIMENS EXAMINED:

2 (128, 135 mm.).	Types, ¹	St. 162 (Bass Strait), 38 fms.	"Challenger."
2 (85, 100 ").		" "	" "
6 (135-180 ").		Port Jackson, N.S. Wales.	Imp. Inst.
1 (155 mm.), skeleton.		Off " "	" "
1 (60 ").		Off " " , 30 fms.	"Challenger."
3 (63-88 mm.).		Off Twofold Bay, N.S. Wales,	" "
		120 fms.	
3 (100-118 mm.).		8 miles east of Sandon Bluff, N.S. Wales, 35-40 fms.	Austr. Mus. ("Endeavour").
4 (75-85 mm.).	Types of	Off C. North, N. Zealand, 14-30 fms.	"Terra Nova."
	<i>Arnoglossus mongonutensis</i> .		

Also 6 from Bass Strait and New South Wales (Austr. Mus. "Endeavour").

This species attains a length of about 8 inches.

Genus 25. ENGYPROSOPON.

Engyprosopon, Gunther, 1862, Cat. Fish., iv, p. 431 [*Rhombus mogkit*, Bleeker].

Scaops, Jordan and Starks, 1904, Bull. U.S. Com. Fish., xxii, (1902), p. 627 [*Rhombus grandisquama*, Schlegel].

Body ovate or rather deep, strongly compressed. Eyes on the left side, separated by a flat or concave space of varying width, which is generally broader in the male; eyes sometimes separated by a bony ridge in young. Male usually with one or more spines on the snout and on the orbital margins. Olfactory laminae as in *Arnoglossus*. Mouth rather small, the length of the maxillary $2\frac{1}{2}$ to $3\frac{1}{2}$ in that of head; jaws and dentition about equally developed on both sides; teeth small, sometimes uniserial, but generally with an outer series of larger teeth anteriorly in upper jaw; no distinct canines; vomer toothless. Gill-opening extending upwards to lateral line, or ending a short distance above pectoral fin, in which case the scaling of the head and body is continuous below lateral line; gill-rakers comparatively few in number, short or of moderate length. Dorsal fin commencing above or a little in advance of nostrils of blind side, and well in front of eye; all the rays simple, scaled (at least on ocular side). Tip of first interhaemal spine not projecting in front of anal fin. Pectoral fins unequal, that of ocular side larger; all the rays simple; upper ray sometimes prolonged in the mature male. Tip of pelvic bone projecting downwards and backwards between the pelvic fins. Scales of moderate size or rather large, somewhat feebly ctenoid on ocular side, cycloid on blind side; no supplementary scales. Lateral line developed only on ocular side of body, with a distinct curve above the pectoral fin; no supra-temporal branch. Vent on blind side, above first ray of anal fin.

About fifteen species from the Indo-Pacific.

¹ The larger specimen is selected as the holotype.

SYNOPSIS OF THE SPECIES.

- I. Maxillary $2\frac{1}{2}$ to $2\frac{1}{2}$ in head
- A. Interorbital width $\frac{1}{2}$ to $\frac{1}{2}$ ($\frac{5}{8}$) or $\frac{1}{4}$ to $\frac{1}{4}$ ($\frac{7}{8}$) eye; 5 to 7 pointed gill-rakers on lower part of anterior arch; about 45 scales in lateral line 1. *cocosensis*
- B. Interorbital width equal to ($\frac{5}{8}$) or $\frac{1}{4}$ ($\frac{7}{8}$) eye; 11 or 12 pointed gill-rakers on lower part of anterior arch; 50 scales in lateral line 2. *xenandrus*.
- C. Interorbital width about $\frac{3}{4}$ eye; 8 "palmate" gill-rakers on lower part of anterior arch; about 60 scales in lateral line 3. *fijiensis*.
- II. Maxillary $2\frac{2}{3}$ to $3\frac{1}{2}$ in head
- A. 50 or more scales in lateral line
1. Dorsal (78) 83-86, anal (58) 61-62 4. *mogkii*.
2. Dorsal 90-93, anal 68-74 5. *bleekeri*
- B. 30 to 40 scales in lateral line
1. Dorsal 78-80, anal 50-60
- a. Caudal fin with a pair of large, dark spots.
- α 5 to 7 gill-rakers on lower part of anterior arch 6. *grandisquama*.
- β 14 gill-rakers on lower part of anterior arch 7. *xvstris*.
- b. Caudal fin without large dark spots
- α Eye more than 4 in head; interorbital space very narrow; 30 scales in lateral line 8. *arcuicola*
- β . Eye 3 to 4 in head
- * 40 scales in lateral line; depth $1\frac{3}{4}$ in length 9. *hawaitensis*
- ** About 40 scales in lateral line
- † Depth $1\frac{1}{2}$ to 2 in length
- ‡ Pectoral $\frac{2}{3}$ to about $\frac{2}{3}$ head, upper ray scarcely prolonged in male
- § Interorbital width 1 to $1\frac{1}{2}$ times ($\frac{5}{8}$) or $\frac{1}{2}$ to $\frac{2}{3}$ ($\frac{7}{8}$) eye; maxillary $2\frac{2}{3}$ to $2\frac{1}{2}$ in head; anterior edge of upper eye above middle of lower 10. *latifrons*.
- §§ Interorbital width $\frac{1}{2}$ ($\frac{5}{8}$) or $\frac{1}{4}$ ($\frac{7}{8}$) eye; maxillary $2\frac{1}{2}$ to $2\frac{2}{3}$ in head; anterior edge of upper eye above anterior part of lower 11. *natalensis*
- ‡‡ Pectoral as long as or longer than head (at least in male), upper ray prolonged in male
- § Anterior edge of upper eye above anterior part of lower; eye $3\frac{1}{2}$ in head 12. *macrolepis*.
- §§ Anterior edge of upper eye above middle of lower; eye 3 in head 13. *filimanus*.
- ‡‡ Depth $2\frac{1}{2}$ in length 14. *sechellensis*.
2. Dorsal 70-76, anal 53-58; caudal without large, dark spots 15. *maldvensis*

The following two species from Japan have been described in Japanese, but, as the diagnoses are very brief, it is impossible to place them:

1. *Scorops kankonis*, Tanaka, 1918, Dobuts. Zasshi ('Zool. Mag. '), xxx, p. 226
2. *Scorops* *sp.*, Tanaka, *loc. cit.*

1. ENGYPTROSOPTON COCOSENSIS (Bleeker)

Rhombus cocosensis, Bleeker, 1855, Nat. Tijdschr. Ned. Ind., viii, p. 179.

Platophris (*Arnolessius*) *cocosensis*, Bleeker, 1866-72, Atl. Ichth., p. 13, Plénon, pl. iv, fig. 1.

Scorpaetes macrophthalmus (part), Jenkins, 1910, Mem. Ind. Mus., iii, p. 27.

Engyptrosopon cocosensis, Norman, 1927, Rec. Ind. Mus., xxix, p. 24.

Arnolessius annulatus, Norman, 1927, *loc. cit.*, p. 19.

Bethu (*Arnolessius*) *cocosensis*, Weber and Beaufort, 1929, Fish. Indo Austral. Arch., v, p. 425.

Depth of body a little more than twice in the length, length of head $3\frac{1}{2}$ to $3\frac{3}{4}$. Snout shorter than eye, diameter of which is 3 to $3\frac{1}{2}$ in length of head; interorbital space concave, width $\frac{1}{2}$ to $\frac{1}{3}$ (σ) or $\frac{1}{3}$ to $\frac{1}{4}$ (ρ) diameter of eye; anterior margins of eyes level or lower a little in advance of upper. A short spine on the snout in the male. Maxillary extending to below middle of eye or not quite as far, length $2\frac{1}{2}$ to $2\frac{3}{4}$ in that of head. Teeth uniserial; some enlarged canines anteriorly. 5 to 7 short, pointed gill-rakers on lower part of anterior arch. About 45 scales in lateral line. Dorsal 77-84. Anal 56-63. Pectoral of ocular side with 11 or 12 rays, the upper ray prolonged in the male, length $\frac{3}{4}$ to $\frac{1}{2}$ that of head. Brownish, with traces of some paler areas, and with some black spots and blotches; median fins with small dark spots; pectoral with dusky cross-bars.

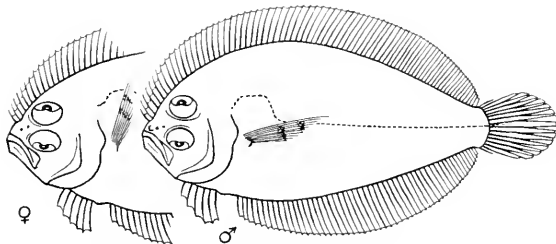


FIG. 151.—*Engyprosopon cocosensis*. B.M. (N.H.) 1927.1.6.33, 34. $\times 1$.

TYPE.—Leiden Museum.

DISTRIBUTION.—Travancore coast (?); coast of Burma; Nicobar Is.; Cocos Is.

SPECIMENS EXAMINED:

5 (3σ , 45-62; 2ρ , 50, 60 mm.).

Nankauri Harbour, Nicobar Is.

Ind. Mus.

Also 7 from India, Burma and Nicobar Islands (Ind. Mus.)

2. *ENGYPROSOPON XENANDRUS*, Gilbert.

Engyprosopon xenandrus, Gilbert, 1905, Bull. U.S. Com. Fish., xxiii (2), (1903), p. 687, fig. 270.
Scæops xenandrus, Fowler, 1928, Mem. B.P. Bishop Mus., x, p. 92.

Depth of body about twice in the length, length of head $3\frac{1}{2}$ to $3\frac{3}{4}$. Snout shorter than eye, diameter of which is about $2\frac{3}{4}$ in length of head; interorbital space concave, width nearly equal to (σ) or about $\frac{1}{4}$ (ρ) diameter of eye; anterior edge of upper eye above middle of lower in the male; each eye in the male with a broad semi-circular fringed membrane. A strong spine on the snout in the male and one or more on each orbital margin. Maxillary nearly reaching middle of eye, length $2\frac{1}{2}$ to $2\frac{1}{2}$ in head. Teeth uniserial (?). 11 to 12 pointed gill-rakers of moderate length on lower part of anterior arch. 50 scales in lateral line. Dorsal 79-91. Anal 61-69. Pectoral of ocular side with 12 rays, length $\frac{1}{2}$ that of head. Yellowish brown; traces of small dark spots on median fins.

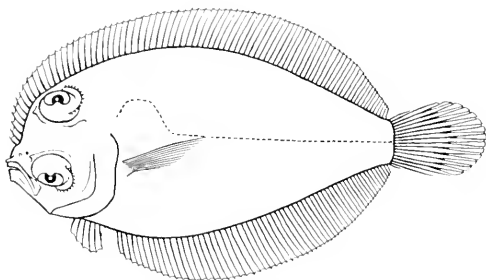


FIG. 152—*Engyprosopon xenandrus*. B. M. (N. H.), 1930, 9, 2, 8. 14.

TYPE—United States National Museum No. 51651.

DISTRIBUTION—Hawaiian Islands; in rather deep water.

SPECIMENS EXAMINED:

2 (♂, 53, 95 mm.) Paratypes

Hawaii.

Stanford Univ.

3. *ENGYPROSOPON FIJIENSIS*, Norman

Rhomboidichthys sp. (?), Günther, 1880, Shore Fishes "Challenger", p. 39.

Engyprosopon fijiensis, Norman, 1931, Ann. Mag. Nat. Hist., (10), VIII, p. 508.

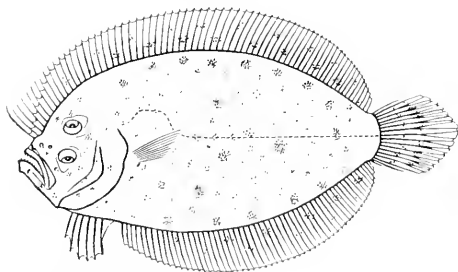


FIG. 153—*Engyprosopon fijiensis*. B. M. (N. H.), 70, 5, 14, 80. 14.

Depth of body nearly twice in the length, length of head $3\frac{1}{2}$. Snout longer than eye, diameter of which is about 5 in length of head and somewhat greater than width of concave interorbital space, lower eye in advance of upper. No rostral or orbital pines. Maxillary extending to below anterior edge of eye, length $2\frac{1}{2}$ in that of head.

Teeth uniserial in both jaws. 8 very short "palmate" gill-rakers on lower part of anterior arch. About 60 scales in lateral line. Dorsal 71. Anal 61. Pectoral of ocular side with 10 rays, length about $\frac{1}{2}$ that of head. Greyish brown, with numerous paler and darker spots and ocelli; a dark blotch on hinder part of lateral line; median fins variegated with paler and darker.

TYPE.—British Museum (Nat. Hist.). Reg. No. 79.5.14.89.

DISTRIBUTION.—Fiji Islands.

SPECIMEN EXAMINED:

1 (83 mm.). Holotype.

Levuka.

"Challenger."

In the peculiar form of the gill-rakers, as well as in other characters, this species resembles *Arnoglossus intermedius* (Bleeker), and should perhaps be included in that genus. The type is rather poorly preserved, and it is impossible to determine the sex.

4. ENGYPROSOPON MOGKII (Bleeker).

Rhombus mogkii, Bleeker, 1854, Nat. Tijdschr. Ned. Ind., vii, p. 256.

Achirus mogki, Bleeker, 1860, Nat. Tijdschr. Ned. Ind., xxii, p. 101.

Rhomboidichthys (Engyprosopon) mogkii, Gunther, 1862, Cat. Fish., iv, p. 438.

Pseudorhombus mogkii, Bleeker, 1863, Nat. Tijdschr. Dierk., i, p. 230.

Platophrys (Arnoglossus) mogki, Bleeker, 1866-72, Atl. Ichth., vi, p. 14, Pleuron., pl. II, fig. 1.

Engyprosopon mogki, Weber, 1913, "Siboga"-Exped., Fische, p. 429; Norman, 1927, Rec. Ind. Mus., xxix, p. 27, pl. v.

Bothus (Arnoglossus) mogki, Weber and Beaufort, 1929, Fish. Indo-Austral. Arch., v, p. 128, fig. 30.

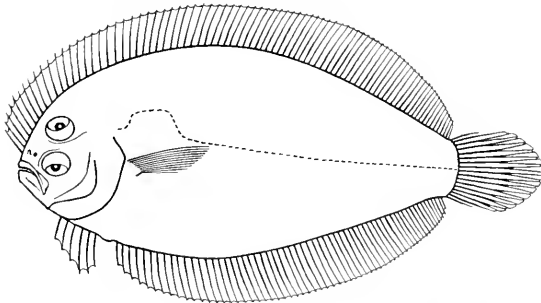


FIG. 154.—*Engyprosopon mogkii*. B.M. (N.H.) 62.6.3.28. 1.

Depth of body about twice in the length, length of head a little more than 4. Snout a little shorter than eye, diameter of which is $3\frac{3}{4}$ to $3\frac{2}{3}$ in length of head; interorbital space concave, width $\frac{1}{4}$ to $\frac{1}{2}$ diameter of eye; lower eye a little in advance of upper. No rostral or orbital spines. Maxillary extending to a little beyond anterior edge of eye, length $2\frac{1}{2}$ to 3 in that of head. Upper jaw with an outer row of stronger teeth. 6 gill-rakers of moderate length on lower part of anterior arch. 51 to 53 scales in lateral line. Dorsal (78) 83-86. Anal (58) 61-62. Pectoral of ocular side with 11 rays, length $\frac{2}{3}$ that of head. Brownish, with numerous small dark spots on head, body and fins.

TYPE — Leiden Museum.

DISTRIBUTION — Indian Ocean, Malay Peninsula and Archipelago.

SPECIMENS EXAMINED:

1 ♂ ♀, 110 mm.). Paratype. F. Indies. Bleeker.

Also one from the Indian Ocean (7° 47' N., 76° 42' E. to 7° 48' N., 76° 41' E.), 102 to 105 fathoms (Ind. Mus. "Investigator").

5. ENGYPROSOPON BLEEKERI (Macleay).

Angoglossus bleekeri, Macleay, 1882, Proc. Linn. Soc. N.S.W., vi, p. 124; McCulloch and Whitley, 1925, Rec. Austr. Mus., xiv, p. 316, fig. 2; Norman, 1926, Biol. Res. "Endeavour", v, p. 240.

Depth of body about twice in the length, length of head $4\frac{1}{2}$ to $1\frac{1}{2}$. Snout shorter than eye, diameter of which is $3\frac{1}{4}$ to $3\frac{1}{2}$ in length of head, interorbital space a narrow

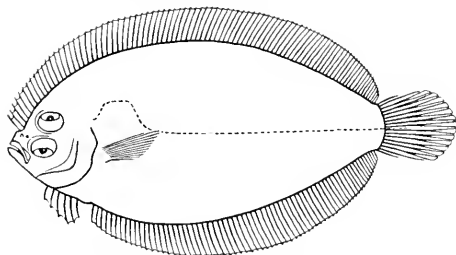


FIG. 155.—*Engyprosopon bleekeri*. B.M. (N.H.) 1925.7.22.44. 1.

groove, width 8 in diameter of eye, lower eye a little in advance of upper. No rostral or orbital spines. Maxillary extending to below anterior edge of eye or a little beyond, length about 3 in that of head. Teeth of upper jaw biserial anteriorly, uniserial laterally. 7 or 8 gill-rakers of moderate length on lower part of anterior arch. About 50 scales in lateral line. Dorsal 90-93. Anal 68-74. Pectoral of ocular side with 12 rays, length about $\frac{2}{3}$ that of head. Brownish.

TYPE — Macleay Museum, Australia.

DISTRIBUTION — East coast of Queensland.

SPECIMENS EXAMINED:

2 ♀ (4 ♀, 80, 84 mm.). 12 miles N.E. of Bowen, Queensland, 19-25 fms. Austr. Mus. ("Endeavour")

Also 4 from the same locality (Austr. Mus. "Endeavour").

This species may prove to belong to the genus *Angoglossus*, but the biserial teeth in the upper jaw suggest that it should be placed here.

The type is 73 mm. in total length.

Since the completion of this catalogue, the following specimen has been received at the British Museum (Natural History) as *Scaops kobensis*, Jordan and Starks. It appears to be an undoubted *Engyprosopon*, and may prove to be a male of this species.

Depth of body about twice in the length, length of head 4½. A rather blunt rostral spine. Diameter of eye 3½ in length of head, about equal to interorbital width. Maxillary extending to below anterior part of eye, length about 3 in that of head. 6 or 7 gill-rakers on lower part of anterior arch. About 47 scales in lateral line. Dorsal 90. Anal 70. Pectoral of ocular side with 11 rays, upper ray prolonged, longer than head. Brownish, with indistinct darker markings.

1 (♂, 106 mm.).

Nagasaki, Japan.

Tokyo Imp. Univ.

6. ENGYPROSOPON GRANDISQUAMA (Temminck and Schlegel).

Rhombus grandisquama, Temminck and Schlegel, 1846, Faun. Japon. (Pisces), p. 183, pl. xcii, figs. 3, 4.
Rhombus paclicurus, Bleeker, 1852, Nat. Tijdschr. Ned. Ind., iii, p. 293; Bleeker, 1852, Verh. Batav. Gen., xxiv, Pleuron., p. 29.

Rhomboidichthys grandisquama (part), Gunther, 1862, Cat. Fish., iv, p. 437.

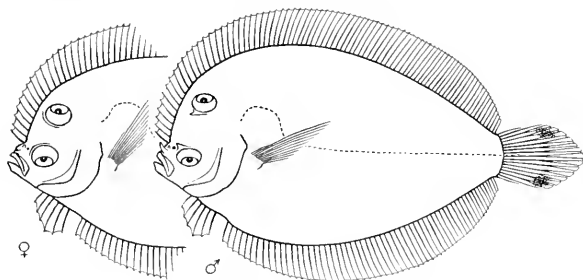


FIG. 156.—*Engyprosopon grandisquama*. B.M. (N.H.) 1925-7. 23-53, 59. · ¼.

Pseudorhombus paclicurus, Bleeker, 1865, Ned. Tijdschr. Dierk., u, p. 274.

Platophrys (Arnoglossus) paclicurus, Bleeker, 1866-72, Atl. Ichth., vi, p. 13, Pleuron., pl. v, fig. 1.

Rhomboidichthys spilurus, Gunther, 1880, Shore Fishes "Challenger", pp. 47, 53, pl. xxi fig. A.

Rhomboidichthys spinoceps, Macleay, 1882, Proc. Linn. Soc. N.S.W., vi, p. 127; Ogilby, 1887, Cat. Fish. N.S. Wales, p. 32.

Rhomboidichthys paclicurus, Regan, 1902, in Gardiner, Faun. Maldive Laccadive Arch., i, p. 277; Regan, 1905, J. Bombay Nat. Hist. Soc., xvi, p. 332.

Arnoglossus spilurus, Johnstone, 1904, Ceylon Pearl Oyster Fish., Suppl. Rep., xv, p. 211.

Scæops grandisquama, Jordan and Starks, 1904, Bull. U.S. Con. Fish., xxii, (1902), p. 627, pl. viii fig. 2; Jordan and Starks, 1906, Proc. U.S. Nat. Mus., xxxi, p. 168, fig. 1; Fowler and Bean, 1922, Proc. U.S. Nat. Mus., lxi (2), p. 67; Von Bonde, 1925, Trans. Roy. Soc. S. Afr., xii, p. 287; Barnard, 1925, Ann. S. Afr. Mus., xxi, p. 387.

Scæops paclicurus, Jordan and Starks, 1903, Proc. U.S. Nat. Mus., xxviii, p. 803; Regan, 1908, Trans. Linn. Soc. London, Zool., xii, p. 233; Weber, 1913, "Siboga"-Exped., Fische, p. 429; Fowler, 1928, Mem. B.P. Bishop Mus., x, p. 92.

Scæops pilulara, Jordan and Seale, 1906, Bull. U.S. Bur. Fish., xxv, (1905), p. 412; Fowler, 1928, Mem. B.P. Bishop Mus., x, p. 92.

Scæops orbicularis, Jordan and Seale, 1907, Bull. U.S. Bur. Fish., xxvi, (1906), p. 45; Jordan and Richardson, 1909, Mem. Carnegie Mus., iv, p. 201; Oshuna, 1927, Japan. J. Zool. Tokyo, Trans. Abstr., i (5), p. 170; Wu, 1932, Thés. Facult. Sci. Univ. Paris, A. 244 (268), p. 91.

- Rhombodichthys valderoastatus*, Jenkins, 1910, Mem. Ind. Mus., iii, p. 26.
Platiphrys grandisquama, Galefish and Thompson, 1917, Ann. Durban Mus., i, p. 400.
Platiphrys spiniceps, McCulloch, 1921, Aust. Zool., ii, p. 40.
Engyprospion (*Sticrops*) *grandisquama*, McCulloch and Whitley, 1925, Rev. Austr. Mus., xiv, p. 343, fig. 1.
Engyprospion grandisquama, Norman, 1926, Biol. Res. "Endeavour", v, p. 250; Norman, 1927, Rev. Ind. Mus., xxix, p. 25, fig. 5; McCulloch, 1929, Mem. Austr. Mus., v, p. 276.
Bathus (*Arnoglossus*) *parvulus*, Weber and Beaufort, 1929, Fish. Indo Austral. Arch., v, p. 131, fig. 31.

Depth of body $1\frac{3}{8}$ to $2\frac{1}{8}$ in the length, length of head $3\frac{3}{8}$ to $4\frac{1}{8}$. Snout shorter than eye, diameter of which is $2\frac{3}{8}$ to nearly 4 in length of head; interorbital space concave, width $\frac{3}{8}$ to $1\frac{1}{8}$ times ($\frac{5}{8}$) or $\frac{1}{2}$ to $\frac{7}{8}$ ($\frac{3}{4}$) diameter of eye; anterior edge of upper eye above middle or posterior part of lower. Rostral and orbital spines present in the male, very small or absent in the female. Maxillary extending to, nearly to, or beyond anterior edge of eye, length 3 to $3\frac{1}{2}$ in that of head. Teeth of upper jaw buccal anteriorly (at least in adults), uniserial laterally, those of lower jaw uniserial, sometimes in two rows posteriorly. 5 to 7 short gill-rakers on lower part of anterior arch. 36 to 45 scales in lateral line. Dorsal 79-89. Anal 59-68. Pectoral of ocular side with 10 to 12 rays, the upper ray sometimes a little prolonged in the male, length equal to or less than that of head. Brownish, generally with some darker spots and other markings, median fins usually with small brown spots, a pair of large blackish spots in the middle of upper and lower margins of caudal.¹

TYPE.—Leiden Museum.

DISTRIBUTION.—East Africa, through the Indian Ocean and Archipelago to Australia and Japan.

SPECIMENS EXAMINED.

1 (♀, 108 mm.)	Natal	Marley.
3 (2♂, 69, 79; 1♀, 64 mm.)	Muscet, 15-30 fms	Townsend.
5 (♂, 65-82 mm.)	Maldives	Gardner.
4 (3♂, 44-72; 1♀, 73 mm.)	"	"
8 (♂, 33-38 mm.)	Galle, Ceylon	Everett Univ.
5 (♂, 59-74 ..)	Aripu, Ceylon	"
3 (♂, 63-79 ..)	Arakan Coast, Burma.	Ind. Mus.
1 (♂, 83 mm.)	Java Sea, (3° 26' S., 107° 51' E.)	Hardenberg.
1 (♂, 108 ..)	" (5° 33' S., 106° 2' E.)	"
1 (♂, 45 ..)	Bali Strait, 58 fms.	"
1 (♂, 103 ..)	S. of New Guinea.	" Challenger."
1 (♂, 83 mm.)	Zebu.	"
3 (♀, 96; 2♂, 83, 105 mm.)	Platypus Bay, Queensland, 7-9 fms	Austr. Mus.
		("Endeavour").
2 (♀, 117; ♂, 120 mm.)	7 to 10 miles N.W. of Hummocky Is., Queensland, 14-16 fms	"
8 (2♂, 72, 80; 3♀, 86, 108 mm.)	20 miles N.N.E. from Double Point, Queensland, 29-30 fms	"
3 (1♀, 105; 2♂, 106, 127 mm.)	Northern N.S. Wales.	"
7 (3♀, 65-97; 4♂, 67-98 ..)	China.	Belcher.
2 (♀, 80; ♂, 92 mm.)	Nagasaki, Japan.	Stanford Univ.
7 (1♀, 65 mm.)	Gulf of Fonseca (??).	Richardson.

Also several from the Mekran Coast, Burma, and the Nicobar Is. (Ind. Mus.), and several from New South Wales and Queensland (Austr. Mus. "Endeavour").

This species exhibits some variation in respect to the relative positions of the eyes, width of the interorbital space, etc., and it is possible that the examination of a large series of specimens from various localities would reveal the existence of more than one species with a pair of dark spots on the caudal fin.

¹ Not shown in Jenkinson and Schlegel's figure, but they remark that "les tentes sont en grande partie effacées".

7. ENGYPROSOPON XYSTRIAS, Hubbs.

Engyprosopon xystrias, Hubbs, 1915, Proc. U.S. Nat. Mus., xlviii, p. 457, pl. xxv, fig. 3.

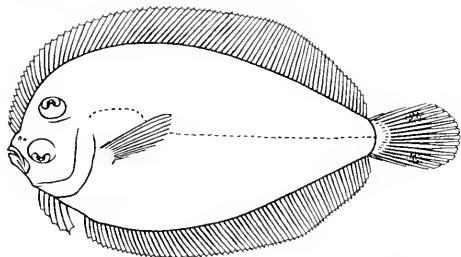


FIG. 157.—*Engyprosopon xystrias*. [After Hubbs.] 1.

Close to *E. grandisquama*, but with anterior profile of head rather more vertical than in the female of that species; anterior teeth of upper jaw protruding outside the symphysis of the lower jaw when the mouth is closed; gill-rakers short, slender, 14 on lower part of anterior arch.

TYPE.—United States National Museum. No. 75672.

DISTRIBUTION.—Vincennes Strait, Japan; in rather deep water.

Known only from the type, a female, 69 mm. in length, taken by the "Albatross" at Station 4931, in 83 fathoms.

8. ENGYPROSOPON ARENICOLA, Jordan and Evermann.

Engyprosopon arenicola, Jordan and Evermann, 1904, Bull. U.S. Com. Fish., xxii, (1902), p. 207; Jordan and Evermann, 1905, Bull. U.S. Com. Fish., xxiii (ii), (1903), p. 515, pl. lxi; Fowler, 1928, Mem. B.P. Bishop Mus., x, p. 92.

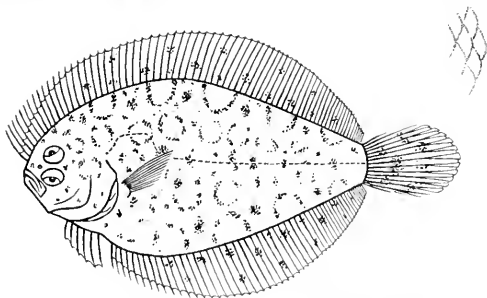


FIG. 158.—*Engyprosopon arenicola*. U.S.N.M. 50658. 14.

Depth of body nearly twice in the length, length of head more than $3\frac{1}{2}$. Snout shorter than eye, diameter of which is $4\frac{1}{4}$ in length of head, interorbital space very narrow, concave; lower eye a little in advance of upper. No rostral or orbital spines. Maxillary extending to below anterior part of eye, length 3 in head. Teeth biserial in upper jaw. Gill rakers rather short, 7 on lower part of anterior arch. 36 scales in lateral line. Dorsal 78. Anal 57. Pectoral of ocular side with 12 rays, length $1\frac{1}{2}$ in that of head. Pale brownish, with many large incomplete rings of blackish or dusky, and with a number of dusky spots in between; median fins with blackish spots, those on the caudal forming about 4 cross-bands; several dusky spots at base of pectoral.

TYPE.—United States National Museum. No. 50658.

DISTRIBUTION.—Hawaiian Islands.

Known only from the type (63 mm.) and one other specimen (50 mm.), both from Hilo. The sex of these examples is not given by Jordan and Evermann.

9. ENGYPROSOPON HAWAIIENSIS, Jordan and Evermann

Engyprosopon hawaiiensis, Jordan and Evermann, 1904, Bull. U.S. Com. Fish., xxii, (1902), p. 207; Jordan and Evermann, 1905, Bull. U.S. Com. Fish., xxiii (1), (1903), p. 514, fig. 227; Gilbert, 1905, Bull. U.S. Com. Fish., xxiii (2), (1903), p. 687; Fowler, 1922, Copeia, No. 112, p. 84; Fowler, 1928, Mem. B. P. Bishop Mus., x, p. 92.

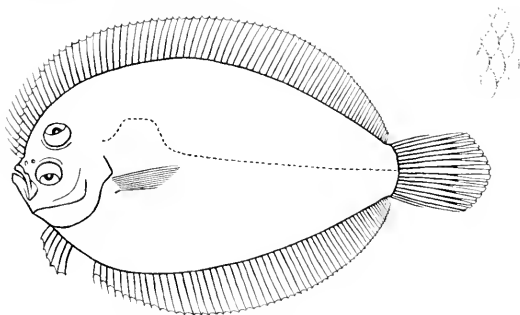


FIG. 150.—*Engyprosopon hawaiiensis*. U.S.N.M. 50657. — 14.

Depth of body $1\frac{1}{2}$ in the length, length of head $3\frac{1}{4}$. Snout a little shorter than eye, diameter of which is about $3\frac{1}{4}$ in length of head; interorbital space concave, width about $\frac{1}{2}$ diameter of eye; lower eye in advance of upper. No rostral or orbital spines. Maxillary extending to a little beyond anterior margin of eye, length $2\frac{1}{2}$ in that of head. Teeth in 2 or 3 series in upper jaw. Gill-rakers rather short, 7 on lower part of anterior arch. 36 scales in lateral line. Dorsal 70-80. Anal 50-58. Pectoral of ocular side with 11 rays, length $1\frac{1}{2}$ in that of head. Dark brown, with or without darker markings; fins greyish brown, finely speckled with darker.

TYPE.—United States National Museum. No. 50657.

DISTRIBUTION.—Hawaiian Islands.

The type is 76 mm. in total length, from Hilo. The sex is not given.

10. *ENGYPROSOPON LATIFRONS* (Regan).

Scæops latifrons, Regan, 1908, Trans. Linn. Soc. London, Zool., xii, p. 233, pl. xxv, fig. 3.

Depth of body $1\frac{1}{2}$ to twice in the length, length of head $3\frac{1}{2}$ to 4. Snout as long as or shorter than eye, diameter of which is 3 to 4 in length of head; interorbital space concave, width 1 to $1\frac{1}{2}$ times (σ) or $\frac{1}{2}$ to $\frac{3}{4}$ (\varnothing) diameter of eye; anterior edge of upper eye above middle of lower. Rostral spine present in the male, but no orbital spines. Maxillary extending to below anterior $\frac{1}{4}$ of eye, length $2\frac{3}{8}$ to $2\frac{3}{4}$ in that of head. Teeth of upper jaw biserial anteriorly (at least in adults). 6 to 8 gill-rakers of moderate length on lower part of anterior arch. About 40 scales in lateral line. Dorsal 80-90. Anal 58-67. Pectoral of ocular side with 12 rays, length $\frac{2}{3}$ that of head; upper ray scarcely prolonged in male. Pale brownish, with traces of dark spots and markings on body and median fins.

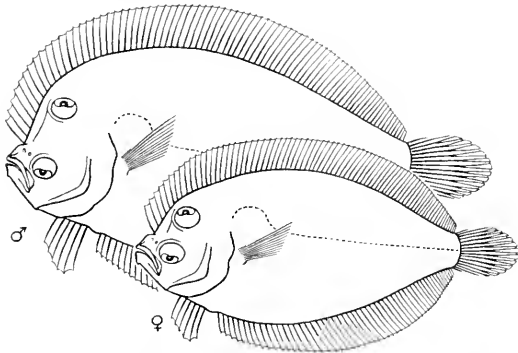


FIG. 160.—*Engyprosopon latifrons*. B.M. (N.H.) 1907.3.23.143. 144. 1.

TYPE—British Museum (Nat. Hist). Reg. No. 1907.3.27.143.

DISTRIBUTION—Indian Ocean.

SPECIMENS EXAMINED:

4 (3 ♂, 75-88; 1 ♀, 73 mm.).	Paratypes.	Seychelles, 37 fms.	Gardiner.
2 (♀, 72; ♂, 92 mm.).	Holotype (92 mm.) and paratype.	Saya de Malha Bank, 47 fms.	..
2 (♂ 64, 93 mm.).	Paratypes.	Cargados Carajos, 20-30 fms.	..
3 (♂, 71-86 ..).	..	Maldives.	..

11. *ENGYPROSOPON NATALENSIS*, Regan.

Engyprosopon natalensis, Regan, 1920, Ann. Durban Mus., ii, p. 211; Von Bonde, 1925, Trans. Roy. Soc. S. Afr., xii, p. 288.

Close to *E. latifrons*. Depth of body twice in the length, length of head $3\frac{1}{2}$. Diameter of eye $3\frac{1}{2}$ to $3\frac{3}{4}$ in length of head, twice (σ) or 3 times (\varnothing) interorbital width; anterior edge of upper eye above anterior part of lower. Rostral spine present in the

male. Maxillary extending to below anterior $\frac{1}{3}$ of eye, length $2\frac{1}{2}$ to $2\frac{2}{3}$ in that of head. 6 gill-rakers on lower part of anterior arch. 40 scales in lateral line. Dorsal 85. Anal 94. Pectoral of ocular side with 11 rays, length $\frac{1}{2}$ that of head, upper ray scarcely prolonged in male. Brown, traces of small dark spots on the fins.

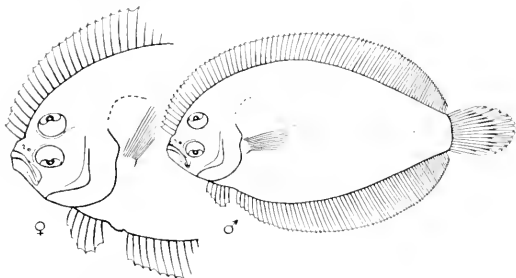


FIG. 161.—*Engyprosopon natalense*. B.M. (N.H.) 1903.9.20.3, 4. 1½

TYPE.—British Museum (Nat. Hist.). Reg. No. 1903.9.20.3

DISTRIBUTION.—Portuguese East Africa and Natal

SPECIMENS EXAMINED:

2 (♂, ♀, 4, 70 mm). Types¹.—On mouth of Amatukulu R., Natal, 26–27 fms. Gilchrist

12. *ENGYPROSOPON MACROLEPIS* (Regan)

Engyprosopon macrolepis, Regan, 1908, Trans. Linn. Soc. London, Zool., XI, p. 257, pl. xxvii, fig. 4.

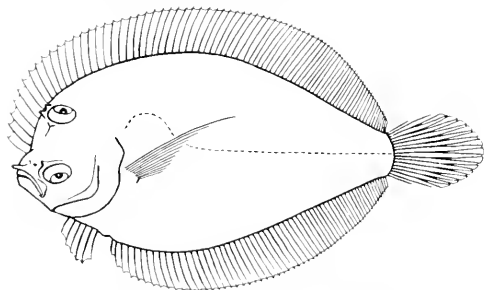


FIG. 162.—*Engyprosopon macrolepis*. B.M. (N.H.) 1908.1.1.145. 1½

¹ The larger specimen (4) is selected as the holotype.

Depth of body $1\frac{1}{2}$ in the length, length of head $3\frac{1}{2}$. Snout shorter than eye, diameter of which is $3\frac{1}{2}$ in length of head; interorbital space concave, width a little more than diameter of eye; anterior edge of upper eye above anterior part of lower. Male with a spine on the snout, one above the lower eye and two in front of the upper eye. Maxillary extending to below anterior $\frac{1}{4}$ of eye, length $2\frac{1}{2}$ in that of head. 6 to 8 gill-rakers of moderate length on lower part of anterior arch. 40 scales in lateral line. Dorsal 84. Anal 60. Pectoral of ocular side with 11 rays, upper ray slightly produced (in the male), length scarcely greater than that of head. Coloration uniform.

TYPE.—British Museum (Nat. Hist.). Reg. No. 1908.3.23.145

DISTRIBUTION.—Cargados Carajos, Indian Ocean

SPECIMEN EXAMINED:

1 (♂, 72 mm.). Holotype.

Cargados Carajos, 20–30 fms.

Gardiner.

13. ENGYPROSOPON FILIMANUS (Regan).

Scæops filimanns, Regan, 1908, Trans. Linn. Soc. London, Zool., xii, p. 234, pl. xxv, fig. 2.

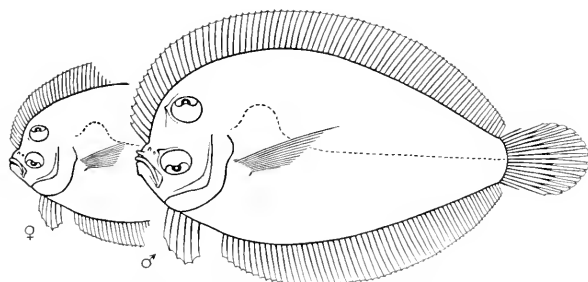


FIG. 103.—*Engyprosopon filimanus*. B.M. (N.H.) 1901.12.31.105, 106. 14.

Depth of body $1\frac{1}{2}$ to twice in the length, length of head $3\frac{1}{2}$ to $3\frac{3}{4}$. Snout shorter than eye, diameter of which is 3 in length of head; interorbital space concave, width equal to or a little less than diameter of eye. Anterior edge of upper eye above middle or anterior part of lower. Male with an antrorse spine on the snout and one or two in front of the upper eye; one or two spines above the lower eye and sometimes one or two very small ones below the upper eye. Maxillary extending to below anterior $\frac{1}{4}$ of eye, length about $2\frac{1}{2}$ in that of head. 7 gill-rakers of moderate length on lower part of anterior arch. 40 scales in lateral line. Dorsal 78–80. Anal 62. Pectoral of ocular side with 12 rays, upper ray produced and longer than head (in the male). Pale brownish, with more or less distinct darker spots and markings.

TYPE.—British Museum (Nat. Hist.). Reg. No. 1901.12.31.105.

DISTRIBUTION.—Muscat (?); Maldive Islands.

SPECIMENS EXAMINED:

? 3 (2 ♀, 63, 64; 1 ♂, 68 mm.).

Muscat, 15–30 fms.

Townsend.

3 (1 ♀, 47; 2 ♂, 52, 70 mm.). Types.¹

Maldives, 27–44 fms.

Gardiner.

¹ The largest specimen (♂) is selected as the holotype.

14. ENGYPROSOPON SECHELLENSIS (Regan)

Scorops sechellensis (Regan, 1908, Trans. Linn. Soc. London, Zool., XII, p. 234, pl. XXXVII, fig.

Depth of body $2\frac{1}{2}$ in the length, length of head $3\frac{3}{5}$. Snout shorter than eye, diameter of which is $3\frac{1}{2}$ in length of head and equal to width of concave interorbital space. anterior edge of upper eye above posterior part of lower. Male with a spine on the snout, one in front of and one above the lower eye, one in front of and one below the upper eye. Maxillary extending to below anterior $\frac{1}{4}$ of eye, length about $2\frac{3}{5}$ in that of head. Gill-rakers of moderate length on lower part of anterior arch. 40 scales in lateral line. Dorsal 82. Anal 63. Pectoral of ocular side with 12 rays, upper ray produced and longer than head (in the male). Pale brownish, dark spots or markings on body and fins.

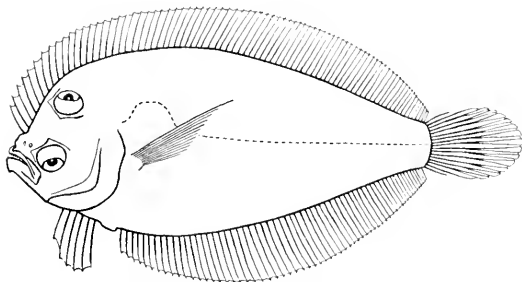


FIG. 104. — *Engyprosopon sechellensis*. B.M. (N.H.) 1908.3.23.146. 13

TYPE — British Museum (Nat. Hist.) — Reg. No. 1908.3.23.146

DISTRIBUTION — Seychelles

SPECIMENS EXAMINED

1 (♂, 72 mm.). Holotype

Seychelles, 17 fms.

Gardner

15. ENGYPROSOPON MALDIVENSIS (Regan)

Scorops maldivensis, Regan, 1908, Trans. Linn. Soc. London, Zool., XII, p. 234, pl. XXXV, fig. 1.

Depth of body about twice in the length, length of head $3\frac{3}{5}$ to 4. Snout shorter than eye, diameter of which is 3 in length of head. interorbital space concave, width nearly $\frac{1}{2}$ ($\frac{1}{5}$) or less than $\frac{2}{3}$ ($\frac{1}{2}$) diameter of eye. lower eye a little in advance of upper. Male with a spine on the snout, no other spines on head. Maxillary extending to a little beyond anterior edge of eye, length $\frac{1}{2}$ that of head. 8 or 9 gill-rakers of moderate length on lower part of anterior arch. About 40 scales in lateral line. Dorsal 70-76. Anal 53-58. Pectoral of ocular side with 10 or 11 rays, upper ray produced and $\frac{1}{2}$ times length of head ($\frac{1}{5}$), or without produced ray and as long as head ($\frac{1}{5}$). Uniformly pale brownish or with traces of darker spots and markings.

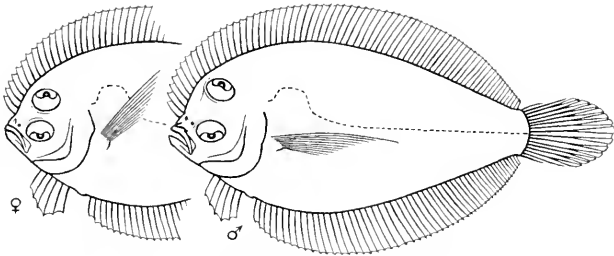


FIG. 105.—*Engyprosopon maldivensis*. B.M. (N.H.) 1901.12.31.94, 95. $\times 1\frac{1}{2}$.

TYPE.—British Museum (Nat. Hist.). Reg. No 1901.12.31.94.

DISTRIBUTION.—Maldive Islands.

SPECIMENS EXAMINED:

8 (5 ♀, 35–60; 3 ♂, 38–93 mm.). Types.¹ Maldives. Gardiner.

Genus 26. CROSSORHOMBUS.

Crossorhombus, Regan, 1920, Ann. Durban Mus., II, p. 211 [*Platophrys dimorphus*, Gilchrist].

Close to *Engyprosopon*, but mouth smaller, the length of the maxillary $3\frac{3}{4}$ to nearly 4 in that of head; teeth uniserial in both jaws. Upper angle of gill-opening a short distance above pectoral fin; scaling of head and body continuous below lateral line; gill-rakers short, few in number. Scales of moderate size, strongly ctenoid² on ocular side, feebly ctenoid or cycloid on blind side.

Two species from the Indo-Pacific.

SYNOPSIS OF THE SPECIES.

- I. Interorbital width $1\frac{1}{2}$ to $1\frac{3}{4}$ times (♂) or $\frac{3}{2}$ to $1\frac{1}{2}$ times (♀) eye; upper pectoral ray prolonged in male 1. *valde-rostratus*.
- II. Interorbital width $\frac{3}{2}$ to $1\frac{1}{2}$ times (♂) or $\frac{1}{2}$ to $\frac{3}{4}$ (♀) eye; upper pectoral ray not prolonged in male 2. *acutus*.

1. CROSSORHOMBUS VALDE-ROSTRATUS (Alcock).

Rhomboidichthys valde-rostratus, Alcock, 1890, Ann. Mag. Nat. Hist., (6) VI, p. 435; Alcock, 1898, Illust. Zool. "Investigator", Fishes, pl. xxiv, fig. 2.

Platophrys dimorphus, Gilchrist, 1905, Mar. Invest. S. Afr., III, p. 10, pl. xxvii; Gilchrist and Thompson, 1917, Ann. Durban Mus., I, p. 400.

Neaops kobensis, Jordan and Starks, 1906, Proc. U.S. Nat. Mus., xxxi, p. 170, fig. 2; Franz, 1910, Abh. Bayer. Akad. Wiss., Suppl. IV, Abh. I, p. 61, pl. VII, fig. 55, pl. VIII, fig. 61; Jordan and Thompson, 1914, Mem. Carnegie Mus., VI, p. 308, ng. 80.

¹ A male of 63 mm. is selected as the holotype.

² The long and delicate spinules of the scales tend to wear off with repeated handling of specimens, so that in fish which have been preserved for some time the scales may appear to be feebly ctenoid or even cycloid. Closer examination, however, generally reveals the presence of a few scales with the spinules still intact. Scales of this nature also occur in the genus *Psettina*.

Platyphylax grandisquama (part), Gilchrist, 1908, Mar. Invest. S. Afr., iv, p. 161.

Eugyprosporon kobensis, Hubbs, 1915, Proc. U.S. Nat. Mus., xlviii, p. 458.

Crossorhombus dimorphus, Regan, 1920, Ann. Durban Mus., ii, p. 212; Barnard, 1925, Ann. S. Afr. Mus., xvi, p. 386; Von Bonde, 1928, Trans. Roy. Soc. S. Afr., xii, p. 287.

Crossorhombus calde rostratus, Norman, 1927, Rep. Ind. Mus., xxix, p. 28, fig. 6.

Depth of body $1\frac{1}{2}$ to twice in the length, length of head $3\frac{2}{3}$ to a little more than 4. Snout shorter than eye, diameter of which is $3\frac{1}{4}$ to $3\frac{2}{3}$ in length of head; each eye with a broad membranous flap in the male; interorbital width $1\frac{1}{2}$ to $1\frac{2}{3}$ times ($\frac{5}{3}$) or $\frac{7}{4}$ to $1\frac{1}{4}$ times ($\frac{5}{2}$) diameter of eye; anterior edge of upper eye above middle or posterior part of lower. Male with a strong spine on the snout and some smaller spines on orbital margins. Maxillary extending to below anterior edge of eye, length $3\frac{1}{4}$ to nearly 4 in that of head. 5 to 7 gill-rakers on lower part of anterior arch. 48 to 61 scales in lateral line. Dorsal 70-80. Anal (61) 63-74. Pectoral of ocular side with 10 or 11 rays, the upper ray prolonged and filamentous in the mature male;

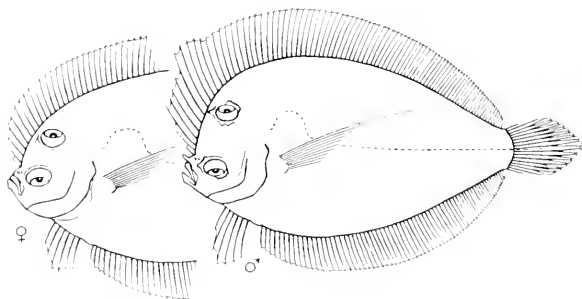


FIG. 196. *Crossorhombus calde rostratus*. B.M. (NH) 1907.12.11.7.8. ♂

length $1\frac{1}{4}$ to $1\frac{1}{2}$ times ($\frac{5}{3}$) or $\frac{7}{4}$ to $\frac{5}{2}$ (.) that of head. Greyish brown, with darker spots and blotches, of which a row near upper and lower edges of body and 2 or 3 larger ones on lateral line are usually most prominent; male sometimes with small dark or bluish spots on head in front of interorbital space; median fins spotted with darker; hinder part of caudal with a broad blackish band.

TYPE.—Indian Museum, No 12010.

DISTRIBUTION.—East Africa, Ceylon, China and Japan.

SPECIMENS EXAMINED:

2 ♀, 107-12, 120 mm.	Co-types of <i>Plato</i>	2½ miles from mouth of	Gilchrist
	<i>phylax dimorphus</i>	Umblanga R., Natal,	22-26 fms.
1 ♀, 106 mm.		N. China.	Jamrach
1 ♀, 101-105 mm.		Japan.	"

Also the holotype of the species ($\frac{5}{3}$, 95 mm), from the coast of Ceylon, 32 fathoms (Ind. Mus. "Investigator"), and 2 (., 84, 125 mm) from Hong Kong (Mus. Comp. Zool.).

Barnard (1925) regards *Eugyprosporon natalensis*, Regan, as synonymous with this species, and states that the original bottle of specimens identified by Gilchrist as *Platyphylax grandisquama* (from which Regan's types are said to have been taken) is in

the South African Museum. He finds that the nine examples in this bottle, measuring up to 70 mm., are exactly similar to young specimens of *C. dimorphus*. It must be concluded, therefore, that specimens of two distinct species were originally included in Gilchrist's series of so-called *Platophys grandisquama*. The two examples sent to the British Museum undoubtedly belong to the genus *Engyproson*, the scales being feebly ctenoid and the length of the maxillary $2\frac{3}{4}$ to $2\frac{2}{3}$ in that of head.

I have identified *Scaeops kobensis* with this species with some doubt, and it may prove to be the same as *Crossorhombus azureus*. Unfortunately, the four examples of *kobensis* in the British Museum are all females. Franz (1910), however, has given an excellent figure of the male, showing the upper pectoral ray filamentous and longer than the head.

2. CROSSORHOMBUS AZUREUS (Alcock).

Rhomboidichthys azureus, Alcock, 1889, J. Asiat. Soc. Beng., lviii (2), p. 283, pl. xvi, fig. 3; Alcock, 1890, Ann. Mag. Nat. Hist., (6) vi, p. 435; Alcock, 1898, Illust. Zool. "Investigator", Fishes, pl. xxiv, fig. 3; Johnstone, 1904, Ceylon Pearl Oyster Fish., Suppl. Rep., xv, p. 210; Jenkins, 1910, Mem. Ind. Mus., iii, p. 27.

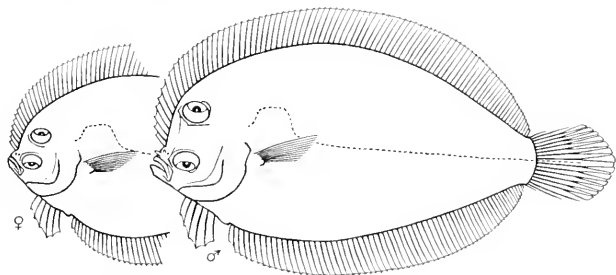


FIG. 107.—*Crossorhombus azureus*. B.M. (N.H.) 1927.1.6.41, 42. . 1.

Platophys microstoma, Weber, 1913, "Siboga"-Exped., Fische, p. 427, pl. vii, fig. 3.
Crossorhombus azureus, Norman, 1927, Rec. Ind. Mus., xxix, p. 30; Wu, 1932, Thés. Facult. Sci. Univ. Paris, A. 244 (268), p. 93.
Bothus (Arnoglossus) microstoma, Weber and Beaufort, 1929, Fish. Indo- Austral. Arch., v, p. 126.
Bothus microstoma, Chabanaud, 1929, Bull. Mus. Hist. nat. Paris, (2) i, p. 379.
Crossorhombus azureus (part), Norman, 1931, Ann. Mag. Nat. Hist., (10) viii, p. 000.

Very close to the preceding species. Depth of body nearly twice in the length, length of head $3\frac{1}{2}$ to 4. Diameter of eye $3\frac{1}{4}$ to $3\frac{2}{3}$ in length of head; membranous flap in male much smaller; interorbital width $\frac{2}{3}$ to $1\frac{1}{4}$ times ($\frac{5}{3}$) or $\frac{1}{2}$ to $\frac{1}{3}$ ($\frac{2}{3}$) diameter of eye; anterior edge of upper eye above middle or anterior part of lower. Maxillary extending to below anterior edge of eye or a little beyond, length $3\frac{2}{3}$ to $3\frac{1}{2}$ in that of head. 5 or 6 gill-rakers on lower part of anterior arch. 52 to 57 scales in lateral line. Dorsal 84-90. Anal 64-73. Pectoral of ocular side with 11 or 12 rays, the upper ray not prolonged in the male; length $\frac{2}{3}$ to $\frac{3}{4}$ that of head. Greyish or brownish, variously spotted and blotched with paler and darker; generally one, two or more dark blotches on lateral line; male sometimes with two or more series of dark spots blue in life) on head in front of interorbital space; median fins with dark brown or

blackish spots and blotches, caudal often with a broad blackish band across its hinder part and a similar but less distinct band at its base

TYPE.—Indian Museum, No. 12184

DISTRIBUTION.—South-eastern India and Ceylon, Indo-China, Aru Islands, China.

SPECIMENS EXAMINED:

1 ♂, 84 mm.)	Paratype	Orissa Coast, 7-13 fms.	Ind. Mus.
			" (Investigator?).
1 ♂, 104 mm.)		Ganjam Coast, 30-33 fms.	"
1 (2 ♂, 72, 76; 2 ♀, 66, 70 mm.)		Off S. coast of Ceylon, 32 fms.	"
2 (♂, 57, 68 mm.)		Galle, Ceylon.	Liverpool Univ.
1 (♂, 112 mm.)		Ponlo Condor Is., French Indo-China.	Chabanaud.

Also several from Ceylon, India, Burma and the Nicobar Islands, including the holotype (♂) of the species (Ind. Mus.).

Genus 27. BOTHUS.

Bothus, Rafinesque, 1810, Car. n. gen., p. 23 [*Bothus rhombus*, Rafinesque, Bonaparte, 1813, Icon Faun. Ital., fasc. 18, (24); Bonaparte, 1816, Cat. method. Pesci Europ., p. 49, Kvie, 1913, Rep. Danish Ocean. Exped. 1908-1910, II, A, 1, p. 91]

solus (non Quensel, 1866), Rafinesque, 1810, Ind. Itt. Sicil., pp. 14, 52 [*Solea rhomboides*, Rafinesque]; *Platophrys*, Swainson, 1839, N. H. Fishes, ed. 2, II, pp. 187, 302 [*Rhombus ocellatus*, Agassiz]; Jordan and Evermann, 1898, Bull. U. S. Nat. Mus., XLVI (3), p. 2600

Peloria, Cocco, 1844, in Krohn, Gabin. Messina, Ann. III, v (XXV), p. 23¹ [*Peloria heckelii*, Cocco]

Coccolus, [Cocco, 1844, *loc. cit.*, p. 21], Bonaparte, 1816, Cat. method. Pesci Europ., p. 47 [*Coccolus amnetens*, (Cocco) Bonaparte]

Rhomboidichthys, Bleeker, 1856, Act. Soc. Sci. Indo-Neerl., 1, Manado etc., p. 67 [*Rhomboidichthys myriaster*, Bleeker]

² *Catharichthys* (non Bleeker, 1862), Day, 1877, Fish. India, p. 422.

Psettylis, Alcock, 1896, Ann. Mag. Nat. Hist., (6) VI, p. 436 [*Psettylis pellucida*, Alcock], Johnstone, 1904, Ceylon Pearl Oyster Fish., Suppl. Rep., xv, p. 297.

³ *Pseudotharichthys*, Weber, 1913, "Siboga" Exped., Fische, p. 413 [*Catharichthys aureus*, Day]

Platoidichthys, Nichols, 1921, Bull. Amer. Mus. Nat. Hist., XLV, p. 21 [*Platoidichthys chartes*, Nichols]

Symboidichthys, Chabanaud, 1927, Bull. Soc. zool. Fr., III, p. 76 [*Platophrys maculifer*, Jordan and Cross]

Body ovate or rather deep, strongly compressed. Eyes on the left side, separated by a flat or concave space of varying width, sometimes broader in the male; lower eye well in advance of upper. Male generally with spines on the snout and sometimes on the orbital margins. Olfactory laminae rather feebly developed, few in number, slightly radiating or sometimes nearly parallel to one another and to the axis of the body, without central radius. Mouth of moderate size or rather small, the length of the maxillary 2 $\frac{1}{2}$ to 4 in that of head; jaws and dentition about equally developed on both sides or stronger on hind side; teeth small, pointed, without distinct canines, in two or more series in both jaws, at least anteriorly (except in young),² vomer toothless. Upper angle of gill-opening a short distance above pectoral fin, the membrane joining the operculum to the pectoral arch scaleless; gill-rakers few in number, short or of moderate length; lower pharyngeals very narrow, each with an inner row of rather strong pointed teeth, and generally one or two outer rows of smaller teeth. Dorsal fin commencing above or just in advance of nostrils of hind side and well in front of eye; all the rays simple, scaled (at least on ocular side). Tip of first inter-haemal spine not projecting in front of anal fin. Pectoral fins unequal, that of ocular side larger; all the rays simple; upper rays sometimes prolonged. Tip of pelvis

¹ *Teste* Lacépède, 1885.

² Sometimes only a single row in *B. mancus*.

bone projecting downwards and backwards between the pelvic fins, sometimes blunt and inconspicuous externally. Scales small, ctenoid or cycloid on ocular side, cycloid on blind side; no supplementary scales. Lateral line developed only on ocular side of body, with a distinct curve above the pectoral fin; a bifurcated supratemporal branch behind upper eye. Vent on blind side, above or a little in front of anterior ray of anal fin. Vertebrae 38 to 40.

About fourteen species from the Mediterranean and from the warmer parts of the Atlantic and Indo-Pacific.

SYNOPSIS OF THE SPECIES.

Mediterranean and Atlantic Species.

- I. Less than 80 scales in lateral line; eye $3\frac{1}{4}$ to nearly 4 in head; dorsal 79-91, anal 59-68; depth $1\frac{1}{2}$ to $1\frac{3}{4}$ in length 1. *ocellatus*.
- II. More than 80 scales in lateral line.
 - A. Eye $3\frac{1}{2}$ to $4\frac{2}{3}$, maxillary $3\frac{1}{4}$ to 4 in head; interorbital width much greater in male; upper pectoral rays not prolonged.
 1. Depth $1\frac{3}{4}$ to $1\frac{1}{4}$ in length; eye $3\frac{1}{2}$ to 4 in head; interorbital width $1\frac{3}{4}$ to nearly $2\frac{1}{2}$ times (mature ♂), or $\frac{3}{4}$ to a little more than once (mature and half-grown ♀) eye 2. *podas*.
 2. Depth $1\frac{1}{2}$ to nearly $1\frac{3}{4}$ in length; eye 4 to $4\frac{2}{3}$ in head; interorbital width $1\frac{3}{4}$ to $2\frac{1}{4}$ times (mature ♂), or $1\frac{1}{4}$ to $1\frac{3}{4}$ times (mature ♀) eye 3. *mellissi*.
 - B. Eye $4\frac{2}{3}$ to 6, maxillary $2\frac{1}{2}$ to 3 in head; interorbital width similar in both sexes or a little greater in male; upper pectoral rays prolonged in mature male.
 1. Dorsal 90-99, anal 70-76.
 - a. Anterior profile notched in front of eyes (except in very young), never convex; eye 5 to 6 in head; anterior edge of upper eye above posterior edge of lower. 8 to 10 gill-rakers on lower part of anterior arch 4. *lanatus*.
 - b. Anterior profile of head distinctly convex, not notched in front of eyes; eye $4\frac{2}{3}$ to 5 in head; anterior edge of upper eye above middle or posterior $\frac{1}{2}$ of lower; 6 or 7 gill-rakers on lower part of anterior arch 5. *maculiferus*.
 2. Dorsal 105, anal 80; anterior profile of head convex 6. *ellipticus*.

Indo-Pacific Species.

- I. Dorsal 98-103, anal 76-80; 9 to 11 rather slender gill-rakers on lower part of anterior arch; eye $4\frac{2}{3}$ to $6\frac{1}{4}$ in head; anterior edge of upper eye above or behind posterior edge of lower 7. *maucus*.
- II. Dorsal 85-99, anal 62-73; 6 to 8 short gill-rakers on lower part of anterior arch; eye 3 to nearly 5 in head; anterior edge of upper eye above or in front of posterior edge of lower.
 - A. Scales all ctenoid on ocular side; interorbital width usually not much greater than eye (even in male); 75 to 92 scales in lateral line.
 1. Maxillary $3\frac{1}{2}$ to nearly 4 in head; anterior profile of head more or less notched in front of eyes; male without orbital spines; 75 to 80 scales in lateral line.
 - a. Depth $1\frac{3}{4}$ in length; anterior profile of head distinctly notched; eye about equal to interorbital width; pectoral with 10 rays 8. *leopardinus*.
 - b. Depth $1\frac{1}{2}$ to $1\frac{3}{4}$ in length; anterior profile slightly notched; eye $1\frac{1}{4}$ to $1\frac{1}{2}$ in interorbital width; pectoral with 12 rays 9. *constellatus*.
 2. Maxillary about 3 in head; anterior profile of head more or less evenly convex; male with orbital spines; 80 to 92 scales in lateral line 10. *panthernus*.

- 13 Scales mostly cycloid on ocular side, sometimes ctenoid at edges of body; interorbital width (in adults) much greater than eye
- 14 Scales ctenoid at edges of body on ocular side, 95 to 104 scales in lateral line; eye 3 to 3½ in head
- a Maxillary 3¼ to 3½ in head, depth 1½ to 1¾, head 3½ to nearly 4 in length 11 *bleekeri*
- b Maxillary 3½ to 3¾ in head
- a Depth 1¾ to 1½, head 4¼ to 4½ in length 12 *myriaster*
- 3 Depth 1½, head 3½ to 3¾ in length 13 *oculis*
- 2 Scales all cycloid on ocular side, 80 in lateral line; eye 4 in head 14 *assimilis*

The following species from Japan has been described in Japanese, but the diagnosis is very brief and it is impossible to place it with certainty:

Platophrys kremsis, Tanaka, 1918, Dobuts. Zasshi ("Zool. Mag."), xxx, p. 225

1 BOTHIUS OCELLATUS (Agassiz)

Rhinobus ocellatus, Agassiz, 1841, in Spry, Pisc. Brasil, p. 85, pl. xlvi

Platophrys ocellatus, Swainson, 1839, N.H. Fishes, (10), ii, p. 392; Jordan and Goss, 1889, Rep. U.S. Com. Fish., xiv, (1889), p. 266; Lonnberg, 1895, Overs. Vet. Akad. Forh., lii, p. 661; Jordan and Evermann, 1898, Bull. U.S. Nat. Mus., xlvii (1), p. 2663, pl. cccxxxii, fig. 939; Evermann and Marsh, 1902, Bull. U.S. Com. Fish., xx, (1900), p. 321, fig. 105; Nichols and Breder, 1927, Zoologica, ix, p. 182, fig. 1; Meek and Hildebrand, 1928, Field Mus. Pub. Chicago, Zool. Ser., xv, No. 249, p. 979.

Rhinobus bahianus, Castelnau, 1855, Ann. Nouv. Rares Amer. Sud., ii, p. 78, pl. xli, fig. 1.

Rhinobidichthys ocellatus, Günther, 1862, Cat. Fish. iv, p. 137; Poey, 1868, Repert. Fis. Nat. Cuba, ii, p. 408; Metzelaar, 1919, Trop. Atlant. Vissch., p. 129, fig. 39.

Rhinobidichthys spinosus, Poey, 1868, *tom. cit.*, p. 409; Poey, 1875, Anál. Soc. Españ. Hist. Nat., v, p. 181.

Platophrys nebularis, Jordan and Gilbert, 1885, Proc. U.S. Nat. Mus., vii, (1884), pp. 31, 147; Goode and Bean, 1895, Ocean. Ichth., p. 441.

Platophrys spinosus, Jordan and Goss, 1889, Rep. U.S. Com. Fish., xiv, (1886), p. 266; Jordan and Evermann, 1898, Bull. U.S. Nat. Mus., xlvii (3), p. 2662.

? *Bothus atlanticus*, Kyle, 1913, Rep. Danish Ocean. Exped. 1908-1910, ii, A, 1, p. 193.

Bothus ocellatus, Regan, 1919, Rep. Brit. Antarct. ("Terra Nova") Exped., 1919, Zool., i, 4, p. 147.

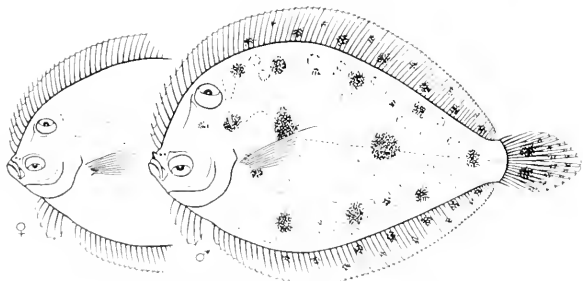


FIG. 135. *Bothus ocellatus*. (B.M. N.H. 11431, 12, 5, 69, 81.)

Depth of body $1\frac{1}{2}$ to $1\frac{2}{3}$ in the length, length of head $3\frac{1}{4}$ to 4. Upper profile of head straight or a little concave in front of eyes. Diameter of eye $3\frac{1}{4}$ to nearly 4 in length of head; interorbital width $1\frac{1}{4}$ to $1\frac{3}{4}$ times ($\frac{3}{5}$) or $\frac{1}{2}$ to a little more than once ($\frac{2}{3}$) diameter of eye; anterior edge of upper eye above posterior edge ($\frac{3}{5}$) or hinder part ($\frac{2}{3}$) of lower. Male with a spine on the snout, and generally one or two in front of each eye. Maxillary extending to below anterior edge of eye or a little beyond, length $3\frac{1}{4}$ to 4 in head. 8 or 9 short gill-rakers on lower part of anterior arch. Scales ctenoid on ocular side, cycloid on blind side; 75 to 78 in lateral line. Dorsal 79-91. Anal 59-68. Pectoral of ocular side with 10 rays, upper ray or rays somewhat prolonged in the male. Caudal pointed. Pale brownish or greyish, covered with small round spots of darker grey, and with irregular pale rings, narrowly edged with darker, enclosing areas of the ground-colour; median fins similarly coloured, and with a series of small dark spots; body with some darker spots, and with a diffuse blotch at junction of straight and curved parts of lateral line and another better defined on middle of its straight portion; pectoral fin with or without small dark spots.

TYPE.—Not traced.

DISTRIBUTION.—Atlantic coast of America, from Long Island to Rio de Janeiro.¹

SPECIMENS EXAMINED:

1 (115 mm.).	Bermudas.	Jones.
2 (32, 68 mm.).	Key West, Florida.	Jordan.
1 (57 mm.).	"	"
5 (115-152 mm.).	Dry Tortugas, Florida.	Amer. Mus. Nat. Hist.
3 (40-51 mm.).	St. Eustatius, W. Indies.	Longley.
1 (38 mm.). Post-larva.	Montserrat, Leeward Is.	Leiden Mus.
2 (75, 85 mm.).	Panama.	Mansell.
3 (85-130 ..).	Tetron Bay, Trinidad.	Stanford Univ.
1 (25 mm.). Post-larva.	5° S., 27° 15' W., 1 fm.	Totton.
2 (104, 117 mm.).	Bahia.	" Terra Nova."
9 (60-95 mm.).	Rio de Janeiro.	Wucherer.
		Ternetz.

Also 100 from the West Indies (Leiden Mus.), and one from Newport (Mus. Comp. Zool.).

It is possible that more than one species has been confused here, but, without further specimens of all ages and of both sexes, it is impossible to settle this point. Examples from the Bermudas, Florida and Panama (*nebularis*) have a somewhat deeper body and a smaller eye than the remainder, but otherwise appear exactly similar.

The types of Poey's *Rhomboidichthys spinosus* are believed to be represented by two specimens, 4½ inches in length, in the Museum of Comparative Zoology (No. 11345). These, which have been partly dried in the sun before being put into spirit, have been examined by Col. Tenison, who regards them as identical with the examples of *B. ocellatus* described above.

Examples of this species, 48 to 60 mm. in total length, have ripe ovaries, and it is doubtful whether it ever exceeds 160 mm.

2. BOTHUS PODAS (Delaroche).

Pleuronectes podas, Delaroche, 1809, Ann. Mus. H. N. (Paris), xiii (77), p. 354.

Pleuronectes argus, Risso, 1810, Ichth. Nice, p. 317.

Pleuronectes mancus (non Broussonet), Risso, 1810, Ichth. Nice, p. 317.

Bothus rumulo, Rafinesque, 1810, Car. n. gen., p. 23.

Solea rhomboide, Rafinesque, 1810, Ind. itt. Sicil., pp. 14, 52.

Bothus diaphanus, Rafinesque, 1814, Précis Son., p. 17.

¹ Judging from the number of rays in the dorsal and anal fins, the larvæ and post-larvæ described by Kyle as *B. atlanticus* probably belong to this species. If this is so, the larval forms extend into the Atlantic as far as about 35° W.

- Rhombus candidissimus*, Risso, 1820, Journ. de Physique, xoi, p. 247; Risso, 1826, H. N. Europe, III, p. 253.
- Rhombus marcus*, Risso, 1826, H. N. Europe, III, p. 253.
- Rhombus gomori*, Risso, 1826, *loc. cit.*, p. 254.
- Rhombus heterophthalmus*, Bennett, 1831, Proc. Conn. Sci. Zool. Soc., (12), p. 147.
- Rhombus heterophthalmus*, Bonaparte, 1833, Icon. Faun. Ital., fasc. iv, (23), fig. 1; Costa, 1847, Faun. R. Napoli, II, fasc. 55-8, p. 19; Canestrini, 1862, Arch. Zool. Anat. Fisiol. Genova, I, p. 24, pl. II, fig. 2.
- Rhombus podas*, Bonaparte, 1833, Icon. Faun. Ital., fasc. iv, (24), fig. 1; Costa, 1847, Faun. R. Napoli, II, fasc. 55-8, p. 22, pl. XIII; Canestrini, 1862, Arch. Zool. Anat. Fisiol. Genova, I, p. 24, pl. II, fig. 3.
- Rhombus maderensis*, Lowe, 1834, Proc. Zool. Soc. (1) (12), p. 143; Lowe, 1838, Trans. Cambridge Phil. Soc., VI, p. 204, pl. VI.
- Rhombus serratus*, Valenciennes, 1843, in Webb and Berthelot, Iles Canar., Ichth., p. 82, pl. XVIII, fig. 1.
- Peloria hackelli*, Corco, 1844, in Krohn, Giorn. Gabin. Messina, Ann. III, V (XXV), p. 21 (teste Faccola, 1885).
- Coccolus annectens*, (Corco, 1844, *loc. cit.*, p. 21) Bonaparte, 1846, Cat. metod. Pesci Europ., p. 47.
- Bothus podas*, Bonaparte, 1846, *loc. cit.*, p. 49; Steindachner, 1868, Sitzber. Akad. Wiss. Wien, LVII (1), p. 717; Moreau, 1881, Hist. Nat. Poiss. France, III, p. 349; Kyle, 1913, Rep. Danish Ocean. Exped. 1908-1910, II, A, I, p. 100, figs.; Ehrenbaum, 1911, Fischerb. v. p. 362, figs.; Buen, 1929, Cat. Ichth. Medit. Españ. Marruecos, p. 96; Norman, 1939, "Discovery" Reports, II, p. 392.
- Euthys rhomboides*, Bonaparte, 1846, *loc. cit.*, p. 49; Moreau, 1881, *loc. cit.*, p. 344, fig. 190.
- Rhomboidichthys podas*, Günther, 1862, Cat. Fish., IV, p. 432; Vinciguerra, 1883, Ann. Mus. Stor. nat. Genova, XVIII, p. 570; Emery, 1888, Mitt. zool. Stat. Neapel, VI, p. 161; Carus, 1889-91, Prodr. Faun. Medit., II, p. 589; Vinciguerra, 1893, Atti Soc. Ital. Milano, XXXIV, p. 328; Monod, 1927, Faune Colon. Franç., I, p. 721.
- Rhomboidichthys marcus*, Günther, 1862, Cat. Fish., IV, p. 432; Emery, 1888, Mitt. zool. Stat. Neapel, VI, p. 161; Pellegrin, 1914, Ann. Inst. océanogr. Paris, VI (4), p. 74; Chabanaud and Monod, 1927, Bull. Com. Etud. Hist. Sci. Afriq. Occ. Fr., (1929), p. 280.
- Rhombus diaphanus*, Richard, 1881, Zool. Anz., IV, p. 502.
- Platichthys podas*, Jordan and Goss, 1889, Rep. U.S. Cont. Fish., XIV, (1886), p. 265; Collett, 1896, Res. Camp. Sci. Monaco, X, p. 100; Pietschmann, 1909, Ann. naturh. Mus. Wien, XXI, p. 141; Chabanaud, 1930, Rivista Sci., Suppl. Mem., II, p. 26; Chabanaud, 1933, Mem. Soc. sci. nat. Maroc, XXXV, pp. 59, 104, figs.
- Platichthys marcus*, Lampe, 1914, Deutsche Südpol. Exped., XV (Zool. VI), p. 247; Chabanaud, 1933, *loc. cit.*, p. 57.
- Pleuronectes cuspidatus*, Machado, Catal., p. 23 (teste Steindachner.)

EGGS, LARVA AND YOUNG.

- Emery, 1883, Mitt. zool. Stat. Neapel, IV, p. 405, pl. xxviii, figs. 4-6; Lage, 1910, Ann. Inst. océanogr. Paris, I (7), p. 34; Kyle, 1913, Rep. Danish Ocean. Exped. 1908-1910, II, A, I, p. 106, figs. 12-15; Pietschmann, 1914, Sitzber. Akad. Wiss. Wien, cxxiii (1), p. 401, pl. vi, figs. 1, 2.

Depth of body $1\frac{3}{4}$ (occasionally $1\frac{1}{2}$) to $1\frac{3}{4}$ in the length, length of head $3\frac{1}{2}$ to 4. Anterior profile of head nearly vertical ($\frac{5}{8}$), a slight notch above and in front of lower eye ($\frac{5}{8}$ and $\frac{1}{4}$). Diameter of eye $3\frac{1}{2}$ to 4 in length of head, interorbital width $1\frac{1}{2}$ to nearly 2½ times (mature $\frac{5}{8}$) or $\frac{1}{2}$ to a little more than once (mature and half-grown $\frac{1}{4}$) diameter of eye, anterior edge of upper eye above hinder edge or posterior part ($\frac{5}{8}$) or about above middle ($\frac{1}{2}$) of lower $\frac{1}{4}$. Male with a spine on the snout and one in front of lower eye, sometimes another in front of upper eye. Maxillary extending to below anterior edge or anterior part of eye, length $3\frac{1}{4}$ to $3\frac{3}{4}$ in that of head. 7 to 9 short gill-rakers on lower part of anterior arch. Scales (tenoid on ocular side, cycloid on blind side): 82-91 in lateral line. Width of curve of lateral line 5 to 6 times in straight part. Dorsal (85) 87-94. Anal (93) 65-73. Pectoral of ocular side with 10 or 11 rays,

¹ Chabanaud (1933) has recently described an example with the eyes wide apart which proved to be a female. He regards this as a case of sexual inversion.

none of the rays prolonged. Caudal pointed. Vertebrae 10 = 28 = 30. Greyish, brownish or blackish, usually covered with greyish or bluish spots and ocelli (made up of similar spots narrowly edged with darker); sometimes nearly uniformly brown¹; generally a diffuse dark blotch at junction of straight and curved parts of lateral line, and another, more distinct, on middle of straight portion; coloration of median fins similar to that of body; pectoral generally with small brown spots.

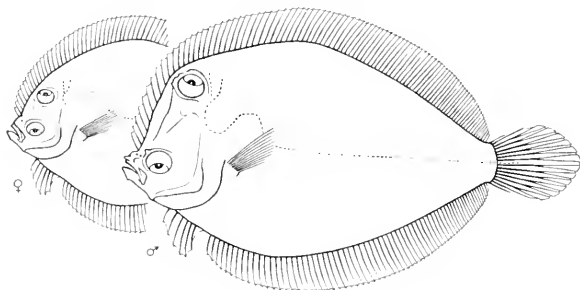


FIG. 169.—*Bothus podas*. ♂ B.M. (N.H.) 61.5.19.42; ♀ B.M. (N.H.) 79.5.14.55. × $\frac{1}{2}$.

TYPE.—Not traced.

DISTRIBUTION.—Mediterranean and adjacent parts of Atlantic, westwards to the Azores and southwards to Angola.

SPECIMENS EXAMINED :

3 (90-98 mm.)	Mediterranean.	Sprott.
1 (135 mm.)	"	Frank.
1 (100 ")	Askalon.	Aharoni.
1 (125 ")	Cyprus.	Carmichael.
1 (90 ")	Sicily.	Swanson.
1 (87 ")	"	"
1 (35 ")	Messina.	Milan Mus.
1 (144 ")	Cannes.	Gunther.
2 (130, 132 mm.)	Nice.	Deakin.
1 (127 mm.)	Lazarote.	Lowe.
2 (200, 207 mm.)	Madeira.	Baring and Grant.
3 (152-170 ")	"	Johnson.
3 (133-195 ")	"	Powell.
1 (200 mm.)	"	Zool. Soc.
1 (128 ")	St. Vincent, C. Verde Is.	" Challenger."
1 (38 ")	C. Verde Is., 4-6 fms.	" Discovery."
5 (55-72 mm.)	Elephant Bay, Angola, 2 $\frac{1}{2}$ -0 fms.	"

Also one from the Azores (Mus. Comp. Zool.).

This species appears to grow to a larger size in the Atlantic than in the Mediterranean, but I am unable to detect any other differences between specimens from the two regions.

¹ According to Kyle, in young specimens, or when the fish is out of condition or has been rubbed.

3. *BOTHUS MELLISSI*, Norman

Rhomboidichthys sp., Melliss, 1875, St. Helena, p. 109.

Platophrys podas (non Delarochet), Cunningham, 1910, Proc. Zool. Soc., p. 113.

Bothus mellissi, Norman, 1931, Ann. Mag. Nat. Hist., (10), viii, p. 509.

Close to *B. podas*. Depth of body $1\frac{1}{2}$ to nearly $1\frac{2}{3}$ in the length, length of head $3\frac{1}{2}$ to $4\frac{1}{8}$. Upper profile of head steeply sloping in front of eyes in the male, but less vertical than in *B. podas*. Diameter of eye 4 to $4\frac{2}{5}$ in length of head, interorbital width $1\frac{1}{4}$ to $2\frac{1}{4}$ times (mature ♀) or $1\frac{1}{4}$ to $1\frac{3}{5}$ times (mature ♂) diameter of eye; anterior edge of upper eye above posterior edge or hinder part of lower. Maxillary extending to below anterior edge or anterior part of eye, length $3\frac{1}{4}$ to 4 in head. 9 or 10 gill-rakers on lower part of anterior arch. 86 to 90 scales in lateral line. Width of curve of lateral line $4\frac{1}{2}$ to $5\frac{1}{4}$ times in straight part. Dorsal 62-68. Anal 70-75. Pectoral of ocular side with 11 or 12 rays. Vertebrae 10 + 30.

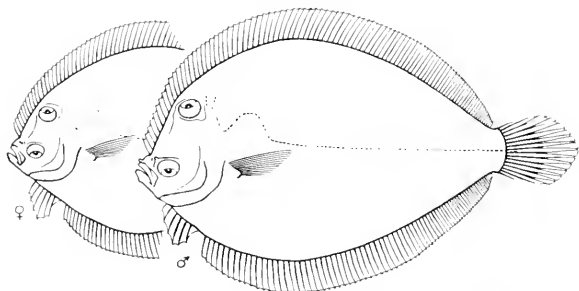


FIG. 170.—*Bothus mellissi*. B.M. (N.H.) 1910.9.9.22, 23.

TYPE.—British Museum (Nat. Hist.) Reg. No. 67.10.8.54.

DISTRIBUTION.—St. Helena and Ascension Islands.

SPECIMENS EXAMINED:

4 (182-225 mm.).	Holotype and paratype- ¹	St. Helena.	Melliss.
7 (158-215 „).	Paratypes.	„	Cunningham.
1 (220 mm.).	skeleton.	„	„
1 (210 „).	Paratype	Ascension.	McCoy.

4. *BOTHUS LUNATUS* (Linnaeus)

PLACOCK FLOUNDER

Pleuronectes lunatus, Linnaeus, 1758, Syst. Nat., ed. 10, p. 209, f. 1790, ed. 12, p. 459.

Pleuronectes aratus, Bloch, 1783, Naturgesh. Fische Deutschl., ii, p. 31, pl. XLVII.

Pleuronectes surinamensis, Schneider, 1801, in Bloch, Syst. Ichth., p. 130.

¹ The holotype is a ♀, 225 mm. in length.

Rhombus argus, Cuvier, 1817, *R. Anni.*, ii, p. 222.

Rhombus lunatus, Cuvier, 1817, *tom. cit.*, p. 222.

Rhomboidichthys lunatus, Gunther, 1862, *Cat. Fish.*, iv, p. 433; Poey, 1868, *Repert. Fis.-Nat. Cuba.*, ii, p. 408; Metzelaar, 1919, *Trop. Atlant. Vissch.*, p. 130.

Rhomboidichthys lunulatus, Poey, 1875, *Anal. Soc. Españ. Hist. Nat.*, v, p. 180.

Platophys lunatus, Jordan, 1887, *Proc. U.S. Nat. Mus.*, ix, (1886), p. 51; Jordan and Goss, 1889, *Rep. U.S. Com. Fish.*, xiv, (1886), p. 267; Jordan and Evermann, 1898, *Bull. U.S. Nat. Mus.*, xlvii (3), p. 2665; Evermann and Marsh, 1902, *Bull. U.S. Com. Fish.*, xx, (1900), p. 322; Borodin, 1928, *Bull. Vanderbilt Ocean. Mus.*, 1 (1), p. 15.

Platotichthys chartes, Nichols, 1921, *Bull. Amer. Mus. Nat. Hist.*, v, p. 21, pl. iii.

Bothus lunatus, Chabanaud, 1927, *Bull. Soc. zool. Fr.*, li, p. 74, fig.

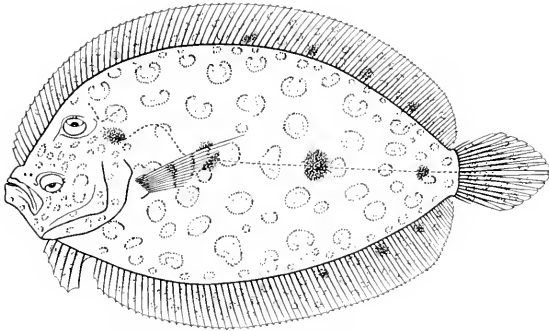


FIG. 171.—*Bothus lunatus*. B.M. (N.H.) 63.8.7.64. $\times 3$.

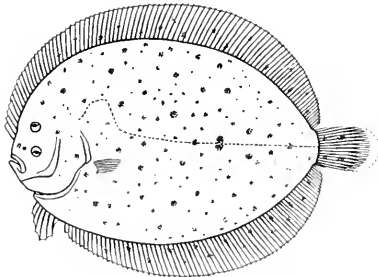


FIG. 172.—*Bothus lunatus*. Type of *Platotichthys chartes*. $\times 2$.

Depth of body $1\frac{3}{4}$ to a little more than twice in the length, length of head $3\frac{2}{3}$ to $3\frac{3}{4}$. Anterior profile of head oblique, a slight notch above and in front of lower eye. Diameter of eye 5 to 6 in length of head, interorbital width $1\frac{1}{4}$ to $2\frac{1}{4}$ times diameter of eye, somewhat wider in the male than in the female, anterior edge of upper eye above posterior edge of lower, eyes in the male each with a fringe of dermal appendages. Male with a strong spine on the snout, represented in the female by a blunt knob. Maxillary extending to below anterior edge of eye or a little beyond, length $2\frac{1}{2}$ to 3 in that of head. 8 to 10 short gill-rakers on lower part of anterior arch. Scales ctenoid on ocular side, cycloid on blind side; 86 to 92 in lateral line. Dorsal 93-99. Anal 71-76. Pectoral of ocular side with 11 or 12 rays, upper rays filamentous and reaching base of caudal in the mature male, about as long as head in the female. Caudal rounded or bluntly pointed. Greyish or brownish; body with numerous rings, curved spots and small dots of sky blue, mostly margined with darker, which are largest near the middle of the side; two or three obscure dark blotches on straight part of lateral line; head and median fins with sharply-defined curved or rounded blue spots, mostly margined with darker; pectoral with narrow dark cross-bars.

TYPE.—Not traced.

DISTRIBUTION.—Atlantic coast of America, from Florida to Fernando Noronha.

SPECIMENS EXAMINED:

1 (302 mm.).	Bermudas.	Jones.
1 (320 ").	" "	" "
2 (175, 268 mm.).	St. Croix.	Stevens.
1 (125 mm.).	San Juan, Porto Rico	Amer. Mus. Nat. Hist.
1 (45 ").	Barbados.	Beckford.
4 (212-265 mm.), skins.	Jamaica.	—
1 (270 mm.), skin.	West Indies.	Srivener.
1 (165 ").	Tobago.	Guppy.
2 (68, 113 mm.).	Fernando Noronha.	Ridley.
1 (315 mm.)	—	Haslar Coll.
2 (378, 350 mm.).	—	—

Also 2 from the West Indies (Leiden Mus.).

This species attains a length of about 18 inches.

There can be no doubt that *Platotichthys chertes* is a post-larval *Bothus*, and it is probably the young of this species. A figure of the type is included here (A.M.N.H. No. 7388).

5. BOTHUS MACULIFERUS (Poey & Jordan and Goss)

- Pleuronectes maculiferus*, Poey, 1856-8, Mem. H. N. Cuba, ii, p. 316.
Rhombodichthys maculiferus, Poey, 1865, Rept. Fis. Nat. Cuba, ii, p. 498; Poey, 1875, Anal. Soc. Españ. Hist. Nat., v, p. 181.
Platophys ellipticus (n. sp.), Jordan, 1887, Proc. U. S. Nat. Mus., ix, (1886), p. 51.
Platophys maculifer, Jordan and Goss, 1889, Rep. U. S. Geol. Surv., xiv, (1886), p. 267; Jordan and Evermann, 1898, Bull. U. S. Nat. Mus., xlvii (3), p. 2604.
Rhombodichthys maculifer, Metzelaar, 1919, Trop. Atlant. Vissch., p. 130, fig. 37.
Platophys maculiferus, Meel. and Hildebrand, 1928, Field Mus. Pub. Chicago, Zool. Ser., xv, No. 249, p. 977.
Symbodichthys maculifer, Chabanaud, 1927, Bull. Soc. zool. Fr., li, p. 76, figs. 2-4.

Depth of body $1\frac{3}{4}$ to $1\frac{1}{2}$ in the length, length of head $3\frac{1}{4}$ to $3\frac{3}{4}$. Upper profile of head convex, scarcely notched in front of eyes. Diameter of eye $1\frac{1}{3}$ to 5 in length of head, interorbital space more or less similar in both sexes, width $\frac{1}{2}$ to more than once diameter of eye (in mature and half-grown specimens); anterior edge of upper eye above middle or posterior $\frac{1}{2}$ of lower. Mature male with a strong spine on end of snout, a smaller one more posteriorly, and some more spines on the orbital margins. Maxillary extending to below anterior part of eye, length 3 or nearly 3 in that of head. An inner regular series of teeth directed somewhat inwards, and 1, 2 or (in large

examples) 3 or 4 irregular outer rows anteriorly in both jaws.¹ 6 or 7 short gill-rakers on lower part of anterior arch. Scales ctenoid on ocular side, cycloid on blind side; 87 to 95 in lateral line. Dorsal (90) 92-95. Anal 70-73. Pectoral of ocular side with 9 or 10 rays, upper rays greatly prolonged in the mature male. Caudal pointed. Greyish or brownish; body covered with rings formed of small sky-blue spots; head with similar spots, but no rings; body with a few other darker markings and with a large diffuse dusky blotch at junction of straight and curved parts of lateral line, another, better defined, on middle of straight portion, and sometimes traces of a third farther back; median fins mottled and spotted; pectoral with irregular dark cross-bars.

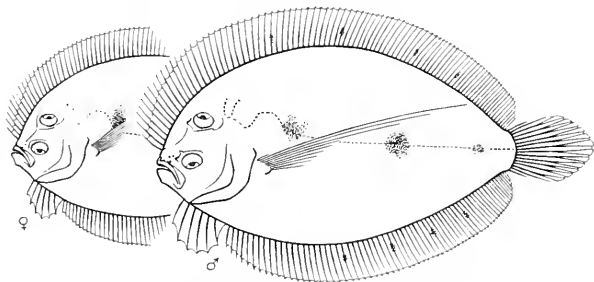


FIG. 173.—*Bothus maculiferus*. B.M. (N.H.) 1924-7-22, 82, 83. $\times \frac{2}{3}$.

TYPE.—Not traced

DISTRIBUTION.—West Indies.

SPECIMENS EXAMINED:

1 (98 mm.).	Curaçao, W. Indies.	Leiden Mus.
1 (150 ,,).	St. Croix.	Stevens.
2 (145, 200 mm.).	Tobago.	Guppy.
1 (180 mm.).	Buccoo Reef, Tobago.	Totton.

Also 3 from Curaçao (Leiden Mus.).

Chabanaud places this species in a distinct genus, *Symboullichthys*, distinguished from *Bothus* by the nature of the dentition. I find, however, that in several species of *Bothus* the inner teeth tend to be directed somewhat inwards, and in large specimens there may be more than one outer series, at least anteriorly. Comparing the dentition of a specimen of *Bothus maculiferus* with that of an example of *B. podas* of similar size, I feel certain that the two species are congeneric.

6. BOTHUS ELLIPTICUS (Poey).

Pleuronectes ellipticus, Poey, 1856-8, Mem. H. N. Cuba, II, p. 315.

Rhomboidichthys ellipticus, Gunther, 1862, Cat. Fish., IV, p. 434; Poey, 1865, Repert. Fis.-Nat Cuba, II, p. 408; Poey, 1875, Anal. Soc. Españ. Hist. Nat., v, p. 181.

Platophys ellipticus, Jordan and Goss, 1889, Rep. U.S. Com. Fish., XIV, (1886), p. 207; Jordan and Evermann, 1898, Bull. U.S. Nat. Mus., XLVI (3), p. 2605.

¹ See Chabanaud, 1927, p. 70, figs. 2, 3.

Probably identical with *B. maculiferus*. Depth of body $1\frac{3}{4}$ in the length. Interorbital width $2\frac{3}{4}$ in length of head. 61 scales in lateral line. Dorsal 105. Anal 80. Greyish, much spotted and mottled with whitish.

TYPE — Not traced.

DISTRIBUTION — Cuba.

A specimen in the Museum of Comparative Zoology, which measures $4\frac{3}{4}$ inches in length, is regarded by Jordan and Goss as representing *B. ellipticus*. This fish was sent to the Museum by Poey, and has been examined by Col. Tension, who records that it is doubtfully distinct from *B. maculiferus*.

7. *BOTHUS MANCUS* (Broussonet).

Pleuronectes mancus, Broussonet, 1782, Ichthyol.

Pleuronectes spinosus, Schneider, (ex Forster MS.), in Bloch, 1801, Svst. Ichth., p. 161.

Rhombus macropterus, Quoy and Gaimard, 1824, Voy. "Uranie", Zool., p. 239, pl. 1.

Pleuronectes patus, Forster, 1814, Ann. Mar. Aust., p. 285.

Rhombus pavo, Bleeker, 1855, Nat. Tijdschr. Ned. Ind., viii, p. 177.

Pleuronectes . . . *rhombus*, Jouan, 1861, Mem. Soc. Cherbourg, viii, p. 256.

Rhomboidichthys pavo, Günther, 1862, Cat. Fish., iv, p. 435.

Platophrys (Platophrys) pavo, Bleeker, 1866-72, Atl. Ichth., vi, p. 11, Pleuron., pl. iv, fig. 2.

Platophrys mancus, Smith and Swain, 1883, Proc. U.S. Nat. Mus., v, (1882), p. 142; Jordan and Evermann, 1905, Bull. U.S. Com. Fish., xxii (1), (1903), p. 513; Gilbert, 1905, Bull. U.S. Com. Fish., xxii (2), (1903), p. 684; Jordan and Seale, 1909, Bull. U.S. Bur. Fish., xxv, (1905), p. 112; Kendall and Goldsborough, 1911, Mem. Mus. Comp. Zool., xxvi, p. 331; Rendahl, 1921, Nat. Hist. Juan Fern. Easter Is., iii, No. 19, p. 66; Fowler, 1928, Mem. B. P. Bishop Mus., v, p. 99, pl. iv, fig. B; Fowler, 1931, Mem. B. P. Bishop Mus., xi, p. 320.

Platophrys leopardinus, Jordan and McGregor, 1899, Rep. U.S. Com. Fish., xxiv, (1898), p. 284.

Platophrys pavo, Steindachner, 1901, Denkschr. Akad. Wiss. Wien, lxx, p. 519; Seale, 1901, Occ. Papers B. P. Bishop Mus., 1, p. 128.

Rhomboidichthys mancus, Günther, 1909, Fische Südsee, viii, p. 142.

Platophrys smithi, Rendahl, 1921, *loc. cit.*, p. 66.

Bothus mancus, Norman, 1927, Rec. Ind. Mus., xxiv, p. 31; Norman, 1931, Ann. Mag. Nat. Hist., (10) viii, p. 509.

Bothus (Platophrys) mancus, Weber and Beanfort, 1929, Fish. Indo Austral. Arch., v, p. 122.

Parabothus mancus, Wu, 1932, Thes. Facult. Sci. Univ. Paris, A. 244 (268), p. 96.

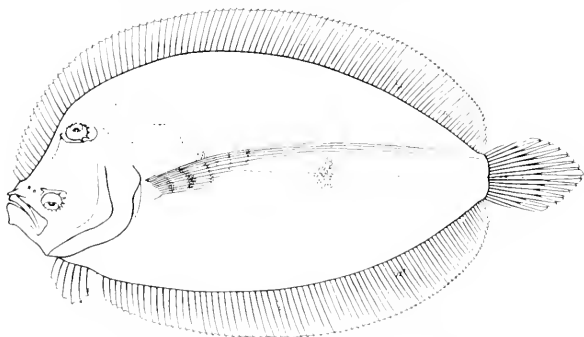


FIG. 174.—*Bothus mancus*. B.M. (N.H.) 77.7.24.1.

Depth of body $1\frac{3}{4}$ to a little more than twice in the length; length of head $3\frac{2}{3}$ to $3\frac{3}{4}$. Anterior profile of head a little concave in front of eyes. Diameter of eye $4\frac{1}{3}$ to $6\frac{1}{2}$ in length of head; interorbital width 2 to $2\frac{1}{2}$ times (σ) or a little more than once to $2\frac{1}{4}$ times (φ) diameter of eye; anterior edge of upper eye above posterior edge of lower (young) or farther back; eyes in the male each with some dermal appendages. Male with a strong spine on the snout, and another in front of lower orbital ridge; 3 or 4 small spines anteriorly on upper orbital ridge. Maxillary extending to below anterior edge or anterior part of eye, length $2\frac{1}{2}$ to 3 in head. Teeth mostly uniserial in both jaws, but with traces of a second row anteriorly. Gill-rakers rather slender and of moderate length, 9 to 11 on lower part of anterior arch. Scales feebly ctenoid or cycloid on ocular side, all cycloid on blind side; 85 to 90 in lateral line. Dorsal 98-103. Anal 76-80. Pectoral of ocular side with 10 or 11 rays, upper rays greatly prolonged in the mature male, moderately produced in the female. Caudal pointed. Pale brownish, everywhere mottled with grey and brown; head and body with rounded bluish spots edged with darker; a diffuse dark blotch at junction of straight and curved parts of lateral line, another on middle of straight portion, and a smaller and less distinct blotch near base of caudal fin; other faint dusky blotches on head, and a series near upper and lower edges of body; median fins variegated with bluish grey spots and ocelli, and with some dark blotches; pectoral with irregular dark brown cross-bars; lower surface sometimes sprinkled with numerous small brown spots.

TYPE.—Not traced.

DISTRIBUTION.—Indian Ocean, through the Malay Peninsula and Archipelago to the Pacific; west coast of Mexico.

SPECIMENS EXAMINED:

1 (240 mm.).	China.	Richardson.
1 (395 ").	Malanipa Isd., near Samboangan.	" Challenger."
1 (280 "), skin.	Aneiteum.	Macgillivray.
1 (280 ").	Lifu, Loyalty Is.	Whitmee.
1 (242 ").	Samoa.	Schmeltz.
1 (300 "), stuffed.	"	Whitmee.
1 (297 ").	Fahti.	Godeffroy Mus.
1 (308 ").	Ponape.	"
1 (160 ").	Christmas Is.	Kirkpatrick.
1 (98 ").	Clarion Is., off west coast of Mexico.	McGregor.

Also 1 from the Maldives (Ind. Mus.); and 1 from the Marshall Islands (Mus. Comp. Zool.).

This species attains to a length of about 18 inches.

Pleuronectes spinosus, Schneider, which was later described by Forster as *P. puctus*, may be this species. The locality was given as Nanoeka Is., New Caledonia.

The specimen from the Pacific coast of Mexico, described by Jordan and McGregor as *Platophrys leopardinus*, is young, but almost certainly represents this species.

8. BOTHUS LEOPARDINUS (Günther).

Rhomboidichthys leopardinus, Günther, 1862, Cat. Fish., IV, p. 434.

Parophrys leopardinus, Jordan, 1885, Proc. U.S. Nat. Mus., VII, p. 260.

Platophrys leopardinus, Jordan and Goss, 1889, Rep. U.S. Com. Fish., XIV, (1886), p. 268; Jordan and Evermann, 1898, Bull. U.S. Nat. Mus., XLVII (3), p. 2666; Garman, 1899, Mem. Mus. Comp. Zool., XXIV, p. 225.

? *Platophrys leopardinus*, Kendall and Radcliffe, 1912, Mem. Mus. Comp. Zool., XXXV, p. 160, pl. VII, fig. 2.

Depth of body $1\frac{1}{2}$ in the length, length of head $3\frac{1}{2}$. Anterior profile of head concave in front of eyes. Diameter of eye $3\frac{2}{3}$ in length of head; interorbital width about equal to diameter of eye; anterior edge of upper eye above middle of lower. No

spines on the head 1-2. Maxillary extending to below anterior edge of eye, length $3\frac{3}{4}$ in that of head. Short gill-rakers on lower part of anterior arch. Scales ctenoid on ocular side, cycloid on blind side, 80 in lateral line. Dorsal (86) 89 (92). Anal (64) 68 (70). Pectoral of ocular side with 10 rays, none of the rays prolonged. Caudal obtusely pointed. Pale brownish, with traces of numerous ocellated spots on head and body; median fins dotted with brown and white.

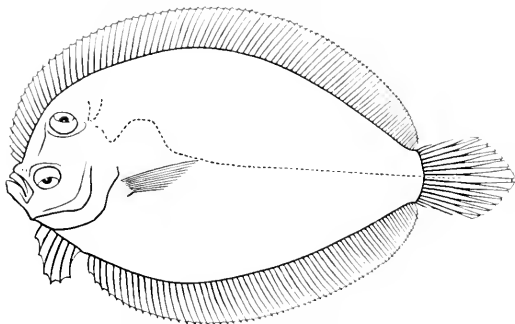


FIG. 175.—*Bothus leopardinus*. B.M. (N.H.) 55.9.19.1250. ♂

TYPE.—British Museum (Nat. Hist.) Reg. No. 55.9.19.1250

DISTRIBUTION.—Pacific coast of Mexico and Central America

SPECIMEN EXAMINED:

1 (147 mm.)—Holotype.

Haslar Coll.

6. *BOTHUS CONSTELLATUS* (Jordan, Jordan and Goss)

Platophrys constellatus, (Jordan) Jordan and Goss, 1889, Rep. U.S. Com. Fish., xiv, (1886), p. 269; Jordan and Bollman, 1890, Proc. U.S. Nat. Mus., xii, (1889), p. 183; Jordan and Evermann, 1898, Bull. U.S. Nat. Mus., xlii (3), p. 2693; Gilbert and Starks, 1904, Mem. Calif. Acad. Sci., iv, p. 199; Kendall and Kitchin, 1912, Mem. Mus. Comp. Zool., xxxv, p. 160; Meek and Hildebrand, 1928, Field Mus. Pub. Chicago, Zool. Ser., xv, No. 249, p. 978; Fowler, 1928, Mem. B. P. Bishop Mus., x, p. 92.

Depth of body $1\frac{1}{2}$ to $1\frac{3}{4}$ in the length, length of head 4. Anterior profile of head very little concave in front of eyes. Diameter of eye about $3\frac{3}{4}$ in length of head, $1\frac{1}{4}$ to $1\frac{1}{2}$ times in interorbital width, anterior edge of upper eye above middle of lower. A blunt rostral spine, no orbital spines. Maxillary extending to below anterior edge of eye, length $3\frac{1}{4}$ to nearly 4 in that of head. 75 scales in lateral line. Dorsal 89. Anal 65. Pectoral of ocular side with 12 rays, length about $1\frac{1}{4}$ in that of head. Dark brown, with numerous stellate white spots, the more distinct of them with darker margins; these generally scattered over the body, but some of those on sides grouped together to form small rings, fins mottled with dark brown, pectoral finely barred (Jordan and Goss).

TYPE.—Museum of Comparative Zoology. No. 11146.

DISTRIBUTION.—Panama Bay; Galapagos Islands; Low Archipelago, Oceania

SPECIMEN EXAMINED:

1 (46 mm.)¹

James I., Galapagos Is.

Sci. Exped. Research Assoc.

("St. George").

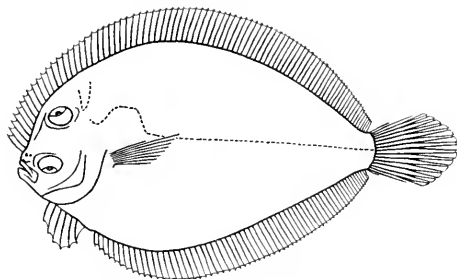


FIG. 170.—*Bothus constellatus*. M.C.Z. 11146. 1.

I have examined no mature examples of this species, and the above description is based on the notes made by Col. Tenison on the 3 type-specimens, said to be males, preserved in the Museum of Comparative Zoology, one of which is figured here. *B. constellatus* is very doubtfully distinct from *B. leopardinus*.

10. BOTHUS PANTHERINUS (Rüppell).

Rhombus pantherinus, Rüppell, 1830-31, in Atlas zu Rüppell, Reise (Senckenb. Nat. Ges.) Fische, p. 121.

Rhombus parvimanus, Bennett, 1832, Proc. Conn. Sci. Zool. Soc., (14), March, p. 168.

Rhombus sumatranus, Bleeker, 1851, Nat. Tijdschr. Ned. Ind., 1, p. 409.

Psetta pantherina, Rüppell, 1852, Verzeichn. Samml. Senckenb. Mus., iv, Fische, p. 19.

? *Passer marchionessarum*, Valenciennes, 1855, in Du Petit-Thouars, Voy. "Venus", Zool., p. 344.

Pleuronectes lunulatus, Jouan, 1861, Mem. Soc. Cherbourg, viii, p. 256.

? *Rhomboidichthys marchionessarum*, Günther, 1862, Cat. Fish., iv, p. 435.

Rhomboidichthys pantherinus, Günther, 1862, Cat. Fish., iv, p. 436; Playfair and Günther, 1866, Fish. Zanzibar, p. 112; Klunzinger, 1871, Verh. zool.-bot. Ges. Wien, xxi, p. 571; Günther, 1909, Fische Südsee, viii, p. 342.

Pseudorhombus pantherinus, Bleeker, 1862, Versl. Akad. Wet. Amsterdam, xiv, p. 103.

Platophrys (Platophrys) pantherinus, Bleeker, 1866-72, Atl. Ichth., vi, p. 11, Pleuron., pl. ii, fig. 3.

? *Citharichthys aureus*, Day, 1877, Fish. India, p. 422, pl. xc, fig. 3.

Platophrys pantherinus, Day, 1877, *loc. cit.*, p. 425, pl. xcii, figs. 3, 4; Steindachner, 1901, Denkschr.

Akad. Wiss. Wien, lxx, p. 511; Jordan and Evermann, 1905, Bull. U.S. Com. Fish., xxii,

(1903), p. 512; Jordan and Seale, 1909, Bull. U.S. Bur. Fish., xxv, (1905), p. 412; Kendall and

Goldsborough, 1911, Mem. Mus. Comp. Zool., xxvi, p. 332; Weber, 1913, "Siboga"-Exped.,

Fische, p. 427; Ogilby, 1913, Mem. Qd. Mus., ii, p. 90; Gilchrist and Thompson, 1917, Ann.

Durban Mus., 1, p. 400; McCulloch, 1922, Mem. Qd. Mus., vii, p. 244; Von Bonde, 1925, Trans.

Roy. Soc. S. Afr., xii, p. 287; Fowler, 1926, Proc. Acad. Nat. Sci. Philad., lxxvii, (1925), p. 204.

Fowler, 1928, Mem. B. P. Bishop Mus., x, p. 91; Schmidt, 1930, Trans. Pacif. Comm. Acad.

Sci. U.S.S.R., 1, p. 111; Fowler, 1931, Mem. B. P. Bishop Mus., xi, p. 320.

¹ Not included in the above description.

- Platypyx manicus*: Jordan and Snyder, 1904, Proc. U.S. Nat. Mus., XXVII, p. 946.
Pseudocitharichthys aureus, Weber, 1913, "Suboga"-Exped., Fische, p. 443.
B. Pius panthorinus, Regan, 1920, Ann. Durban Mus., 11, p. 242, fig. 3; Barnard, 1925, Ann. S. Afr. Mus., XXI, p. 378; Norman, 1926, Biol. Res. "Endeavour", v, p. 282; Norman, 1927, Rec. Ind. Mus., XXIX, p. 33; McCulloch, 1929, Mem. Aust. Mus., v, p. 276.
B. thus: *Platypyx panthorinus*, Weber and Beaufort, 1929, Fish. Indo-Austral. Arch., v, p. 123.

Depth of body $1\frac{1}{2}$ to twice in the length, length of head $3\frac{1}{2}$ to 4. Upper profile of head convex, or with a slight notch in front of lower eye. Diameter of eye $3\frac{1}{2}$ to nearly 5 in length of head, interorbital width equal to or a little less than diameter of eye in the male, rather narrower in the female; anterior edge of upper eye above, or a little behind middle of lower; male generally with a dorsal tentacle on hinder part of each eye. Mature male with one or more irregular bony tubercles on the

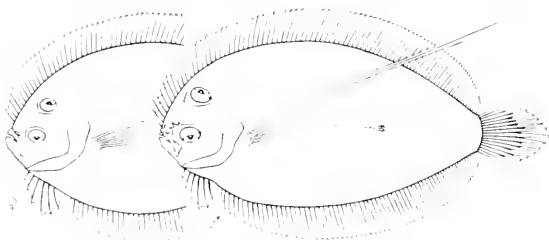


FIG. 177. *Botus panthorinus*. ♂ BM (NH) 74.5.14.1, ♀ BM (NH) 69.3.1.25.

snout, in front of lower eye, and often one or two in front of upper eye; except for a blunt knob on the snout, these are wanting in the female. Maxillary extending to below anterior edge or anterior $\frac{1}{2}$ of eye, length about 3 in that of head. About 6 to 8 very short gill-rakers on lower part of anterior arch. Scales ctenoid on ocular side, cycloid on blind side, 80 to 92 in lateral line. Dorsal 85-95. Anal 94-74. Pectoral of ocular side with 9 to 11 rays, upper rays greatly prolonged in the mature male, sometimes reaching base of caudal. Caudal obtusely pointed. Vertebrae 10 + 20. Brownish, covered with paler and darker spots, blotches, rings or ocelli; generally a large dark blotch on middle of straight portion of lateral line; median fins similarly coloured and marked; pectoral spotted with brown, with or without irregular dark cross-bars.

TYPE.—Senckenberg Museum, Frankfurt a. Main.

DISTRIBUTION.—From East Africa and the Red Sea, through the Indian Ocean and Archipelago, to Australia and the Pacific.

SPECIMENS EXAMINED:

2 (68, 86 mm.)	—	—
1 (85 mm.)	Madagascar.	Gray.
2 (109, 298 mm.)	Zanzibar.	Playfair.
1 (71, 34 mm.)	Post-larva	"
1 (44.9 mm.)	"	"
1 (42, 472 mm.)	Mombasa	Cunningham.
1 (184 mm.)	Durban.	Marley.
1 (51.45 mm.)	Mauritius.	Cutler.
1 (32 mm.)	"	Gerrard Coll.
	Type of <i>Rhombus parimanius</i> .	

1 (50 mm.).	Persian Gulf.	Townsend.
1 (52 ").	Muscat.	"
1 (200 ").	Seychelles.	Wright.
5 (117-190 mm.).	"	"
1 (83 mm.).	Amirantes, 30 fms.	Gardner.
2 (58, 135 mm.).	Maldives.	"
1 (37 mm.).	Feheudu Isd., Maldives.	Ind. Mus.
4 (60-105 mm.).	Karachi.	Townsend.
1 (72 mm.).	Nicobar Is.	Day.
1 (87 ").	Andaman Is.	"
1 (180 ").	Java Sea (8° 47' S., 114° 38' E.).	Hardenberg.
2 (144, 173 mm.).	Amboyna.	Frank.
2 (145, 152 ").	N. Celebes.	Higgins and Meyer.
1 (120 mm.).	New Britain.	—
2 (82, 120 mm.).	Goram.	B.O.U. New Guinea Exped.
1 (130 mm.).	Manado, Philippines.	Meyer.
1 (98 ").	Lord Howe Isd.	Austr. Mus.
2 (180, 183 mm.).	Raine Isd., N. Queensland.	Queensland Mus
1 (150 mm.).	Honolulu.	" Challenger."
1 (128 ").	"	Stanford Univ.
3 (140-154 mm.).	Hawaiian Is.	Hawaiian Govt.
1 (130 mm.), skeleton.	"	"
1 (170 ").	Coast of Savati, Samoa.	Whitmee.
1 (52 ").	" " "	Schmeltz.
1 (42 ").	" " "	"
1 (185 ").	Samoa.	Whitmee.
2 (170, 184 mm.).	Fiji Is.	Admiralty (" Herald").
1 (210 mm.).	Tahiti.	Godeffroy Mus.
1 (163 ").	Ponape.	"
1 (190 ").	"	"
1 (200 ").	"	"

Also specimens from Madras, Maldives and Andaman Islands (Ind. Mus.); Red Sea, Java, Amboina and East Indies (Leiden Mus.); and Red Sea, Hawaiian and Caroline Islands (Mus. Comp. Zool.).

The type of *Citharichthys aureus*, Day (= *Pseudocitharichthys*, Weber), examined by me, appears to be a post-larval *Bothus*, and probably belongs to this species.

11. BOTHUS BLEEKERI, Steindachner.

Rhomboidichthys myriaster (non Temminck and Schlegel), Bleeker, 1856, Act. Soc. Sci. Indo-Neerl., 1, Menado etc., p. 67.

Bothus bleekeri, Steindachner, 1861, Verh. zool.-bot. Ges. Wien, xi, p. 178.

Rhomboidichthys myriaster, Gunther, 1862, Cat. Fish., iv, p. 436.

Platophrys (Platophrys) myriaster, Bleeker, 1866-72, Atl. Ichth., vi, p. 10, Pleuron., pl. ix, fig. 4, pl. xi, fig. 1.

Psettylus ocellata, Johnstone, 1904, Ceylon Pearl Oyster Fish., Suppl. Rep., xv, p. 207, pl. 1, fig. 3, pl. II.

? *Platophrys (myriaster)*, Weber, 1913, " Siboga " Exped., Fische, p. 428.

Platophrys thompsoni, Fowler, 1923, Occ. Papers B. P. Bishop Mus., viii, p. 358; Fowler, 1928, Mem. B. P. Bishop Mus., x., p. 91, pl. iv, fig. c.

Bothus ovalis (part), Norman, 1927, Rec. Ind. Mus., xxix, p. 32.

Bothus (Platophrys) myriaster, Weber and Beaufort, 1929, Fish. Indo-Austral. Arch., v, p. 120.

Depth of body $1\frac{1}{2}$ to $1\frac{3}{4}$ in the length, length of head $3\frac{3}{4}$ to nearly 4. Profile of head convex in front of upper eye, concave above and just in front of lower eye. Diameter of eye $3\frac{1}{4}$ to $3\frac{3}{4}$ in length of head; interorbital width $1\frac{1}{4}$ to nearly $1\frac{1}{2}$ times (a little less in young) diameter of eye; anterior edge of upper eye above middle of lower. Male with a strong spine on the snout, and another at symphysis of lower jaw; one or two spines anteriorly on orbital margins. Maxillary extending to below anterior margin of eye, length $3\frac{1}{4}$ to $3\frac{3}{4}$ in that of head. Teeth more strongly developed

on blind side of jaws. 8 short gill-rakers on lower part of anterior arch. Scales all cycloid on ocular side, except at extreme upper and lower edges of body, where they are ctenoid; those of blind side cycloid; about 100 scales in lateral line. Dorsal 86-89/99. Anal (62) 67-73. Pectoral of ocular side with 8 or 9 rays, upper rays greatly prolonged in the male, a little produced in the female. Caudal obtusely pointed. Brownish, with numerous dark spots and annular markings scattered over the body; often a circular ocellus just behind curve of lateral line; a diffuse dark blotch on middle of straight portion; sometimes some transverse dark bands (blue in life) on blind side of body; dorsal and anal fins with a series of dark brown spots, and with other darker markings; distal part of caudal dark brown.

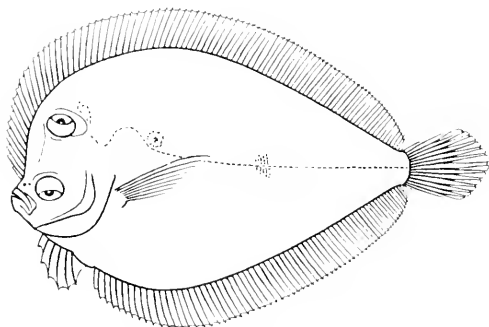


FIG. 178.—*Bothus bleekeri*. B.M. (N.H.) 1928, 3, 22, 17. 1/2

TYPE.—Not traced.

DISTRIBUTION.—Ceylon, Indo-Australian Archipelago, Hawaiian Islands.

SPECIMENS EXAMINED.

4 (49-115 mm.)

1 (115 mm.).

Palk Bay, Ceylon.

East Indies.

Liverpool Univ.

Bleeker Coll.

This species is very doubtfully distinct from *B. myriaster* and *B. ovalis*, and it seems probable that an examination of a complete series of examples of both sexes and of all ages would show that the three species are identical.

12. BOTHUS MYRIASTER (Temminck and Schlegel)

Rhombus myriaster, Temminck and Schlegel, 1846, in Siebold, F. Japon. (Pisces), p. 181, pl. 301, fig. 2.

Platophry. myriaster, Jordan and Evermann, 1902, Proc. U.S. Nat. Mus., xxv, p. 365; Jordan and Starks, 1906, Proc. U.S. Nat. Mus., xxxi, p. 107; Hubbs, 1915, Proc. U.S. Nat. Mus., xlviii, p. 457.

Platophry. circularis, Franz, 1910, Abh. Bayer. Akad. Wiss., Suppl. 1v, Abh. 1, p. 62, pl. viii, fig. 66.

Bothus myriaster, Chabanaud, 1929, Bull. Mus. Hist. nat. Paris, (2) 1, p. 379; Wu, 1932, Thés. Facult. Sci. Univ. Paris, A. 244 (298), p. 95.

Depth of body $1\frac{3}{4}$ to $1\frac{1}{2}$ in the length, length of head $4\frac{1}{8}$ to $4\frac{1}{4}$. Profile of head distinctly convex in front of upper eye, concave in front and just above lower eye. Diameter of eye $3\frac{3}{4}$ in length of head; interorbital width more than twice diameter of eye; anterior edge of upper eye above posterior part of lower; each eye with a large membranous flap on its hinder part in the male. Male with a strong spine on the snout and another at symphysis of lower jaw; some smaller spines round orbits. Maxillary extending to below anterior edge of eye, length $3\frac{1}{2}$ in that of head. Teeth more strongly developed on blind side of jaws. 6 short gill-rakers on lower part of anterior arch. Scales all cycloid on ocular side, except at extreme upper and lower edges of body, where they are ctenoid; those of blind side cycloid; 104 scales in

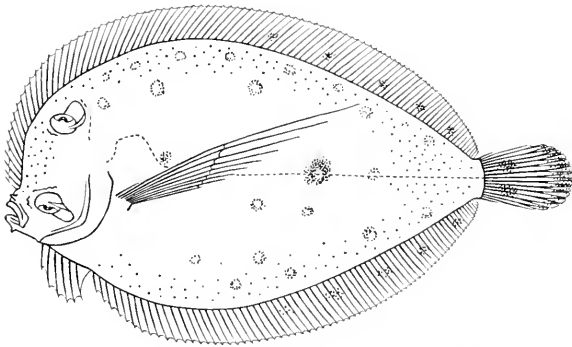


FIG. 179.—*Bothus myriaster*. Paris Museum (Indo-China). $\times \frac{2}{3}$.

lateral line. Dorsal 93-95. Anal 67-71. Pectoral of ocular side with 8 or 9 rays, upper rays prolonged and filamentous in the male, longest more than twice as long as head. Caudal obtusely pointed. Pale brownish; head and body with numerous small brown spots ringed with pale brown, paler than the ground-colour, and pale blue spots ringed with dark brown; a diffuse dark blotch at junction of straight and curved parts of lateral line and another more distinct blotch at the middle of its straight portion; dorsal and anal fins with small brown dots, and each with a row of larger dusky spots; caudal dark at base and at tip of rays, a pale band across the middle; pectoral with traces of faint cross-bars; blind side of fish yellowish-white anteriorly, becoming dark brown posteriorly; a number of narrow, wavy, dark transverse bars (blue in life) just in front of the posterior dark portion.

TYPE.—Leiden Museum.

DISTRIBUTION.—Indo-China; coast of China (?) and Japan; Formosa.

SPECIMENS EXAMINED:

? 1 (43 mm.).
1 (σ , 117 mm.).

China Seas,
Keerung, Formosa.

Belcher.
Tokyo Imp. Univ.

Also one (σ , 190 mm) from Indo-China (Paris Mus.).

13. *BOTHUS OVALIS* (Regan).

Platiphrys ovalis n. *Rhombus ocellatus*, Agassiz, Alcock, 1899, Ann. Mag. Nat. Hist., (6) vi, p. 147, fig. 12. — Alcock, 1906, J. Asiatic Soc. Beng., lxxv (2), p. 328.

Platiphrys myriaster, Steindachner, 1902, Denkschr. Akad. Wiss. Wien, lxxvi, p. 152.

Platiphrys ovalis, Regan, 1908, Trans. Linn. Soc. London, Zool., xii, p. 232, pl. xxvii, fig. 6.

Platiphrys circularis, Regan, 1908, *loc. cit.*, p. 233, pl. xxvi, fig. 3.

Platiphrys pantherinus, Jenkins, 1919, Mem. Ind. Mus., iii, p. 26.

Platiphrys circularis, Barnard, 1925, Ann. S. Afr. Mus., xxi, p. 394.

Bothus ovalis (part), Norman, 1927, Rev. Ind. Mus., xxix, p. 32, fig. 7.

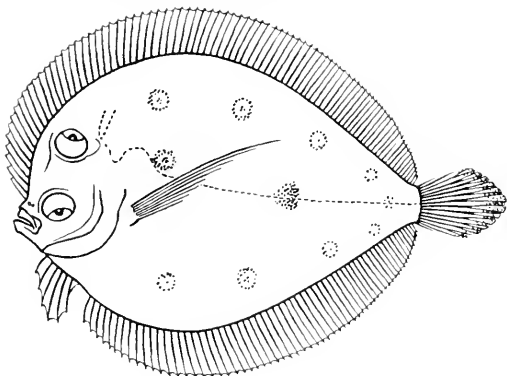


FIG. 180.—*Bothus ovalis*. B. M. (N.H.) 1908, 7, 21, 127. 1

Depth of body $1\frac{2}{3}$ in the length, length of head $3\frac{1}{2}$ to $3\frac{2}{3}$. Profile of head distinctly convex in front of upper eye, concave in front and just above lower eye. Diameter of eye 3 to $3\frac{1}{4}$ in length of head, interorbital width a little less (young) or a little greater than diameter of eye, anterior edge of upper eye above middle of lower, each eye with a semi-circular membranous flap on its posterior part in the male. Male with a strong spine on the snout, but only a slight projection below symphysis of lower jaw. Maxillary extending to below anterior margin of eye or a little beyond, length $3\frac{1}{2}$ to $3\frac{2}{3}$ in that of head. Teeth more strongly developed on blind side of jaws, 6 or 7 short gill-rakers on lower part of anterior arch. Scales all cycloid on ocular side, except at extreme upper and lower edges of body, where they are ctenoid, those of blind side cycloid, 95 to 100 scales in lateral line. Dorsal 88–92. Anal 64–70. Pectoral of ocular side with 8 or 9 rays, upper rays more or less prolonged in both sexes. Caudal obtusely pointed. Greyish brown, clouded and marked with darker, and with numerous small pale spots, head with some small sky-blue spots, a circular ocellus just behind curve of lateral line, and 3 or 4 similar but less distinct ocelli on upper and lower halves of body, becoming fainter with age, a diffuse dark blotch on middle of straight portion of lateral line, and generally a faint blotch near base of caudal fin, dorsal and anal fins with minute dark brown spots, and with a series of larger spots, distal part of caudal dark brown.

TYPE.—British Museum (Nat. Hist.). Reg. No. 1908.3.23.127.

DISTRIBUTION.—South Africa (?); Seychelles Group; south-eastern India; Burma

SPECIMENS EXAMINED :

3 (44-95 mm.).	Holotype (95 mm.) and paratypes.	Amirantes, 30 fms.	Gardiner.
1 (38 mm.).	Type of <i>Platophrys</i> <i>circularis</i> .	„ 22-85 „	„
1 (88 „).		—	Ind. Mus.

Also one from Arakan Coast, Burma, and the type of *Psettylis ocellata* (Ind. Mus.).

Examination of a series of examples leaves no doubt that *B. circularis* (= *Psettylis ocellata*) is the young of *B. ovalis*, and it is more than likely that this species may itself prove to be the same as *B. myriaster*.

14. BOTHUS ASSIMILIS (Günther).

Rhomboidichthys assimilis, Günther, 1862, Cat. Fish., iv, p. 437.

Platophrys assimilis, Oshima, 1927, Japan. J. Zool. Tokyo, Trans. Abstr., 1 (5), p. 178.

Bothus assimilis, Wu, 1932, Thès. Facult. Sci. Univ. Paris, A. 244 (268), p. 95.

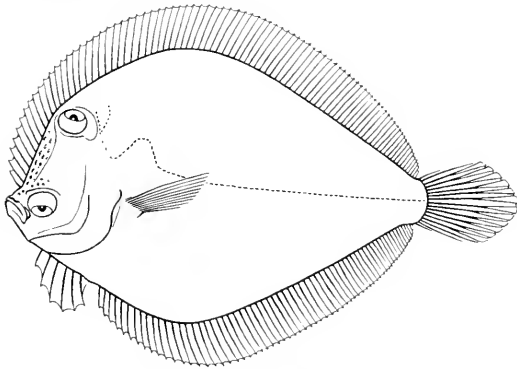


FIG. 181.—*Bothus assimilis*. B.M. (N.H.) [749.] × $\frac{1}{2}$.

Depth of body $1\frac{1}{2}$ in the length, length of head $3\frac{1}{2}$. Profile of head convex in front of upper eye, concave above and in front of lower eye. Diameter of eye $\frac{1}{4}$ in length of head, about $\frac{1}{2}$ the interorbital width; anterior edge of upper eye above posterior edge of lower. A blunt spine on the snout. Maxillary extending to below anterior edge of eye, length nearly $\frac{1}{4}$ in that of head. 6 or 7 short gill-rakers on lower part of anterior arch. Scales all cycloid; about 80 in lateral line. Dorsal 87. Anal 65. Pectoral of ocular side with 11 rays, upper rays not prolonged (?). Caudal obtusely pointed. Brownish; several series of dark spots on anterior part of interorbital space; median fins dusky.

TYPE—British Museum (Nat. Hist.), Reg. No. 749

DISTRIBUTION—China; Formosa

SPECIMENS EXAMINED:

1 (45 mm.), Holotype, China, Richardson.

BOTHUS sp.

Psettylis pellucida, Alcock, 1890, Ann. Mag. Nat. Hist., (10) VI, p. 437, fig. 2. Johnstone, 1904, Ceylon, Pearl Oyster Fish., Suppl. Rep., xv, p. 207; Weber, 1913, "Siboga"-Exped., Fische, p. 412, footnote.*Bothus* sp., Norman, 1927, Rec. Ind. Mus., xxix, p. 34.

The descriptions quoted above refer to post-larval specimens, probably belonging to this genus, which cannot be specifically identified. The following post-larvæ are also indeterminate:

1 (40 mm.),	Dar-es-Salaam,	Smart.
1 (24 ..),	Abyssinia,	Day.
2 (35, 37 mm.),	Madras coast, 20 fms.	Ind. Mus.
1 (32 mm.),	Ganjam coast,	"
1 (40 ..),	Ceylon,	Colombo Mus.
1 (44 ..),	Palk Bay, Ceylon,	Liverpool Univ.
1 (32 ..),	Nankauri Harbour, Nicobar Is.,	Ind. Mus.
	12-27 fms.	("Investigator").

Genus 28. PARABOTHUS.

Parabothus, Norman, 1931, Ann. Mag. Nat. Hist., (10) VIII, p. 600 [*Amnoglossus polylepis*, Alcock].

Close to *Amnoglossus* and *Bothus*. Body ovate or rather elongate. Eyes on the left side, separated by a flat or concave space, which is narrow or of moderate width (a bony ridge in the young), and somewhat broader in the male; lower eye only a little in advance of upper. Male without rostral or orbital spines. Olfactory laminae few in number, radiating from a very short central rachis¹. Mouth of moderate size, the length of the maxillary 2½ to 3 in that of head; jaws and dentition about equally developed on both sides; teeth small, pointed, more or less enlarged and wider apart anteriorly, uniserial in both jaws; vomer toothless. Upper angle of gill-opening close to lateral line; the membrane joining the operculum to the pectoral arch partly scaled; gill-rakers of moderate length or rather short. Dorsal fin commencing above nostrils of blind side and well in front of eye; all the rays simple, scaled (at least on ocular side). Tip of first interhaemal spine not projecting in front of anal fin. Pectoral fins unequal, that of ocular side larger; none of the rays prolonged. Scales small, ctenoid (or cycloid) on ocular side, cycloid on blind side. Lateral line developed only on ocular side, with a distinct curve above the pectoral fin.

Four or five species from the Indo-Pacific.

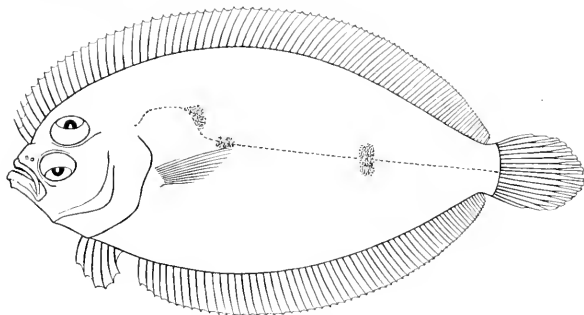
SYNOPSIS OF THE SPECIES.

- I. Depth 2 to 2½ in length; scales ctenoid on ocular side.
- A. Head 3½ to 3¾ in length; dorsal 83, anal 63-66. 1. *polylepis*
- B. Head 3¾ to 4 in length; dorsal 100-121, anal 80-99
1. Dorsal 106-113, anal 86-94; depth about 2½ in length; eye 3, maxillary 2½ in head. 2. *chlorospilus*.
2. Dorsal 115, anal 92; depth 2½ in length; eye 4½, maxillary 2½ in head. 3. *violaceus*.
3. Dorsal 114-121, anal 93-99; depth 2½ in length; eye 3½, maxillary 2½ in head. 4. *coarctatus*.
- H. Depth about 3; head 4 in length; scales cycloid on ocular side; dorsal 112, anal 92. 5. *malhensis*?

¹ In *P. chlorospilus*. Not examined in other species.

1. *PARABOTHUS POLYLEPIS* (Alcock).

- Arnoglossus polylepis*, Alcock, 1889, J. Asiat. Soc. Beng., lvi (2), p. 290, pl. xvi, fig. 1.
Rhomboidichthys polylepis, Alcock, 1890, Ann. Mag. Nat. Hist., (6) vi, p. 434; Alcock, 1898, Illust. Zool. "Investigator", Fishes, pl. xxiv, figs. 4, 5.
Bothus polylepis, Norman, 1927, Rec. Ind. Mus., xxix, p. 31.
Parabothus polylepis, Norman, 1931, Ann. Mag. Nat. Hist., (10) viii, p. 600.

FIG. 182.—*Parabothus polylepis*. Ind. Mus. 12713. $\times 1$.

Depth of body $2\frac{1}{2}$ in the length, length of head $3\frac{1}{2}$ to $3\frac{3}{4}$. Upper profile of head a little notched in front of eyes. Diameter of eye 3 to nearly 4 in length of head, and about 6 times interorbital width (mature ♀). A blunt knob on the snout above the maxillary. Maxillary extending to a little beyond anterior edge of eye, length $2\frac{3}{4}$ to 3 in that of head. 8 or 9 gill-rakers on lower part of anterior arch. 82 to 85 scales in lateral line. Dorsal 83. Anal 63-66. Pectoral of ocular side with 11 rays, length $1\frac{1}{2}$ to $1\frac{3}{4}$ in that of head. Brownish; a series of large dark rings at upper and lower edges of body, inconspicuous in the larger specimen; two dark blotches or ocelli at junction of straight and curved parts of lateral line, and a larger blotch on middle of straight portion; median fins with small brown spots; pectoral with three indistinct brown cross-bars.

TYPE.—Indian Museum. No. 11750.

DISTRIBUTION.—Off Ceylon, 32 to 34 fathoms.

SPECIMENS EXAMINED:

The holotype (♀, 80 mm.) and another example (♀, 130 mm.) from off Ceylon (Ind. Mus.).

2. *PARABOTHUS CHLOROSPILUS* (Gilbert).

- Platophrys chlorospilus*, Gilbert, 1905, Bull. U.S. Com. Fish., xxiii (2), (1903), p. 684, fig. 267; Fowler, 1928, Mem. B. P. Bishop Mus., x, p. 91.
Platophrys inermis, Gilbert, 1905, *tom. cit.*, p. 685, fig. 268.
Rhomboidichthys chlorospilus, Gunther, 1909, Fische Sudsee, viii, p. 343.
Parabothus chlorospilus, Norman, 1931, Ann. Mag. Nat. Hist., (10) viii, p. 601.

Depth of body about $2\frac{1}{2}$ in the length, length of head $3\frac{3}{4}$ to 4. Upper profile of head scarcely notched in front of eyes. Diameter of eye about 3 in length of head, about $1\frac{1}{2}$ times (♂) or nearly 3 times (♀) interorbital width. Maxillary extending to below anterior part of eye, length $2\frac{1}{2}$ in that of head. 9 or 10 gill-rakers on lower part of anterior arch. 83 to 90 scales in lateral line. Dorsal 106-113. Anal 86-94.

Pectoral of ocular side with 13 or 14 rays, length $1\frac{1}{2}$ to nearly $1\frac{1}{2}$ in that of head. Greyish or brownish, with olive brown dots, spots, rings or ocelli; male with some greenish-yellow spots on the snout and an interorbital bar of the same colour; median fins finely spotted with dark brown; dorsal and anal each with a series of oblong brown spots.

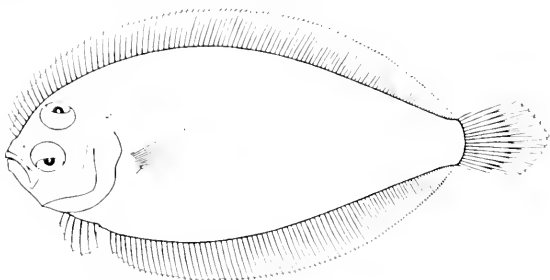


FIG. 183. — *Parabothus chlorospilus*. B.M. (N.H.) 1931.8.19.5. ♂ $\frac{3}{4}$.

TYPE.—United States National Museum No. 51617¹

DISTRIBUTION.—Hawaiian Islands, 75–173 fathoms.

SPECIMENS EXAMINED:

2 ($\frac{1}{2}$, 97; $\frac{3}{4}$, 195 mm.).

Hawaiian Is.

U.S. Nat. Mus.

3. PARABOTHUS VIOLACEUS (Franz).

Amoglossus violaceus, Franz, 1910, Abh. Bayer. Akad. Wiss., Suppl. iv, Abh. 1, p. 64, pl. vii, fig. 50.
Parabothus (?) *violaceus*, Norman, 1931, Ann. Mag. Nat. Hist., (10) viii, p. 607.

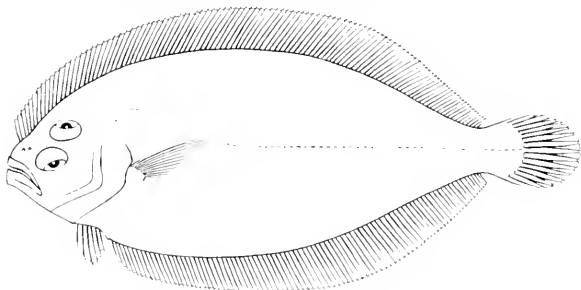


FIG. 184. — *Parabothus violaceus*. After Franz. $\frac{1}{2}$.

¹ A male, 183 mm. in total length. The type of *Platophys incanus* is a female of 179 mm. U.S. Nat. Mus. No. 51948).

Depth of body $2\frac{1}{2}$ in the length, length of head 4. Upper profile of head a little concave in front of eyes. Diameter of eye $4\frac{1}{2}$ in length of head, about $3\frac{1}{2}$ times interorbital width. Maxillary extending to below anterior part of eye, length $2\frac{1}{2}$ in that of head. 9 gill-rakers on lower part of anterior arch. 100 scales in lateral line. Dorsal 115. Anal 92. Length of pectoral $1\frac{3}{4}$ in that of head. Dark brown, with black spots on head and body; fins blackish, spotted with paler.

TYPE.—Zoologische Sammlung des Bayerischen Staates, Munich.

DISTRIBUTION.—Japan

The type, from Aburatsubo, the only specimen known, is 235 mm. in length.

4. PARABOTHUS COARCTATUS (Gilbert).

Platophrys coarctatus, Gilbert, 1905, Bull. U.S. Com. Fish., xxiii (2), (1903), p. 686, fig. 269; Fowler, 1928, Mem. B. P. Bishop Mus., x, p. 92.

Rhomboidichthys coarctatus, Gunther, 1909, Fische Sudsee, viii, p. 343.

Parabothus coarctatus, Norman, 1931, Ann. Mag. Nat. Hist., (10) viii, p. 601.

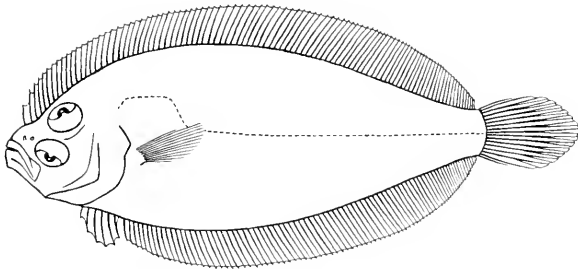


FIG. 185.—*Parabothus coarctatus*. U.S.N.M. 51694. ♂.

Depth of body about $2\frac{3}{8}$ in the length, length of head $3\frac{1}{2}$. Upper profile of head a little concave in front of eyes. Diameter of eye $3\frac{1}{2}$ in length of head; interorbital space a very narrow concave groove ($\frac{1}{2}$). Maxillary extending to below anterior part of eye, length $2\frac{3}{4}$ in that of head. 10 gill-rakers on lower part of anterior arch. 93 to 96 scales in lateral line. Dorsal 114–121. Anal 93–99. Pectoral of ocular side with 13 or 14 rays, length nearly $\frac{3}{4}$ that of head. Pale olive brown, profusely covered with green spots of varying size, each margined with darker; a series of larger spots near upper and lower edges of body; two dark spots at junction of straight and curved parts of lateral line, one on middle of straight portion, and another near base of caudal fin; head with spots and dashes of green; dorsal and anal fins mottled with darker, and each with a series of regularly arranged dark blotches.

TYPE.—United States National Museum. No. 51602.¹

DISTRIBUTION.—Hawaiian Islands, 138 to 220 fathoms.

SPECIMEN EXAMINED:

A paratype (154 mm). U.S. Nat. Mus. No. 51694.

This species may be identical with *P. polylepis*.

¹ A female, 162 mm. in length.

5. PARABOTHUS MALHENSIS (Regan).

Trigloporus malhensis, Regan, 1908, Trans. Linn. Soc. London, Zool., XII, p. 235, pl. XXVI, fig. 2; Norman, 1927, Rec. Ind. Mus., XXIX, p. 21.

Depth of body about 3 in the length, length of head 4. Upper profile of head a little concave in front of eyes. Diameter of eye $\frac{1}{4}$ in length of head and about $1\frac{1}{2}$ times the interorbital width. Maxillary extending nearly to below middle of eye, length $2\frac{1}{4}$ in that of head. Teeth of upper jaw rather small and close-set laterally, some enlarged canines anteriorly; lateral teeth of lower jaw much stronger and wider apart than those of upper. 11 rather slender gill-rakers on lower part of anterior arch. Scales apparently all cycloid; 66 in lateral line. Dorsal 112. Anal 92. Pectoral of ocular side with 13 rays, length more than $\frac{1}{2}$ that of head. Uniformly yellowish.

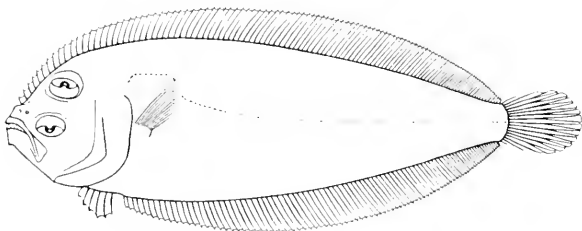


FIG. 186.—*Parabothus malhensis*. B.M. (N.H.) 1908.3.23.147. ♂.

TYPE—British Museum (Nat. Hist.) Reg. No. 1908.3.23.147.

DISTRIBUTION—Saya de Malha Bank, Indian Ocean.

SPECIMEN EXAMINED:

1 (♂, 175 mm). Holotype. Saya de Malha Bank, over 123 fms. Gardiner.

The generic position of this species is uncertain, but, pending the discovery of further specimens, it may be provisionally placed here.

Genus 29. GRAMMATOBOTHUS.

Grammatobothus, Norman, 1926, Biol. Res. "Endeavour", v, p. 253 [*Platophrys polyophthalmus*, Bleeker].

Very close to *Bothus*. Olfactory laminae few or in moderate number, radiating from a rather short central rachis. Interorbital region narrow, concave, similar in both sexes. Teeth uniserial in both jaws, scarcely enlarged anteriorly. Scaling of head and body more or less continuous between lateral line and upper angle of gill-opening. Anterior rays of dorsal fin somewhat prolonged in both sexes. Scales small, ctenoid on ocular side, cycloid on blind side. Lateral line equally developed on both sides of body.

Three species from the Indo-Pacific.

SYNOPSIS OF THE SPECIES.

- I. Depth about $1\frac{2}{3}$ in length; dorsal (77) 80-86, 2nd to 5th or 6th rays moderately prolonged; anal (61) 64-67 1. *polyopthalmus*.
 II. Depth $1\frac{1}{2}$ to 2 in length; 2nd to 4th rays of dorsal more or less prolonged, expanded and pinniform.
 A. Dorsal 88-91, anal 72-76; rays of left pelvic not prolonged. 2. *pennatus*.
 B. Dorsal 82, anal 66; rays of left pelvic prolonged and pinniform 3. *kremphi*.

I. GRAMMATOBOTHUS POLYOPHTHALMUS (Bleeker).

- Platyphrys polyopthalmus*, Bleeker, 1866, Ned. Tijdschr. Dierk., iii, p. 46; Bleeker, 1866-72, Atl. Ichth., vi, p. 12, Pleuron., pl. iii, fig. 3; McCulloch, 1922, Mem. Qd. Mus., vii, p. 244.
Rhomboidichthys angustifrons, Günther, 1880, Shore Fishes "Challenger", p. 46, pl. xxi, fig. B;
 Alcock, 1890, Ann. Mag. Nat. Hist., (6) vi, p. 435.
Psettylis ocellata, Jenkins, 1910, Mem. Ind. Mus., iii, p. 27.
Grammatobothus polyopthalmus, Norman, 1920, Biol. Res. "Endeavour", v, p. 253; Norman, 1927, Rec. Ind. Mus., xxix, p. 35, fig. 8; McCulloch, 1929, Mem. Aust. Mus., v, p. 270.
Platophrys angustifrons, Fowler, 1928, Mem. B. P. Bishop Mus., x, p. 91.
Bothus (Platophrys) polyopthalmus, Weber and Beaufort, 1929, Fish. Indo-Austral. Arch., v, p. 119.

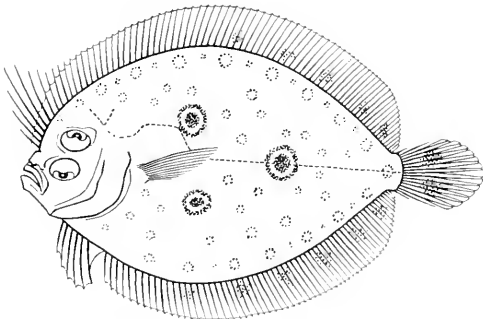


FIG. 187.—*Grammatobothus polyopthalmus*. B.M. (N.H.) 79.5.14.86. $\times 3$.

Depth of body about $1\frac{2}{3}$ in the length, length of head $3\frac{1}{2}$ to 4. Upper profile of head more or less deeply notched in front of eyes. Snout shorter than eye, diameter of which is $3\frac{1}{2}$ to $3\frac{1}{3}$ in length of head and about 3 times interorbital width; lower eye a little in advance of upper. Usually one or two blunt prominences in front of lower eye, and two more above the maxillary. Maxillary extending to below anterior edge of eye or a little beyond, length $3\frac{1}{2}$ to $3\frac{1}{3}$ in that of head; lower jaw $2\frac{1}{2}$ to $2\frac{1}{4}$ in head. 8 or 9 short gill-rakers on lower part of anterior arch. 77 to 82 scales in lateral line. Dorsal (77) 80-86; second to fifth or sixth rays moderately prolonged, highest $\frac{2}{3}$ to $\frac{1}{2}$ length of head. Anal (61) 64-67. Pectoral of ocular side with 13 to 15 rays, upper ray frequently prolonged to below posterior half of dorsal (? male); length (without produced ray) $1\frac{1}{4}$ to $1\frac{1}{3}$ in that of head. Caudal pointed. Pale brownish, with 3 large conspicuous black ocelli forming a triangle, the two anterior ones above and below the pectoral, the third on the middle of the straight portion

of the lateral line, head and body with a number of smaller and less distinct spots and markings, arranged in more or less regular series, generally a dark bar above upper eye, median fins with obscure dusky spots and blotches, pectoral with broad darker and paler cross-bars.

TYPE: Leiden Museum.

DISTRIBUTION: From the Indian Ocean through the Malay Peninsula and Archipelago to Australia.

SPECIMENS EXAMINED:

1 (17600)	Off C. Negrais, Burma,	Ind. Mus.
1 (132 ..)	Gulf of Mantaban	Oates.
1 (199 ..)	"	"
1 (102 ..)	Java Sea (5° 22' S., 107° 42' E.),	Hardenberg.
1 (123 ..)	Malacca Strait (0° 34' N., 104° 04' E.).	"
1 (135 ..)	Agatara Sea, 30 fms.	" Challenger."
1 (170 ..)	12 miles N. E. of Bowen, Queensland,	Austr. Mus.
	19-25 fms.	(" Endeavour ").
1 (171 ..)	11-14 miles N. W. of Pine Peak,	"
	Queensland, 24-26 fms.	"

Also 1 from off Ceylon (Ind. Mus.), and 3 from Queensland (Austr. Mus. "Endeavour").

2. GRAMMATOBOTHUS PENNATUS (Ogilby).

Platophrys pennata, Ogilby, 1917, Mem. Qd. Mus., 11, p. 82.

Grammatobothus pennatus, Norman, 1920, Biol. Res. "Endeavour", 5, p. 255, fig. 74; McCulloch, 1929, Mem. Austr. Mus., 5, p. 277.

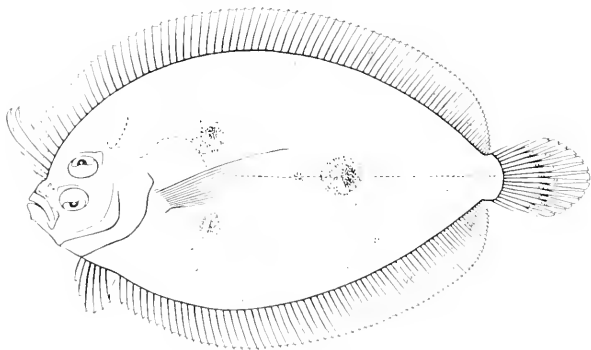


FIG. 188. *Grammatobothus pennatus*. B.M. (N.H.) 1925.7.22.99. $\frac{2}{3}$.

Depth of body $1\frac{1}{2}$ to twice in the length, length of head $3\frac{2}{3}$ to 4. Notch in front of eyes less marked than in the preceding species, the upper profile of the head less convex. Snout about as long as eye, diameter of which is about $\frac{1}{4}$ in length of head.

and 3 to 4 times the interorbital width; lower eye in advance of upper. One or two blunt prominences in front of lower eye, and two more above the maxillary. Maxillary extending to below anterior edge of eye, length a little more than 3 in that of head; lower jaw $2\frac{1}{2}$ to $2\frac{1}{4}$ in head. Gill-rakers rather more slender than in *G. polyophthalmus*; 8 to 10 on lower part of anterior arch. 79 to 83 scales in lateral line. Dorsal 88-91; third ray prolonged, more or less expanded and pinniform, about $\frac{3}{4}$ length of head; the fourth ray also prolonged in one or two specimens. Anal 72-76. Pectoral of ocular side with 13 to 15 rays, upper ray sometimes moderately prolonged. Rays of left pelvic not prolonged. Coloration similar to that of *G. polyophthalmus*, but the black ocellus on middle of straight part of lateral line is darker and more prominent.

TYPE.—Queensland Museum.

DISTRIBUTION.—Eastern Queensland.

SPECIMENS EXAMINED:

2 (159, 177 mm.).	12 miles N.E. of Bowen, Queensland, 19-25 fms.	Austr. Mus. ("Endeavour").
1 (162 mm.).	25 miles S.E. of Double Island Point, Queensland, 33 fms.	"

Also 5 from Queensland (Austr. Mus. "Endeavour").

3 GRAMMATOBOTHUS KREMPFI, Chabanaud.

Grammatobothus kempfii, Chabanaud, 1929, Bull. Mus. Hist. nat. Paris, (2) i, p. 377.

Very close to the preceding species, but dorsal 82; second to fourth rays progressively and considerably prolonged, pinniform, third about $1\frac{1}{4}$ in length of head. Anal 66. Rays of left pelvic prolonged, pinniform; third ray longest.

TYPE.—Paris Museum¹

DISTRIBUTION.—Poulo Condore, Indo-China.

Genus 30. MANCOPSETTA.

Lepidopsetta (non Gill, 1864), Gunther, 1880, Shore Fishes "Challenger", p. 18 [*Lepidopsetta maculata*, Gunther].

Mancopsetta, (Gill) Jordan, 1920, Genera Fish., iv, p. 514 [*Lepidopsetta maculata*, Gunther].

Body rather elongate, compressed. Eyes on the left side, separated by a bony ridge, the lower a little in advance of upper; upper parts of both eye-balls densely scaled, interorbital region similar in both sexes. No rostral or orbital spines. Olfactory laminae well developed, rather few in number, parallel with one another and with the main axis of the body; no central rachis. Mouth of moderate size, the maxillary narrow, scarcely expanded behind, length about $\frac{1}{3}$ that of head; jaws about equally developed on both sides, but dentition stronger on blind side; teeth small, conical, scarcely enlarged anteriorly, uniserial in both jaws; vomer toothless. Upper angle of gill-opening well below lateral line; gill-rakers comparatively few in number, rather short and stout. Dorsal fin commencing behind level of posterior nostril of blind side and just in front of eye; all the rays simple, scaled. Tip of first interhæmal spine not projecting in front of anal fin. No pectoral fins. Posterior part of pelvic fin of ocular side scarcely deflected on to left side of body. Scales small, ctenoid on both sides of body; no supplementary scales. Lateral line equally developed on both sides of body, nearly straight; no supratemporal branch. Vent on median line, just in front of anal fin.

A single species from the southern Atlantic and Indian Ocean.

¹ A male, 175 mm. in length.

1. *MANCOPSETTA MACULATA* (Günther)

Lepidopsetta maculata, Günther, 1859, Shore Fishes "Challenger", p. 18, pl. xxx, fig. c., Norman, 1939, "Discovery" Reports, II, p. 361.
Mancopsetta maculata, Jordan, 1920, Genera Fish., IV, p. 514.

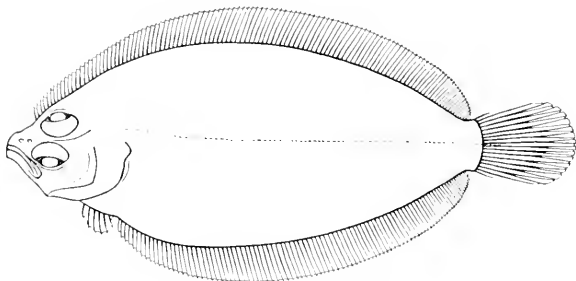


FIG. 180.—*Mancopsetta maculata*. B.M. (N.H.) 1939. 5. 6. 41. 1/2.

Depth of body $2\frac{1}{4}$ to $2\frac{1}{2}$ in the length, length of head about $3\frac{1}{4}$. Upper profile of head a little notched in front of eyes. Snout shorter than eye, diameter of which is 3 to $3\frac{1}{4}$ in length of head. Maxillary extending to below anterior part of eye, length $\frac{3}{4}$ or more than $\frac{1}{2}$ that of head; lower jaw about $\frac{1}{2}$ head. About 12 gill-rakers on lower part of anterior arch. 114 to 120 scales in lateral line. Dorsal 118-119. Anal 97-98. Caudal rounded, caudal peduncle very short. Brownish; head, body and fins covered with irregular rounded darker spots and blotches.

TYPE.—British Museum (Nat. Hist.) Reg. No. 79.5.14.00.

DISTRIBUTION.—South Atlantic, north of the Falkland Islands, southern Indian Ocean, near Prince Edward's Island.

SPECIMENS EXAMINED:

1 (11.4 mm.)	Holotype	Near Prince Edward's Isl., 310 fms.	"Challenger"
1 (27 "	"	45° 45' S., 59° 35' W., 120-125 fms.	"Discovery"

Genus 31. *ACHIROPSETTA*.

Achiropsetta, Norman, 1939, "Discovery" Reports, II, p. 361. *Achiropsetta tricholepis*, Norman.

Close to *Lepidopsetta*, but body more elongate, the middle portion fairly thick and muscular, continued above and below as a thin semi-transparent region containing the supports of the fins. Eyes separated by a flat, scaled space. Jaws and dentition about equally developed on both sides. Dorsal fin commencing above posterior nostril of blind side, dorsal and anal ending very close to base of caudal. Pelvic fin of ocular side median in position anteriorly, twisted on to left side of body posteriorly. Scales very small, ctenoid, the long spinules directed vertically, giving the skin a pilose appearance.

A single species from Tierra del Fuego and the Falkland Islands.

1. ACHIROPSETTA TRICHOLEPIS, Norman

Achiropsetta tricholepis, Norman, 1930, "Discovery" Reports, II, p. 362, fig. 47.

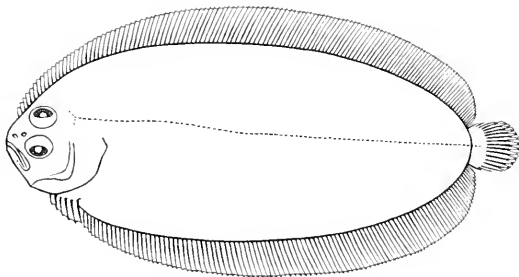


FIG. 100.—*Achiropsetta tricholepis*. B.M. (N.H.) 1930.5.6.42. $\times 1$.

Depth of body $2\frac{1}{2}$ in the length, length of head $4\frac{1}{2}$. Upper profile of head evenly convex. Snout shorter than eye, diameter of which is about $3\frac{1}{2}$ in length of head and 3 times the interorbital width. Maxillary extending to below anterior part of eye, length a little more than $\frac{1}{2}$ that of head; lower jaw nearly $\frac{1}{2}$ head. 9 or 10 gill-rakers on lower part of anterior arch. Dorsal about 130. Anal 114. Caudal rounded. Uniformly yellowish brown.

TYPE.—British Museum (Nat. Hist.). Reg. No. 1930.5.6.42.

DISTRIBUTION.—Off Tierra del Fuego; Falkland Islands.

SPECIMENS EXAMINED:

1 (100 mm.).	Holotype.	9 miles N. 21° E. of Arenas Point Light, 12-11 fms.	"Discovery."
1 (105 ,,).		Falkland Is.	„

Genus 32. CHASCANOPSETTA.

Chascanopsetta, Alcock, 1894, J. Asiat. Soc. Beng., lxiii (2), p. 128 [*Chascanopsetta lugubris*, Alcock]; Alcock, 1899, Cat. Indian Deep-Sea Fishes, p. 125.
Trachypterophrys, Franz, 1910, Abh. Bayer. Akad. Wiss., Suppl. iv, Abh. 1, p. 60 [*Trachypterophrys raptator*, Franz].

Body elongate, tapering posteriorly, strongly compressed. Eyes on the left side, separated by a rather narrow and slightly concave space; interorbital region similar in both sexes. No rostral or orbital spines. Olfactory laminae rather numerous, arranged transversely to a long central rachis. Mouth very large, the length of the maxillary more than $\frac{1}{2}$ that of head; tip of lower jaw projecting in front of upper; mandibular membranes not forming a distinct pouch; jaws and dentition about equally developed on both sides; teeth small, slender, curved, pointed, those of the lower jaw depressible; uniserial in both jaws; no distinct canines; vomer toothless. Gill-openings wide; gill-rakers absent or represented by one or two rudiments. Dorsal fin commencing above anterior nostril of blind side and well in front of eye; anterior rays connected by membrane only at their bases; all the rays simple, not scaled.

Tip of first interhamal spine not projecting in front of anal fin. Pectoral fins unequal, that of ocular side larger; all the rays simple. Anterior ray of left pelvic well in advance of that of right. Scales very small, cycloid on both sides of body; no supplementary scales. Lateral line equally developed on both sides of body, with a low, flat-topped curve above the pectoral fin; no supratermporal branch. Vent on blind side, just in front of anal fin.

Two species from the Indo-Pacific.

KEY TO THE SPECIES.

- I. Maxillary extending beyond posterior edge of eye, length $1\frac{1}{2}$ to $1\frac{3}{4}$ in head;
width of curve of lateral line 5 to $5\frac{1}{2}$ in straight part 1. *lugubris*
II. Maxillary extending to below posterior edge of eye, length $1\frac{2}{3}$ in head;
width of curve of lateral line 6 in straight part 2. *prolonga*

1. CHASCANOPSETTA LUGUBRIS, Alcock

- chascanopsetta lugubris*, Alcock, 1894, J. Asiatic Soc. Bengal, LXIV (2), p. 129, pl. vi, fig. 1, Alcock, 1895, Illust. Zool. "Investigator", Fishes, pl. xv, fig. 7, Alcock, 1899, Cat. Indian Deep-Sea Fishes, p. 128; Brauer, 1906, "Valdivia" Tiefsee-Fische, p. 295; Norman, 1927, Rec. Ind. Mus., XLV, p. 35, fig. 9; Norman, 1931, Ann. Mag. Nat. Hist., (10) VII, p. 601.
Brachypteropterus nuptator, Trauz, 1910, Abh. Bayer. Akad. Wiss., Suppl. IV, p. 60, pl. VII, fig. 54; Hubbs, 1915, Proc. U.S. Nat. Mus., XLVI, p. 452.
sa chascanopsetta gibberita, Von Bonde, 1922, Rep. Fish. Mar. Bol. Surv. S. Afr., II, (1921), Spéc. Rep. 1, p. 7, pl. II, fig. 2; Barnard, 1925, Ann. S. Afr. Mus., XXI, p. 399.
chascanopsetta maculata, Von Bonde, 1922, *loc. cit.*, p. 8; Von Bonde, 1925, Trans. Roy. Soc. S. Afr., VII, p. 288.

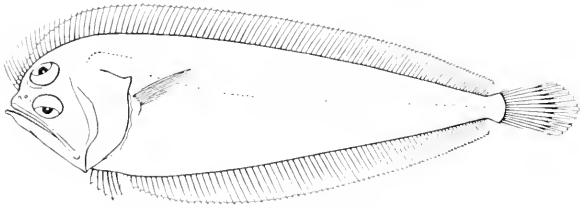


FIG. 131. — *Chascanopsetta lugubris*. B.M. (N.H.) 1909, t. 20, f. 7.

Depth of body $3\frac{1}{2}$ to nearly 4 in the length, length of head 4 to $5\frac{1}{2}$. Diameter of upper eye $3\frac{1}{2}$ to 4 in length of head, 3 to 5 times interorbital width. Cleft of mouth generally oblique, but sometimes nearly vertical or horizontal; maxillary extending to well beyond eye, length $1\frac{1}{2}$ to $1\frac{3}{4}$ in that of head. Width of curve of lateral line 5 to $5\frac{1}{2}$ in straight part. Dorsal 114-122. Anal 77-85. Pectoral of ocular side with 14 to 17 rays, length $1\frac{1}{2}$ to $2\frac{1}{2}$ in that of head. Caudal obtusely pointed, caudal peduncle deeper than long. Greyish or yellowish brown, with or without numerous small dark spots; fins dusky.

TYPE: Indian Museum, No. 13728.

DISTRIBUTION: Off south-east Africa; Gulf of Manar; Bay of Bengal; Japan; in deep water.

SPECIMENS EXAMINED:

1 (205 mm.).	Paratype of <i>C. gilchristi</i> .	Natal, 275 fms.	Gilchrist.
2 (145, 245 mm.).	Paratypes of <i>C. maculata</i> .	" 174-225 fms.	"
1 (210 mm.).		West of Ceylon.	Ind. Mus.
1 (180 ").		Off Madras coast.	"
1 (142 ").	Co-type of <i>Trachyptero-</i> <i>phrys raptator</i> .	Fukuura, Japan.	Zool. Samml. Munich.

Also 4 from off Ceylon and the Bay of Bengal, including the type of the species (Ind. Mus. "Investigator"); and 5 from Japan, co-types of *Trachyptero-phrys raptator* (Zool. Samml., Munich).

In the type of *C. lugubris* the curve of the lateral line has a sharp angle above the base of the pectoral fin on the ocular side, as shown in Alcock's figure. This is clearly an abnormal condition, the curve being normally flat-topped on the blind side of the body.

This fish exhibits some variation in form, size of eye, etc., but I am unable to recognise any specific differences.

2. CHASCANOPSETTA PRORIGERA, Gilbert.

- Chascanopsetta prorigera*, Gilbert, 1905, Bull. U.S. Com. Fish., xxiii (2), (1903), p. 689, fig. 271;
Jordan and Seale, 1906, Bull. U.S. Bur. Fish., xxv, (1905), p. 413.
Chascanopsetta prorigera, Fowler, 1928, Mem. B. P. Bishop Mus., 8, p. 92.

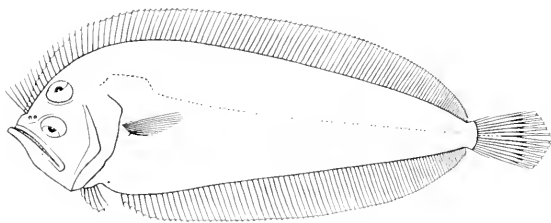


FIG. 192.—*Chascanopsetta prorigera*. U.S.N.M. 51605. < 1/2.

Close to *C. lugubris*. Depth of body about 3 in the length, length of head a little more than 4. Diameter of upper eye about 4 in length of head, twice interorbital width. Cleft of mouth oblique; maxillary extending to below posterior edge of eye, length $1\frac{2}{3}$ in that of head. Width of arch of lateral line 6 in straight part. Dorsal 125. Anal 89. Pale brownish olive, everywhere finely spotted with pale brown; 3 irregular dark blotches on lateral line, the middle one largest; dorsal and anal fins finely mottled, a row of inconspicuous large brown spots on basal half.

TYPE.—United States National Museum. No. 51605¹

DISTRIBUTION.—Hawaiian Islands, 178 to 202 fathoms.

Only the type known.

¹ A male, 225 mm. in total length.

Genus 33. PELECANICHTHYS.

Pelecanichthys, Gilbert and Cramer, 1897, Proc. U.S. Nat. Mus., xix, (1896), p. 432 [*Pelecanichthys crumenalis*, Gilbert and Cramer].

Close to *Chasmopsella*, but with larger mouth, the maxillary being longer than the head (without projection of lower jaw), about $\frac{1}{4}$ of the length of the lower jaw projecting in front of the upper, mandibular membranes voluminous, forming a distinct gular pouch. Anterior ray of left pelvic not very far in advance of that of right, right pelvic with rather long base. The middle portion of the body fairly thick and muscular, continued above and below as a thin semi-transparent region containing the supports of the fins.

A single species from the Hawaiian Islands.

1. PELECANICHTHYS CRUMENALIS, Gilbert and Cramer

Pelecanichthys crumenalis, Gilbert and Cramer, 1897, Proc. U.S. Nat. Mus., xix, (1896), p. 437, pl. xlvii; Jordan and Evermann, 1905, Bull. U.S. Com. Fish., xxiii (1), (1903), p. 510, fig. 226; Gilbert, 1905, Bull. U.S. Com. Fish., xxiii (2), (1903), p. 699; Fowler, 1928, Mem. B. P. Bishop Mus., x, p. 93.

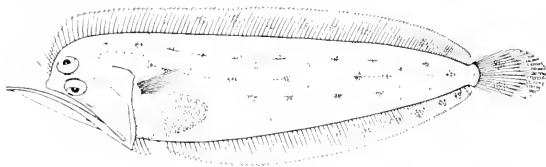


FIG. 167.—*Pelecanichthys crumenalis*. B.M. (N.H.) 1930.9.2.7. $\frac{1}{2}$.

Depth of body about $\frac{1}{4}$ in the length (without lower jaw), length of head $4\frac{1}{2}$. Diameter of eye about $\frac{1}{4}$ in length of head (without lower jaw), 4 times the interorbital width. Maxillary extending nearly to edge of operculum, longer than head. Width of curve of lateral line nearly 6 in straight part. Dorsal 121. Anal 88. Pectoral of ocular side with 13 or 14 rays, length $1\frac{3}{4}$ in that of head. Yellowish brown, with 5 or 6 series of large round dark spots, dorsal and anal fins with traces of similar spots, caudal dusky.

TYPE.—United States National Museum, No. 48738.

DISTRIBUTION.—Hawaiian Islands, 238 to 344 fathoms.

SPECIMENS EXAMINED.

1 (215 mm) — Paratype.

Hawaiian I.

Stanford Univ.

Genus 34. LEOIPS.

Leop, Guntler, 1850, Shore Fishes "Challenger", p. 20. *Leops parviceps*, Guntler¹, Norman, 1871, Ann. Mag. Nat. Hist., (10) xiii, p. 693.

Scangela, Alcock, 1889, J. Asiat. Soc. Bengal, lxxvii (2), p. 284. Alcock, 1890, Ann. Mag. Nat. Hist., (10) xl, p. 219. *Scangela macrophthalmus*, Alcock.

Lamblopsella, Smith and Pope, 1906, Proc. U.S. Nat. Mus., xxxi, p. 499. *Lamblopsella kitaharae*, Smith and Pope.

Leoptichthys, Hubbs, 1911, Proc. U.S. Nat. Mus., xlviii, p. 460. *Leoptichthys fragilis*, Hubbs.

Body ovate or rather elongate, broad in front, tapering behind, compressed. Eyes on the left side, separated by a bony ridge or very narrow concave space; interorbital region similar in both sexes. No rostral or orbital spines. Olfactory laminae in moderate number, arranged transversely to or radiating from a fairly long central rachis. Mouth small, protractile, the length of the maxillary $3\frac{2}{3}$ to $4\frac{2}{3}$ in that of head. Jaws about equally developed on both sides, but dentition almost entirely confined to blind side; teeth all very small, pointed, more or less uniserial or in narrow bands in both jaws; vomer toothless. Gill-rakers few in number, very short, sometimes rudimentary. Dorsal fin commencing above nostrils of blind side and in front of or above anterior edge of eye; all the rays simple, scaled (at least on ocular side); first two rays generally separated by an interspace from remainder of fin. Tip of first interhæmal spine not projecting in front of anal fin. Pectoral fins unequal, that of ocular side larger. Scales very small, all cycloid; no supplementary scales. Lateral line developed only on ocular side of body, with a distinct curve above the pectoral fin; without or with a very short supratemporal branch. Vent on blind side, above first ray of anal fin.

Eight or nine species from the Indo-Pacific.

SYNOPSIS OF THE SPECIES.

- I. Origin of dorsal above anterior nostril of blind side; first two rays not detached from remainder of fin, second and third a little prolonged; dorsal 103-106, anal 83-85. 1. *nigromaculatus*.
- II. Origin of dorsal above posterior nostril of blind side; first two rays detached from remainder of fin, but none of the rays prolonged (except in very young).
 - A. Dorsal 85-90, anal 67-70; head 3 to $3\frac{2}{3}$ in length; eye $3\frac{2}{3}$ to $4\frac{1}{2}$ ($5\frac{1}{2}$ in young) in head 2. *macrophthalmus*.
 - B. Dorsal 95-115, anal 75-95; head 4 to $6\frac{1}{2}$ in length.
 1. Dorsal 95-104, anal 75-86; 89 to 100 scales in lateral line.
 - a. Pectoral as long as or longer than head, which is 4 to $4\frac{2}{3}$ in length 3. *nigrescens*.
 - b. Pectoral shorter than head, which is $4\frac{1}{3}$ to $5\frac{2}{3}$ in length.
 - a. Head $4\frac{1}{3}$ to $5\frac{1}{3}$ in length; eye 3 to $3\frac{1}{2}$ in head.
 - * Upper profile nearly straight above and behind eyes; depth $2\frac{2}{3}$, head $5\frac{1}{2}$ in length; maxillary $4\frac{2}{3}$ in head; dorsal 104, anal 86 4. *parviceps*.
 - ** Upper profile a little convex above and behind eyes; depth $2\frac{1}{2}$ to 3, head $4\frac{1}{3}$ to 5 in length; maxillary 4 to $4\frac{2}{3}$ in head; dorsal 97-102, anal 77-81 5. *guentheri*.
 - *** Upper profile markedly convex above and behind eyes; depth $2\frac{1}{2}$ to $2\frac{1}{2}$, head 5 to $5\frac{1}{2}$ in length; maxillary a little more than 4 in head; dorsal 97-99, anal 75-77 6. *natalensis*.
 - β. Head $5\frac{2}{3}$ in length; eye $2\frac{1}{2}$ in head; depth nearly 3 in length 7. *kitaharæ*.
 2. Dorsal 104-115, anal 85-95; 98 to 120 scales in lateral line.
 - a. Pectoral shorter than head; eye $2\frac{2}{3}$ or more in head.
 - a. Eye $2\frac{2}{3}$ to $3\frac{2}{3}$, maxillary $3\frac{2}{3}$ to $3\frac{2}{3}$ in head; first dorsal ray not prolonged 8. *lanceolata*.
 - β. Eye $6\frac{1}{2}$, maxillary about $3\frac{2}{3}$ in head; first dorsal ray filamentous, more than twice as long as head 9. *variegata*.
 - b. Pectoral nearly twice as long as head; eye $2\frac{1}{2}$ to $2\frac{2}{3}$ in head 10. *pectoralis*.

Scianectes and *Lambdopselta* are clearly synonyms of *Laops*, and there seems to be no valid reason for retaining *Laoptichthys* as a distinct genus (see p. 260). In *Laops nigromaculatus* the first two rays are continuous with the remainder of the dorsal fin, but in other respects this species is a typical *Laops*.

1. *LÆOPS NIGROMACULATUS*, Von Bonde

Læops nigromaculatus, Von Bonde, 1922, Rep. Fish. Mar. Biol. Surv. S. Afr., ii, (1921), Spec. Rep. 1, p. 19, pl. 10. Von Bonde, 1923, Trans. Roy. Soc. S. Afr., xii, p. 289; Barnard, 1923, Ann. S. Afr. Mus., xxi, p. 122; Norman, 1931, Ann. Mag. Nat. Hist., (10) viii, p. 519.

Depth of body $2\frac{3}{4}$ to $2\frac{1}{2}$ in the length, length of head 5 to $5\frac{1}{2}$. Upper profile of head and body markedly convex above and behind eyes. Diameter of eye $3\frac{2}{3}$ to $3\frac{3}{4}$ in length of head; lower eye scarcely in advance of upper, which is separated from edge of head by a space equal to $\frac{1}{4}$ or $\frac{1}{3}$ its diameter. Maxillary scarcely reaching anterior edge of eye, length $3\frac{1}{2}$ to 4 in head; teeth uniserial, almost entirely confined to blind side of jaws. 6 or 7 gill-rakers on lower part of anterior arch. 102 scales in lateral

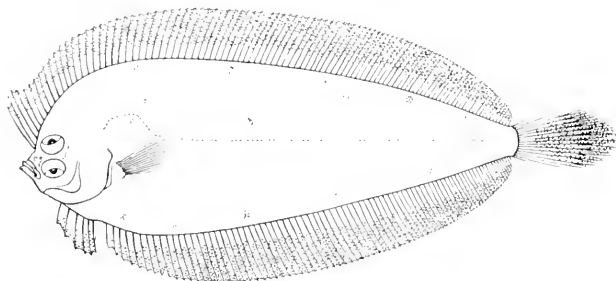


FIG. 194. *Læops nigromaculatus*. B.M. (N.H.) 1922, 127, 1, 4.

line. Dorsal 103–106, origin above anterior nostril of blind side, first two rays not detached from remainder of fin; second and third rays a little prolonged. Anal 83–85. Pectoral of ocular side with 14 rays, length $1\frac{1}{4}$ to $1\frac{1}{2}$ in that of head. Caudal obtusely pointed. Brownish, with small black spots scattered irregularly over the body; outer parts of dorsal and anal fins black; caudal blackish.

TYPE.—Government Marine Survey of South Africa Collection.

DISTRIBUTION.—Off Natal coast and Delagoa Bay, 55 to 100 fathoms.

SPECIMENS EXAMINED:

2 (166, 178 mm.). Paratypes.

Natal, 55–100 fms.

Gulchrist

2. *LÆOPS MACROPHthalmus* (Alcock)

Macranectes macrophthalmus, Alcock, 1889, J. Asiatic Soc. Beng., lviij (2), p. 292, pl. xvi, fig. 4; Alcock, 1890, Ann. Mag. Nat. Hist., (6) iv, p. 395; Alcock, 1899, Ann. Mag. Nat. Hist., (6) vi, p. 216; Alcock, 1898, Illust. Zool. "Investigator", Fishes, pl. xxiii, fig. 1.

Macranectes lophoptera, Alcock, 1889, J. Asiatic Soc. Beng., lviij (2), p. 284, pl. xvi, fig. 2.

Læops macrophthalmus, Alcock, 1899, Cat. Ind. Deep-Sea Fishes, p. 128; Regan, 1905, J. Bombay Nat. Hist. Soc., xxi, p. 329; Norman, 1927, Rep. Ind. Mus., xxix, p. 35.

Læops lophoptera, Norman, 1927, *ibid.*, p. 39.

Depth of body $2\frac{1}{4}$ to $2\frac{3}{4}$ in the length, length of head 3 to $3\frac{1}{2}$. Upper profile of head and body more or less convex above and behind eyes. Diameter of eye $3\frac{1}{4}$ to a little

more than 4 ($5\frac{1}{2}$ in young) in length of head; lower eye a little in advance of upper, which is very close to edge of head. Maxillary extending to beyond anterior edge of eye, length $3\frac{3}{4}$ to $4\frac{1}{4}$ ($3\frac{3}{4}$ in young) in that of head; teeth uniserial, almost entirely confined to blind side of jaws. 6 to 8 gill-rakers on lower part of anterior arch. About 93 scales in lateral line. Dorsal 85-90; origin above posterior nostril of blind side; first two rays detached from remainder of fin; none of the rays prolonged, longest shorter than head (except in young). Anal 67-70. Pectoral of ocular side with 13 to 15 rays, length $1\frac{1}{2}$ to $1\frac{3}{4}$ in that of head. Caudal obtusely pointed. Brownish; dorsal and anal fins darker towards their margins; middle rays of caudal and distal part of left pectoral dark brown or blackish.

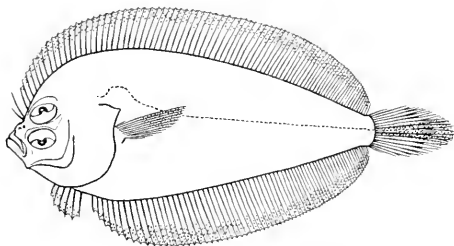


FIG. 195.—*Leops macrophthalmus*. B.M. (N.H.) 1927.1.6.58. . . 3.

TYPE.—Indian Museum. No. 11721.

DISTRIBUTION.—From the Gulf of Oman through the Indian Ocean to Burma; in deep water.

SPECIMENS EXAMINED:

4 (92-138 mm.).	Sea of Oman, 180 fms.	Townsend.
2 (100, 130 ").	Off Calicut, Madras, 100 fms.	Ind. Mus.
2 (90, 95 ").	Off Ganjam Coast, Bay of Bengal, 98-102 fms.	"
2 (105, 106 ").	" " "	"

Also several from India and Burma, including the holotype of the species and the holotype and first paratype of *L. lophoptera* (Ind. Mus.).

Examination of the types of *L. lophoptera* (No. 12435-6), 78 and 85 mm. in total length, leaves little doubt that this is the young of *L. macrophthalmus*.

3 LÆOPS NIGRESCENS, Lloyd.

Leops nigrescens, Lloyd, 1907. Rec. Ind. Mus., i, p. 9; Lloyd, 1908, Illust. Zool. " Investigator ", Fishes, pl. xliii, fig. 2; Lloyd, 1909, Mem. Ind. Mus., ii, p. 161; Norman, 1927, Rec. Ind. Mus., xxix, p. 38, fig. 10.

Depth of body $2\frac{1}{2}$ to $2\frac{3}{4}$ in the length, length of head 4 to $4\frac{1}{2}$. Upper profile of head and body moderately convex above and behind eyes. Diameter of eye about 3 in length of head; lower eye a little in advance of upper, which is very close to edge of head. Maxillary extending to beyond anterior edge of eye, length $3\frac{3}{4}$ to $4\frac{1}{4}$ in that of head; teeth more or less biserial, mainly confined to blind side of jaws. 8 to 10 gill-rakers on lower part of anterior arch. 89 to 92 scales in lateral line. Dorsal 95-98; origin above posterior nostril of blind side; first two rays detached from

remainder of fin, none of the rays prolonged. Anal 86-83. Pectoral of ocular side with 13 rays, as long as or longer than head. Caudal obtusely pointed. Brownish, with irregular patches of darker, dorsal and anal fins darker towards their margins.

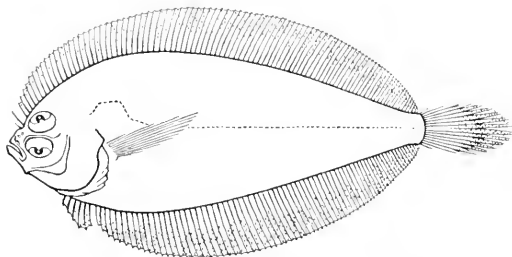


FIG. 196.—*Laeops nigrescens*. B.M. (N.H.) 1927.1.6.56. ♂.

TYPE.—Indian Museum. No. F. 1291.

DISTRIBUTION.—Gulf of Aden; in deep water.

SPECIMENS EXAMINED:

♂ (147, 150 mm). Paratypes. 13° 36' N, 47° 32' E, 130 fms. Ind. Mus.

Also 2 other paratypes from the same locality (Ind. Mus.).

4. *LAEOPS PARVICEPS*, Gunther.

Laeops parviceps, Gunther, 1880, *Short Fishes "Challenger"*, p. 29, pl. xv, fig. A; Fowler, 1928, *Mem. B. P. Bishop Mus.*, x, p. 92; Weber and Beaufort, 1929, *Fish. Indo-Austral. Arch.*, v, p. 116, fig. 28.

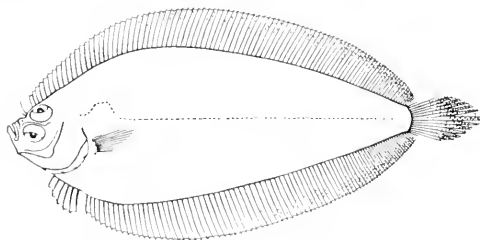


FIG. 197.—*Laeops parviceps*. B.M. (N.H.) 79.5.14.92. ♂.

Depth of body $2\frac{1}{2}$ in the length, length of head $5\frac{1}{4}$. Upper profile of head and body nearly straight above and behind eyes. Diameter of eye $\frac{3}{4}$ in length of head, lower

eye a little in advance of upper, which touches edge of head. Maxillary scarcely reaching anterior edge of eye, length $4\frac{2}{3}$ in that of head; teeth in narrow bands, confined to blind side of jaws. 7 gill-rakers on lower part of anterior arch. 93 scales in lateral line. Dorsal 10.4; origin above posterior nostril of blind side; first two rays detached from remainder of fin; none of the rays prolonged. Anal 86. Pectoral of ocular side with 13 rays, length a little more than $\frac{1}{2}$ that of head. Caudal pointed. Yellowish brown, with traces of darker markings; dorsal and anal fins darker towards their margins; caudal dusky.

TYPE.—British Museum (Nat. Hist.). Reg. No. 79.5.14.98.

DISTRIBUTION.—Arafura Sea, 35 to 49 fathoms.

SPECIMEN EXAMINED:

1 (140 mm.). Holotype.

Arafura Sea, 35-49 fms.

"Challenger."

5. *LEOPS GUENTHERI*, Alcock.

Leops guentheri, Alcock, 1890, Ann. Mag. Nat. Hist., (6) vi, p. 438; Alcock, 1898, Illust. Zool.

"Investigator", Fishes, pl. xxii, fig. 4; Norman, 1927, Rec. Ind. Mus., xxix, p. 37.

Scianectes macrophthalmus (part), Jenkins, 1910, Mem. Ind. Mus., iii, p. 27.

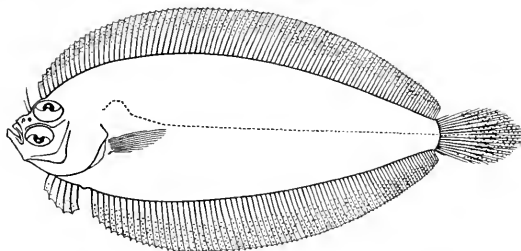


FIG. 198.—*Leops guentheri*. B.M. (N.H.) 1927.1.6.55. 1.

Depth of body $2\frac{1}{2}$ to 3 in the length, length of head $4\frac{1}{3}$ to 5. Upper profile of head and body a little convex above and behind eyes. Diameter of eye 3 to $3\frac{1}{3}$ in length of head; lower eye in advance of upper, which enters upper profile of head. Maxillary scarcely reaching anterior edge of eye, length 4 to $4\frac{2}{3}$ in that of head; teeth in narrow bands, confined to blind side of jaws. 6 to 8 gill-rakers on lower part of anterior arch. About 95 scales in lateral line. Dorsal 97-102; origin above posterior nostril of blind side; first two rays detached from remainder of fin; none of the rays prolonged. Anal 77-81. Pectoral of ocular side with 14 rays, length $1\frac{2}{3}$ to $1\frac{3}{4}$ in that of head. Caudal pointed. Pale brownish; dorsal and anal fins darker towards their margins; caudal dusky.

TYPE.—Indian Museum No. 12888.

DISTRIBUTION.—Persian Gulf; east coast of India; Gulf of Martaban.

SPECIMENS EXAMINED:

1 (102 mm.).	Ganjam Coast, 15-25 fms.	Ind. Mus.
1 (100 ").	Puri, Orissa coast.	"
2 (75, 95 mm.).	Mouth of R. Hughli, Calcutta.	"

Also 6 from the Persian Gulf, India and Burma, including the holotype of the species (Ind. Mus.).

6. *LEOPS NATALENSIS*, Norman

Lambdopsitta kitaharae, (non) Smith and Pope, Von Bonde, 1922, Rep. Fish. Mar. Biol. Surv. S. Afr., II, (1923), Spec. Rep., 1, p. 6; Barnard, 1925, Ann. S. Afr. Mus., XXI, p. 393.
Leops natalensis, Norman, 1931, Ann. Mag. Nat. Hist., (10) VIII, p. 510.

Depth of body $2\frac{1}{2}$ to $2\frac{1}{4}$ in the length, length of head 5 to $5\frac{1}{4}$. Upper profile of head and body markedly convex above and behind eyes. Diameter of eye about $\frac{3}{4}$ in length of head; lower eye a little in advance of upper, which almost touches edge of head. Maxillary extending to below anterior edge of eye, length a little more than $\frac{1}{4}$ in that of head; teeth in narrow bands, mostly confined to blind side of jaws. 5 or 6 gill-rakers on lower part of anterior arch. About 100 scales in lateral line. Dorsal 97-99—origin above posterior nostril of blind side; first two rays detached from remainder of fin; none of the rays prolonged. Anal 75-77. Pectoral of ocular side with 14 rays, length about $1\frac{1}{2}$ in that of head. Caudal rounded. Yellowish brown; median fins dusky towards their margins.

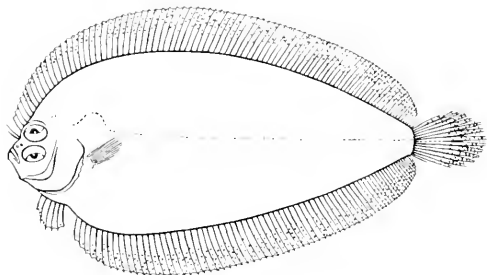


FIG. 1091.—*Leops natalensis*. B.M. (N.H.) 1922, 3, 27, 19. ♂

TYPE.—British Museum (Nat. Hist.)—Reg. No. 1922.3.27.19.

DISTRIBUTION.—Coast of Natal, 180 to 230 fathoms.

SPECIMENS EXAMINED

1 (135 mm).—Holotype. Natal, 230 fms. Gilchrist

Also a paratype (115 mm) from Natal, 180 fms. (Government Marine Survey Coll.)

Readily distinguished from *L. kitaharae* by the deeper body, larger head, more convex profile, etc.

7. *LEOPS KITAHARAE* (Smith and Pope)

Lambdopsitta kitaharae, Smith and Pope, 1909, Proc. U.S. Nat. Mus., XXXI, p. 496, fig. 12; Jordan, Tanaka and Snyder, 1913, J. Coll. Sci. Tokyo, XXXIII (4), p. 317, fig. 295.
Leops kitaharae, Hubbs, 1915, Proc. U.S. Nat. Mus., XLV, p. 460; Norman, 1931, Ann. Mag. Nat. Hist., (10) VIII, p. 507.

Depth of body nearly 3 in the length, length of head $5\frac{1}{4}$. Upper profile of head and body moderately convex above and behind eyes. Diameter of eye $2\frac{1}{2}$ in length of head; lower eye very slightly in advance of upper, which touches edge of head. Maxillary extending to a little beyond anterior margin of eye, length nearly $\frac{1}{4}$ in that

of head, teeth in narrow bands, confined to blind side of jaws. 5 or 6 gill-rakers on lower part of anterior arch. 100 scales in lateral line. Dorsal 103; first two rays detached from remainder of fin; none of the rays prolonged. Anal 76. Pectoral of ocular side about $\frac{2}{3}$ length of head. Caudal rounded. Greenish yellow; median fins blackish towards their margins.

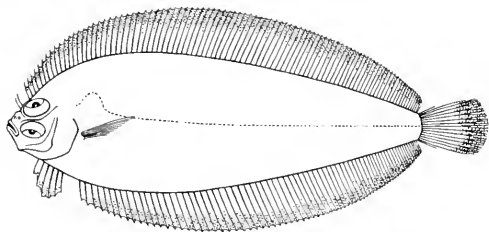


FIG. 200.—*Laeops kitaharae*. U.S.N.M. 55612. $\times \frac{3}{4}$.

TYPE.—United States National Museum. No. 55612.

DISTRIBUTION.—Japan.

The type (137 mm.), from Kagoshima, is the only specimen known.

8. *LEOP'S LANCEOLATA*, Franz.

Laeops lanceolata, Franz, 1910, Abh. Bayer. Akad. Wiss., Suppl. iv, Abh. 1, p. 62, pl. viii, fig. 60; Hubbs, 1915, Proc. U.S. Nat. Mus., xlviii, p. 460; Jordan and Hubbs, 1925, Mem. Carnegie Mus., x, p. 295.

Laoptichthys fragilis, Hubbs, 1915, Proc. U.S. Nat. Mus., xlviii, p. 460, pl. xxvi, fig. 4.

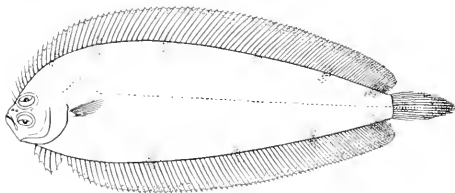


FIG. 201.—*Laeops lanceolata*. Co-type. $\times 1$.

Depth of body 3 to $3\frac{1}{4}$ in the length, length of head $5\frac{1}{4}$ to 6. Upper profile of head and body more or less convex above and behind eyes. Diameter of eye $2\frac{2}{3}$ to $3\frac{2}{3}$ in length of head; lower eye very little in advance of upper, which touches edge of head. Maxillary extending to below anterior edge of eye or beyond, length $3\frac{2}{3}$ to $3\frac{3}{4}$ in that of head; teeth apparently in narrow bands, confined to blind side of jaws. 6 to 8

gill-rakers on lower part of anterior arch—98 to 120 scales in lateral line. Dorsal 104-115; first two rays detached from remainder of fin; none of the rays prolonged. Anal 85-95. Pectoral of ocular side with 11 rays, length $1\frac{1}{2}$ to twice in that of head. Caudal pointed. Yellowish, with a series of 5 or 6 faint dark blotches at upper and lower edges of body, extending on to fins; median fins darker towards their margins.

TYPE.—Zoologische Sammlung des Bayerischen Staates, Munich.

DISTRIBUTION.—Japan.

SPECIMENS EXAMINED:

1 (80 mm.). Co-type. Ozushi, Japan, 27-55 fms. Zool. Samml., Munich.

Also 4 other co-types (77-87 mm.) from the same locality (Zool. Samml., Munich).

Col. Tenson has examined the type of *Leoptichthys fragilis* (U. S. Nat. Mus. No. 75073), 68 mm. in length, from Suruga Gulf, 47 fathoms, and assures me that this is identical with *Laeops lanceolata*. Hubbs described the teeth in this species as being in "a single even series", but Col. Tenson was unable to be sure of this character. Within the genus *Laeops* the arrangement of the teeth varies from narrow bands to a single series, and in young or poorly preserved examples it is often very difficult to be certain whether the teeth have the one arrangement or the other.

Laeops lanceolata may eventually prove to be the young of *L. kitaharae*, with which, apart from the higher number of dorsal and anal rays, it agrees very closely.

9. *LAEOPS VARIEGATA*, Franz.

Laeops variegata, Franz, 1010, Abh. Bayer. Akad. Wiss., Suppl. iv, Abh. 1, p. 93, pl. viii, fig. 59.
Hubbs, 1915, Proc. U. S. Nat. Mus., xlviii, p. 460.

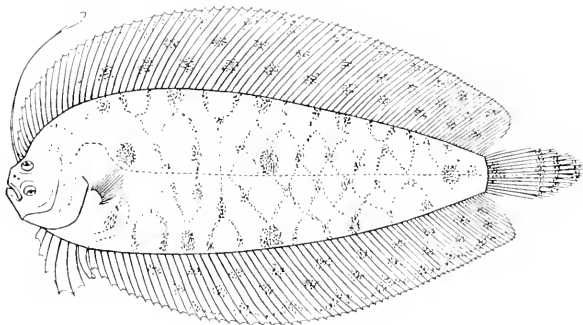


FIG. 202.—*Laeops variegata*. Co-type. $\times 13$.

A post-larval form, probably identical with *L. lanceolata*. Depth of body $2\frac{1}{2}$ in the length, length of head 6. Upper profile of head and body distinctly convex above and behind eyes. Diameter of eye $6\frac{1}{2}$ in length of head; anterior margins of eyes about level, upper rather close to edge of head. Length of maxillary about $3\frac{2}{3}$ in that of head. 8 or 9 gill-rakers on lower part of anterior arch. 110 scales in lateral line.

Dorsal 110; basal part of first ray strong, longer than head, the ray being produced to form a filament, the whole being more than twice length of head. Anal 90. Pectoral of ocular side with 15 (?) rays, length $2\frac{1}{2}$ in that of head. Caudal obtusely pointed. Yellowish brown, with dark spots and blotches connected by a network of dark lines; dorsal and anal with dark spots and markings; distal part of caudal with 3 cross-bars.

TYPE.—Zoologische Sammlung des Bayerischen Staates, Munich.

DISTRIBUTION.—Japan.

SPECIMENS EXAMINED:

Two co-types (77, 92 mm.) from Dzushi, 27 to 55 fms. (Zool. Samml., Munich).

10. *LÆOPS PECTORALIS* (Von Bonde).

Lambdopssetta pectoralis, Von Bonde, 1922, Rep. Fish. Mar. Biol. Surv. S. Afr., ii, (1921), Spec. Rep., i, p. 10, pl. i, fig. 3; Von Bonde, 1925, Trans. Roy. Soc. S. Afr., xii, p. 280; Barnard, 1925, Ann. S. Afr. Mus., xxi, p. 393.

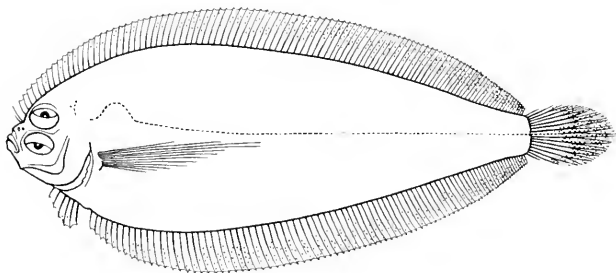


FIG. 203.—*Læops pectoralis*. B.M. (N.H.) 1922.3.27.20. $\times \frac{3}{4}$.

Depth of body $2\frac{3}{4}$ to nearly 3 in the length, length of head $5\frac{3}{4}$ to $6\frac{1}{4}$. Upper profile of head and body moderately convex above and behind eyes. Diameter of eye $2\frac{1}{2}$ to $2\frac{3}{4}$ in length of head; lower eye a little in advance of upper, which is close to edge of head. Maxillary extending to below anterior edge of eye, length about $4\frac{1}{4}$ in that of head; teeth apparently in one or two series, mostly confined to blind side of jaws. 7 or 8 gill-rakers on lower part of anterior arch. 105 to 110 scales in lateral line. Dorsal 108–113; origin above posterior nostril of blind side; first two rays detached from remainder of fin; none of the rays prolonged. Anal 91–94. Pectoral of ocular side with 12 rays, length nearly twice that of head. Caudal obtusely pointed. Brownish; fins dusky.

TYPE.—Government Marine Survey of South Africa Collection.

DISTRIBUTION.—Off coast of Natal and Delagoa Bay, 150 to 170 fathoms.

SPECIMENS EXAMINED:

1 (190 mm.). Paratype.

Natal, 150 fms.

Gilchrist.

Also the holotype (155 mm.) from the same locality (Govt. Marine Survey Coll.).

Both specimens are mature females

Subfamily 3. SCOPHTHALMINÆ.

Both pelvic fins elongate, extending forward to the urohyal, supported by cartilaginous plates placed in advance of the cleithra; caudal vertebrae with well-developed transverse apophyses.

Four genera from the North Atlantic and Mediterranean.

SYNOPSIS OF THE GENERA.

- I. Branchial septum entire, scales small, cycloid, or replaced by bony tubercles; dorsal and anal fins not continued on to blind side of caudal peduncle; post-larval stages with an air-bladder 35 SCOPHTHALMUS
- II. Branchial septum with a large foramen between lower pharyngeals and urohyal, scales ctenoid (at least on ocular side); dorsal and anal fins terminating on blind side of caudal peduncle, post-larval stages without air-bladder
 - A. Scales rather small, somewhat deciduous, ctenoid on ocular side, cycloid on blind side; pelvics free from anal; vomer with teeth 36 LEPIDORHOMBUS
 - B. Scales small or of moderate size, very adherent
 1. Scales ctenoid on both sides of body; vomer without teeth; pelvics free from anal; pyloric appendages present 37 PHRYNORHOMBUS
 2. Scales ctenoid on ocular side, cycloid on blind side; vomer with teeth; pelvics united with anal; no pyloric appendages 38 ZEUGOPTERUS

Genus 35. SCOPHTHALMUS.¹

- Rhombus* (non Costa, 1776), Humphreys, 1797; Lacépède, 1800, [Klein] Walbaum, 1792, *Arted. Ichth.* (1), vol. 2, p. 582; Cuvier, 1817, *R. Ann.*, ii, p. 222 [*Pleuronectes rhombus*, Linnaeus]; Kyle, 1913, *Rep. Danish Ocean. Exped.*, 1908-1910, II, A, 1, pp. 8, 34.
- scophthalmus*, Rattinesque, 1810, *Ind. it. Sicil.*, pp. 14, 53 [*Pleuronectes rhombus*, Linnaeus]; Chabanaud, 1930, *Bull. Mus. Hist. nat. Paris*, (2) ii, p. 628; Norman, 1931, *Ann. Mag. Nat. Hist.*, (10) viii, p. 513.
- Rhomboides*, Goldfuss, 1820, *Handb. d. Zoologie*, II, *Handb. d. Naturg.* (Schubert), iii (2), p. 73 [*Pleuronectes rhombus*, Linnaeus].
- Psetta* (non *Psetta*, Cuvier, 1817), Swanson, 1879, *N. H. Fishes, etc.*, ii, pp. 187, 302 [*Pleuronectes maximus*, Linnaeus]; Bonaparte, 1846, *Cat. method. Pêch. Europ.*, p. 49.
- Pleuronectes* (non Linnaeus, 1758), De Kay, 1842, *N. H. New York (Fish)*, p. 391; Jordan and Goss, 1880, *Rep. U.S. Com. Fish.*, xiv, (1880), p. 251 [*Pleuronectes maximus*, Linnaeus].
- Passer* (non Brisson, 1760), Valenciennes, 1855, *Voy. "Venus"*, v, *Zool.*, p. 341 [*Pleuronectes maximus*, Linnaeus].
- Lophopsetta*, Gill, 1862, *Proc. Acad. Nat. Sci. Philad.* (1861), *Suppl.* (Cat. Fish. F. Coast N. Amer.), p. 51; Gill, 1864, *Proc. Acad. Nat. Sci. Philad.*, xvi, p. 226 [*Pleuronectes maculatus*, Mitchell].
- Bothus* (non Rattinesque, 1810), Jordan and Gilbert, 1882, *Bull. U.S. Nat. Mus.*, xvi, p. 845; Jordan and Gilbert, 1883, *Proc. U.S. Nat. Mus.*, v, (1882), p. 527; Chabanaud, 1930, *Rivista Sci.*, *Suppl. Mem.* ii, p. 21; Chabanaud, 1931, *Bull. Mus. Hist. nat. Paris*, (2) iii, p. 793.

Body deep, more or less compressed. Eyes on the left side, separated by a flat space of moderate width, the interorbital region similar in both sexes. No rostral or orbital spines. Olfactory laminae in moderate number or rather numerous, arranged transversely to or radiating from a long central rachis. Mouth large, the length of the maxillary $\frac{1}{2}$ that of head; jaws and dentition about equally developed on both sides; teeth small, curved, pointed, in narrow bands in both jaws (sometimes in a single series posteriorly); no canines; a patch of teeth on the vomer. Gill-rakers of moderate length and rather slender, not very numerous; lower pharyngeals narrow, separated for the greater part of their length, each with several rows of small teeth.

¹ For a complete discussion of the nomenclature of this genus, see Norman, 1931, *Ann. Mag. Nat. Hist.*, (10) viii, p. 513.

branchial septum without a foramen between lower pharyngeals and urohyal. Dorsal fin commencing in front of anterior nostril of blind side and well in advance of eye; most of the rays branched. Dorsal and anal fins not continued on to blind side of caudal peduncle. Tip of first interhamal spine not projecting in front of anal fin. Pectoral fins unequal, that of ocular side a little larger; middle rays branched. Pelvic fins free from anal; first ray of that of blind side opposite second or third of that of ocular side. Scales, when present, small, cycloid; sometimes replaced by bony tubercles. Lateral line equally developed on both sides of body, with a strong curve above the pectoral fin; a distinct supratemporal branch. Two pyloric appendages; vent on blind side, above first ray of anal fin. An air-bladder present in the post-larval stages.

Four or five species from the North Atlantic and Mediterranean.

SYNOPSIS OF THE SPECIES.

- I. Scales absent, replaced by scattered bony tubercles; anterior dorsal rays not much branched, not free from membrane [PSETTA].
- A. Dorsal 57-71, anal 43-52.
1. Depth $1\frac{1}{3}$ to $1\frac{2}{3}$ in length; highest rays of dorsal $2\frac{1}{2}$ to $2\frac{2}{3}$ in head; tubercles generally developed only on ocular side, always much smaller than eye 1. *maximus*.
 2. Depth $1\frac{1}{2}$ to $1\frac{2}{3}$ in length; highest rays of dorsal $1\frac{1}{2}$ to twice in head; tubercles generally developed on both sides of body, mostly larger than eye (in adults) 2. *maeoticus*.
- B. Dorsal 78-80, anal 55-58 3. *ponticus*.
- II. Scales present; no bony tubercles; anterior rays of dorsal much branched, more or less free from membrane [SCOPHTHALMUS].
- A. Body not strongly compressed; dorsal 73-83, anal 56-62; 11 to 13 gill-rakers on lower part of anterior arch 4. *rhombus*.
- B. Body strongly compressed, translucent in life; dorsal 65-71, anal 50-55; 22 to 26 gill-rakers on lower part of anterior arch 5. *aquosus*.

I. SCOPHTHALMUS MAXIMUS (Linnæus).

[TURBOT.]

- Pleuronectes maximus*, Linnæus, 1758, Syst. Nat., ed. 10, p. 271; 1766, ed. 12, p. 459; Bloch, 1783, Naturgesch. Fische Deutsch., II, p. 53; Quensel, 1806, Vet. Akad. Handl., xxvii, pp. 54, 203; Risso, 1810, Ichth. Nice, p. 314; Jordan and Goss, 1889, Rep. U.S. Com. Fish., xiv, (1880), p. 257.
- Pleuronectes turbot*, Lacépède, 1802, Hist. Nat. Poiss., iv, p. 645.
- Pleuronectes tuberculatus*, Shaw, 1803, Gen. Zool., iv (2), p. 312; Turton, 1807, Brit. Fauna, p. 97.
- Pleuronectes cyclops*, Donovan, 1806, N. H. Brit. Fishes, iv, pl. xc; Turton, 1807, *tom. cit.*, p. 97.
- Scophthalmus maximus*, Rafinesque, 1810, Ind. itt. Sicil., p. 14; Chabanaud, 1930, Bull. Mus. Hist. nat. Paris, (2) ii, p. 028; Norman, 1931, Ann. Mag. Nat. Hist., (10) vii, p. 513.
- Rhombus maximus*, Cuvier, 1817, R. Anim., ii, p. 222; Risso, 1826, H. N. Europe, iii, p. 250; Kroyer, 1845, Danmarks Fiske, II, p. 424, fig.; Costa, 1847, Faun. R. Napoli, II, fasc. 55-8, p. 15, pl. xviii, figs. 1, 2; Nilsson, 1855, Skand. Faun., ed. 2, Fiskar, p. 636; Yarrell, 1859, Hist. Brit. Fishes, ed. 3, I, p. 634, fig.; Canestrini, 1862, Arch. Zool. Anat. Fisiol. Genova, I, p. 25, pl. III, fig. 1; Gunther, 1862, Cat. Fish., iv, p. 407; Malmgren, 1864, Arch. Naturgesch., xxx (1), p. 293; Steindachner, 1868, Sitzber. Akad. Wiss. Wien, lvii (1), p. 714; Collett, 1875, Vid.-Selsk. Forh., (1874), Tilf. p. 137; Malm, 1877, Göteborgs Bohus. Fauna, p. 510; Collett, 1880, Vid.-Selsk. Forh., (1879), p. 76; Moreau, 1881, Hist. Nat. Poiss. France, III, p. 338; Dav., 1880-84, Fish. Britain, II, p. 11, pl. xcvi; Hock, 1903, Pub. Circ. Cons. Explor. Mer., III, p. 49, pl. v.; Danois, 1913, Ann. Inst. océanogr. Paris, v (5), p. 98, fig. 170; Saemundsson, 1922, Videns. Medd. naturh. Foren. Kjob., lxxiv, p. 102; Schnakenbeck; 1925, Tier. Nord Ostsee, I, II, xii (1), p. 7, fig. 7; Knipovich, 1926, Trans. Inst. Sci. Explor. North, xxvii, p. 137, fig. 100; Buen, 1926, Cat. ictiol. Medit. Españ. Marruecos, p. 97; Saemundsson, 1927, Videns. Medd. naturh. Foren. Kjøb., lxxxiv, p. 173; Schnakenbeck, 1930, in Joubin, Faun. Ichth. Atlant. Nord, iv, fig.

Platessa (Léps), Fleming, 1828, Brit. Anim., p. 199.

Rhombus aculeatus, Gottsche, 1835, Arch. Naturgesch., 1 (2), p. 172.

Psetta maximus, Swainson, 1839, N. H. Fishes, etc., ii, p. 302; Bonaparte, 1846, Cat. method. Pêches Europ., p. 49.

Pleuronectes rhombus, Gray, 1851, Cat. Fish. Gronow, p. 90.

Bothus maximus, Jordan and Gilbert, 1882, Bull. U.S. Nat. Mus., xvi, p. 577; Collett, 1881, Nyt Mag. Naturv., Christiania, xix, p. 109; Lilljeborg, 1891, Sverig. Norg. Fiskar., ii, p. 305; Smith, 1893, Scand. Fish., i, p. 434, pl. xviii, fig. 1; Collett, 1903, Vid.-Selsk. Forh., (1902), p. 86; Chabanand, 1931, Riviera Sci., Suppl. Mem. ii, p. 21; Chabanand, 1931, Bull. Mus. Hist. nat. Paris, (2) iii, p. 303.

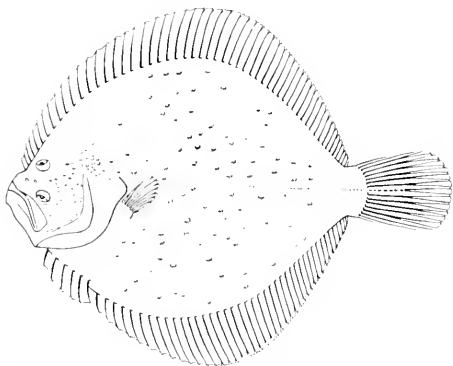


FIG. 204.—*Scophthalmus maximus*. B.M. (N.H.) DEPT. 7.6.2. 4

EGGS, LARVAE AND YOUNG.

Holt, 1891, Sci. Trans. R. Dublin Soc., (2) iv, p. 199, pl. xlviii, fig. 18, xlix, fig. 25; Cano, 1893, Ann. stat. aquac. Boulogne, i, p. 131, pl. x, figs. 1-5; Petersen, 1894, Rep. Danish Biol. Stat., iv, (1893), pp. 11, 131, pl. 1, figs. 1-4; McIntosh, 1895, Rep. Fish. Board Scotland, xii (3), p. 224, pl. viii, figs. 1-14; Cunningham, 1896, N. H. Market. Mar. Fish., p. 260, figs. 120-124; McIntosh and Masterman, 1897, Brit. Mus. Food-fish., p. 328, figs.; Ehrenbaum, 1897, Wiss. Meeresunters., Abt. Helgoland, 8 F., ii (1), p. 282, pl. v, figs. 19, 20, vi, fig. 21; Holt, 1899, Ann. Mus. hist. nat. Marseille, Zool., v (2), p. 65, pl. viii, figs. 85-88; Hencke and Ehrenbaum, 1900, Wiss. Meeresunters., Abt. Helgoland, 8 F., iii, p. 230¹; Hock, 1903, Pub. Agr. Cons. Explor. Mer., iii, p. 49, pl. v; Ehrenbaum, 1905, in Brandt and Apstein, Nordisches Plankton, 1. Eier Larv. Fisch. (1), p. 104, fig. 77.

Body of a rounded rhomboid form. Depth of body $1\frac{1}{4}$ to $1\frac{3}{4}$ in the length, length of head $2\frac{1}{2}$ to 3. Snout much longer than eye, diameter of which is 6 to 11 in length of head and (in adults) less than interorbital width; anterior margins of eyes about level or lower a little in advance of upper, which is well separated from edge of head. Maxillary extending to below posterior part of eye or beyond, length $2\frac{1}{2}$ to $2\frac{3}{4}$ in that

¹ Consult for full list of references.

of head. 10 to 12 gill-rakers on lower part of anterior arch. Head and body without distinct scales, but with scattered bony tubercles, typically present only on ocular side or very much more feeble on blind side, always smaller than eye.¹ Dorsal 57-71; highest rays $4\frac{1}{2}$ to nearly 5 in depth of body and $2\frac{1}{2}$ to $2\frac{3}{4}$ in length of head. Anal 43-52. Rays of dorsal and anal without scales. Pectoral of ocular side with 11 or 12 rays, length $2\frac{1}{4}$ to $2\frac{1}{2}$ in that of head. First ray of right pelvic opposite second of left. Caudal rounded. Vertebrae 12 + 18-19. Coloration very variable; generally greyish or sandy brown, with darker spots and blotches; fins spotted and mottled with brown.

TYPE.—Not traced.

DISTRIBUTION.—Coasts of Europe, from Scandinavia to the Mediterranean; Iceland.

SPECIMENS EXAMINED:

1 (190 mm.).	Bohuslän, Sweden. ²	Malm.
1 (19 ").	Stromstad, "	"
2 (18, 20 mm.).	Lunnevik "	"
1 (185 mm.).	Gestrickland, Sweden.	Wheelwright.
2 (24, 25 mm.).	Scotland.	McIntosh.
6 (330-400 mm.).	Aberdeen Market.	Fish. Board Scotland.
3 (170-370 "), stuffed.	Firth of Forth.	—
18 (15-40 ").	E. coast of England.	Günther.
1, skull.	North Sea.	"
1 (675 mm.).	Grimsby.	Mar. Biol. Assoc.
1 (650 "), stuffed.	"	"
1 (780 "), "	"	Gerrard.
4 (37-55 mm.).	Brighton.	Children.
1 (308 mm.), skin.	Plymouth.	—
1 (204 "), "	"	Yarrell Coll.
1 (600 ").	"	Mar. Biol. Assoc.
1 (570 "), stuffed.	Devonshire.	Spence.
1 (180 "), skin.	"	Yarrell Coll.
20 (10-40 mm.).	Mevagissey.	Day.
1 (470 mm.), stuffed.	Jersey.	Hornell.
1 (100 ").	Mogador.	Rein.
4 (360-570 mm.).	London Market.	Fishmongers' Co.
1 (750 mm.), skeleton.	Great Britain.	Damon.
1 (450 "), skin.	"	Donovan.
1 (700 "), stuffed.	—	Willoughby.
1 (222 "), "	—	—
1 (215 "), skin.	—	Gronow Coll.
1 (140 ").	—	Haslar Col.
2 (92, 130 mm.).	—	Frank.

Also 2 skins (5 and 9 inches) from Linnæus's collection (Linnæan Society of London).

ABNORMALITIES.³

1 (410 mm.).	Albino.	London Market.	Gow.
1 (500 ").	"	"	Howlett.
1 (320 ").	Ambicolorate.	"	Fishmongers' Co.
1 (150 ").	Partial ambicolorate.	British coast.	Day.

¹ As Smitt (1893) has pointed out, there are shallow, and, in most cases, definitely bounded scale-sacs (follicles) in the skin between the tubercles, but these never contain true scale-like structures.

² It seems possible that the Turbot of the Baltic area may prove to represent a distinct race, as does the Plaice, but further material is required in order to decide this point.

³ The following papers describe abnormalities of the Turbot: McIntosh, 1875, 'Mar. Invertebr. Fish. St. Andrews', p. 170, pl. vi, figs. 5, 6; Ewart, 1884, 'Rep. Fish. Board Scotland', II (F. 7), p. 80, pl. xiii; Bateson, 1894, 'Mater. Study Variation', p. 470; Cunningham and McMunn, 1894, 'Phil. Trans. Roy. Soc.', B. 184, p. 803; Sacchi, 1898, 'Boll. Mus. zool. anat. comp. Genova',

1349	00	Ambicolorate	Yarmouth.	Patterson.
1349	00	Allano.	..	..
1360	00	Ambicolorate	Suffolk.	Collings.
1375	00	..	Weymouth	Hompson
1378	00	..	Semen Cove, Cornwall	Stewart
1383	00	..	..	Lord Willoughby

In spite of the records of gigantic specimens, mostly based on hearsay, it is doubtful whether this species normally attains a length greater than 3 feet or a weight of more than 50 pounds.

HYBRID TURBOT AND BULL.

(*S. maximus* - *S. rhombus*)¹

Rhombus hybridus, Mahu, 1877, Gøteborgs Bohus Länna, p. 511; Mahu, 1882, Gøteborgs Mus.

Arskr., III, (1881), p. 23.

Rhombus levis var., Moreau, 1881, Hist. Nat. Poiss. France, III, p. 342.

Bullus maximus hybridus, Smitth, 1893, Scand. Fish., 3, p. 344, fig. 113.

Bullus rhombus hybridus, Smitth, 1893, *Icon. cit.*, p. 315, fig. 114.

Rhombus maximus - *Rhombus rhombus*, Buen, 1926, Cat. Pictol. Molt. Españ. Marruecos, p. 67.

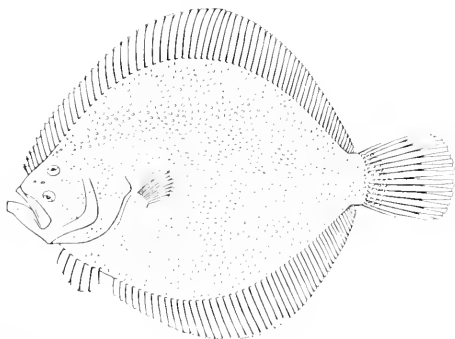


FIG. 367. Hybrid *Scophthalmus maximus* - *S. rhombus*. B.M. (N.H.) S7 5 17 3 4.

Depth of body about $1\frac{1}{2}$ in the length, length of head $\frac{3}{4}$. Snout longer than eye, diameter of which is $8\frac{1}{4}$ to 9 in length of head and equal to or a little greater than interorbital width; lower eye in advance of upper, which is well separated from edge of head. Maxillary extending to below hinder part of eye or beyond, length $2\frac{1}{2}$ to $2\frac{3}{4}$ in that of head. 11 or 12 gill-rakers on lower part of anterior arch. Head and body on both sides with cycloid scales, separated from each other, embedded in the

¹ See also Mcintosh, 1902, 'Ann. Mag. Nat. Hist.', (7) IX, p. 291; Cunningham, 1907, 'Proc. Zool. Soc.', p. 174, pl. XI; Cunningham, 1907, 'J. Mar. Biol. Ass.', 8, 5, VII, p. 44, pl. III; Kitchin, 1908, 'Ann. Scot. Nat. Hist.', p. 149, fig. 1; Eubhurst, 1911, 'Ann. Scot. Nat. Hist.', p. 79; Eubhurst, 1911, 'Zoologist', (4) LV, p. 70; Nixon, 1932, 'Bull. Soc. zool. Fr.', LVII, p. 70, fig. Reference to others are included in the synonymy of the species.

² See also Quoy, 1860, 'Proc. Zool. Soc.', p. 473; Lombard, 1894, 'Overs. Vet. Akad. Forh.', 3, p. 71, fig. 3; Holt, 1893, 'J. Mar. Biol. Ass.', 8, 8, VII, p. 262.

skin, and appearing as rounded or oval protuberances. Dorsal (63) 69-72 (75); anterior rays more or less forked, but not free from membrane; highest rays about $4\frac{1}{2}$ in depth of body and $2\frac{1}{2}$ in length of head. Anal (47) 50-52 (58). Most rays of dorsal and anal with rudimentary scales on ocular side. Pectoral of ocular side with 11 or 12 rays, length $2\frac{1}{2}$ to $2\frac{2}{3}$ in that of head. First ray of right pelvic opposite second of left. Caudal rounded. More or less uniformly brownish.

DISTRIBUTION —Atlantic coasts of Europe; Mediterranean.

SPECIMENS EXAMINED :

1 (490 mm.).	London Market.	Quelch.
1 (550 ").	"	Gibson.
1 (490 ").	"	Gow.
1 (450 "), stuffed.	Yarmouth.	Patterson.

The specimens described above appear to be genuine hybrids, and such forms would seem to be not very uncommon in the Cattegat (Lönnerberg) and on the Dutch coast (Quelch). No experimental evidence of their hybrid nature is yet forthcoming, but, in view of the fact that they cannot definitely be assigned to either parent species, and in certain features seem to be intermediate between the two, this would appear probable. Further, the Turbot and Brill are closely related forms and spawn at about the same time and in similar localities. Of five of such forms examined by Lönnerberg, two were males with well-developed testes, one was a female with a large ovary, and two (the most essentially intermediate examples) showed no trace of reproductive organs.

2. SCOPHTHALMUS MÆOTICUS (Pallas).

BLACK SEA TURBOT.]

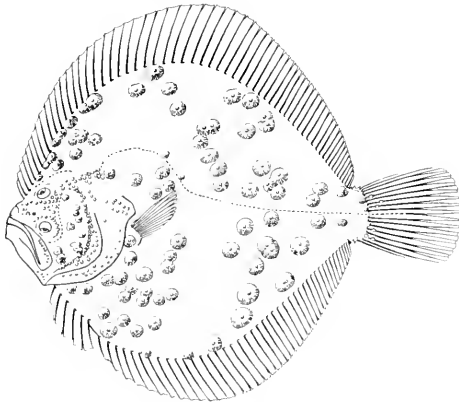


FIG. 206.—*Scophtalmus mæoticus*. B.M. (N.H.) 84.8.26.38 $\times \frac{1}{2}$.

Pleuronectes mæoticus, Pallas, 1814, Zoographia, iii, p. 419.

Rhombus stellosus, Bennett, 1835, Proc. Zool. Soc., iii (30), p. 92.

- Rhombus torus*, Rathke, 1837, Mem. pres. Ac. Imp. Sci. St. Pétersb., 10 (3 and 4), p. 319.
Rhombus rhombitis, Rathke, 1837, *loc. cit.*, p. 351.
Rhombus maoticus, Nordman, 1840, in Demidov, Voy. Russ. merid., 10, p. 534, pl. 28, fig. 3, pls. 29, 30; Kessler, 1850, Bull. Soc. Nat. Moscou, xxxii (2), p. 441; Günther, 1862, Cat. Fish., iv, p. 499.
Psetta maotica, Bonaparte, 1846, Cat. metod. Pesci Europ., p. 49.
Pleuronectes maximus var. *maoticus*, Jordan and Goss, 1889, Rep. U.S. Com. Fish., xiv, (1886), p. 257.
Bothus maoticus, Berg, 1910, Poiss. eaux douces Kuss., p. 466, fig. 352.
Scophthalmus maoticus, Norman, 1931, Ann. Mag. Nat. Hist., (10) viii, p. 513.

Close to *S. maximus*, but the body is more rhomboid in shape, the depth $1\frac{1}{2}$ to $1\frac{3}{4}$ in the length, length of head $2\frac{1}{2}$ to nearly 3. Diameter of eye 6 to 11, length of maxillary 2 to $2\frac{1}{2}$ in that of head. 11 or 12 gill-rakers on lower part of anterior arch. Tubercles generally strongly developed on blind side of body as well as on ocular side, much stronger than in *S. maximus* (in adults), those on body mostly larger than eye.¹ Dorsal 61-68; highest rays $3\frac{1}{2}$ to $4\frac{1}{2}$ in depth of body, and $1\frac{1}{2}$ to 2 in length of head. Anal 44-50. Pectoral of ocular side with 11 to 13 rays, length $1\frac{1}{4}$ to $2\frac{1}{4}$ in that of head. Caudal rounded.

TYPE — Zoologisches Museum der Universität, Berlin (?)

DISTRIBUTION — Black Sea, extending into the eastern Mediterranean.

SPECIMENS EXAMINED:

3 (520-675 mm.)	London Market.	Hatterslev.
3 (250-415 ..)	Constantinople.	Dickson.
3 (230-272 ..)	Bosphorus	Millingen
2 (470, 500 ..)	"	"
1 (270 mm.)	Type of <i>Rhombus stellatus</i> , Erzeroum.	Zool. Soc. Coll.
2 (66, 200 mm.)	Black Sea.	Spratt.
1 (170 mm.)	Sebastopol	Popov.
1 (70 ..)	"	"
4 (54-63 mm.)	"	"
2 (155, 175 mm.)	Eupatoria, Crimea	"

3 SCOPHTHALMUS PONTICUS, Ninni

Scophthalmus ponticus, Ninni, 1932, Bull. Soc. zool. Fr., lvii, p. 83.

Very close to the preceding species, but dorsal 78-80, anal 55-58, caudal with 19 branched rays.

TYPE — Not traced.

DISTRIBUTION — Black Sea.

4 SCOPHTHALMUS RHOMBUS (Linnaeus)

BRILL

- Pleuronectes rhombus*, Linnaeus, 1758, Syst. Nat., ed. 10, p. 271; 1766, ed. 12, p. 458; Bloch, 1783, Natürgesch. Fische Deutschl., ii, p. 36, pl. xliii; Schneider, 1801, in Bloch, Syst. Ichth., p. 152; Lacepède, 1802, Hist. Nat. Poiss., iv, p. 649; Quoy and Gosselin, 1829, Vet. Akad. Handl., pp. 34, 207; Risso, 1810, Ichth. Nice, p. 315; Jordan and Goss, 1889, Rep. U.S. Com. Fish., xiv, (1886), p. 258.
Pleuronectes cristatus, Eichtenstein, 1801, in Schneider (Bloch), Syst. Ichth., p. 153.
Pleuronectes larvix, Turton, 1802, Linnaeus, Syst. Nat., i, p. 704.
Scophthalmus rhombus, Rütimeyer, 1810, Ind. Ich. Spid., p. 14; Chabanaud, 1930, Bull. Mus. Hist. Nat. Paris, (2) ii, p. 628; Norman, 1931, Ann. Mag. Nat. Hist. (10), viii, p. 513.

¹ In young and immature individuals the form and size of the tubercles, as well as the extent of their development, frequently approach closely to the conditions found in *S. maximus*.

- Rhombus rhombus*, Cuvier, 1817, R. Anm., ii, p. 222; Buen, 1926, Cat. ictiol. Medit. Españ. Marruecos, p. 97.
Rhombus cristatus, Cuvier, 1817, *tom. cit.*, p. 222.
Rhombus vulgaris, (Cuvier) Kroyer, 1845, Danmarks Fiske, ii, p. 405, fig.; Costa, 1847, Faun. R. Napoli, ii, fasc. 55-8, p. 10, pl. xiii; Yarrell, 1859, Hist. Brit. Fishes, ed. 3, i, p. 641, fig.
Rhombus barbatus, Risso, 1826, H. N. Europe, iii, p. 251.
Pleuronectes hoderma, Nardo, 1827, Isis, xx (6), p. 481.
Rhombus laevis, Bonaparte, 1833, Icon. Faune Ital., (4); Gottsche, 1835, Arch. Naturgesch., 1 (2), p. 175; Nilsson, 1855, Skand. Faun., ed. 2, Fiskar, p. 638; Canestrini, 1862, Arch. Zool. Anat. Fisiol. Genova, i, p. 27, pl. ii, fig. 4; Günther, 1862, Cat. Fish., iv, p. 410; Steindachner, 1868, Sitzber. Akad. Wiss. Wien, lvii (1), p. 714; Moreau, 1881, Hist. Nat. Poiss. France, iii, p. 340; Day, 1880-4, Fish. Britain, ii, p. 14, pl. xcvi; Danois, 1913, Ann. Inst. océanogr. Paris, v (5), p. 98, fig. 169; Schnakenbeck, 1925, Tier. Nord Ostsee, L. ii, xii (1), p. 8, fig. 8; Schnakenbeck, 1930, in Joubin, Faun. Ichth. Atlant. Nord, iii, fig.
Psetta rhombus, Bonaparte, 1846, Cat. method. Pesci Europ., p. 49.
Platessa pavonina, Costa, 1847, Faun. R. Napoli, ii, fasc. 55-8, p. 5.

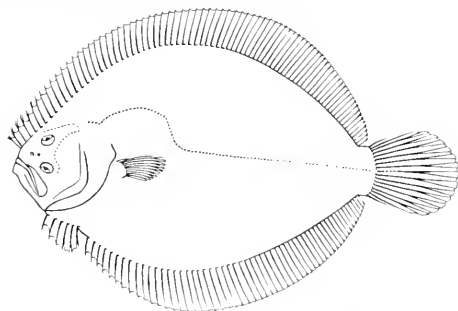


FIG. 207.—*Scophthalmus rhombus*. 4.

- Pleuronectes passer*, Gray, 1854, Cat. Fish. Gronow, p. 90.
Rhombus linnei, Malm, 1877, Göteborgs Bohus. Faun., p. 513.
Bothus rhombus, Jordan and Gilbert, 1883, Proc. U.S. Nat. Mus., v, (1882), p. 577; Lilleborg, 1891, Sverig. Norg. Fiskar, ii, p. 319; Smitt, 1893, Scand. Fish., 1, p. 441, pl. xviii, fig. 2; Collett, 1903, Vid.-Selsk. Forh., (1902), p. 85; Buen, 1919, Bol. Pesc. Madrid, iv, p. 301; Nordgård, 1929, Forh. Norske Vid. Selsk. Trondhjem, 1 (8), p. 24; Chabanaud, 1931, Riviera Sci., Suppl. Mem. ii, p. 21; Chabanaud, 1931, Bull. Mus. Hist. nat. Paris, (2) iii, p. 303.

EGGS, LARVÆ AND YOUNG.

- Raffaele, 1888, Mitt. zool. Stat. Neapel, viii, p. 48, pl. iv, figs. 8, 11, 12, 15, 18; Mañón, 1894, Ann. Mus. hist. nat. Marseille, iv, (1890-4), pl. ii, fig. 20; McIntosh, 1891, Rep. Fish. Board Scotland, ix (3), p. 317, pl. xiii, figs. 1-3; McIntosh, 1892, Rep. Fish. Board Scotland, x (3), p. 294, pl. xiv, fig. 9, xv, fig. 1, xvi, figs. 14-18; Canu, 1893, Ann. stat. aquic. Boulogne, 1, p. 132, pl. xi, figs. 1-4; Petersen, 1894, Rep. Danish Biol. Stat., iv, (1893), pp. 43, 131, pl. 1, figs. 5-8; Cunningham, 1896, N. H. Market. Mar. Fish., p. 267, figs. 125, 126; McIntosh and Masterman, 1897, Brit. Mar. Food-ush., p. 337, figs.; Ehrenbaum, 1897, Wiss. Meeresunters., Abt. Helgoland, ii (1), p. 201, pl. vi, figs. 22-24; Heinke and Ehrenbaum, 1900, Wiss. Meeresunters., Abt. Helgoland, N.F., iii, p. 231; Ehrenbaum, 1905, in Brandt and Apstein, Nordisches Plankton, I. Eier Larv. Fisch. (1), p. 198, fig. 78; Fage, 1910, Ann. Inst. océanogr. Paris, 1 (7), p. 35.

¹ Consult for full list of references.

Body not strongly compressed or translucent in life. Depth of body $1\frac{2}{3}$ to nearly twice in the length, length of head $\frac{3}{5}$ to $3\frac{1}{2}$. Snout (in adults) much longer than eye, diameter of which is $6\frac{1}{2}$ to 9 in length of head and a little less than interorbital width. Maxillary extending to below posterior edge of eye or beyond, length $2\frac{1}{2}$ to $2\frac{1}{2}$ in that of head. 11 to 13 gill-rakers on lower part of anterior arch. Scales all cycloid, more or less imbricated, 115 to 125 in lateral line. Dorsal 73-83; anterior rays generally much branched and more or less free from membrane distally. Anal 56-62. Dorsal and anal rays mostly scaled on both sides. Pectoral of ocular side with 11 or 12 rays, length $2\frac{1}{2}$ to $2\frac{1}{2}$ in that of head. First ray of right pelvic opposite second of left. Caudal rounded. Vertebrae 11-12 + 23-25. Brownish or greyish, generally with numerous small dark spots or pale areas margined with darker; usually some scattered small white spots and a series of larger ones at upper and lower edges of body; fins spotted and mottled with paler and darker brown.

TYPE.—Not traced.

DISTRIBUTION.—Coasts of Europe, from Scandinavia (about 64° N.) to the Mediterranean.

SPECIMENS EXAMINED:

1 (260 mm.).	Bohuslan, Sweden.	Malm.
12 (4-24 mm.).	" "	" "
6 (320-430 mm.).	Aberdeen Market.	Fish. Board Scotland.
1 (290 mm.), skeleton	Great Britain.	—
3 (120-172 mm.), skins.	" "	Yarrell.
1 (595 mm.), stuffed	Grimsby.	Mar. Biol. Assoc.
2 (470, 500 mm.).	" "	" "
1 (115 mm.).	Brighton	Gunther.
1 (660 "), stuffed	Plymouth.	Spence.
1 (575 ") "	" "	Mar. Biol. Assoc.
3 (197-307 mm.), skins.	" "	Yarrell.
1 (640 mm.), stuffed.	Brixham.	Gerrard.
1 (600 ").	Fowey	Gunther.
1 (300 "), stuffed.	Jersey	Hornell.
1 (310 ").	France.	Parudaka.
1 (460 ").	Lisbon.	Lowe.
1 (210 ").	Dalmatia	—
1 (293 ").	Constantinople.	Dickson

ABNORMALITIES,¹

1 (183 mm.).	Ambicolorate, skin.	—	Yarrell.
1 (332 ").	" "	Yarmouth.	Patterson.

This species very rarely exceeds a length of 2 feet or a weight of 8 pounds, although in the Mediterranean larger specimens have been recorded.

5 SCOPHTHALMUS AQUOSUS (Mitchill).

(WINDOW PANE)

Pleuronectes maculatus (non Schneider²), Mitchell, 1814, Rept. Fish. N. York, p. 9; De Kay, 1842, N. H. New York (Fish.), p. 301, pl. xlvii, fig. 151; Storer, 1846, Mem. Amer. Acad. Arts Sci., s. s., II, p. 479; Storer, 1867, Hist. Fish. Massach., p. 204, pl. xxxi, fig. 4; Jordan and Goss, 1889, Rep. U. S. Com. Fish., xiv, (1886), p. 238.

Pleuronectes aquosus, Mitchell, 1815, Tr. Lit. Phil. Soc. N. York, I, p. 389, pl. II, fig. 3.

¹ The following papers describe abnormalities of the Brill: Fihol, 1896, 'Bull. Soc. Philom. Paris', (7) II, p. 54, fig.; Bateson, 1894, 'Proc. Zool. Soc.', p. 246, pl. xvii; Cunningham and McMunn, 1894, 'Phil. Trans. Roy. Soc.', B 184, p. 897; Johnstone, 1909, 'Trans. Liverpool Biol. Soc.', xxiii, p. 209, pl. III, fig. 1, text fig. 18; Niimi, 1932, 'Bull. Soc. zool. Fe', lvii, p. 76, fig.

² An Indian species of Sole.

Rhombus aquosus, (Cuvier) Storer, 1830, Rept. Ichth. Massach., p. 146; Gunther, 1862, Cat. Fish., iv, p. 411.

Lophopsetta maculata, Gill, 1862, Proc. Acad. Nat. Sci. Philad., (1861), Suppl. (Cat. Fish. E. Coast N. Amer.), p. 216; Gill, 1864, Proc. Acad. Nat. Sci. Philad., xvi, p. 220; Jordan and Evermann, 1898, Bull. U.S. Nat. Mus., xlvii (3), p. 2660, pl. cccclxxxii, fig. 938; Bean, 1902, Ann. Rep. Forest Fish Game Comm. N.Y., vi, (1901), p. 474; Huntsman, 1922, Contr. Canad. Biol., 1921, No. iii, p. 22; Bigelow and Welsh, 1925, Bull. U.S. Bur. Fish., xl (1), (1924), p. 516, figs. 268-270; Nichols and Breder, 1927, Zoologica, ix, p. 181, fig.; Hildebrand and Schroeder, 1928, Bull. U.S. Bur. Fish., xliii (1), p. 171.

Bothus maculatus, Jordan and Gilbert, 1882, Bull. U.S. Nat. Mus., xvi, p. 815.

Scophthalmus aquosus, Norman, 1931, Ann. Mag. Nat. Hist., (10) viii, p. 513.

EGGS, LARVÆ AND YOUNG.

Agassiz, 1878, Proc. Amer. Acad., xiv, p. 1, figs.; Bigelow and Welsh, 1925, *loc. cit.*, p. 516, figs. 269, 270.

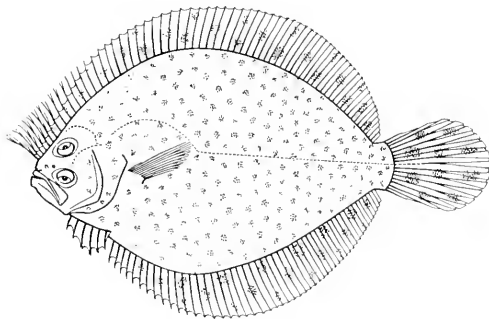


FIG. 268.—*Scophthalmus aquosus*. B.M. (N.H.) 79.10.9.66. $\times \frac{1}{4}$.

Body strongly compressed, nearly translucent in life. Depth of body $1\frac{1}{2}$ to $1\frac{2}{3}$ in the length, length of head $3\frac{1}{2}$ to $3\frac{2}{3}$. Snout longer than eye, diameter of which is $\frac{4}{5}$ to nearly 6 in length of head and greater than interorbital width; anterior margins of eyes level or lower a little in advance of upper, which is close to edge of head. Maxillary extending to below middle or posterior part of eye, length about $2\frac{1}{2}$ in that of head; a bony tubercle at anterior end of maxillary on ocular side. 22 to 26 gill-rakers on lower part of anterior arch. Scales all cycloid, loosely imbricated; 90 to 95 in lateral line. Dorsal 65-71; anterior rays somewhat higher than those which follow, branched, free from membrane for the greater part of their length. Anal 50-55. Pectoral of ocular side with 11 rays, length $1\frac{1}{2}$ to $1\frac{2}{3}$ in that of head. First ray of right pelvic opposite third of left. Caudal rather long, rounded or obtusely pointed. Vertebrae 11 + 25. Brownish, marbled with paler, and with a number of small, dark spots irregularly arranged; median fins with larger brown spots and blotches.

TYPE.—Not traced.

DISTRIBUTION.—Atlantic coast of the United States, from Casco Bay to South Carolina.

SPECIMENS EXAMINED.

1 (260 mm.), skin	New York.	Farnell Coll.
1 (90 " " ")	Long Island, New York.	Amer. Mus. Nat. Hist.
1 (265 " " ")	Noank, Conn.	U.S. Nat. Mus.
2 (138, 145 mm.)	N. Carolina.	Amer. Mus. Nat. Hist.
3 (95, 122 " " ")	Off Charleston Harbour, S. Carolina.	Charleston Mus.
1 (160 mm.)	N. America.	U.S. Nat. Mus.

Also one from Massachusetts Bay (Mus. Comp. Zool.).

This species rarely exceeds a weight of one pound.

Genus 36. LEPIDORHOMBUS

Lepidorhombus, Günther, 1862, Cat. Fish., iv, pp. 407, 411 (*Pleuronectes megastoma*, Donovan).
Zucoplerus (part), Steenstrup, 1865, Overs. Dansk. Vid. Selsk., p. 112.

Body rather elongate, compressed. Eyes on the left side, large, separated by a narrow space or bony ridge, the interorbital region similar in both sexes, upper eye close to edge of head. No rostral or orbital spines. Olfactory laminae in moderate number, arranged transversely to or radiating from a central rachis. Mouth large, the length of the maxillary about $\frac{1}{2}$ that of head, jaws and dentition nearly equally developed on both sides, teeth small, curved, pointed, in narrow bands anteriorly in both jaws, tapering to a single series posteriorly, no distinct canines; a few small teeth on the head of the vomer. Gill-rakers of moderate length and rather stout, not numerous, lower pharyngeals narrow, separated throughout their length, each with several rows of small teeth; branchial septum perforated by a large foramen between the lower pharyngeals and orohyal. Dorsal fin commencing above or slightly behind anterior nostril of blind side and well in advance of eye, most of the rays branched and scaled on both sides, dorsal and anal fins terminating a little on blind side of caudal peduncle. Tip of first interhemal spine not projecting in front of anal fin. Pectoral fins unequal, that of ocular side much larger, middle rays branched. Pelvic fins free from anal; first ray of that of blind side opposite second of that of ocular side. Scales rather small, more or less deciduous, feebly ctenoid on ocular side, cycloid on blind side. Lateral line equally developed on both sides of body, with a strong curve above the pectoral fin, a short, indistinct supratemporal branch. Two pyloric appendages; vent a little on blind side, just in front of first ray of anal fin. No air-bladder in post-larval stages.

Two species from the Mediterranean and north-eastern Atlantic.

SYNOPSIS OF THE SPECIES.

- I. Eye $3\frac{2}{3}$ (young) to $5\frac{1}{4}$ in head, lower jaw strongly projecting, 95 to 109 scales in lateral line, dorsal 85-94, 1 *whiff-lagonis*.
- II. Eye 3 to $3\frac{1}{4}$ in head, lower jaw a little projecting, 87 to 93 scales in lateral line, dorsal 79-89, 2 *boscii*.

1. LEPIDORHOMBUS WHIFF-LAGONIS (Walbaum).

MEGRIM; SAIL-FLUKE

- Pleuronectes whiff-lagonis*, Walbaum, 1792, Arted. Ichth., (3), ed. 2, p. 120.
Pleuronectes megastoma, Donovan, 1804, N. H. Brit. Fish., iv, pl. 51. Moreau, 1881, Hist. Nat. Poiss. France, iii, p. 332; Kolombatovic, 1887, Godis 1209 (K. Vel. Kral. Splitu), p. 27; Vaillant, 1888, Exped. "Travailleur" et "Talisman", Poissons, p. 188.
Pleuronectes pseudopilus, Pennant, 1812, Brit. Zool., new ed., iii, p. 324, pl. 52.
Pleuronectes (*Rhombus*) *cardina* (part), Cuvier, 1829, R. Anim., ed. 2, ii, p. 341.

- Rhombus megastoma*, Yarrell, 1836, Brit. Fish., ed. 1, ii, p. 251, fig.; 1841, ed. 2, ii, p. 342, fig.; Nilsson, 1855, Skand. Faun., ed. 2, Fiskar, p. 641; Günther, 1862, Cat. Fish., iv, p. 411; Malm, 1877, Göteborgs. Bohus. Fauna, p. 516; Günther, 1888, Proc. Roy. Soc. Edinb., xv, p. 217; Holt and Calderwood, 1895, Sci. Trans. R. Dublin Soc., (ii) v, p. 481; Nimni, 1930, in Faun. Flore Médit., x, fig.
- Zeugopterus megastoma*, Yarrell, 1859, Brit. Fish., ed. 3, i, p. 654, fig.; Collett, 1875, Vid.-Selsk. Forh., (1874), Till., p. 138; Collett, 1880, Vid.-Selsk. Forh., (1879), p. 76; Lilljeborg, 1891, Sverig. Norg. Fiskar, ii, p. 341; Danois, 1913, Ann. Inst. océanogr. Paris, v (5), p. 99, fig. 165; Saemundsson, 1927, Rit. Visind. Island, ii, p. 35.
- Zeugopterus ? velivolans*, (Richardson) Yarrell, 1859, Brit. Fish., ed. 3, i, p. 656a, fig.
- Arnoglossus megastoma*, Day, 1880-4, Fish. Britain, ii, p. 21, pl. xxviii.
- Lepidorhombus megastoma*, Collett, 1884, Nvt. Mag. Naturv. Christiania, xxix, p. 100; Goode and Bean, 1895, Ocean. Ichth., p. 439; Collett, 1896, Rés. Camp. Sci. Monaco, x, p. 93; Kyle, 1913, Rep. Danish Ocean. Exped. 1908-1910, ii, A.1, pp. 15, etc.
- Lepidorhombus whiff-iazonis*, Jordan and Goss, 1889, Rep. U.S. Com. Fish., xiv, (1886), p. 252; Collett, 1903, Vid.-Selsk. Forb., (1902), p. 89; Nordgard, 1929, Forh. Norske Vid. Selsk. Trondhjem, i (8), p. 24; Chabanaud, 1931, Riviera Sci., Suppl. Mem. ii, p. 22.
- Lepidorhombus whiff*, Smitt, 1893, Scand. Fish., 1, p. 448, fig. 115; Schnakenbeck, 1925, Tier. Nord Ostsee, L. ii, xii (1), p. 9, figs. 9, 10; Buen, 1926, Cat. Ichtiol. Médit. Espa. Marruecos, p. 98; Schnakenbeck, 1930, in Joubin, Faun. Ichth. Atlant. Nord, iv, fig.
- Lepidorhombus megastoma borealis*, Kyle, 1913, Rep. Danish Ocean. Exped. 1908-1910, ii, A.1, p. 13.

EGGS, LARVE AND YOUNG.

- McIntosh, 1892, Rep. Fish. Board Scotland, x (3), p. 292, pl. xvi, figs. 1-10; Cunningham, 1896, N. H. Market. Mar. Fish., p. 271, fig. 127; McIntosh and Masterman, 1897, Brit. Mar. Food-fish., p. 352, figs.; Petersen, 1905, Rep. Danish Biol. Stat., xii, (1902-3), p. 28, pl. 1, figs. 9, 10; Ehrenbaum, 1905, in Brandt and Apstein, Nordisches Plankton, I. Eier Larv. Fisch. (1), p. 202, fig. 79; Petersen, 1906, Medd. Komm. Havundersog. Kjob., Ser. Fisk., ii (1), p. 8; Petersen, 1909, Medd. Komm. Havundersog. Kjob., Ser. Fisk., iii (1), p. 1, pl. i, figs. 7-12.

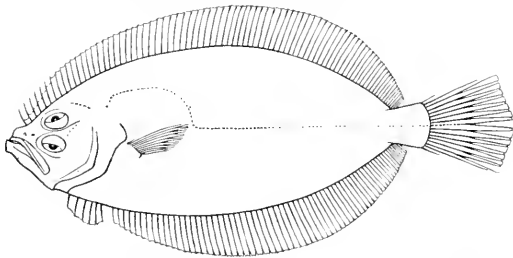


FIG. 209.—*Lepidorhombus whiff-iazonis*. B.M. (N.H.) 1931.4.12.1. ¼.

Depth of body $2\frac{1}{2}$ to 3 in the length, length of head $3\frac{1}{8}$ to $3\frac{3}{8}$. Snout (in adults) longer than eye, diameter of which is $3\frac{3}{8}$ (young) to $5\frac{1}{4}$ in length of head; lower eye generally in advance of upper, which is close to edge of head. Maxillary extending about to below middle of eye or not quite as far, length $2\frac{1}{2}$ to $2\frac{1}{4}$ in that of head; lower jaw usually strongly projecting. 12 to 14 gill-rakers on lower part of anterior arch. Scales moderately deciduous, 95 to 109 in lateral line. Dorsal 85-94. Anal 64-74. Pectoral of ocular side with 11 or 12 rays, length $1\frac{1}{2}$ to $2\frac{1}{4}$ in that of head. Caudal rounded or double-truncate. Vertebrae 9-10 + 31-32. Yellowish or greyish brown, uniform or with some rather obscure darker spots and rings; median fins with some indefinite darker spots.

TYPE.—Not traced

DISTRIBUTION.—Coasts of western Europe, from Scandinavia (about 64° N.) to the Iberian Peninsula and beyond¹, Iceland

SPECIMENS EXAMINED.

1 (530 mm.)	Iceland.	Mar. Biol. Assoc.
1 (410 ..)	Orkneys.	Rae.
1 (415 ..)	Kilbrennan Sound, 40 fms.	Murray.
1 (395 ..)	Off S.W. Ireland (52° 20' N., 12° W.), 100 fms.	Brunner
1 (283-495 mm.)	" "	"
7 (190-400 ..)	Plymouth.	Mar. Biol. Assoc.
1 (150 mm.)	Minehead.	Brunner.
1 (349 ..)	London Market.	Gibson and Quelch.
6 (400-495 mm.)	" "	Fishmongers' Co.
1 (355-475 ..), skins.	Great Britain.	—
1 (420 mm.), skin.	" "	Yarrell Coll.
1 (412 ..), skeleton.	" "	—
6 (335-350 mm.)	Coast of Portugal.	Henriques.

Attains to a length of about 24 inches

It is possible that two species are included here, as suggested by Kyle—a northern form (*velivolans*), and the true *whiff-tagoons* from the English Channel and western coasts. Petersen's descriptions of post-larval specimens rather suggest that this is the case, but the material at my disposal does not enable me to recognise more than one species. *L. velivolans* is said to have a deeper body and rather fewer fin-rays than *L. whiff-tagoons*

2 LEPIDORHOMBUS BOSCHI (Risso)

Pleuronectes boschi, Risso, 1810, Ichth. Nice, p. 319, pl. vii, fig. 33; Bonaparte, 1837, Icon. Faun. Ital., (4), fig.; Canestrini, 1862, Arch. Zool. Anat. Fisiol. Genova, 1, p. 19, pl. II, fig. 2; Moreau, 1881, Hist. Nat. Poiss. France, III, p. 330; Kolombatovic, 1887, Godiš. izoj. C. K. Real. Sphu, p. 27.

Hypoglossus boschi, Cuvier, 1817, R. Annu., II, p. 221; Risso, 1826, H. N. Europe, III, p. 246; Costa, 1847, Faun. R. Napoli, II, fasc. 55-8, p. 31.

Pleuronectes (Rhombus) boschi, Cuvier, 1829, R. Annu., ed. 2, II, p. 341.

Arnoglossus boschi, Gunther, 1862, Cat. Fish., IV, p. 416; Canestrini, 1871-2, Faun. Ital., Pesci, III, p. 193; Vinciguerra, 1883, Ann. Mus. Stor. nat. Genova, xviii, p. 570; Zugmayer, 1911, Res. Camp. Sci. Monaco, xxxv, p. 129.

Arnoglossus megastoma (part), Day, 1886-4, Fish. Britain, II, p. 21.

Rhombus boschi, Gunther, 1860, Ann. Mag. Nat. Hist., (6) IV, p. 418; Gunther, 1860, Proc. Zool. Soc., p. 43; Bourne, 1860, J. Mar. Biol. Ass., 8, 8, 1, p. 311; Holt and Calderwood, 1895, Sci. Trans. R. Dublin Soc., (II) V, p. 486, figs.

Rhombus megastomus, Carus, 1886, 93, Prodr. F. Medit., II, p. 586.

Lepidorhombus boschi, Smitth, 1893, Scand. Fish., 1, p. 447; Collett, 1896, Res. Camp. Sci. Monaco, X, p. 64; Kyle, 1913, Rep. Danish. Ocean. Exped. 1908-1910, II, A.1, p. 15; Buen, 1926, Cat. ictiol. Medit. Españ., Marruecos, p. 98; Chabanaud, 1931, Riviera Sci., Suppl. Mem. II, p. 22.

EGGS, LARVÆ AND YOUNG.

Holt, 1895, Sci. Trans. R. Dublin Soc., (II) V, pl. xv, fig. 116; Petersen, 1905, Rep. Danish Biol. Stat., xii, (1902-3), pl. 1, fig. 11; Petersen, 1906, Medd. Komm. Havundersøg. Kjob., Ser. Fisk., II (1), p. 8; Petersen, 1909, Medd. Komm. Havundersøg. Kjob., Ser. Fisk., III (1), pl. II, figs. 22-25.

Close to *L. whiff-tagoons*.—Depth of body $2\frac{2}{3}$ to $2\frac{1}{2}$ in the length, length of head $3\frac{1}{2}$ to $3\frac{1}{3}$. Snout as long as or shorter than eye, diameter of which is 3 to $3\frac{1}{3}$ in length of head. anterior margins of eyes about level. Maxillary extending to below middle of

¹ The exact southerly limit of the range of this species is difficult to ascertain, as some of the records probably refer to *L. boschi*. According to Vaillant, it occurs off the coast of Morocco and at the Azores. It does not appear to enter the Mediterranean, except on rare occasions.

eye or not quite as far, length $1\frac{1}{2}$ to $2\frac{1}{8}$ in that of head; lower jaw a little projecting. 11 to 13 gill-rakers on lower part of anterior arch. Scales very deciduous, 87 to 93 in lateral line. Dorsal 79-86. Anal 65-69. Pectoral of ocular side with 11 or 12 rays, length $1\frac{3}{4}$ to $2\frac{1}{2}$ in that of head. Caudal rounded or double-truncate. Vertebrae 10 + 29-32. Yellowish brown, without definite markings on head or body; a pair of large, rounded black spots on hinder parts of dorsal and anal fins

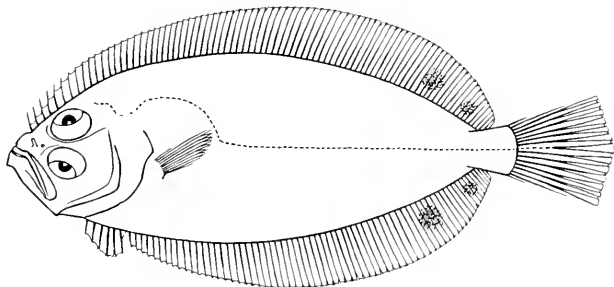


FIG. 210.—*Lepidorhombus bosciu*. B.M. (N.H.) 1928.9.18.82. $\times \frac{1}{2}$.

TYPE.—Not traced

DISTRIBUTION.—Mediterranean; Atlantic coasts of south-western Europe, in deep water, northwards to about 52° N.¹

SPECIMENS EXAMINED:

3 (192-355 mm.).	Off S.W. Ireland, 150 fms.	Green.
1 (250 mm.).	" (52° 20' N., 12' W.), 140 fms.	Brunner.
1 (223 ").	Off Fastnet, Co. Cork, 180 fms.	Holt.
2 (273, 305 mm.).	Off C. St. Mary, 308 fms.	Wolfenden.
1 (188 mm.).	Nice.	Bellotti.
1 (180 ").	Palermo.	Doderlein.
1 (200 ").	Genoa.	Doria.

It is of interest to note that this species occurs in comparatively shallow water in the Mediterranean, whereas, in the Atlantic it has always been recorded from deep or moderately deep water. *L. whiffiagonis*, on the other hand, occurs at all depths from 2 or 3 down to about 300 fathoms, and Holt and Calderwood have pointed out that the uniformly coloured individuals occur mostly in deep water, and those with dark ring-like markings in shallower water.

Genus 37 PHRYNORHOMBUS.

Scophthalmus (non Rafinesque, 1810), Bonaparte, 1832, Icon. Faun. Ital., (4), p. 23 [under *Rhombus rhomboides*]; Bonaparte, 1846, Cat. metod. Pesci Europ., p. 49; Smitt, 1893, Scand. Fish., 1, p. 452; Kyle, 1913, Rep. Danish Ocean. Exped. 1908-1910, II, A 1, p. 15.
Phrynorhombus, Gunther, 1862, Cat. Fish., IV, p. 414 [*Rhombus unimaculatus*, Risso].
Zeugopterus (part), Steenstrup, 1865, Overs. Dansk. Vid. Selsk., p. 112.

¹ Some of Petersen's post-larval forms, identified by him as *L. bosciu*, were taken farther north, off the Hebrides.

Close to *Lepidorhombus*, but olfactory laminae few in number, parallel or a little radiating, without central rachis. Mouth rather smaller, the length of the maxillary $\frac{1}{2}$ or less than $\frac{1}{3}$ that of head; teeth very small; vomer toothless. Gill-rakers rather short. Dorsal fin commencing above or just behind nostrils of blind side; dorsal and anal fins terminating well on blind side of caudal peduncle. Middle rays of pectoral fin simple or branched. Pelvic fins of equal length, symmetrical, free from anal, their anterior rays united by membrane at their bases. Scales small or of moderate size, adherent, ctenoid on both sides of body. Two pyloric appendages¹, vent median in position, between posterior rays of pelvic fins. No air-bladder in post-larval stages.

Two species from the Mediterranean and eastern Atlantic.

SYNOPSIS OF THE SPECIES.

- 1 Depth $2\frac{1}{3}$ to $2\frac{2}{3}$ in length; eye $3\frac{1}{2}$ to 4, maxillary $2\frac{1}{2}$ to $2\frac{2}{3}$ in head; 40 to 52 scales in lateral line 1. *norvegicus*.
 11 Depth about 2 in length; eye 4 to $4\frac{1}{2}$, maxillary about 2 in head; 72 to 80 scales in lateral line 2. *regius*.

1. PHRYNORHOMBUS NORVEGICUS (Gunther).

[NORWEGIAN TOPKNOT]

- Pleuronectes cardina* (non Cuvier), Fries, 1839, Vet. Akad. Handl., (1838), p. 181; Fries, Ekstrom and Sundewall, 1846, Skand. Fisk., p. 200, pl. 50.
Rhombus cardina (non Cuvier), Nilsson, 1855, Skand. Faun., ed. 2, Fiskar, p. 643.
Rhombus norvegicus, Gunther, 1862, Cat. Fish., iv, p. 518; Gunther, 1888, Proc. Roy. Soc. Edinb., xv, p. 217, pl. iv, fig. C; Holt, 1891, Sci. Proc. R. Dublin Soc., vii, p. 218; Cunningham, 1892, J. Mar. Biol. Ass., 8, s. 1, p. 325; Holt and Calderwood, 1895, Sci. Trans. R. Dublin Soc., (ii) v, p. 484.
Zeugopterus norvegicus, Collett, 1875, Vid.-Selsk. Forh., (1874), Till., p. 438, Lilleborg, 1891, Sverig. Norg. Fiskar, ii, p. 330; Saemundsson, 1927, Vit. Visind. Island, ii, p. 36.
Lepidorhombus norvegicus, Collett, 1880, Vid.-Selsk. Forh., (1879), p. 77; Collett, 1884, Nyt. Mag. Naturv. Christiania, xxix, p. 100; Jordan and Goss, 1889, Rep. U.S. Com. Fish., xiv, (1886), p. 253.
Scophthalmus norvegicus, Smitt, 1893, Scand. Fish., i, p. 453, pl. xix, fig. 1; Collett, 1903, Vid.-Selsk. Forh., (1902), p. 99; Kvale, 1913, Rep. Danish Ocean. Exped. 1908-1910, ii, A.1, p. 15; Schnakenbeck, 1925, Tier. Nord Ostsee, L. ii, xii (1), p. 9, fig. 11; Kimpovich, 1929, Trans. Inst. Sci. Explor. North, xxvii, p. 137, fig. 101; Schnakenbeck, 1930, in Joulin, Faun. Ichth. Atlant. Nord, iv, fig.
Rhombus (*Zeugopterus*) *norvegicus*, McIntosh, 1895, Rep. Fish. Board Scotland, xii (3), p. 227

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- Cunningham, 1892, J. Mar. Biol. Ass., 8, s. 1, p. 325; Holt, 1893, Sci. Trans. R. Dublin Soc., (ii) v, p. 104, pl. xi; Petersen, 1894, Rep. Danish Biol. Stat., iv, (1893), p. 135, pl. ii, fig. 16; Ehrenbaum, 1897, Wiss. Meeresuntersuch., Abt. Helgoland, ii, p. 317; McIntosh and Masterman, Brit. Mar. Food-fish., p. 149, figs.; Heincke and Ehrenbaum, 1900, Wiss. Meeresuntersuch., Abt. Helgoland, iii, p. 232; Petersen, 1905, Rep. Danish Biol. Stat., xii (2), (1902-3), p. 28, pl. 1, figs. 6-8; Ehrenbaum, 1905, in Brandt and Apstein, Nordisches Plankton, 1. Eier Larv. Fisch., (1), p. 210, fig. 81; Petersen, 1909, Medd. Komm. Havundersog. Kjob., Ser. Fisk., iii, (1) p. 1, pl. 1, figs. 13-19; Schnakenbeck, 1928, Ber. d. wiss. Komm. Meeresf., 8, F., iv (4), p. 214, pls. vi, vii.

Depth of body $2\frac{1}{2}$ to $2\frac{2}{3}$ in the length, length of head $2\frac{1}{2}$ to $3\frac{1}{2}$. Dorsal profile of head a little concave in front of upper eye. Snout as long as or shorter than eye, diameter of which is $3\frac{1}{2}$ to 4 in length of head; lower eye slightly in advance of upper,

¹ Not verified in *P. norvegicus*.

² Consult for full list of references.

which is close to edge of head; upper surfaces of eyes not scaled. Olfactory laminae parallel. Maxillary extending to below anterior part of eye, length $2\frac{1}{2}$ to $2\frac{3}{4}$ in that of head. 6 to 8 gill-rakers on lower part of anterior arch. Posterior edges of scales with numerous, fine, close-set spinules; in certain scattered scales the spinule in the centre is enlarged and produced backwards, giving the appearance of a pointed projection; 46 to 52 scales in lateral line. Curve of lateral line rather low, its width $3\frac{1}{2}$ to $3\frac{3}{4}$ in length of straight portion. Dorsal 76-84; origin immediately behind posterior nostril of blind side; first ray not prolonged; rays scaled only on ocular side. Anal 58-68. Pectoral of ocular side with 9 or 10 simple rays, length $\frac{3}{4}$ to $\frac{1}{2}$ that of head. Caudal rounded. Vertebrae 9 + 25-26. Brownish, with irregular darker markings; a series of dark brown patches at upper and lower edges of body, extending on to the fins; a large dark blotch at commencement of straight portion of lateral line and another, less distinct, behind middle of straight part; a dark transverse band on caudal peduncle; all these markings together suggest traces of 7 or 8 irregular transverse bands; median fins spotted and streaked with dark brown.

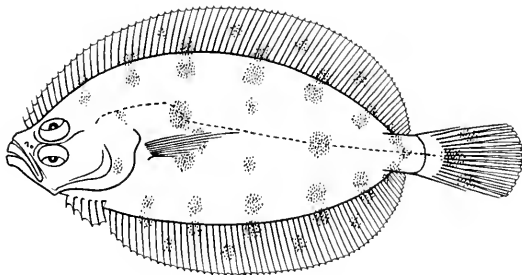


FIG. 211.—*Phrynorhombus norvegicus*. B.M. (N.H.) 88.4.3.83. · 1.

TYPE.—Royal Museum, Stockholm¹

DISTRIBUTION.—Coasts of Europe, from the Lofoten Islands to south-western England; Iceland.

SPECIMENS EXAMINED :

1 (94 mm.).	Christianiafiord.	Collett.
1 (53 ,,).	Shetland Is.	Jeffreys.
1 (95 ,,).	Lamlash Bay, 6-18 fms.	Murray.
1 (92 ,,).	Kilbrennan Sound, 45 fms.	„
1 (47 ,,).	Clock Light House, Firth of Clyde. 43 fms.	„
1 (55 ,,).	Firth of Forth, 25 fms.	„
1 (70 ,,).	Inishohn, Co. Galway.	Holt.
3 (53-67 mm.).	3 miles S.S.W. of Rame, nr. Plymouth.	Mar. Biol. Assoc.
1 (86 mm.).	4 miles S.W. by W. of the Mewstone, near Plymouth.	„

The maximum length of this species is about 120 mm.

¹ These are the specimens originally described by Fries, from the entrance of Gullmar Fjord near Fiskebäckskil, Bohuslan.

2. *PLEURONORHOMBUS REGIUS* (Bonnaterre).

ECKSTROM'S TOPKNOT.]

Pleuronectes regius, Bonnaterre, 1788, Encyc. Méth. (Ich.), p. 79.

Pleuronectes calmaranda, Lacépède, 1802, Hist. Nat. Poiss., iv, pp. 599, 654.

Pleuronectes punctatus (non Bloch), Fleming, 1818, Mem. Werner Soc., ii, p. 241; Fleming, 1822, Phil. Zool., pl. iii, fig. 2; Fleming, 1828, Brit. Anim., p. 199; Thompson, 1839, Ann. Nat. Hist., ii, p. 271.

Pleuronectes unimacellatus, Nardo, 1824, Giorn. di Fisica etc., (2) vii, p. 233.

Rhombus unimacellatus, Kisso, 1826, H. N. Europe, iii, p. 252, fig. 35; Bonaparte, 1833, Icon. Faun. Ital., (3), p. 28**, fig.; Costa, 1847, Faun. R. Napoli, ii, fasc. 55-8, p. 24; Nilsson, 1855, Skand. Faun., ed. 2, Fiskar., p. 645.

Rhombus unocellatus, Nardo, 1827, Prodr. Adriat. Ichth., p. 15, No. 135.

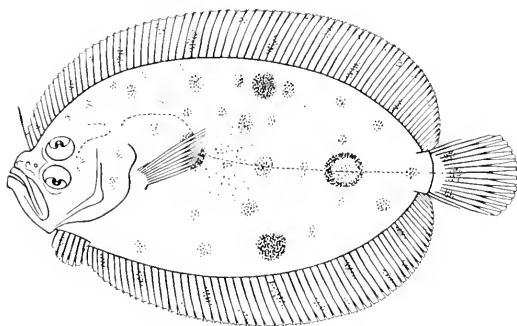


FIG. 212.—*Phrynorhombus regius*. B.M. (N.H.) 92.12.10.11. 1

Pleuronectes (Rhombus) cardina (part), Cuvier, 1829, R. Anim., ed. 2, ii, p. 341.

Rhombus setiger, Michahelles, 1829, Isis (Oken), p. 1016.

Rhombus punctatus, Yarrell, 1836, Brit. Fish., ed. 1, ii, p. 247, fig.; 1841, ed. 2, ii, p. 338, fig.; 1859, ed. 3, i, p. 659, fig.

Rhombus cardina, Krøyer, 1843-5, Danmarks Fiske, ii, p. 494, fig.

Scophthalmus punctatus, Bonaparte, 1849, Cat. meth. Pesi Europ., p. 49.

Scophthalmus unimacellatus, Bonaparte, 1849, *tom. cit.*, p. 49; Staudachner, 1868, Sitzber. Akad. Wiss. Wien, LVII (1), p. 715; Kvie, 1913, Rep. Danish Ocean. Exped. 1908-1910, II, A 1, p. 15; Buen, 1926, Cat. Ichth. Mecht. Españ. Marruecos, p. 99; Schmalebeck, 1930, in Journa. Faun. Ichth. Atlant. Nord, iv, fig.

Pleuronectes savatilis, Nardo [ex Chiarogham MS.], 1847, Sin. Mod. spec. Lag. Veneto, p. 121.

Zenopterus punctatus, White, 1851, 11st Brit. Anim., viii, Fish., p. 104.

Phrynorhombus unimacellatus, Günther, 1862, Cat. Fish., iv, p. 414; Canestrini, 1871-2, Faun. Ital., Pesci, iii, p. 161; Carus, 1889-93, Prodr. F. Mecht., ii, p. 586; Chabanand, 1937, Rivista Sci., Suppl. Mem. ii, p. 27.

Zenopterus unimacellatus, Day, 1880-1881, Fish. Britain, ii, p. 17, pl. xcix; Brook, 1886, Rep. Fish. Board Scotland, ix (2), p. 225, pl. ix; Proc. R. Phys. Soc. Edinb., ix, p. 368, pl. xvi; Liljeborg, 1891, Sverig. Norg. Fiskar., ii, p. 349.

Pleuronectes unimacellatus, Moreau, 1881, Hist. Nat. Poiss. France, iii, p. 323.

Phrynorhombus regius, Jordan and Goss, 1889, Rep. U.S. Com. Fish., xiv, (1886), p. 251.

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Brook, 1886, Rep. Fish. Board Scotland, iv (2), p. 225, pl. ix; McIntosh, 1892, Rep. Fish. Board Scotland, x (3), p. 274, pl. xiv, figs. 2-6, 8, 11 (?); Holt, 1893, Sci. Trans. R. Dublin Soc., (ii) v, pp. 101, 104, pl. viii, figs. 66-68, pl. xi, figs. 88-93; Holt, 1897, J. Mar. Biol. Ass., N.S., v, pp. 45, 128; Holt, 1899, Ann. Mus. hist. nat. Marseille, Zool., v (2), p. 74, pl. viii, fig. 89; Ehrenbaum, 1905, in Brandt and Apstein, Nordisches Plankton, I. Eier Larv. Fisch. (1), p. 214, fig. 82; Petersen, 1906, Medd. Komm. Havundersøg. Kjøb., Ser. Fisk., ii (1), p. 8; 1909, iii (1), p. 1, pl. ii, figs. 20-21.

Depth of body about twice in the length, length of head $3\frac{1}{2}$ to $3\frac{3}{4}$. Dorsal profile of head distinctly notched in front of upper eye. Snout about as long as eye, diameter of which is 4 to $4\frac{1}{2}$ in length of head; anterior margins of eyes level or lower very slightly in advance of upper, which is fairly close to edge of head; upper surfaces of eyes densely scaled. Olfactory laminae a little radiating. Maxillary extending nearly to below middle of eye, length about twice in that of head. 11 or 12 gill-rakers on lower part of anterior arch. Posterior edges of scales of ocular side with a few, rather strong spinules; scales of blind side with the marginal spinules feebler and more numerous; 72 to 80 scales in lateral line. Curve of lateral line not low, its width $2\frac{1}{4}$ to $2\frac{1}{2}$ in length of straight portion. Dorsal (70) 73-80; origin above space between nostrils of blind side; first ray a little prolonged and setiform; most of the rays scaled on both sides. Anal 60-68. Pectoral of ocular side with 9 or 10 rays, the middle rays branched; length $1\frac{1}{2}$ to $1\frac{3}{4}$ in that of head. Caudal rounded. Vertebrae 9-10 + 26. Brownish, with irregular dark spots and blotches; a distinct round dark spot on commencement of last third of straight part of lateral line; a dark blotch below hinder part of curve of lateral line and pair of larger blotches above and below first half of its straight portion, close to upper and lower edges of body; median fins spotted and streaked with dark brown or black.

TYPE.—Not traced.

DISTRIBUTION.—Atlantic coasts of south-western Europe, northwards to the British Isles and Denmark; Mediterranean.

SPECIMENS EXAMINED:

1 (80 mm.)	Ardrossan, 10 fms.	Murray.
1 (110 ,,)	Inverary	Macpherson.
3. (92-145 mm.)	Scotland.	Brook.
1 (104 mm.)	Loch Striven.	"
1 (123 ,,)	Off S.W. Ireland.	Grenfell.
1 (160 ,,), skin.	Plymouth.	Yarrell Coll.
1 (130 ,,), stuffed.	"	Gerrard.
1 (145 ,,)	"	Spence.
1 (125 ,,)	Arosa Bay, N.W. Spain.	Ducie.
1 (95 ,,)	Nice.	Gal.
1 (128 ,,)	Dalmatia.	—
1 (120 ,,), skeleton.	Mediterranean.	Cutler.

Also one from Europe (Mus. Comp. Zool.).

Genus 38. ZEUGOPTERUS.

Zeugopterus, Gottsche, 1835, Arch. Naturgesch., i (2), p. 178 [*Pleuronectes hirtus*, Abildgaard]; Jordan and Goss, 1889, Rep. U.S. Com. Fish., xiv, (1886), p. 251; Smitt, 1893, Scand. Fish., i, p. 45b.

Scophthalmus (part), Bonaparte, 1846, Cat. metod. Pesci Europ., p. 49; Kyle, 1913, Rep. Danish Ocean. Exped. 1908-1910, II, A.1, p. 15.

Zeugopterus (part), Steenstrup, 1865, Overs. Dansk. Vid. Selsk., p. 112.

Close to *Phrynorhombus*. Body ovate. Mouth very protractile. A patch of teeth on the head of the vomer. Gill-rakers of moderate length. Nostrils of blind

side very small,¹ situated below second and third rays of dorsal fin; olfactory laminae few in number, radiating from a short central rachis. Most of the rays of dorsal and anal fins branched, scaled only on ocular side. Pectoral fin of ocular side with the middle rays branched. Pelvic fins of equal length, symmetrical, their last rays firmly joined by a membrane to the first ray of the anal fin; a similar but much lower membrane unites their first rays, the whole forming a channel-like cup. Scales small, ctenoid on ocular side, cycloid on blind side; each scale of ocular side with only a narrow strip of the posterior part not covered by the scale immediately in front, this area provided with strong spinules directed vertically, giving the skin a roughened, pilose appearance; scales of blind side normally imbricated. No pyloric appendages.

A single species from the coasts of western Europe.

1. ZEUGOPTERUS PUNCTATUS (Bloch).

[COMMON TOPKNOT, BLOCH'S TOPKNOT.]

Pleuronectes punctatus, Bloch, 1787, Nat. Hist. Fische, iii, p. 31, pl. cxxxix.

Pleuronectes hirtus, Abildgaard, 1789, in Müller, Zool. Dan., ed. 3, iii, p. 36, pl. ciii; Nilsson, 1832, Prodr. Ichth. Scand., p. 59; Fries, 1838, Vet. Akad. Handl., p. 184; Fries, 1840, Arch. Naturgesch., p. 32; Krøyer, 1843-5, Danmarks Fisk., ii, p. 445, fig.; Moreau, 1881, H. N. Poiss. France, iii, p. 321.

Pleuronectes kitt, Schneider, 1801, in Bloch, Syst. Ichth., p. 192.

Zeugopterus hirtus, Gottsche, 1835, Arch. Naturgesch., (2), p. 178.

Rhombus hirtus, Yarrell, 1836, Brit. Fish., ed. 1, ii, p. 243, fig.; 1841, ed. 2, ii, p. 314, fig.; Nilsson, 1855, Skand. Faun., ed. 2, Fiskar., p. 646; Yarrell, 1859, Brit. Fish., ed. 3, i, p. 646, fig.; Smith, 1864-5, Proc. R. Phys. Soc. Edinb., p. 213.

Scophthalmus hirtus, Bonaparte, 1846, Cat. method. Pêches Europ., p. 49.

Rhombus punctatus, Günther, 1862, Cat. Fish., iv, p. 413.

Zeugopterus punctatus, Collett, 1875, Vid.-Selsk. Forh., (1874), Till. p. 139; Malm, 1877, Göteborgs Bohus. Faun., p. 518; Dav., 1880-4, Fish. Britan., ii, p. 18, pl. c; Collett, 1884, Nyt Mag. Naturv. Christiania, xxix, p. 101; Brook, 1886, Proc. R. Phys. Soc. Edinb., ix, p. 366, pl. xiv; Jordan and Goss, 1889, Rep. U.S. Com. Fish., xiv, (1886), p. 251; Liljeborg, 1891, Sverig. Norg. Fiskar., ii, p. 350; Smith, 1893, Scand. Fish., i, p. 459, pl. xix, fig. 2, text-fig. 116; Collett, 1903, Vid. Selsk. Forh., (1902), p. 92; Danøis, 1913, Ann. Inst. océanogr. Paris, v (5), p. 94, figs.; Schnakenbeck, 1925, Tier Nord Ostsee, I, ii, xii (1), p. 19, fig. 12; Breen, 1926, Cat. Ichth. Médit. Españ. Marruecos, p. 99; Schnakenbeck, 1930, in Jouban, Faun. Ichth. Atlant. Nord, iii, fig.; Chabanaud, 1931, Riviera Sci., Suppl. Mem. ii, p. 23.

Zeugopterus papillosus, Brook, 1886, Proc. R. Phys. Soc. Edinb., ix, p. 367, pl. xv.

Scophthalmus (Zeugopterus) punctatus, Ktze, 1913, Rep. Danish Ocean Exped. 1908-1910, ii, A 1, p. 15.

EGGS, LARVA AND YOUNG.

McIntosh and Prince, 1899, Trans. R. Soc. Edinb., xxxv, p. 852, pl. 1, fig. 6, pl. xix, fig. 1 (?); Holt, 1893, Sci. Trans. R. Dublin Soc., (iii) v, pp. 96, 97, 111, figs.; Cunningham, 1894, J. Mar. Biol. Ass., s.s., iii, p. 202; Petersen, 1894, Proc. Danish Biol. Stat., iv, (1893), p. 135, pl. ii, fig. 15; McIntosh and Masterman, 1897, Brit. Mar. Food-fish., p. 345, figs.; Holt, 1899, Ann. Mus. hist. nat. Marseille, Zool., v (2), p. 79, pl. viii, figs. 90, 91; Petersen, 1905, Rep. Danish Biol. Stat., xii (2), (1902-3), p. 25, pl. 1, figs. 1-5; Fehrenbaum, 1905, in Brandt and Apstein, Nordisches Plankton, I. Eier Larv. Fisch. (1), p. 206, fig. 80; Petersen, 1909, Medd. Komm. Havundersøg. Kjob., Ser. Fisk., iii (1), p. 1, pl. 1, figs. 1-6.

Depth of body 1½ to twice in the length, length of head about 3. Snout longer than eye, diameter of which is 4 to 5 times in length of head and 3 or more times the interorbital width; anterior margins of eyes level or lower very slightly in advance of upper, which is well separated from edge of head, upper surfaces of eyes densely scaled. Maxillary extending to below anterior part of eye, length 2¼ to 2½ in that of head; lower jaw scarcely projecting. 16 to 20 gill-rakers on lower part of anterior arch. About 200 scales in lateral line. Dorsal (85) 88-102. Anal 67-76 (80).

¹ In most specimens it is impossible to detect these in the loose skin covering the nasal cavity.

Pectoral of ocular side with 11 or 12 rays, length $\frac{1}{2}$ or less than $\frac{1}{2}$ that of head. Caudal rounded. Vertebrae 9 + 26-28. Brownish, with darker spots and blotches; sometimes with numerous small pale spots; the most conspicuous markings are a pair of broad bars, one sloping obliquely backwards above the upper eye, the other directed obliquely downwards and backwards from the lower eye, a rounded blotch just behind the curve of the lateral line, a smaller blotch below the base of the pectoral fin, extending on to the operculum, and two or three blotches, less well-defined, near upper and lower edges of body; median fins with spots and bars of dark brown

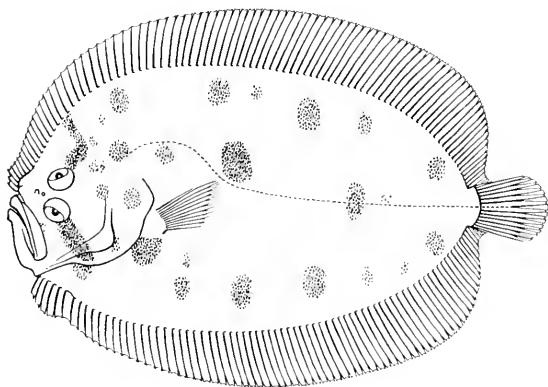


FIG. 213.—*Zeugopterus punctatus*. B. M. (N.H.) 1928. 7. 12. 13. · 4.

TYPE.—Zoologisches Museum der Universität, Berlin.

DISTRIBUTION.—Coasts of western Europe, from the Trondhjem Fiord to the Bay of Biscay.¹

SPECIMENS EXAMINED :

1 (172 mm.).	Christianafjord.	Collett.
1 (153 ,,).	North coast of Norway.	Brandt.
2 (177, 178 mm.).	Böhuslän.	Malm.
1 (218 mm.).	Orkneys.	Cowan.
1 (80 ,,).	Cumbræ Light House, 60 fms.	Murray.
1 (210 ,,).	Aberdeen Market.	Fish. Board Scotland.
1 (78 ,,). Co-type of <i>Z. papillosus</i> .	Scotland.	Brook.
1 (218 ,,).	North Sea.	Stokes.
1 (225 ,,).	Scarborough.	Stevenson.
1 (150 ,,).	Yarmouth (?).	Patterson.
1 (192 ,,).	Plymouth.	Studdy

¹ According to Buen (1926) this species has been recorded from the Mediterranean coast of Spain.

1 (100 mm)	Plymouth.	Byrne.
1 (195 ..) ♀, stuffed	..	Spence
1 (150 ..) ..	Dawlish.	..
2 (125, 168 mm)	Dartmouth.	Powell
1 (220 mm) ..	S. Devon.	—
1 (165 ..) ♀, stuffed	Jersey.	Hornell
1 (85-170 mm) .., skins.	Great Britain	Yarrell Coll.
1 (120 mm) ♀, skeleton.	..	..
1 (225 ..) ..	London Market.	Harrod's Stores
1 (195 ..) ..	..	..

Comparison of one of the types of *Z. papillosus* with an example of *Z. punctatus* of similar size leaves little doubt that the two are identical, *papillosus* being at the most a local variety.

Family 3. PLEURONECTIDÆ.

Eyes on the right side, except in reversed examples in certain species; optic chiasma monomorphic, the nerve of the left eye always dorsal. Dorsal fin extending forward on the head at least to above the eye; all the fin-rays articulated. Each pelvic fin of from 3 to 13 rays. Mouth usually terminal, with the lower jaw more or less prominent; maxillary without a supplemental bone; palatines toothless. Lower edge of rohyral deeply emarginate, so that the bone appears forked. Preoperculum with free margin. Nasal organ of blind side usually near edge of head, but sometimes nearly opposite that of ocular side. Vertebræ never fewer than 30. On each side a single post-cleithrum. Ribs present. Egg without an oil-globule in the yolk.

Five subfamilies may be recognised.

SYNOPSIS OF THE SUBFAMILIES

1. Pelvic fins generally short-based, symmetrical, or that of ocular side median and somewhat advanced, the fins supported by the pelvic bones behind or below the cleithra; pectoral radials present.
 - A. Origin of dorsal fin above the eyes, behind nasal organ of blind side; præcaudal parapophyses separate, divergent; hypocoracoids narrowed forward below.
 1. Lateral line well developed on both sides of body; olfactory laminae (except in *Atheresthes*) parallel, without rachis. 1. PLEURONECTINÆ
 2. Lateral line rudimentary and scarcely apparent on blind side of body; olfactory laminae radiating from a short central rachis. 2. PEGELOPETTINÆ
 - B. Origin of dorsal fin in front of the eyes, the fin extending forward on snout either above or below nasal organ of blind side.
 1. Dorsal fin extending forward on snout above nasal organ of blind side; last 5 præcaudal vertebræ with parapophyses, of which the last pair are connected by a bridge; hypocoracoids narrowed forward below; olfactory laminae arranged transversely to or radiating from a central rachis; lateral line well developed on both sides of body. 3. PARALICHTHODINÆ
 2. Dorsal fin extending forward on snout below nasal organ of blind side; parapophyses of præcaudal vertebræ united to form closed hæmal arches, bearing the slender ribs at their extremities; hypocoracoids expanded; olfactory laminae parallel, without rachis; lateral line rudimentary and scarcely apparent on blind side. 4. SAMARINÆ

- II. Pelvic fins asymmetrical; that of ocular side median, elongate, extending forward to the urohyal, supported by a cartilaginous plate placed in advance of the cleithra, well in advance of that of blind side, which (if present) is small and short-based; no pectoral radials, the rays inserted on the hypercoracoid; dorsal fin extending forward on snout above nasal organ of blind side, or commencing behind it; parapophyses of præcaudal vertebræ not united; hypocoracoids narrowed forward below; olfactory laminae with or without a central rachis; lateral line equally developed on both sides of body 5. RHOMBOSOLEINÆ.

I am unable to determine the systematic position of the following genus and species from Chesapeake Bay. The eyes and colour are on the right side, but the pelvic fins are said to be asymmetrical. It may belong to the subfamily Pæcilopsettinæ.

NEOETROPUS.

Neotropus, Hildebrand and Schroeder, 1928, Bull. U.S. Bur. Fish., xliii (1), (1927), p. 174.

NEOETROPUS MACROPS, Hildebrand and Schroeder.

Neotropus macrops, Hildebrand and Schroeder, 1928, *tom. cit.*, p. 174, fig. 89.

The single known specimen (U.S. Nat. Mus. No. 87653) is only 55 mm. in total length, and is from off Smith's Point, Va.

Subfamily I. PLEURONECTINÆ.

Characters as given in the synopsis above. Twenty-seven genera from Arctic and northern seas.

SYNOPSIS OF THE GENERA.

- I. Mouth large, maxillary on ocular side generally at least $\frac{1}{2}$ head; jaws and dentition nearly equally developed on both sides; vertebræ 40 to 62.
 - A. Maxillary at least $\frac{1}{2}$ head, teeth sharply pointed or barbed.
 1. Vertebræ 49 to 62; dorsal 93-114, anal 71-80; body rather elongate; caudal peduncle slender; caudal strong, lunate.
 - a. Teeth mostly with barbed tips, some depressible, biserial in both jaws; olfactory laminae arranged transversely to a central rachis; gill-rakers rather long and slender; upper eye with vertical range; lateral line without curve anteriorly; vertebræ 49 to 53 1. ATHERESTHES.
 - b. Teeth all pointed, none depressible, biserial or multiserial above, uniserial below; olfactory laminae parallel, without rachis; gill-rakers short and stout.
 - a. Upper eye with vertical range, the interorbital space broader than orbit; lateral line without curve anteriorly; 10 to 12 gill-rakers on lower part of anterior arch; vertebræ 62 2. REINHARDTIUS.
 - β. Upper eye lateral, the interorbital space not broader than orbit; lateral line with distinct curve above pectoral; 7 or 8 gill-rakers on lower part of anterior arch; vertebræ 50 to 51 3. HIPPOGLOSSUS.

2. Vertebrae 40 to 15, dorsal 97-101, anal 51-79, body not elongate, caudal peduncle not slender, caudal never lunate; teeth pointed
- a* Interorbital space an obtuse ridge; supratemporal branch of lateral line, if present, without posterior prolongation; dorsal origin above eye, anterior rays not free.
- a* Teeth in upper jaw uniserial
- * All pectoral rays generally simple, dorsal origin above anterior part of eye; upper eye completely lateral; snout and eye-balls not scaled 4. HIPPOGLOSSOIDES
 - ** Middle rays of pectoral branched, dorsal origin above middle or posterior part of eye.
 - † Upper eye completely lateral, snout and upper surfaces of eye-balls densely scaled 5. ACANTHOPSETTA.
 - †† Upper eye with vertical range; snout more or less scaled, eye-balls not scaled 6. CLEISTHENES
- β. Teeth in upper jaw biserial
- * Scales of moderate size, deciduous; all pectoral rays simple; jaws without distinct canines 7. LYOPSETTA.
 - ** Scales small, adherent, middle rays of pectoral branched, jaws with canines anteriorly 8. EOPSETTA.
- b* Interorbital space flat; supratemporal branch of lateral line with a long posterior prolongation; dorsal origin in front of eye, anterior rays a little prolonged, more or less free from membrane; teeth in upper jaw uniserial, middle rays of pectoral branched
9. PSETTICHTHYS.
- B. Maxillary scarcely $\frac{1}{3}$ head; jaws rather stronger on blind side, but dentition nearly equally developed on both sides, teeth obtusely conical, biserial above, uniserial below 10. VERASPER
- II. Mouth smaller, maxillary on ocular side less than $\frac{1}{3}$ head, jaws and dentition better developed on blind side.
- A. Maxillary on blind side nearly $\frac{1}{2}$ head; teeth stout, conical, in two distinct rows in both jaws, scales of ocular side (in adults) all replaced by rough tubercles, blind side quite naked 11. CLIDODERMA
1. Maxillary on blind side not more than $\frac{1}{3}$ head
1. Teeth small, acute, in villiform bands; supratemporal branch of lateral line with a long posterior prolongation, lower pharyngeals narrow, scarcely approximated; scales all cycloid
- a* Lips simple, dorsal origin on median line of head 12. HYPHOPSETTA
 - b* Lips thick, with transverse plicae, dorsal origin on blind side of head 13. PLEURONICHTHYS
2. Teeth larger, obtuse, conical or incisor-like, uniserial or sometimes irregularly biserial
- a* Pyloric appendages well developed, generally of moderate length or rather long, 2 to 4 + 1 to 5; lower pharyngeals generally narrow, the inner edges usually evenly curved and scarcely approximated (except in *Pleuronectes*), the teeth generally in two rows
- a* Supratemporal branch of lateral line with a posterior prolongation
 - * Lateral line with low curve above pectoral
 - † Scales of ocular side strongly ctenoid; eyes rather small, upper lateral; teeth conical 14. ISOPSETTA
 - †† Scales of ocular side mostly cycloid, eyes large, upper with nearly vertical range; teeth with truncated tips 15. PAROPHRYS
 - ** Lateral line with high curve above pectoral 16. LEPIDOPSETTA

- β. Supratemporal branch of lateral line, if present, without posterior prolongation.
- * Vertebrae 35 to 44; dorsal less than 90, anal less than 70; intestine nearly entirely contained within body-cavity of blind side.
 - † Postocular ridge sometimes rugose or with one or two protuberances, never broken up into a series of prominences; lower pharyngeals narrow and rather slender, $4\frac{1}{2}$ to 7 times as long as broad, their inner edges evenly curved and scarcely approximated, the teeth sharply or obtusely conical.
 - ‡ Lateral line with more or less distinct curve above pectoral; scales adherent; when ctenoid, the spinules rather short and usually not numerous; eye-balls not scaled.
 - § Teeth obtusely conical, lanceolate or with truncated tips, usually not much compressed, never forming a continuous cutting edge; at least 6 teeth on ocular side of each jaw; intestine of moderate length, not very narrow, generally with 2 or 3 coils; caudal with 11 or 12 branched rays
17. LIMANDA.
- §§ Teeth incisor-like, compressed, sometimes forming a more or less continuous cutting edge; less than 6 teeth on ocular side of each jaw; intestine elongate, narrow, with 3 or more coils; caudal with 13 or 14 branched rays 18. PSEUDOPLEURONECTES.
 - ‡‡ Lateral line rising a little above pectoral, but without distinct curve; scales thin, rather deciduous, those of ocular side ctenoid, the spinules slender and numerous; upper surfaces of eye-balls scaled; teeth obtusely conical 19. DEXISTES.
 - †† Post-ocular ridge broken up into a series of 4 to 7 bony prominences; lower pharyngeals broader, stout, $2\frac{1}{2}$ to nearly 5 times as long as broad, their inner edges more or less approximated anteriorly, each with about 2 rows of obtusely pointed or molariform teeth; lateral line with very low curve above pectoral; scales mostly cycloid and embedded in the skin 20. PLEURONECTES.
 - ** Vertebrae 48 to 65; dorsal 80-120, anal 65-102; second loop of intestine elongate, extending well into secondary body-cavity of ocular side.
 - † Teeth almost entirely confined to blind side, never more than 3 on ocular side of each jaw; lips thick; 2 or 3 + 1 pyloric appendages; dorsal origin not far behind posterior nostril of blind side; fin-rays stout 21. MICROSTOMUS.
 - †† Teeth fairly well developed on both sides, at least 7 on ocular side of each jaw; 2 to 4 + 2 to 5 pyloric appendages¹; dorsal origin usually well behind posterior nostril of blind side.
 - ‡ Body ovate; skin thick, the median fins densely scaled; lips thick; gill-opening scarcely extending above level of axil of pectoral; dorsal origin nearly diameter of eye's length behind posterior nostril of blind side; fin-rays stout 22. EMBASSICHTHYS.

¹ Not examined in *Embassichthys*.

- †† Body elongate-elliptical; skin rather thin, the median fins not very densely scaled, lps thin, gill-opening extending above level of axil of pectoral; dorsal origin well behind posterior nostril of blind side, fin-rays not stout
- § No mucous cavities on blind side of head, posterior rays of dorsal and anal branched 23 TANAKIUS.
- §§ Large mucous cavities on blind side of head, all dorsal and anal rays simple 24 GLYPHOCEPHALUS
- b* Two very short pyloric appendages, lower pharyngeals broader, 2 to 4½ times as long as broad, massive, the inner edges more or less angular, usually approximated for at least ½ their length, the teeth usually coarser and blunter, often molariform, in 2 or more series
- a* Scales well developed, ctenoid in male, smoother in female, no bony tubercles, teeth incisor-like, forming a continuous cutting edge, supratemporal branch of lateral line without posterior prolongation 25 LIORSETTA
- β* Scales well developed, all strongly ctenoid in both sexes, some of those on head nearly tuberculate, teeth incisor-like, close-set, supratemporal branch of lateral line with short posterior prolongation 26 LIORSETTA.
- γ* Scales reduced, more or less embedded in the skin, all cycloid, head and body with bony tubercles or rugose plates; teeth obtusely conical or rather incisor-like, not usually forming a continuous cutting edge 27 PLATICHTHYS.

Genus I. ATHERESTHES.

Atheresthes, Jordan and Gilbert, 1881, Proc. U. S. Nat. Mus., 11, (1880), p. 51 (*Platysomatichthys stomias*, Jordan and Gilbert); Jordan and Evermann, 1898, Bull. U. S. Nat. Mus., XLVII (3), p. 2709.

Body rather elongate, compressed. Eyes on the right side, separated by a narrow, scaled space, the upper with a more or less vertical range. Olfactory laminae in moderate number, arranged transversely to or radiating from a long central rostrum. Mouth very large, oblique, the length of the maxillary more than ½ that of head, jaws and dentition about equally developed on both sides; teeth in two series in both jaws, some of them long, freely depressible, wide-set, others small, fixed and close-set, most of the teeth with barbed tips, vomer toothless. Gill-rakers rather long and slender, few in number; lower pharyngeals very narrow, scarcely approximated anteriorly, each with two series of slender, slightly curved teeth with barbed tips, the teeth of the inner row much larger than those of the outer. Dorsal fin with 98 to 114 rays, commencing well behind nostrils of blind side and above eye, most of the rays simple, scaled on both sides. Tip of first interhemal spine not projecting in front of anal fin, which has 80 to 86 rays. Pectoral fins unequal, that of ocular side larger, middle rays branched. Pelvic fins short-based, unequal and subsymmetrical. Caudal fin lunate; caudal peduncle slender. Scales small, thin, rather deciduous, feebly ctenoid on ocular side, cycloid on blind side, supplementary scales present. Lateral line without a distinct curve above the pectoral fin. Vent median, between the pelvic fins. Vertebrae 40 to 53 (12 - 37 = 11).

One or two species from the North Pacific.

I. ATHERESTHES STOMIAS (Jordan and Gilbert).

[ARROW-TOOTHED HALIBUT.]

Platysomatichthys stomias, Jordan and Gilbert, 1881, Proc. U.S. Nat. Mus., iii, (1880), pp. 51, 301.
Atheresthes stomias, Jordan and Gilbert, 1881, *tom. cit.* p. 51; Jordan and Gilbert, 1882, Proc. U.S. Nat. Mus., iv, (1881), p. 66; Bean, 1882, *tom. cit.*, p. 242; Jordan and Gilbert, 1883, Bull. U.S. Nat. Mus., xvi, p. 820; Bean, 1884, Proc. U.S. Nat. Mus., vi, (1883), p. 354; Jordan, 1884, Nat. Hist. Aquat. Amm. (Fisheries Fish. Indust. U.S., i), p. 188, pl. lxx; Jordan and Goss, 1889, Rep. U.S. Com. Fish., xiv, (1886), p. 236, pl. i, fig. 1; Jordan and Evermann, 1898, Bull. U.S. Nat. Mus., xlvii (3), p. 2609, pl. cclxxi, fig. 917; Evermann and Goldsborough, 1907, Bull. U.S. Bur. Fish., xxvi (1906), p. 350, fig. 132; Starks, 1918, Calif. Fish Game, iv (4), p. 4, fig. 82.

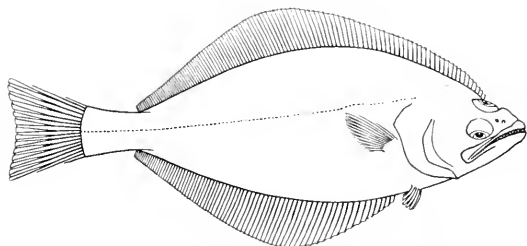


FIG. 214.—*Atheresthes stomias*. B.M. (N.H.) 1923.11.21.7. $\cdot \frac{1}{2}$.

Depth of body nearly 3 in the length, length of head $3\frac{2}{3}$. Snout (in adults) longer than eye, diameter of which is $4\frac{1}{3}$ in length of head, and more than 3 times interorbital width; upper eye slightly in advance of lower, reaching edge of head. Anterior nostril of blind side with a small flap. Maxillary extending to beyond eye, length $1\frac{1}{2}$ in that of head; lower jaw about $1\frac{2}{3}$ in head. Upper jaw laterally with two series of small, fairly close-set teeth; anteriorly those of the inner row become long, slender and wide-set, the outer row being reduced to some small teeth set between the larger ones; teeth of lower jaw in two series, in the inner row long, fixed, wide-set teeth alternating with shorter depressible teeth, in the outer row small, fixed teeth. 11 or 12 gill-rakers on lower part of anterior arch. About 95 pores in lateral line.¹ Dorsal (101) 105 (106); origin above middle of eye. Anal 81-82 (86). Pectoral of ocular side with 14 or 15 rays, length $2\frac{2}{3}$ in that of head. Caudal peduncle a little longer than deep. More or less uniformly brownish.

TYPE.—Not traced.

DISTRIBUTION.—Pacific coast of North America, from the Bering Sea to San Francisco.

SPECIMENS EXAMINED:

1 (490 mm.).	48° 21' N., 124° 52' W.	U.S. Nat. Mus.
1 (290 ,,). ²	Pt. Reyes, California.	„

This species is said to attain a length of 2 feet.

¹ In large examples small pores are present here and there between the principal pores. Only the latter have been counted here.

² In a very bad state.

- *ATHERESTHES EVERMANNI*, Jordan and Starks

Atheresthes evermanni, Jordan and Starks, 1901, Bull. U.S. Com. Fish., xxi (1902), p. 921, pl. 3, fig. 1; Jordan and Starks, 1909, Proc. U.S. Nat. Mus., xxxi, p. 197, fig. 11; Jordan, Tanaka and Eschscholtz, 1913, J. Coll. Sci. Tokyo, xxxiii (1), p. 321, fig. 270; Hubbs, 1915, Proc. U.S. Nat. Mus., xlvii, p. 473; Jordan and Hubbs, 1925, Mem. Carnegie Mus., x, p. 268; Soldatov and Lindberg, 1930, Bull. Pac. Sci. Fish. Inst., v, p. 399.

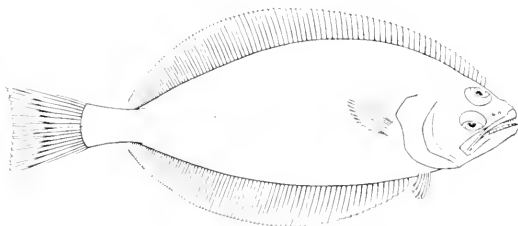


FIG. 215.—*Atheresthes evermanni*. B.M. (N.H.) 1928.9.28.2 (3).

Very close to the preceding species. Depth of body $2\frac{1}{2}$ to 3 in the length, length of head $3\frac{1}{2}$ to $3\frac{3}{4}$. Snout as long as or longer than eye, diameter of which is $4\frac{1}{4}$ to 5 in length of head; upper eye not quite reaching edge of head. Anterior nostril of blind side with a rather long flap. Length of maxillary $1\frac{1}{2}$ to $1\frac{3}{4}$, of lower jaw $1\frac{1}{2}$ to $1\frac{3}{4}$ in that of head. 10 gill-rakers on lower part of anterior arch. (86) 90 to 102 pores in lateral line. Dorsal (98) 101-107 (114); origin in front of middle of eye. Anal (78) 80-87 (86). Pectoral of ocular side with 13 or 14 rays, length about 2 in that of head. Caudal peduncle longer than deep. Dark brownish, young somewhat spotted.

TYPE.—United States National Museum. No. 51410.

DISTRIBUTION.—Japan.

SPECIMENS EXAMINED:

7 (248-275 mm.).

Japan.

Tokyo Imp. Univ.

I have been unable to compare these specimens with examples of *A. stomas* of similar size, but the two species may eventually prove to be identical.

Genus 2. REINHARDTIUS.

Reinhardtius, Gill, 1861, Proc. Nat. Acad. Sci. Philad., Suppl. (Cat. Fish. E. Coast N. Amer.), p. 50. *Pleuronectes cynoglossus*, Fabricius; Jordan and Evermann, 1898, Bull. U.S. Nat. Mus., xlvii (3), p. 2610.

Platysomatichthys, Bleeker, 1862, Versl. Akad. Wet. Amsterdam, xiii, p. 426. *Pleuronectes pinguis*, Fabricius.

Perhaps related to *Atheresthes*. Body not much compressed. Eyes separated by a wide space, the upper with vertical range. Olfactory laminae fairly numerous, nearly parallel to one another and to the axis of the body, without central rachis. Mouth rather large, oblique, the length of the maxillary more than $\frac{1}{2}$ that of head; teeth of upper jaw in two series, which converge posteriorly, inner row with a pair of strong canines anteriorly on each side; teeth of lower jaw uniserial; all the teeth pointed, none depressible. Gill-rakers short, stout, roughly spinulate, 10 to 12 on

lower part of anterior arch; lower pharyngeals each with a single row of unequal teeth. Dorsal fin commencing behind or above posterior part of eye. Pectoral fins nearly equally developed on both sides of body. Scales very small, adherent, cycloid on both sides of body. Vertebrae 62. Head and body (in adults) coloured on blind side.

One or two species from the Arctic parts of the Atlantic and from Japan.

The following species from Japan has been briefly described in Japanese, without an abstract in English or other European language:

Reinhardtius oleosus, Tanaka, 1918, *Dobuts. Zasshi* ('Zool. Mag.'), xxx, p. 220.

I. REINHARDTIUS HIPPOGLOSSOIDES (Walbaum).

[GREENLAND HALIBUT; LESSER HALIBUT.]

Pleuronectes cynoglossus (non Linnaeus), Fabricius, 1780, *Fauna Groenland*, p. 103.

Pleuronectes hippoglossoides, Walbaum, 1792, *Arted. Ichth.*, (3), ed. 2, p. 115.

Pleuronectes pinguis, Fabricius, 1824, *Afhandl. K. Danske Vid. Selsk.*, i, p. 40.

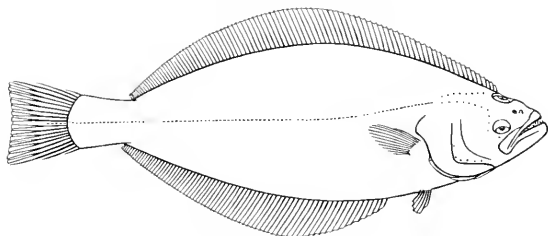


FIG. 216.—*Reinhardtius hippoglossoides*. B.M. (N.H.) 1926.2.17.1. 1.

Hippoglossus pinguis, Reinhardt, 1838, *Afhandl. K. Danske Vid. Selsk.*, vii, p. 116; Kroyer, 1850 (?), in Fabvre, *Voy. Scand. Lapon.*, Zool., pl. xxii; Esmark, 1869, *Forh. Skand. Naturf.*, M. x, (1868), p. 526; Collett, 1875, *Vid.-Selsk. Forh.*, (1874), Till. p. 135; Lutken, 1875, in Jones, *Man. Nat. Hist. Greenland*, vii, p. 120; Collett, 1880, *Vid.-Selsk. Forh.*, (1879), p. 74; Gunther, 1887, *Deep-Sea Fishes "Challenger"*, p. 161.

Reinhardtius hippoglossoides, Gill, 1861, *Proc. Acad. Nat. Sci. Philad.*, Suppl. (Cat. Fish. E. Coast N. Amer.), p. 50; Gill, 1864, *Proc. Acad. Nat. Sci. Philad.*, xvi, p. 218; Jordan and Evermann, 1898, *Bull. U.S. Nat. Mus.*, xlvii (3), p. 2611; Collett, 1903, *Vid.-Selsk. Forh.*, (1902), p. 82; Norman, 1924, *Ann. Mag. Nat. Hist.*, (9), xiii, p. 539; Bigelow and Welsh, 1925, *Bull. U.S. Bur. Fish.*, xl (1), (1924), p. 481, fig. 242; Knipovich, 1926, *Trans. Inst. Sci. Explor. North*, xxvii, p. 149, fig. 104.

Platysomatichthys pinguis, Bleeker, 1862, *Versl. Akad. Wet. Amsterdam*, xiii, p. 426; Steenstrup, 1863, *Overs. D. Vid.-Selsk. Forh.*, p. 186.

Hippoglossus groenlandicus, Gunther, 1862, *Cat. Fish.*, iv, p. 404.

Platysomatichthys hippoglossoides, Goode and Bean, 1879, *Bull. Essex Inst.*, xi, p. 7; Collett, 1880, *Norske Nordhavs-Exped.*, Zool., Fiske, p. 142; Jordan and Gilbert, 1883, *Bull. U.S. Nat. Mus.*, xvi, p. 819; Goode, 1884, *Nat. Hist. Aquat. Anim. (Fisheries Fish. Indust. U.S.)*, i, p. 197, pl. lvi; Collett, 1885, *Nvt Mag. Naturv. Christiania*, xxix, p. 98; Jordan and Goss, 1889, *Rep. U.S. Com. Fish.*, xiv, (1886), p. 237, pl. i, fig. 2; Smit, 1893, *Scand. Fish.*, i, p. 417, fig. 112; Goode and Bean, 1895, *Ocean. Ichth.*, p. 435, pl. cv, ng. 364; Grieg, 1898, *Bergens Mus. Aarb.*, No. iii, p. 14.

- Hippoglossus hippoglossoides*, Lilljeborg, 1891, Sverig. Fiskar, ii, p. 295; Saemundsson, 1911, Valensk Medd naturh. Foren. Kjob., lxxv, p. 28; Saemundsson, 1927, Rit. Visind. Isl., ii, p. 34.
Reinhardtius (Platysomatichthys) hippoglossoides, Jensen, 1925, Medd. Komm. Havundersog. Kjob., Ser. Fisk., vii (7), p. 10.
Hippoglossus (Platysomatichthys) hippoglossoides, Jensen, 1904, Medd. Gronland, xxix, p. 271.

EGGS, LARVA AND YOUNG.

- Peterson, 1894, Rep. Danish Biol. Stat., iv, (1893), p. 130, pl. ii, fig. 21; Schmidt, 1904, Medd. Komm. Havundersog. Kjob., Ser. Fisk., i (3), p. 8, pl. 1, figs. 1-3; Ehrenbaum, 1905, in Brandt and Apstein, Nordisches Plankton, I. Eier Larv. Fisch. (ii), p. 181, fig. 73; Koefoed, 1909, Crois. Ocean. Mer. Gronland 1905, Poiss., p. 17, fig. 9.

Depth of body $2\frac{1}{2}$ to $3\frac{1}{2}$ in the length, length of head $3\frac{2}{3}$ to nearly 4. Snout longer than eye, diameter of which is $7\frac{1}{4}$ to $8\frac{1}{2}$ in length of head and equal to or (usually) less than interorbital width. anterior margins of eyes about level, the upper entering dorsal profile of head and with an entirely vertical range. Maxillary extending to below posterior part of eye or beyond, length $2\frac{1}{4}$ to $2\frac{1}{2}$ in that of head; lower jaw strongly projecting, nearly twice in head. 10 to 12 gill-rakers on lower part of anterior arch. About 110 pores in lateral line. Dorsal (62) 94-102. Anal 71-79. Pectoral of ocular side with 13 to 15 rays, length $2\frac{1}{4}$ to $2\frac{1}{2}$ in that of head. Caudal with 15 branched rays, emarginate or lunate; caudal peduncle as deep as long or a little longer than deep. More or less uniformly blackish or brownish on both sides, the blind side a little paler; blind side white in the young.¹

TYPE.—Not traced.

DISTRIBUTION.—Arctic parts of the Atlantic, southwards to the Grand Banks off Newfoundland and the British Isles², in deep water.

SPECIMENS EXAMINED:

2 (420, 539 mm.).	Off Siglu Fjord, N. Iceland	Eye.
1 (490 mm.) ³	12 miles off Siglu Fjord, N. Iceland.	Schmidt ("Dana" Coll.).
9 (470-580 mm.).	N. Iceland.	Bárdarson.
1 (790 mm.), stuffed	Greenland	—
One of the types of <i>Hippoglossus groenlandicus</i>		
1 (720 mm.).	S. W. of Ireland (52° 30' N.), 170 fms.	Fattersall.
1 (640 "), skeleton.	—	Brooks.
1 (115 "), skull.	—	Kyle.

This species is said to attain a length of a little more than 3 feet.

2. REINHARDTIUS MATSUURÆ, Jordan and Snyder.

- Hippoglossus groenlandicus* (non Gunther), Ishikawa and Matsura, 1897, Prel. Cat., p. 25.
Reinhardtius matsuuræ, Jordan and Snyder, 1901, J. Coll. Sci. Tokyo, xv, p. 309, pl. xvi, figs. 7, 8; Jordan and Starks, 1906, Proc. U. S. Nat. Mus., xxxi, p. 196; Jordan, Tanaka and Snyder, 1913, J. Coll. Sci. Tokyo, xxxiii (1), p. 322; Sokolov and Landberg, 1930, Bull. Pac. Sci. Fish. Inst., v, p. 398.

Probably identical with the preceding species, but length of head $4\frac{1}{4}$ in that of fish (without caudal). Dorsal 96. Anal 69. 117 scales in lateral line.

TYPE.—Imperial Museum, Tokyo.

DISTRIBUTION.—Misaki, Japan.

Known only from the type, a stuffed specimen about 1 $\frac{1}{4}$ feet in total length.

¹ The pelagic larval form is pigmented on both sides, although the coloration is darker on the right side. After passing into the bottom stage the pigment of the blind side gradually disappears and this becomes entirely white to the naked eye. Later, pigment is again developed on the blind side [Jensen].

² Probably extending southwards normally to about 70° N. on the eastern side of the Atlantic.

³ Reversed example.

Genus 3. HIPPOGLOSSUS.

Hippoglossus, Cuvier, 1817, R. Anim., ii, p. 221 [*Pleuronectes hippoglossus*, Linnaeus]; Gottsche, 1835, Arch. Naturgesch., i (2), p. 164; Jordan and Evermann, 1898, Bull. U.S. Nat. Mus., xlvii (3), p. 2611.

Body rather elongate, compressed. Eyes on the right side, separated by a wide, flat space, not broader than the orbit, the upper eye not placed on top of the head. Olfactory laminae in moderate number, parallel, without central rachis. Mouth rather large, oblique, the length of the maxillary more than $\frac{1}{3}$ that of head; jaws and dentition about equally developed on both sides; teeth strong, pointed, mostly curved, in two or more series in the upper jaw and in one or more series in the lower; vomer toothless. Gill-rakers rather short, very stout, few in number; lower pharyngeals narrow, scarcely approximated anteriorly, each with two series of teeth, those of the inner row very much larger than those of the outer. Dorsal fin with 93 to 110 rays, commencing at a short distance behind nostrils of blind side and above eye; rays simple anteriorly, branched posteriorly, more or less scaled on both sides. Tip of first inter-hæmal spine projecting in front of anal fin, which has 71 to 85 rays. Pectoral fins unequal, that of ocular side larger; middle rays branched. Pelvic fins short-based, subequal and subsymmetrical. Caudal fin lunate; caudal peduncle slender. Scales very small, adherent, cycloid, many of them with a small rough plate posteriorly; supplementary scales present. Lateral line with a distinct curve above the pectoral fin. Vent median, between the pelvic fins. Vertebrae 50 to 51 (16 + 34 - 35).

Two species from Arctic and northern seas.

SYNOPSIS OF THE SPECIES.

- I. Dorsal 98-106 (110), anal 73-80 (85); depth $2\frac{2}{3}$ to $2\frac{1}{2}$ in length; supplementary scales surrounding primary scales 1. *hippoglossus*.
- II. Dorsal 93-97 (100), anal 71-75 (78); depth nearly 3 in length; supplementary scales present, but not surrounding primary scales. 2. *stenolepis*.

I. HIPPOGLOSSUS HIPPOGLOSSUS (Linnæus).

[HALIBUT.]

Pleuronectes hippoglossus, Linnaeus, 1758, Syst. Nat., ed. 10, p. 269; 1766, ed. 12, p. 456; Bloch, 1783, Naturgesch. Fische Deutsch., ii, p. 47, pl. xlvii; Schneider, 1801, in Bloch, Syst. Ichth., p. 147; Lacepède, 1802, Hist. Nat. Poiss., iv, p. 601; Shaw, 1803, Gen. Zool. iv (2), p. 295; Quensel, 1806, Vet. Akad. Handl., xxvii, p. 225; Nilsson, 1832, Prodr. Ichth. Scand., p. 57; Valenciennes, 1851, in Tréhouart, Voy. Isl. Groen., Zool., Poiss., p. 207, pl. xiv.

Pleuronectes hippoglossus (part), Pallas, 1814, Zoographia, iii, p. 421.

Hippoglossus vulgaris, Fleming, 1828, Brit. Anim., p. 199; Yarrell, 1836, Brit. Fish., ed. 1, ii, p. 230, fig.; Storer, 1839, Rep. Ichth. Massach., p. 145; DeKay, 1842, N. H. New York (Fish.), p. 294, pl. xlix, fig. 157; Yarrell, 1850, Brit. Fish., ed. 3, i, p. 630, fig.; Günther, 1862, Cat. Fish., iv, p. 403; Malmgren, 1864, Arch. Naturgesch., xxx (1), p. 296; Storer, 1867, Hist. Fish. Massach., p. 192, pl. xxx, fig. 1; Gilpin, 1869, Proc. Trans. N. Scotia Inst. N.S., ii (2), p. 20; Collett, 1875, Vid.-Selsk. Forh., (1874), Till. p. 134; Collett, 1880, Vid.-Selsk. Forh., (1879), p. 74; Day, 1880-4, Fish. Britain, ii, p. 5, pl. xciv; Goode, 1881, Proc. U.S. Nat. Mus., iii, (1880), p. 471; Moreau, 1881, Hist. Nat. Poiss. France, iii, p. 287; Collett, 1885, Nyt Mag. Naturv. Christiania, xxix, p. 98; Lilljeborg, 1891, Sverig. Norg. Fiskar, ii, p. 282; Smitt, 1893, Scand. Fish., i, p. 409, pl. xvii, figs. 1, 2; Goode and Bean, 1895, Ocean. Ichth., p. 434, pl. cv, fig. 363; Holt and Calderwood, 1895, Sci. Trans. R. Dublin Soc. (ii) v, p. 478; Jouan, 1897-1900, Mem. Soc. Cherbourg, xxxi, p. 223; Jespersen, 1917, Medd. Komm. Havundersøg. Kjob., Ser. Fisk., v (5), p. 3; Huutsman, 1922, Contr. Canad. Biol., (1921), No. iii, p. 21; Schnakenbeck, 1925, Tier. Nord Ostsee, L. ii, xii (1), p. 3, fig. 1; Jensen, 1925, Medd. Havundersøg. Kjob., Ser. Fisk., vii (7), p. 17; Jespersen, 1926, Rapp. proc.-verb. explor. mer., xxxix, p. 103; Saemundsson, 1927, Rit. Visind. Isl., ii, p. 34; Schnakenbeck, 1930, in Joubin, Faun. Ichth. Atlant. Nord, iii, fig.

- Hippoglossus septentrionalis*, Thoms, 1831, In Ersch and Gruber, Allg. Encyc., (2) viii, p. 335.
Hippoglossus maximus, Gottsche, 1835, Arch. Naturgesch., 1 (2), p. 104; Krøyer, 1845, Danmarks Fiske, ii, p. 351; Nilsson, 1855, Skand. Faun., ed. 2, Fiskar, p. 641.
Hippoglossus gigas, Swanson, 1839, N. H. Fishes etc., ii, p. 302.
Hippoglossus ponticus, Bonaparte, 1846, Cat. method. Pêches Europ., p. 47¹.
Hippoglossus americanus, Gill, 1864, Proc. Acad. Nat. Sci. Philad., xvi, p. 220.
Hippoglossus boreal, Malm, 1877, Göteborgs Bohus, Fauna, p. 508.
Hippoglossus vulgaris (part), Jordan and Gilbert, 1882, Bull. U.S. Nat. Mus., xvi, p. 810; Goode, 1884, Nat. Hist. Aquat. Anim. (Fisheries Fish. Indust. U.S.), i, p. 189, pl. liv; Goode, 1885, Amer. Nat., xix, p. 953.
Hippoglossus hippoglossus (part), Jordan, 1887, Rep. U.S. Com. Fish., xiii, (1885), p. 921; Jordan and Goss, 1889, Rep. U.S. Com. Fish., xiv, (1889), p. 237, pl. 1, fig. 3; Jordan and Evermann, 1898, Bull. U.S. Nat. Mus., xvii (3), p. 2611.
Hippoglossus hippoglossus, Bean, 1902, Ann. Rep. Forest Fish Game Comm. N.Y., vi, (1901), p. 172; Collett, 1903, Vid.-Selsk. Forh., (1902), p. 78; Evermann and Goldsborough, 1907, Bull. U.S. Bur. Fish., xxvi, (1906), p. 351, fig. 133; Pietschmann, 1909, Ann. naturh. Mus. Wien, xlii, (1907-8), p. 304; Danois, 1913, Ann. Inst. océanogr. Paris, v (5), p. 99, fig. 171; Bellef, 1925, Rapp. proc.-verb. explor. mer, xxxv, p. 50; Bigelow and Welsh, 1925, Bull. U.S. Bur. Fish., xl (1), (1924), p. 473, figs. 238-241; Кнпповъ, 1926, Trans. Inst. Sci. Explor. North, xxxvii, p. 139; Nichols and Breder, 1927, Zoologica N.Y., iv, p. 175, fig.; Chabanaud, 1930, Bull. Mus. Hist. nat. Paris, (2) ii, p. 627.

EGGS, LARVÆ AND YOUNG.

- McIntosh, 1902, Rep. Fish. Board Scotland, x, (1891), p. 285, pl. xvi, figs. 11-13, 22; McIntosh, 1903, Rep. Fish. Board Scotland, xi, (1892), p. 244; Petersen, 1894, Rep. Danish Biol. Stat., iv, (1893), p. 139, pl. ii, fig. 21 (2); Cunningham, 1896, N.H. Market Mar. Fish., p. 242; McIntosh and Masterman, 1897, Brit. Mar. Food-fish., p. 315, figs.; Petersen, 1904, Medd. Komm. Havundersog., Kjob., Ser. Fisk., 1 (1), p. 3; Schmidt, 1904, *ibid.*, (3), p. 5, pl. 1, figs. 5-12; Ehrenbaum, 1905, in Brandt and Apstein, Nordisches Plankton, I. Eier Larv. Fisch., 1, p. 177, fig. 72; Jespersen, 1917, Medd. Komm. Havundersog., Kjob., v (5), p. 28; Nordaard, 1929, K. Norske Vid. Selsk. Forh. Trondhjem, 1, (1926-8), p. 22.

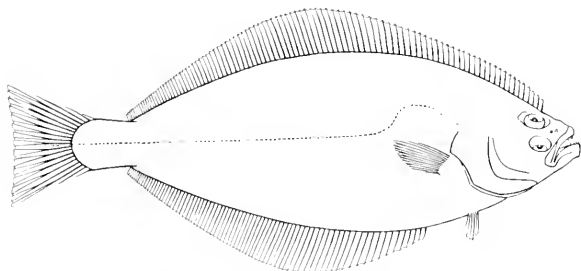


FIG. 217.—*Hippoglossus hippoglossus*. B.M. (N.H.) 1913.11.26.1. 3.

Depth of body $2\frac{3}{4}$ to $2\frac{1}{2}$ in the length, length of head $3\frac{3}{4}$ to $4\frac{1}{4}$. Snout (in adults) longer than eye, diameter of which is 5 to 7 in length of head and a little greater² than to nearly three times (young) the interorbital width; anterior margins of eyes level or lower a little in advance of upper, which is close to edge of head. Maxillary

¹ " 395. *H. ponticus*, Bp (*Pleuronectes hippoglossus*, Fall). *M. nigrum*."

² The interorbital width is much broader in very large specimens.

extending to below middle of eye or a little beyond, length $2\frac{3}{4}$ to $2\frac{5}{8}$ in that of head; lower jaw projecting, a little more than twice in head. 7 or 8 gill-rakers on lower part of anterior arch. Scales of ocular side with rounded outlines, mostly oval or nearly circular; most of the primary scales each surrounded by a series of small elongate supplementary scales with rounded tips; many of the primary scales with a small horny plate on their free hinder ends; about 160 scales in lateral line. Dorsal 98-100 (110); commencing above anterior part of eye, highest rays $\frac{1}{2}$ to $\frac{3}{4}$ length of head. Anal 73-80 (85). Pectoral of ocular side with 15 or 16 rays (12 or 13 branched), length about twice in that of head. Caudal with 10 rays (15 branched), emarginate or lunate; caudal peduncle $1\frac{1}{4}$ to $1\frac{1}{2}$ times as long as deep. Nearly uniformly dark brown or black; young marbled or spotted with paler.

TYPE.—Not traced.

DISTRIBUTION.—North Atlantic, from Spitzbergen, Murman coast and Iceland, southwards to the Bay of Biscay, and from Greenland southwards to Cape Cod and Sandy Hook

SPECIMENS EXAMINED:

1 (305 mm.).	Christianiafiord, Norway.	U.S. Nat. Mus.
1 (595 ").	E. Coast of Scotland.	Murray.
1 (22 ").	Off the Irish Coast.	Holt.
1 (670 "), stuffed.	Devonshire.	Spence.
1 (1880 mm.), ¹ "	Grimsby Market.	Gerrard.
1 (1120 "), "	" "	Mar. Biol. Assoc.
1 (700 "), "	London Market.	Fishmongers' Co.
2 (690, 700 mm.).	" "	" "
3 (285-365 ").	" "	" "
1 (400 mm.), skin.	—	Gronow Coll.
1 (455 ").	Jeffrey's Bank.	U.S. Nat. Mus.
1 (950 "), skeleton.	—	—

ABNORMALITY.

1 (600 mm.). Ambicolorate.	Norway.	Clark and Gillam.
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In Europe this species attains a weight of at least 500 lb. There is in the British Museum a cast of a specimen which weighed about 456 lb. when ungutted. The length of this fish was nearly 8 feet.

2. HIPPOGLOSSUS STENOLEPIS, Schmidt.

[PACIFIC HALIBUT]

Pleuronectes hippoglossus (part), Pallas, 1814, Zoographia, iii, p. 421.

Hippoglossus vulgaris (non Flensburg), Ayres, 1854, Proc. Calif. Acad. Sci., i, p. 41; 1859, ii, p. 30; Bean, 1880, Proc. U.S. Nat. Mus., ii, (1879), p. 63; Lockington, 1880, *tom. cit.*, p. 71; Jordan and Gilbert, 1881, Proc. U.S. Nat. Mus., iii, (1880), p. 454; Jordan and Gilbert, 1882, Proc. U.S. Nat. Mus., iv, (1881), p. 66; Bean, 1882, *tom. cit.*, p. 242.

Hippoglossus vulgaris (part), Jordan and Gilbert, 1882, Bull. U.S. Nat. Mus., xvi, p. 810; Goode, 1884, Nat. Hist. Aquat. Anm. (Fisheries Fish. Indust. U.S.), p. 189; Goode, 1885, Amer. Nat., xix, p. 953.

Hippoglossus hippoglossus (part), Jordan, 1887, Rep. U.S. Com. Fish., xiii, (1885), p. 921; Jordan and Goss, 1889, Rep. U.S. Com. Fish., xiv, (1886), p. 237; Jordan and Evermann, 1898, Bull. U.S. Nat. Mus., xlvii (3), p. 2611, pl. cccclxxi, fig. 918.

Hippoglossus stenolepis, Schmidt, 1904, Pisc. Mar. Orient., p. 224, fig. 15; Jordan and Starks, 1906, Proc. U.S. Nat. Mus., xxxi, p. 195; Jordan, Tanaka and Snyder, 1913, J. Coll. Sci. Tokyo, xxxiii (1), p. 322; Schmidt, 1930, C. R. Acad. Sci. Russ., p. 203, figs.; Soldatov and Lundberg, 1930, Bull. Pac. Sci. Fish. Inst., v, p. 397.

Hippoglossus hippoglossus, Starks, 1918, Calif. Fish Game, iv (4), p. 5, fig. 83.

Hippoglossus hippoglossus camtschaticus, Rendahl, 1931, Ark. Zool., xxii, No. 18, p. 61.

¹ This fish weighed 12 stone.

Close to *H. hippoglossus*, but with a more slender body, the depth nearly 3 in the length, length of head about 4. Scales mostly elongate, the small supplementary scales present but not surrounding the primary scales. Dorsal 0.3-0.7 (100), highest rays $\frac{1}{2}$ or less than $\frac{1}{2}$ length of head. Anal 7.3-7.5 (78). Length of pectoral of ocular side $1\frac{1}{2}$ to $1\frac{3}{4}$ in that of head. Olivaceous brown, generally mottled with paler.

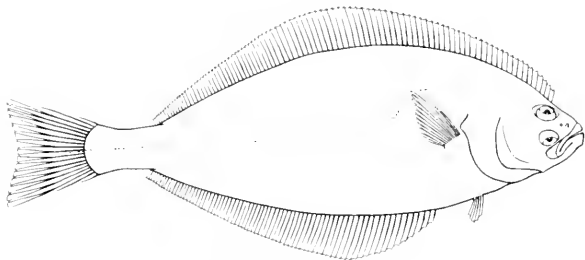


FIG. 218. *Hippoglossus stenolepis*. B.M. (N.H.) 1923, 9, 28, 1.

TYPE: Zoological Museum, Leningrad. No. 12588.

DISTRIBUTION:—North Pacific, from the Bering Sea to the Okhotsk Sea, and from Alaska to California.

SPECIMENS EXAMINED:

1 (135 mm), skull.	Straits of Fuca.	U.S. Nat. Mus.
1 (449 "), skeleton.	Kodiak, Alaska.	Bretherton.
1 (192 "), "	Makushin Bay.	U.S. Nat. Mus.
1 (127 "), "	Fokyo Market.	Fokyo Imp. Univ.
1 (129 "), "	"	"

I have only seen young and half-grown Japanese examples of this species, but follow Schmidt in regarding all Hahbut from the Pacific as representing *H. stenolepis*.

Genus 4. HIPPOGLOSSOIDES

Hippoglossoides, Göttsche, 1835, Arch. Naturgesch., 1(2), p. 164 (*Hippoglossoides limanda*, Göttsche).

Jordan and Evermann, 1898, Bull. U.S. Nat. Mus., xlvii (3), p. 2614.

Citharus (von Bleeker, 1862), Reinhardt, 1838, Abhandl. K. Danske Vid.-Selsk., vii, p. 116 (*Pleuronectes platessoides*, Fabricius).

Triclinopsetta, Gill, 1861, Proc. Acad. Nat. Sci. Philad., Suppl. (Cat. Fish. F. Coast N. Amer.), p. 50 (*Pleuronectes platessoides*, Fabricius); Stütt, 1893, 80 and Fish., 1, p. 120.

Pomatopsetta, Gill, 1864, Proc. Acad. Nat. Sci. Philad., xvi, p. 217 (*Platessa dentata*, Storer).

Cymopsetta, (Schmidt or litt.) Jordan and Starks, 1906, Proc. U.S. Nat. Mus., xxxi, p. 188 (*Hippoglossoides dubius*, Schmidt).

Body ovate or rather elongate, compressed. Eyes usually on the right side,¹ separated by an obtuse, scaled ridge, the upper close to edge of head, but without vertical range. Snout naked or with very few scales; eye-balls not scaled. Olfactory laminae rather few in number, parallel, without central rachis. Mouth rather large, oblique, the length of the maxillary more than $\frac{1}{2}$ that of head; jaws and dentition about equally developed on both sides; teeth sharp, conical, in a single series in

¹ According to Jordan and Evermann, reversed examples occur in *H. clausodoni*.

each jaw, more or less enlarged anteriorly; vomer toothless. Gill-rakers rather long and slender, in moderate number; lower pharyngeals narrow, scarcely approximated anteriorly, each with two irregular series of teeth. Dorsal fin with 67 to 101 rays, commencing just behind nostrils of blind side and above anterior part of eye; anterior rays not free; all the rays simple, mostly scaled on ocular side. Tip of first inter-hæmal spine projecting in front of anal fin, which has 51 to 79 rays. Pectoral fins unequal, that of ocular side a little larger; all the rays usually simple. Pelvic fins short-based, subequal and subsymmetrical. Caudal fin with the middle rays longest, caudal peduncle of moderate length. Scales small, adherent, ctenoid or cycloid; supplementary scales not usually developed. Lateral line rising slightly or with a low curve above the pectoral fin. Vent median, between the pelvic fins; 3 + 1 pyloric appendages. Vertebrae 42 to 45 (13 + 29 = 32).

Four species from the North Atlantic and North Pacific.

SYNOPSIS OF THE SPECIES AND SUBSPECIES.

- I. 8 branchiostegal rays; lateral line nearly straight; contours of posterior parts of dorsal and anal fins (at least in adults) more or less convex [Atlantic species]
 - A. Depth $2\frac{1}{2}$ to $2\frac{3}{4}$ in length; maxillary $2\frac{2}{3}$ to nearly 3, lower jaw $2\frac{1}{10}$ to $2\frac{1}{2}$ in head; 41 to 43 scales between lateral line and middle of back
 - 1a. *platessoides platessoides*.
 - 1b. *platessoides lmandoides*.
 - B. Depth ($2\frac{1}{2}$) $2\frac{2}{3}$ to 3 in length; maxillary $2\frac{1}{2}$ to $2\frac{2}{3}$, lower jaw $1\frac{1}{8}$ to 2 in head; 25 to 40 scales between lateral line and middle of back
 2. *elassodon*.
 3. *dubius*.
 4. *robustus*.
- II. 7 branchiostegal rays; lateral line generally with a low curve above pectoral (sometimes nearly straight); contours of posterior parts of dorsal and anal fins more or less concave; præmaxillary teeth rather stronger [Pacific species].
 - A. Dorsal about 80-90, anal about 60-70; 12 to 19 gill-rakers on lower part of anterior arch.
 1. (14) 15 to 19 gill-rakers; canine teeth moderately developed; outline of upper jaw evenly curved
 2. (11) 13 to 15 (16) gill-rakers; canine teeth strongly developed; outline of upper jaw more strongly curved and irregular
 - B. Dorsal about 70-80; anal about 50-60; 10 to 13 gill-rakers on lower part of anterior arch

I have followed Schmidt (1915) in recognising only three forms from the North Pacific, but prefer to regard these, provisionally at any rate, as species rather than subspecies. As Hubbs (1918) has pointed out, there is as yet no evidence that these forms occupy different geographical areas, nor has any intergradation been demonstrated in the areas where their ranges overlap. The distinctions between *robustus*, *hamiltoni* and *propinquus*—depth of body, length of pectoral fin, form of the scales, etc.—are of very doubtful value, especially when the differences in the sizes of the specimens are taken into consideration.

I. HIPPOGLOSSOIDES PLATESSOIDES (Fabricius).

[Synonymy under *Subspecies*].

Depth of body $2\frac{1}{2}$ to 3 in the length, length of head 3 to $4\frac{1}{8}$. Snout as long as or shorter than eye, diameter of which is $3\frac{1}{4}$ to $5\frac{1}{4}$ in length of head; anterior margins of eyes about level. Maxillary extending to below middle of eye or a little beyond, length $2\frac{1}{4}$ to nearly 3 in that of head; lower jaw a little projecting, $1\frac{1}{8}$ to $2\frac{1}{4}$ in head; anterior teeth of upper jaw not greatly enlarged, not forming distinct canines. 8 branchiostegal rays; 9 to 12 gill-rakers on lower part of anterior arch. Scales ctenoid on

ocular side, ctenoid or cycloid on blind side; 85 to 97 in lateral line, 26 to 44 between lateral line and middle of back. Lateral line nearly straight. Dorsal (76) 78-98 (100), origin above anterior part of eye. Anal 60-70. Contours of posterior parts of dorsal and anal fins (at least in adults) more or less convex. Pectoral of ocular side with 6 to 12 rays, length $1\frac{1}{2}$ to $2\frac{1}{2}$ in that of head. Caudal with 18 or 19 rays (12 or 13 branched), double-truncate, caudal peduncle as long as deep or a little deeper than long. Brownish, with or without some darker spots of varying size, fins generally paler.

DISTRIBUTION.—North Atlantic, southwards to Cape Cod and the British Isles.

This species appears to be divisible into two distinct forms, each with its own geographical range, which may be regarded as subspecies. As is to be expected, they tend to intergrade in the areas where their ranges overlap. Specimens from Iceland and Spitzbergen, for example, approach the American subspecies in depth of body, number of scales, etc.

1a. HIPPOGLOSSOIDES PLATESSOIDES PLATESSOIDES (Fabricius)

[SAND DAB]

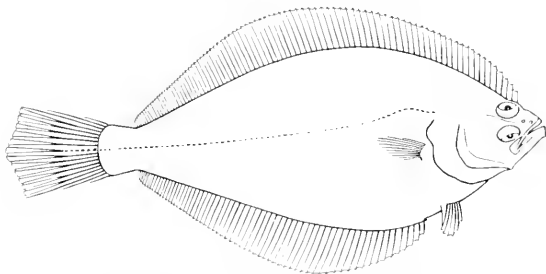


FIG. 215. *Hippoglossoides platessoides platessoides*. B.M. (N.H.) 1930.9.4.10. 1/4.

- P. arenata platessoides*, Fabricius, 1789, F. Gædon, p. 104; Fabricius, 1824, Athandl. K. Danske Vid. Selsk., 3, (1824), p. 50, pl. 31, fig. 2.
Parusa platessoides, Cuvier, 1829, Dict. Sci. Nat., XI, p. 3.
Cithara platessoides, Reinhardt, 1835, Athandl. K. Danske Vid. Selsk., VII, pp. 116, 120; Krøyer, 1850, 2, in Fabyre, Voy. Sand. Lapon., Zool., p. 88.
Parusa dentata, Stead, 1879, Rep. Fish. Massach., p. 147; Stead, 1897, Hist. Fish. Massach., p. 197, pl. 88, fig. 4.
Otophanopelta platessoides, Gill, 1861, Proc. Acad. Nat. Sci. Philad., Suppl. (Cat. Fish. F. Coast N. Amer.), p. 50; Jensen, 1904, Medd. Grønland, XXIX, p. 272.
Hippoglossoides dentatus, Gill, 1861, *loc. cit.*, p. 50; Günther, 1862, Cat. Fish., XIV, p. 100.
Hippoglossoides platessoides, Gill, 1864, Proc. Acad. Nat. Sci. Philad., XVI, p. 217; Goode, 1881, Proc. U.S. Nat. Mus., 11, (1880), p. 471; Jordan and Gilbert, 1883, Bull. U.S. Nat. Mus., XVI, p. 8, 6; Goode, 1884, Nat. Hist. Aquat. Anim. Fisheries Fish. Indust. U.S., 1, p. 107, pl. IV; Jordan and Goode, 1878, Rep. U.S. Com. Fish., XIV, (1886), p. 249, pl. 11, fig. 4; Goode and Bean, 1897, Ocean. Ichth., p. 148, pl. cvii, fig. 297; Jordan and Evermann, 1898, Bull. U.S. Nat. Mus., XLV, 1, p. 204, pl. cccxxx, fig. 319; Huntsman, 1918, Bull. Biol. Board Canada, No. 2, fig. 1; Huntsman, 1922, Contr. Canad. Biol., (1921), No. 11, p. 21; Bigelow and Welsh, 1923, Bull. U.S. Bur. Fish., 81(1), (1921), p. 482, figs. 243, 248; Nichols and Bichel, 1927, Zoologica N.Y., 13, p. 178, fig. 1; Probstmann, 1932, Medd. Grønland, XXX (3), p. 57.

- Pomatomys dentata*, Gull, 1864, Proc. Acad. Nat. Sci. Philad., xvi, p. 217.
Hippoglossoides limandoides, Goode and Bean, 1879, Amer. Journ. Sci. Arts, (3) xvii, p. 39.
Hippoglossoides platessoides (part), Collett, 1880, Norske Nordhavs-Exped., Zool., Fiske, p. 144.
Drepanopsetta platessoides (part), Sniitt, 1893, Scand. Fish., i, p. 421.
Drepanopsetta (Hippoglossoides) platessoides, Lutken, 1808, Danish Ingolf Exped., ii (1), p. 19.
Hippoglossoides (Hippoglossoides) platessoides, Hubbs, 1918, Annot. Zool. Japon., ix, p. 373.

EGGS, LARVÆ AND YOUNG.

Huntsman, 1918, Bull. Biol. Board Canada, No. 1, p. 14, figs.

Principal characters those of the species. Depth of body $2\frac{1}{8}$ to $2\frac{3}{8}$ in the length. Maxillary extending about to below middle of eye, length $2\frac{2}{3}$ to nearly 3 in that of head; lower jaw $2\frac{1}{10}$ to $2\frac{1}{8}$ in head. Scales generally rather smoother than in the European subspecies; 90 to 97 in lateral line, 41 to 43 between lateral line and middle of back. Dorsal (80) 86-94. Anal 64-73 (75).

TYPE.—Zoological Museum, Copenhagen.

DISTRIBUTION.—Greenland¹; Atlantic coast of North America, southwards to Cape Cod.

SPECIMENS EXAMINED:

1 (42 mm.).	South of Nova Scotia, 83 fms.	"Challenger."
1 (225 ,,).	Halifax, Nova Scotia.	U.S. Nat. Mus.
1 (360 ,,).	" "	" "
1 (240 ,,).	Chebuctoe Head, Nova Scotia.	" "
1 (175 ,,).	Massachusetts Bay.	" "
2 (310, 320 mm.).	Salem, Mass.	Mus. Comp. Zool.
1 (380 mm.).	New York Market.	Amer. Mus. Nat. Hist.

Said to attain to a length of 20 to 24 inches, and a weight of 2 to 5 pounds.

1b. HIPPOGLOSSOIDES PLATESSOIDES LIMANDOIDES (Bloch).

[LONG ROUGH DAB; ROUGH DAB.]

- Pleuronectes linguatula* (non Linnaeus), Muller, 1776, Zool. Danicæ prodr. Anm., p. 45, No. 377.
Pleuronectes limandoides, Bloch, 1787, Nat. aush. Fische, iii, p. 24, pl. clxxxvi; Lacepède, 1802, Hist. Nat. Poiss., iv, p. 635; Shaw, 1803, Gen. Zool., iv (2), p. 390; Quensel, 1806, Vet. Akad. Handl., xxvii, pp. 54, 222; Nilsson, 1832, Prodr. Ichth. Scand., p. 57; Nilsson, 1855, Skand. Faun., ed. 2, Fiskar, p. 629.
Hippoglossus limandoides, Cuvier, 1817, R. Anim., ii, p. 221.
Pleuronectes limandanus, Parnell, 1835, Edinburgh New Phil. Journ., xix, p. 210.
Platessa limandoides, Jenyns, 1835, Man. Brit. Vert., p. 459; Yarrell, 1836, Brit. Fish., ed. 1, ii, p. 224, fig.; Parnell, 1838, Mem. Werner Soc., vii, p. 368, pl. xxxviii; Yarrell, 1841, Brit. Fish., ed. 2, ii, p. 312, fig.; Krover, 1843-5, Danmarks Fisk., ii, p. 358, fig.; Yarrell, 1850, Brit. Fish., ed. 3, i, p. 625, ng.; Malmgren, 1864, Arch. Naturgesch., xxx (1), p. 296.
Hippoglossoides limanda, Gottsche, 1835, Arch. Naturgesch., i (2), p. 168.
Limanda limandoides, Bonaparte, 1846, Cat. metod. Pesci Europ., p. 48.
Hippoglossoides limandoides, Günther, 1862, Cat. Fish., iv, p. 405; Collett, 1875, Vid.-Selsk. Forh. (1874), Till. p. 136; Malm, 1877, Göteborgs Bohus. Fauna, p. 509; Day, 1880-4, Fish. Britain, ii, p. 9, pl. xcv.
Drepanopsetta platessoides, Malmgren, 1865, Öfvers. K. Svensk. Vet.-Akad. Forh., (1864), p. 525; Lönnberg, 1899, Vet. Akad. Handl., xxiv (4), No. 9, p. 20; Pietschmann, 1909, Ann. naturh. Mus. Wien, xxii, (1907-8), p. 301; Schnakenbeck, 1925, Tier. Nord. Ostsee, L. ii, xii (1), p. 4, fig. 2; Knipovich, 1926, Trans. Inst. Sci. Explor. North, xxvii, p. 138, fig. 102; Saemundsson, 1927, Rit. Visind. Isl., ii, p. 35; Schnakenbeck, 1930, in Joubin, Faun. Ichth. Atlant. Nord, iv, fig.

¹ I have recently received a paper from Dr. Pietschmann (1932), in which a number of examples from Greenland are described. These appear to belong to this subspecies, but the author does not give any scale counts.

- Hippoglossoides platessoides*, Collett, 1878, Vid. Selsk. Forh., No. 41, p. 92; Collett, 1879, Vid. Selsk. Forh., No. 1, p. 74; Gunther, 1888, Proc. Roy. Soc. Edinb., xv, p. 216; Lilleborg, 1891, Sverig. Norg. Fiskar., ii, p. 299; Holt and Calderwood, 1895, Sci. Trans. R. Dublin Soc., (ii) v, p. 178, figs.; Collett, 1903, Vid. Selsk. Forh., (1902), p. 84; Johnsen, 1919, Bergens Mus. Aarb., 1918-19, No. 6, p. 12.
- Hippoglossoides platessoides* (part), Collett, 1880, Norske Nordhavs-Exped., Zool., Fiske, p. 144.
- Drepanopsetta platessoides* (part), Smitt, 1893, Scand. Fish., i, p. 421, pl. xvii, fig. 3.
- Hippoglossoides (Hippoglossoides) limandoides*, Hubbs, 1918, Annot. Zool. Jap., ix, p. 373.

EGGS, LARVA AND YOUNG.

- Cunningham, 1888, Trans. Roy. Soc. Edinb., xxxiii (1), p. 195, pl. vii, fig. 2; McIntosh, 1889, Rep. Fish. Board Scotland, vii, (1888), p. 391, pl. iii, figs. 1-3; McIntosh and Prince, 1890, Trans. Roy. Soc. Edinb., xxxv (3), p. 853, pl. xii, fig. 3, xviii, fig. 2; McIntosh, 1891, Rep. Fish. Board Scotland, ix, (1890), p. 319; Holt, 1893, Sci. Trans. R. Dublin Soc., (2) v, p. 57, pl. vii, figs. 57-61, xii, figs. 98-106; McIntosh, 1895, Rep. Fish. Board Scotland, xiii, (1894), p. 220, pl. vi, figs. 1-11, vii, figs. 1-3; Cunningham, 1896, N.H. Market. Mar. Fish., p. 244, figs. 112, 113; Heisen and Apstein, 1897, Wiss. Meeresuntersuch., Abt. Kiel, ii (2), pp. 36, 46, 74, pl. ii, figs. 11-13, iii, fig. 22; McIntosh and Masterman, 1897, Brit. Mar. Food-fish., p. 319, figs.; Kyle, 1898, Rep. Fish. Board Scotland, xvi, 3, (1897), pp. 235, 245, pl. x, figs. 17-23, xi, figs. 24-29; Heucke and Ehrenbaum, 1900, Wiss. Meeresuntersuch., Abt. Helgoland, iii, pp. 225, 325, fig. 9; Petersen, 1904, Medd. Komm. Havundersog. Kjob., Ser. Fisk., i (1), p. 5, pl. 1; Schmidt, 1904, *how. cit.*, i (3), p. 10, pl. 1, fig. 4; Ehrenbaum, 1905, in Brandt and Apstein, Nordisches Plankton, I. Eier-Larv. Fisch. (1), p. 182, fig. 74.

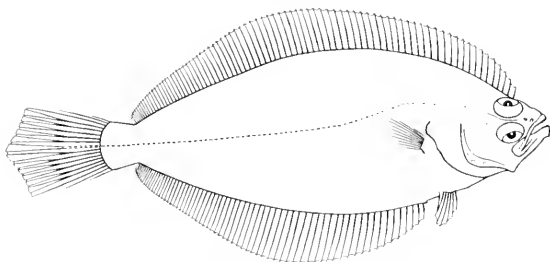


FIG. 220.—*Hippoglossoides platessoides limandoides*. B.M. (N.H.) 88. 2. 6. (5) 3.

Principal characters those of the species. Depth of body $2\frac{2}{3}$ (occasionally $2\frac{1}{2}$) to 3 in the length. Maxillary generally extending to a little beyond middle of eye (at least in adults), length $2\frac{1}{4}$ to $2\frac{2}{3}$ in that of head; lower jaw $1\frac{1}{4}$ to 2 in head. All the teeth a little stronger than in the American subspecies. Scales generally rather rougher, 85 to 92 in lateral line, 25 to 40 between lateral line and middle of back. Dorsal (76) 78-98 (101). Anal 60-79.

TYPE.—Not traced.

DISTRIBUTION.—Coasts of north-western Europe, from the Murman Coast to the British Isles; Spitzbergen, Bear Island, Iceland, etc.

SPECIMENS EXAMINED:

1 (390 mm.),	Iceland,	Mar. Biol. Assoc.
1 (183, 222 mm.),	South of Spitzbergen,	Collett.
1 (182 mm.),	Bear Island,	Robertson.
1 (210 "),	Murman Coast	Popov.

5 (225-340 mm.).	Herdla I., nr. Bergen, 66 fms.	Bergen Mus.
1 (308 mm.).	Baltic.	Mar. Biol. Assoc.
6 (150-325 mm.).	St. Andrew's Bay, 13 fms.	Fish. Board Scotland.
4 (62-88 ").	" " "	" "
3 (170-200 ").	Kilbrennan Sound, 20 fms.	Murray. "
3 (200-222 ").	" " 26 fms.	" "
9 (64-144 ").	" " "	" "
2 (77, 245 ").	Sanda Isd., 30-35 fms.	" "
1 (200 mm.), skeleton.	" " "	" "
9 (98-210 mm.).	Between Sanda Isd., and Ailsa Craig, 24 fms.	" "
1 (178 mm.).	Loch Houn, 70 fms.	" "
1 (158 ").	Lanilach Bay.	" "
2 (160, 178 mm.).	Off Whiting Bay, Firth of Clyde	" "
4 (60-98 mm.).	Loch Lunart, 45-50 fms.	" "
2 (128, 140 mm.).	Off Skate Isd., Loch Fyne, 100 fms.	" "
1 (90 mm.).	Upper Loch Nevis, 50 fms.	" "
2 (100, 110 mm.).	Loch Duide, 60 fms.	" "
3 (65-112 ").	Sound of Mull, 70 fms.	" "
2 (37, 38 ").	Between Skelmorlie Bay and Cumbræe Isd., 20 fms.	" "
5 (150-295 mm.), skins.	Firth of Forth.	Parnell Coll.
1 (280 mm.), stuffed.	" "	" "
2 (157, 185 mm.).	Off S.W. of Ireland.	Grenfell.
1 (245 mm.), skin.	Brixham, Devon.	Parnell Coll.
1 (335 "), "	London Market.	Yarrell Coll.

Collett (1880)¹ has shown that (in general) the number of dorsal and anal rays is greater in specimens from northerly than in those from more southerly localities, and notes that "the increased number of fin-rays involves a proportionate augmentation in the number of scales, vertebræ, and pores in the lateral line". Below are given the counts of fin-rays and scales for a number of specimens selected from several localities:

Locality.	Dorsal rays.	Anal rays.	Scales in lateral line.	Scales between lateral line and back.
Spitzbergen (3)	85-98	69-78	85-90	37-40
Bear Isd. (1)	85	70	91	32
Murman Coast (1)	93	72	91	33
Iceland (1)	95	70	90	38
Bergen (5)	78-81	62-66	81-90	28-30
Baltic (1)	84	65	88	32
British Isles (35)	77-88	61-71	87-92	26-30

This subspecies is said to attain to a length of about 350 mm.

2. HIPPOGLOSSOIDES ELASSODON, Jordan and Gilbert.

Hippoglossoides elassodon, Jordan and Gilbert, 1881, Proc. U.S. Nat. Mus., xi, (1880), pp. 278, 454; Bean, 1882, Proc. U.S. Nat. Mus., iv, (1881), p. 242; Jordan and Gilbert, 1883, Bull. U.S. Nat. Mus., xvi, p. 820; Jordan, 1884, Nat. Hist. Aquat. Anm. (Fisheries Fish. Indust. U.S., 1), p. 188, pl. lii; Jordan and Goss, 1889, Rep. U.S. Com. Fish., xiv, (1886), p. 241, pl. ii, fig. 5; Jordan and Evermann, 1898, Bull. U.S. Nat. Mus., xlvii (3), p. 2615, pl. cccxxii, fig. 920; Schmidt, 1904, Pisc. Mar. Orient., p. 225; Jordan and Starks, 1906, Proc. U.S. Nat. Mus., xxxi, p. 189, fig. 8; Evermann and Goldsborough, 1907, Bull. U.S. Bur. Fish., xxvi, (1906), p. 352, fig. 134; Gilbert and Burke, 1912, Bull. U.S. Bur. Fish., xxx, (1910), p. 95; Jordan, Tanaka and Snyder, 1913, J. Coll. Sci. Tokyo, xxxiii (1), p. 320, fig. 268; Hubbs, 1915, Proc. U.S. Nat. Mus., xlviii, p. 466.

¹ See also Pietschmann (1909).

Hippoglossoides chasmodon chasmodon, Schmidt, 1915, Ann. Mag. Nat. Hist., (8) xvi, p. 397, Soldatov and Lindberg, 1933, Bull. Pac. Sci. Fish. Inst., v, p. 4395.

Hippoglossoides (Synopsetta) chasmodon, Hubbs, 1918, Annot. Zool. Jap., ix, p. 373.

Depth of body $2\frac{1}{2}$ to $2\frac{1}{2}$ in the length, length of head $3\frac{1}{4}$ to $3\frac{1}{2}$. Snout as long as or shorter than eye, diameter of which is $4\frac{1}{4}$ to $5\frac{1}{2}$ in length of head; anterior margins of eyes about level. Maxillary extending to below middle of eye or beyond, length $2\frac{1}{2}$ to $2\frac{1}{2}$ in that of head, lower jaw a little projecting, $1\frac{1}{2}$ to 2 in head; outline of upper jaw evenly curved. Anterior teeth in upper jaw somewhat enlarged, but not forming distinct canines. 7 branchiostegal rays. (14) 15 to 18 (16) gill-rakers on lower part of anterior arch. Scales rather strongly ctenoid on ocular side, mostly cycloid on blind side, 87 to 94 in lateral line, 36 to 42 between lateral line and middle of back. Lateral line generally with a low curve above pectoral fin, but sometimes

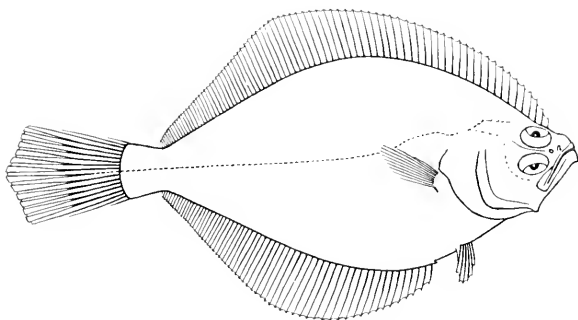


FIG. 224.—*Hippoglossoides chasmodon*. B.M. (N.H.) 9672, 22, 22. ♂.

nearly straight. Dorsal (76) 79-86, origin above anterior margin of eye. Anal 60-67 (66). Contours of posterior parts of dorsal and anal fins more or less concave. Pectoral of ocular side with 10 to 12 rays, length about twice in that of head. Caudal with 18 rays (12 branched), rounded or double-truncate; caudal peduncle as long as deep or a little deeper than long. Brownish, with or without darker spots, fins greyish, spotted and blotched with darker.

TYPE.—United States National Museum. No. 27263.

DISTRIBUTION.—Pacific coast of North America, from the Bering Sea to Cape Flattery, Okhotsk Sea.

SPECIMENS EXAMINED

1 (137 mm)	Unalaska, Alaska	U.S. Nat. Mus.
1 (275 "	Bering Sea (57° N., 153° 18' W.)	"
1 (416 "	" (53° 56' N., 166° 28' W.), 58 fms.	"
1 (577 "	" (53° 26' N., 167° 31' W.), 51 "	"
1 (416 "	Puget Sound	"

This species attains to a length of about 18 inches.

3. HIPPOGLOSSOIDES DUBIUS, Schmidt.

Hippoglossoides dubius, Schmidt, 1904, Pisc. Mar. Orient., p. 227, pl. vi, fig. 1; Snyder, 1912, Proc. U.S. Nat. Mus., xlii, p. 439; Hubbs, 1915, Proc. U.S. Nat. Mus., xlvi, p. 466; Jordan and Hubbs, 1925, Mem. Carnegie Mus., x, p. 298.

Cynopsetta dubia, (Schmidt *in litt.*) Jordan and Starks, 1906, Proc. U.S. Nat. Mus., xxxi, p. 188; Tanaka, 1913, Fish. Japan, xi, p. 207, pl. lxxviii, fig. 212; Jordan, Tanaka and Snyder, 1913, J. Coll. Sci. Tokyo, xxxiii (1), p. 320.

Hippoglossoides katakuræ, Snyder, 1911, Proc. U.S. Nat. Mus., xl, p. 546; Snyder, 1912, Proc. U.S. Nat. Mus., xlii, p. 439, pl. lviii, fig. 1; Jordan, Tanaka and Snyder, 1913, J. Coll. Sci. Tokyo, xxxiii (1), p. 320.

Hippoglossoides classodon dubius, Schmidt, 1915, Ann. Mag. Nat. Hist., (8) xvi, p. 307; Soldatov and Lindberg, 1930, Bull. Pac. Sci. Fish. Inst., v, p. 394; Schmidt, 1931, C.R. Acad. Sci. Russ., p. 316.

Hippoglossoides (Cynopsetta) dubius, Hubbs, 1918, Annot. Zool. Japon., ix, p. 374.

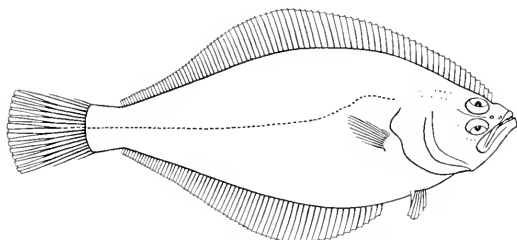


FIG. 222.—*Hippoglossoides dubius*. B.M. (N.H.) 1923.11.21.4. · 4.

Depth of body $2\frac{2}{3}$ to $2\frac{1}{2}$ in the length, length of head $3\frac{1}{4}$ to $3\frac{3}{8}$. Snout (in adults) longer than eye, diameter of which is $4\frac{1}{3}$ to $6\frac{1}{4}$ in length of head; anterior margins of eyes about level. Maxillary extending to below posterior part of eye, length $2\frac{1}{2}$ to $2\frac{3}{4}$ in that of head; lower jaw a little projecting, $1\frac{1}{2}$ to nearly 2 in head; outline of upper jaw more strongly curved and irregular than in *H. classodon*; anterior teeth in upper jaw enlarged and forming distinct canines. 7 branchiostegal rays; (11) 13 to 15 (16) gill-rakers on lower part of anterior arch. Scales moderately ctenoid on ocular side, cycloid or rather feebly ctenoid on blind side; 88 to 93 in lateral line, about 38 between lateral line and middle of back. Lateral line with a low curve above the pectoral fin. Dorsal (79) 82-87 (90); origin just in front of eye or above its anterior margin. Anal (62) 64-65 (69). Contours of posterior parts of dorsal and anal fins more or less concave. Pectoral of ocular side with 10 or 11 rays, length $1\frac{3}{4}$ to $2\frac{1}{2}$ in that of head. Caudal with 18 rays (10 to 12 branched), rounded or nearly truncate; caudal peduncle deeper than long. Uniformly brownish; dorsal and anal fins sometimes with pale margins.

TYPE.—Zoological Museum, Leningrad. No. 12366.

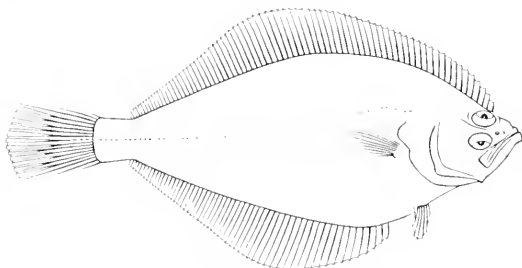
DISTRIBUTION.—Southern Okhotsk Sea; Gulf of Tartary; Sea of Japan, southwards to Corea.

SPECIMENS EXAMINED:

1 (390 mm.).	Gulf of Tartary (47° 32' N., 141° 45' W.).	U.S. Nat. Mus.
2 (165, 266 mm.).	Tokyo Market.	Tokyo Imp. Univ.
1 (415 mm.).	"	"
1 (300 ").	Sea of Japan, off Tajima Prov.	"

4 HIPPOGLOSSOIDES ROBUSTUS, Gill and Townsend.

- Hippoglossoides robustus*, Gill and Townsend, 1897, Proc. Biol. Soc. Washington, XI, p. 274; Jordan and Evermann, 1898, Bull. U. S. Nat. Mus., XLVI (3), p. 2016; Jordan and Gilbert, 1899, Fur seals and fur seal islands N. Pacific, III, p. 489; Hubbs, 1918, Proc. U. S. Nat. Mus., XLVIII, p. 466.
- Hippoglossoides hamiltoni*, (Jordan and Gilbert) Jordan and Evermann, 1898, Bull. U. S. Nat. Mus., XLVI (3), p. 2016; Jordan and Gilbert, 1899, Fur seals and fur seal islands N. Pacific, III, p. 489, pl. LXXXIV; Schmidt, 1904, Proc. Mar. Orient., p. 229; Jordan and Starks, 1906, Proc. U. S. Nat. Mus., XXXI, p. 199, fig. 97; Jordan, Tanaka and Snyder, 1913, J. Coll. Sci. Tokyo, XXXIII (1), p. 320, fig. 269; Hubbs, 1918, Proc. U. S. Nat. Mus., XLVIII, p. 466.
- Hippoglossoides classodon robustus*, Schmidt, 1918, Ann. Mag. Nat. Hist., (8) XVI, p. 308; Soldatov and Lindberg, 1930, Bull. Pac. Sci. Fish. Inst., v, p. 705.
- Hippoglossoides propinquus*, Hubbs, 1918, Proc. U. S. Nat. Mus., XLVIII, p. 469, pl. XXXI, fig. 3.
- Hippoglossoides (Cynopsetta) robustus*, Hubbs, 1918, Ann. Zool. Jap., 18, p. 374.
- Hippoglossoides (Cynopsetta) hamiltoni*, Hubbs, 1918, *tom. cit.*, p. 374.
- Hippoglossoides (Cynopsetta) propinquus*, Hubbs, 1918, *tom. cit.*, p. 374.

FIG. 223.—*Hippoglossoides robustus*. B. M. (N. H.) 1929: 1, 15, 3. 3.

Depth of body ($2\frac{1}{2}$) $2\frac{3}{8}$ to $2\frac{1}{2}$ in the length, length of head $3\frac{1}{2}$ to $3\frac{1}{2}$. Snout as long as or shorter than eye, diameter of which is $4\frac{1}{2}$ to $5\frac{1}{4}$ in length of head; anterior margins of eyes about level or upper a little in advance of lower. Maxillary extending to below middle of eye or a little beyond, length $2\frac{1}{2}$ to $2\frac{1}{2}$ in that of head; lower jaw distinctly projecting, $1\frac{1}{8}$ to about 2 in head; anterior teeth in upper jaw somewhat enlarged, but not forming distinct canines. 7 branchiostegal rays; 10 to 13 gill-rakers on lower part of anterior arch. Scales very variable, more or less ctenoid on ocular side, ctenoid or cycloid on blind side; 87 to 94 in lateral line, about 40 between lateral line and middle of back. Lateral line with a low but distinct curve above pectoral fin. Dorsal (67) 69-77; origin above anterior margin or anterior part of eye. Anal (51) 53-59 (60). Contours of posterior parts of dorsal and anal fins more or less concave. Pectoral of ocular side with 10 or 11 rays, length $1\frac{1}{2}$ to $2\frac{1}{4}$ in that of head. Caudal with 18 rays (12 branched), rounded or double-truncate; caudal peduncle as long as deep or a little deeper than long. More or less uniformly brownish, fins paler.

TYPE.—United States National Museum. No. 48766.

DISTRIBUTION.—From the Bering Sea southwards to northern Japan.

SPECIMENS EXAMINED:

1 (119 mm)	Kamchatka.	U. S. Nat. Mus.
1 (115 ")	Mouth of R. Oserraja, Kamchatka.	Popov
1 (162 ")	Avacha Bay, Kamchatka.	Berg
1 (193 ")	Paratype of Japan	Stanford Univ.

H. propinquus.

Genus 5. ACANTHOPSETTA.

Acanthopsetta, Schmidt, 1904, Pisc. Mar. Orient., p. 237 [*Acanthopsetta nadeshnyi*, Schmidt]; Hubbs, 1915, Proc. U.S. Nat. Mus., xlviii, p. 464.

Very close to *Hippoglossoides*, but with snout and upper parts of eyeballs densely scaled (at least in adults); teeth less strong, scarcely enlarged anteriorly; dorsal fin commencing above middle or posterior part of eye; rays of dorsal and anal fins more or less scaled on both sides; middle rays of pectoral fin branched; lateral line with distinct supratemporal branch.

A single species from the North Pacific.

I. ACANTHOPSETTA NADESHNYI, Schmidt.

Acanthopsetta nadeshnyi, Schmidt, 1904, Pisc. Mar. Orient., p. 237, pl. v, fig. 1; Jordan and Starks, 1906, Proc. U.S. Nat. Mus., xxxi, p. 187; Jordan, Tanaka and Snyder, 1913, J. Coll. Sci. Tokyo, xxxiii (1), p. 319; Hubbs, 1915, Proc. U.S. Nat. Mus., xlviii, p. 464; Soldatov and Lindberg, 1930, Bull. Pac. Sci. Fish. Inst., v, p. 393; Schmidt, 1931, C.R. Acad. Sci. Russ., p. 316.

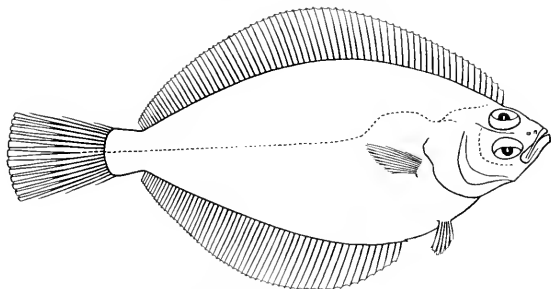


FIG. 224.—*Acanthopsetta nadeshnyi*. B.M. (N.H.) 1923.11.21.6. $\times \frac{2}{3}$.

Depth of body $2\frac{1}{4}$ to $2\frac{3}{5}$ in the length, length of head $3\frac{2}{3}$ to $3\frac{3}{5}$. Snout shorter than eye, diameter of which is $3\frac{2}{3}$ to 4 in length of head; lower eye very slightly in advance of upper, which touches edge of head. Maxillary not extending to below middle of eye, length about 3 in that of head; lower jaw scarcely projecting, a little more than 2 in head. 10 to 12 gill-rakers on lower part of anterior arch. Scales ctenoid on both sides of body, 75 to 81 in lateral line. Dorsal (67) 70-74 (78). Anal (54) 57-60 (62). Pectoral of ocular side with 9 to 11 rays (5 to 7 branched), length a little more than $\frac{1}{2}$ that of head. Caudal with 18 rays (12 branched), rounded; caudal peduncle nearly as long as deep. Uniformly brownish; median fins rather paler.

TYPE.—Zoological Museum, Leningrad. No. 12339-46.

DISTRIBUTION.—Okhotsk Sea; Gulf of Tartary; Sea of Japan, southwards to Corea.

SPECIMENS EXAMINED:

1 (280 mm.).
1 (182 ").
1 (170 ").

Petropavlosk.
Sea of Japan (42° 51' N., 133° 56' E.).
Broughton Bay, Corea.

U.S. Nat. Mus.
Berg.
Popov.

Genus 6.—CLEISTHENES.

Cleisthenes herzensteini, Jordan and Starks, 1904, Bull. U. S. Geol. Surv., xxii, (1902), p. 622. *Cleisthenes punctatum*, Jordan and Starks.
Protopsalta, Schmidt, 1904, Pisc. Mar. Orient., p. 250. *Hippoglossoides herzensteini*, Schmidt.

Close to *Hippoglossoides*, but with the upper eye on the dorsal surface of the head, its range almost entirely vertical; snout more or less scaled; eyeballs not scaled; teeth rather small, scarcely enlarged anteriorly; dorsal fin commencing on blind side of head, well behind nostrils and above posterior part of eye; rays of dorsal and anal fins more or less scaled on both sides; middle rays of pectoral fin branched. Two species from the north-western Pacific.

SYNOPSIS OF THE SPECIES.

- I 15 to 21 (occ. 23) gill-rakers on lower part of anterior arch 1 *herzensteini*.
 II 20 to 25 (occ. 27) gill-rakers on lower part of anterior arch 2 *punctatum*.

1. CLEISTHENES HERZENSTEINI (Schmidt)

Hippoglossoides herzensteini, Schmidt, 1904, Pisc. Mar. Orient., p. 229.

Protopsalta herzensteini, Jordan and Starks, 1906, Proc. U. S. Nat. Mus., xxxi, pp. 194, 525; Snyder, 1912, Proc. U. S. Nat. Mus., xli, p. 439; Jordan, Tanaka and Snyder, 1913, J. Coll. Sci. Tokyo, xxxviii (1), p. 321.

Cleisthenes herzensteini, Hubbs, 1915, Proc. U. S. Nat. Mus., xlviii, p. 473; Hubbs, 1918, Annot. Zool. Japon., ix, p. 370; Soldatov and Lindberg, 1920, Bull. Pac. Sci. Fish. Inst., v, p. 399; Schmidt, 1931, U. R. Acad. Sci. Russ., p. 316.

Cleisthenes punctatum, Jordan and Hubbs, 1925, Mem. Carnegie Mus., x, p. 298.

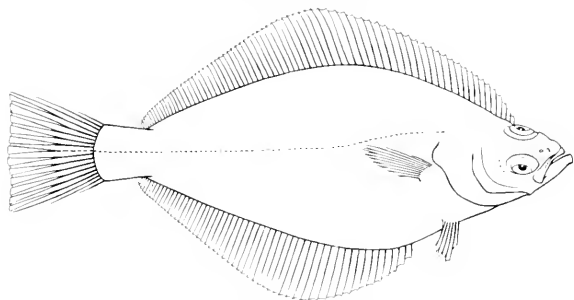


FIG. 225.—*Cleisthenes herzensteini*. B. M. (N. H.) 1923, 11, 21, 9. 1/2.

Depth of body $2\frac{1}{2}$ to $2\frac{3}{4}$ in the length, length of head $3\frac{1}{2}$ to $3\frac{2}{3}$. Snout about as long as eye, diameter of which is $4\frac{1}{4}$ to $5\frac{1}{4}$ in length of head, and more than twice the interorbital width; anterior margins of eyes about level. Maxillary extending to below middle of eye, or not quite as far, length $2\frac{3}{4}$ to about 3 in that of head; lower jaw projecting, 2 to $2\frac{1}{4}$ in head. (15) 17 to 20 (occasionally 23) gill-rakers on lower part of anterior arch. Scales very variable, generally more or less ctenoid on ocular

side, but sometimes a number of cycloid scales present, especially on head and anterior part of body; scales on head and parts of body frequently with small bony papillæ on their surfaces in addition to the marginal spinules; scales on blind side all cycloid or those on posterior parts and edges of body ctenoid; 77 to 84 scales in lateral line. Dorsal 70-75 (77). Anal 53-58. Pectoral of ocular side with 10 to 12 rays (7 or 8 branched), length $1\frac{1}{2}$ to 2 in that of head. Caudal with 18 rays (12 branched), double-truncate or rounded; caudal peduncle about as long as deep. Uniformly brownish.

TYPE.—Zoological Museum, Leningrad. Nos. 12361-65.

DISTRIBUTION.—Okhotsk Sea; Gulf of Tartary; Sea of Japan; Corea; coast of Shantung.

SPECIMENS EXAMINED:

1 (340 mm.).	Gulf of Tartary (47° 38' N., 141° 39' E.).	U.S. Nat. Mus.
1 (215 ,,).	Gensan, Corea.	Popov.
4 (200-230 mm.)	Tokyo Market.	Tokyo Imp. Univ.
1 (225 mm.).	Toyama, Japan.	Wu. "
2 (207, 225 mm.).	Coast of Shantung.	Wu. "

The specimens from China have a rather more slender body and narrower caudal peduncle, but are otherwise identical with the remainder.

2. CLEISTHENES PINETORUM, Jordan and Starks.

Cleisthenes pinetorum, Jordan and Starks, 1904, Bull. U.S. Com. Fish., xxii, (1902), p. 622, fig.; Jordan and Starks, 1906, Proc. U.S. Nat. Mus., xxxi, p. 192, fig. 10; Jordan, Tanaka and Snyder, 1913, J. Coll. Sci. Tokyo, xxxiii (1), p. 323, fig. 271; Hubbs, 1915, Proc. U.S. Nat. Mus., xlviii, p. 472; Hubbs, 1918, Annot. Zool. Japon., ix, p. 370.

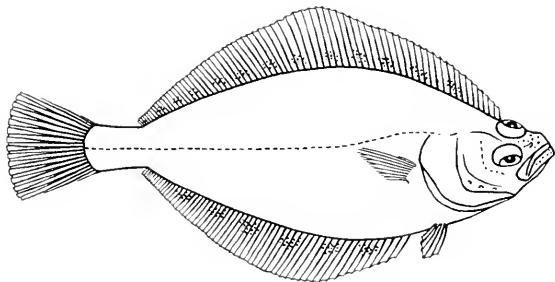


FIG. 226.—*Cleisthenes pinetorum*. [After Jordan and Starks.] $\times \frac{2}{3}$.

Probably identical with the preceding species, but with 20 to 25 (occasionally 27) gill-rakers on lower part of anterior arch. Scales all cycloid in specimens of 4 to 5 inches in total length; larger specimens have a few ctenoid scales on ocular side of head and near upper and lower edges of body. Dorsal 76. Anal 56-57.

TYPE.—United States National Museum. No. 51403.

DISTRIBUTION.—Matsushima Bay, Japan.

SPECIMENS EXAMINED:

1 (112 mm.).	Off Matsushima.	U.S. Nat. Mus.
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Genus 7 LYOPSETTA.

Lyopsetta, Jordan and Goss, 1887, Rep. U.S. Com. Fish., xiii, (1885), p. 923 [*Hippoglossoides exilis*, Jordan and Gilbert, 1881; Jordan and Evermann, 1898, Bull. U.S. Nat. Mus., xlvii (3), p. 2012.

Close to *Hippoglossoides*, but with two series of teeth in the upper jaw, those of the outer row larger than those of the inner and a little enlarged anteriorly; no distinct canines; pectoral fin of ocular side much larger than that of blind side, all the rays simple; scales of moderate size, thin, deciduous, ctenoid on both sides of body; vertebrae 45 (II + 34).

A single species from the North Pacific.

1 LYOPSETTA EXILIS (Jordan and Gilbert)

[SLENDER FLOUNDER]

Hippoglossoides exilis, Jordan and Gilbert, 1881, Proc. U.S. Nat. Mus., iii, (1880), pp. 454, 454; Jordan and Gilbert, 1882, Proc. U.S. Nat. Mus., iv, (1881), p. 67; Jordan and Gilbert, 1883, Bull. U.S. Nat. Mus., xvi, p. 827.

Hippoglossoides (Lyopsetta) exilis, Jordan and Goss, 1887, Rep. U.S. Com. Fish., xiii, (1885), p. 923.

Lyopsetta exilis, Jordan and Goss, 1889, Rep. U.S. Com. Fish., xiv, (1886), p. 238; Jordan and Evermann, 1898, Bull. U.S. Nat. Mus., xlvii (3), p. 2012; Evermann and Goldsborough, 1907, Bull. U.S. Bur. Fish., xxvi, (1906), p. 352; Starks and Morris, 1907, Univ. Calif. Pub. Zool., iii (11), p. 241; Starks, 1911, Ann. Carnegie Mus., vii, p. 203; Gilbert, 1915, Proc. U.S. Nat. Mus., xlviii, p. 370; Starks, 1918, Calif. Fish Game, iv (4), p. 6, fig. 84.

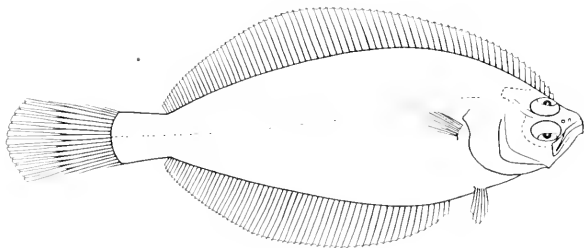


FIG. 227.—*Lyopsetta exilis*. B.M. (N.H.) 96-7-23-233. $\times \frac{1}{4}$.

Depth of body 3 to $3\frac{1}{2}$ in the length, length of head $3\frac{1}{2}$ to 4. Snout as long as or shorter than eye, diameter of which is $3\frac{1}{3}$ to $4\frac{1}{4}$ in length of head. Anterior margins of eyes level or lower a very little in advance of upper, which touches edge of head. Maxillary scarcely extending to below middle of eye, length about $2\frac{1}{2}$ in that of head. Lower jaw scarcely projecting, $2\frac{1}{8}$ to $2\frac{1}{4}$ in head. 9 to 11 gill-rakers on lower part of anterior arch. 65 to 72 scales in lateral line, 16 to 19 between lateral line and middle of back. Dorsal (77) 78-83 (85). Anal 50-65. Pectoral of ocular side with 10 rays, length $1\frac{1}{2}$ to 2 in that of head. Caudal with 18 or 19 rays (12 or 13 branched), rounded

or double-truncate; caudal peduncle generally a little longer than deep. Pale brownish, the scales with or without dark edges; sometimes some darker spots; fins mostly dusky.

TYPE.—United States National Museum. No. 27121.

DISTRIBUTION.—Pacific coast of North America, from Alaska to San Francisco; in rather deep water.

SPECIMENS EXAMINED:

1 (240 mm.).	Nanaimo, B.C.	Clemens.
3 (200–235 mm.).	California.	Stanford Univ.
1 (232 mm.).	Off Central California, 77 fms.	U.S. Nat. Mus.
2 (232, 245 mm.).	San Francisco.	Eigenmann.
5 (200–255 „).	„	U.S. Nat. Mus.
1 (245 mm.).	„	„
2 (148, 162 mm.).	Off Avalon.	„
2 (115, 185 „).	Sta. Catalina.	„
1 (227 mm.).	Pt. Reyes, Cal.	Eigenmann.
1 (140 „).	Off Southern California, 36 fms.	U.S. Nat. Mus.

A small species, rarely exceeding 10 or 12 inches in length.

Genus 8. EOPSETTA.

Eopsetta, Jordan and Goss, 1887, Rep. U.S. Com. Fish., xiii, (1885), p. 923 [*Hippoglossoides jordani*, Lockington]; Norman, 1933, Ann. Mag. Nat. Hist., (10) xi, p. 220.

Xystrias, Jordan and Starks, 1904, Bull. U.S. Com. Fish., xxii, (1902), p. 623 [*Hippoglossus grigorjewi*, Herzenstein].

Close to *Hippoglossoides*, but with two series of teeth in the upper jaw, those of the outer row larger than those of the inner, enlarged and forming distinct canines anteriorly; teeth of the lower jaw in a single series. Lower pharyngeals narrow, scarcely approximated anteriorly; each with an inner row of long, pointed teeth, outside these an irregular series of smaller teeth, and on the edge a number of minute teeth. Rays of dorsal and anal fins more or less scaled on both sides. Pectoral fin of ocular side much larger than that of blind side; middle rays branched. Scales small, adherent, mostly ctenoid on ocular side, cycloid on blind side. Lateral line nearly straight or with a curve of moderate height above the pectoral fin. Vertebrae 42 (10 + 32).

Two species from the Pacific coast of North America and Japan.

SYNOPSIS OF THE SPECIES.

- I. Lateral line nearly straight or with a very low curve above pectoral; depth $2\frac{1}{4}$ to $2\frac{3}{8}$, head 3 to $3\frac{1}{4}$ in length; 45 to 52 scales between lateral line and middle of back 1. *jordani*.
- II Lateral line with a distinct curve above pectoral; depth $2\frac{3}{8}$ to $2\frac{5}{8}$, head $3\frac{3}{8}$ to nearly 4 in length; 28 to 30 scales between lateral line and middle of back 2. *grigorjewi*.

I. EOPSETTA JORDANI (Lockington).

[CALIFORNIA "SOLE"; JORDAN'S FLOUNDER.]

Hippoglossoides jordani, Lockington, 1880, Proc. U.S. Nat. Mus., iii, (1879), p. 73; Jordan and Gilbert, 1881, Proc. U.S. Nat. Mus., iii, (1880), p. 454; Jordan and Gilbert, 1882, Proc. U.S. Nat. Mus., iv, (1881), p. 67; Jordan and Gilbert, 1883, Bull. U.S. Nat. Mus., xvi, p. 827; Jordan, 1884, Nat. Hist. Aquat. Annu. (Fisheries Fish. Indust. U.S., i), p. 187.

Hippoglossoides (Lopsetta) jordani, Jordan and Goss, 1887, Rep. U. S. Com. Fish., xiii, (1885), p. 923.

Lopsetta jordani, Jordan and Goss, 1880, Rep. U. S. Com. Fish., xiv, (1886), p. 239; Jordan and Evermann, 1898, Bull. U. S. Nat. Mus., xlvii (3), p. 2943; Evermann and Goldsborough, 1907, Bull. U. S. Bur. Fish., xxvi, (1909), p. 352; Starks and Morris, 1907, Univ. Calif. Pub. Zool., iii (11), p. 242; Starks, 1918, Calif. Fish Game, iv (4), p. 6, fig. 85.

Depth of body $2\frac{1}{2}$ to $2\frac{3}{4}$ in the length, length of head 3 to $3\frac{1}{2}$. Snout as long as or shorter than eye, diameter of which is $4\frac{1}{2}$ to $5\frac{1}{2}$ in length of head and about 4 times the interorbital width; anterior margins of eyes level or lower very slightly in advance of upper, which is very close to edge of head. Maxillary extending to below middle

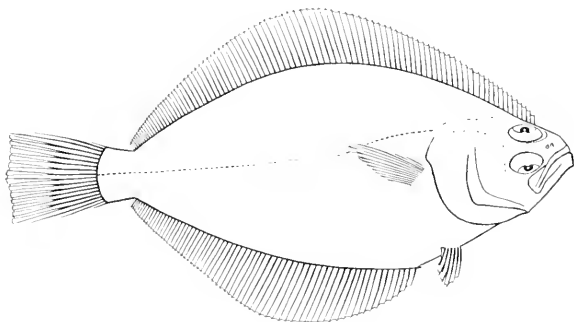


FIG. 228.—*Eopsetta jordani*. B. M. (N. H.) 96. 11. 15. 276. $\times \frac{1}{4}$.

of eye or a little beyond, length about $2\frac{3}{4}$ in that of head, lower jaw scarcely projecting, 2 to $2\frac{1}{2}$ in head. 15 to 17 gill-rakers on lower part of anterior arch. 93 to 100 scales in lateral line, 45 to 52 between lateral line and middle of back. Lateral line nearly straight or with a very low curve above pectoral fin. Dorsal 80-95. Anal 70-75. Pectoral of ocular side with 13 rays (8 to 10 branched), length $1\frac{3}{4}$ to 2 in that of head. Caudal with 19 or 20 rays (14 or 15 branched), rounded or double-truncate; caudal peduncle a little deeper than long. More or less uniformly brownish, young often with whitish spots on body; dorsal and anal fins sometimes clouded with darker.

TYPE.—Not traced.

DISTRIBUTION.—Pacific coast of North America, from Puget Sound to Monterey.

SPECIMENS EXAMINED:

1 (435 mm.)	Yaguina Bay, Oregon.	Bretherton.
1 (205 ")	Off Central California, 37 fms.	U. S. Nat. Mus.
1 (188 ")	Coast of California.	Avres.
2 (199, 435 mm.).	"	Gerrard.
1 (235-415 ")	Pt. Reyes, Cal.	Eigenmann.
1 (111 mm.), skeleton.	"	"
1 (170 ")	Monterey, Cal.	U. S. Nat. Mus.

This species is said to attain to a length of 20 inches and a weight of 6 to 8 pounds.

2. EOPSETTA GRIGORJEWI (Herzenstein).

Hippoglossus grigorjewi, Herzenstein, 1891, [Mél. Biol., xiii (1)], Bull. Ac. Imp. Sci. St. Pétersbourg, xxxiv, (N.S. II), p. 56.

Hippoglossoides sp., Otaki, 1897, Journ. Fish. Bur. Tokyo, vi (1), p. 2, pl. v, fig. 1.

Verasper otaki, Jordan and Snyder, 1900, Proc. U.S. Nat. Mus., xxiii, p. 378.

Xystrias grigorjewi, Jordan and Starks, 1904, Bull. U.S. Com. Fish., xxii, (1902), p. 623; Jordan and Starks, 1906, Proc. U.S. Nat. Mus., xxxi, p. 182, fig. 6; Jordan, Tanaka and Snyder, 1913, J. Coll. Sci. Tokyo, xxxiii (1), p. 319, fig. 267; Jordan and Thompson, 1914, Mem. Carnegie Mus., vi, p. 309, fig. 81; Hubbs, 1915, Proc. U.S. Nat. Mus., xlviii, p. 463; Jordan and Hubbs, 1925, Mem. Carnegie Mus., x, p. 297; Oshima, 1927, Japan. J. Zool., Trans. Abstr., i (5), p. 193; Soldatov and Lindberg, 1930, Bull. Pac. Sci. Fish. Inst., v, p. 391; Schuudt, 1931, C.R. Acad. Sci. Russ., p. 316.

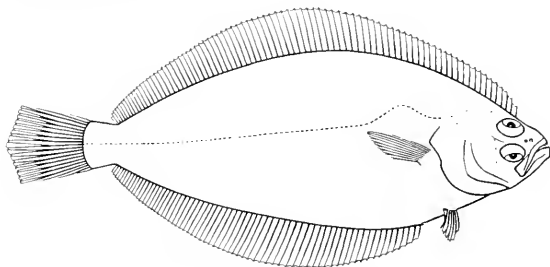


FIG. 229.—*Eopsetta grigorjewi*. B.M. (N.H.) 98.12.1.22. $\times \frac{2}{3}$.

Depth of body $2\frac{3}{4}$ to $2\frac{7}{8}$ in the length, length of head $3\frac{3}{4}$ to nearly 4. Snout a little shorter than eye, diameter of which is $4\frac{1}{4}$ to $4\frac{1}{2}$ in length of head, and about 4 times the interorbital width; anterior margins of eyes about level, upper very close to edge of head. Maxillary extending to below middle of eye or not quite as far, length $2\frac{1}{2}$ to $2\frac{3}{4}$ in that of head; lower jaw not or a little projecting, about 2 in head. (14) 16 to 18 (19) gill-rakers on lower part of anterior arch. 86 to 90 scales in lateral line, 28 to 30 between lateral line and middle of back. Lateral line with a distinct curve above pectoral fin. Dorsal (85) 87-88 (92). Anal 67-70 (77). Pectoral of ocular side with 11 rays (7 branched), length $1\frac{3}{4}$ to $1\frac{1}{2}$ in that of head. Caudal with 19 to 21 rays (15 branched), rounded or double-truncate; caudal peduncle about as deep as long. Brownish, with a number of indistinct darker blotches, spots or ocelli, of which 6 in the middle of the body, 3 above and 3 below lateral line, are most prominent.

TYPE.—Zoological Museum, Leningrad. No. 8732.

DISTRIBUTION.—Japan; Corea; Formosa.

SPECIMENS EXAMINED:

1 (280 mm.) ¹	Aomori, Japan.	Jordan.
1 (250 ,,)	Sea of Japan, off Nagato Prov.	Tokyo Imp. Univ.
1 (255 ,,)	Bay of Mutsu, "	Kishinouye.
1 (235 ,,)	Tokyo Market.	Tokyo Imp. Univ.
1 (188 ,,)	Matsuyama Market.	"

Apart from the more marked anterior curve of the lateral line, this species is not unlike the American *Eopsetta jordani*, and the two appear to be congeneric.

¹ This specimen differs somewhat from the others, having a larger head, mouth, eye, etc.

Genus 9. PSETTICHTHYS.

Psettichthys, Girard, 1854, Proc. Acad. Nat. Sci. Philad., vii, p. 140 [*Psettichthys melanostictus*, Girard]. Jordan and Evermann, 1898, Bull. U.S. Nat. Mus., xlvii (3), p. 2617.

Related to *Hippoglossoides*, but eyes separated by a nearly flat, scaled space of moderate width; a single series of teeth in each jaw, with a few rather strong canines anteriorly. Lower pharyngeals each with a row of sharp, curved teeth, and with traces of a second row of smaller teeth outside. Dorsal fin commencing above posterior nostril of blind side and in front of eye; anterior rays a little prolonged, more or less free from membrane; rays of dorsal and anal fins more or less scaled on both sides. Middle rays of pectoral fin branched. Scales small, adherent, mostly ctenoid on ocular side, cycloid on blind side. Lateral line rising a little above pectoral fin; a suprtemporal branch present, with long posterior prolongation. Vertebrae 40 (11 + 29).

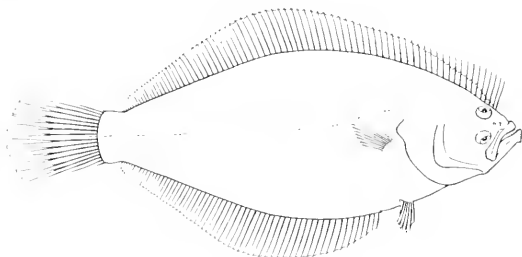
A single species from the Pacific coast of North America.

1. PSETTICHTHYS MELANOSTICTUS, Girard

[SPOTTED FLOUNDER; "SOLE"]

Psettichthys melanostictus, Girard, 1854, Proc. Acad. Nat. Sci. Philad., vii, p. 140; Girard, 1858, U.S. Pacif. R. R. Survey, x, Fishes, p. 154; Günther, 1862, Cat. Fish., iv, p. 426; Lockington, 1880, Proc. U.S. Nat. Mus., ii, (1879), p. 70; Jordan and Gilbert, 1881, Proc. U.S. Nat. Mus., iii, (1880), p. 453; Jordan and Gilbert, 1882, Proc. U.S. Nat. Mus., iv, (1881), p. 67; Jordan, 1884, Nat. Hist. Aquat. Anim. (Fisheries Fish. Indust. U.S.), i, p. 186, pl. ii; Jordan and Goss, 1889, Rep. U.S. Com. Fish., xiv, (1886), p. 241, pl. ii, fig. 6; Jordan and Evermann, 1898, Bull. U.S. Nat. Mus., xlvii (3), p. 2618, pl. cccxxiii, fig. 921; Evermann and Goldsborough, 1907, Bull. U.S. Bur. Fish., xxvi, (1906), p. 353, fig. 135; Starks, 1918, Calif. Fish Game, iv (4), p. 7, fig. 86.

Hippoglossoides melanostictus, Jordan and Gilbert, 1883, Bull. U.S. Nat. Mus., xvi, p. 828.



116. 230.—*Psettichthys melanostictus*. B.M. (N.H.) 90 11. 15. 266. 1.

Depth of body $2\frac{1}{3}$ to $2\frac{2}{3}$ in the length, length of head $3\frac{1}{2}$ to $3\frac{2}{3}$. Snout longer than eye, diameter of which is 6 to 8 in length of head and $1\frac{1}{4}$ times to twice the interorbital width; anterior margins of eyes level or lower a little in advance of upper, which is

close to edge of head. Maxillary extending to below middle of eye or not quite as far, length $2\frac{3}{4}$ to nearly 3 in that of head; lower jaw projecting, about twice in head. 14 to 17 gill-rakers on lower part of anterior arch. 100 to 112 scales in lateral line, 40 to 46 between lateral line and middle of back. Lateral line with a supratemporal branch, which divides into a short anterior portion and a long posterior prolongation extending to below the eighteenth to twenty-second rays of dorsal fin. Dorsal 79-85; first ray nearly entirely free from membrane, its height 3 to $3\frac{3}{8}$ in length of head. Anal 57-61. Pectoral of ocular side with 10 to 12 rays (7 to 9 branched), length $2\frac{1}{4}$ to $2\frac{3}{8}$ in that of head. Caudal with 16 to 20 rays (11 to 14 branched), rounded; caudal peduncle twice or more than twice as deep as long. Brownish; head, body and fins finely speckled with darker.

TYPE.—Not traced.

DISTRIBUTION.—Pacific coast of North America, from Sitka to Monterey.

SPECIMENS EXAMINED:

2 (255, 275 mm.).	Yaguana Bay, Oregon.	Bretherton.
1 (320 mm.).	San Francisco Bay.	Gerrard.
3 (255-400 mm.).	Pt. Reves, Cal.	Eigenmann.
1 (250 mm.).	Monterey, Cal.	U.S. Nat. Mus.
1 (212 ,,).	California.	Ayres.

This species is said to attain to a length of about 20 inches and a weight of from 4 to 5 pounds.

Genus 10. VERASPER.

Verasper, Jordan and Evermann (*ex* Jordan and Gilbert MS.), 1898, Bull. U.S. Nat. Mus., xlvii (3), p. 2618 [*Verasper moseri*, (Jordan and Gilbert) Jordan and Evermann].

Body ovate, compressed. Eyes on the right side, separated by a rather flat, scaled space of moderate width, the upper close to edge of head. Olfactory laminae in moderate number, parallel, without rachis. Mouth of moderate size, subsymmetrical, the length of the maxillary scarcely $\frac{1}{2}$ that of head; dentition about equally developed on both sides; teeth obtusely conical, not greatly enlarged anteriorly; in two series in upper jaw and in a single series in lower jaw, except anteriorly, where there may be an additional irregular series; vomer toothless. Gill-rakers short, stout, with a patch of spines on their inner margins, few in number; lower pharyngeals narrow, scarcely approximated anteriorly, each with conical teeth arranged more or less in three rows. Dorsal fin commencing at a short distance behind nostrils of blind side and above eye; most of the rays simple, scaled on both sides. Tip of first interhaemal spine projecting to a greater or lesser extent in front of anal fin. Pectoral fin of ocular side a little larger than that of blind side; middle rays branched. Pelvic fins short-based, subequal and subsymmetrical. Caudal fin with the middle rays longest; caudal peduncle short. Scales small, adherent, ctenoid on ocular side, mostly cycloid on blind side; no supplementary scales. Lateral line with a rounded curve above the pectoral fin; a short supratemporal branch. Vent median, between the pelvic fins; 3 + 1 pyloric appendages.

Two closely related species from Japanese and Chinese Seas.

SYNOPSIS OF THE SPECIES.

- I. Anterior curve of lateral line low, its height $3\frac{3}{8}$ to 4 in its width; dorsal and anal fins with rounded, dark spots 1. *variegatus*.
 II. Anterior curve of lateral line higher, its height $2\frac{1}{4}$ to $2\frac{1}{2}$ in its width; dorsal and anal fins with vertical dark bars 2. *moseri*.

1. *VERASPER VARIEGATUS* (Temminck and Schlegel).

Platessa variegata, Temminck and Schlegel, 1846, in Siebold, F. Japon. (Pisces), p. 170, pl. xc.

Pleuronectes variegatus, Günther, 1862, Cat. Fish., iv, p. 453; Otake, 1897, Journ. Fish. Bur. Tokyo, vi (1), p. 7, pl. vii, fig. 9.

Verasper variegatus, Jordan and Snyder, 1901, Proc. U.S. Nat. Mus., xxiii, p. 378; Jordan and Starks, 1906, Proc. U.S. Nat. Mus., xxxi, p. 184; Jordan, Tanaka and Snyder, 1913, J. Coll. Sci. Tokyo, xxxiii (1), p. 318; Jordan and Hubbs, 1925, Mem. Carnegie Mus., x, p. 297; Soldatov and Lindberg, 1930, Bull. Pac. Sci. Fish. Inst., v, p. 302; Schmidt, 1931, C.R. Acad. Sci. Russ., p. 315.

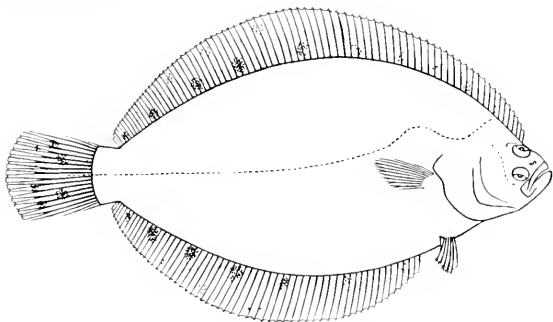


FIG. 231.—*Verasper variegatus*. B.M. (N.H.) 1924 2 4 1. . 7.

Depth of body 2 to $2\frac{1}{2}$ in the length, length of head $3\frac{2}{3}$ to $3\frac{5}{8}$. Snout as long as or a little longer than eye, diameter of which is $4\frac{1}{2}$ to $6\frac{1}{2}$ in length of head and more than twice the interorbital width; lower eye scarcely in advance of upper. Maxillary extending to below middle of eye or not quite as far, length 3 to $3\frac{1}{2}$ in that of head, lower jaw a little projecting, 2 to $2\frac{1}{2}$ in head. 6 or 7 gill-rakers on lower part of anterior arch. Scales all ctenoid on ocular side, on blind side the scales are mostly cycloid in young specimens, except those in an area along middle of anterior part of body, where each scale has a few spinules; in adults the area of ctenoid scales is more extensive, and in some large specimens all the scales of the blind side have one or more spinules. 78 to 90 scales in lateral line, 30 to 36 between lateral line and middle of back. Lateral line with a low curve above pectoral fin, its height $3\frac{2}{3}$ to 4 in its width. Dorsal 77-87. Anal 57-68. Pectoral of ocular side with 10 to 12 rays (8 or 9 branched), length 2 to $2\frac{1}{2}$ in that of head. Caudal with 18 to 21 rays (14 or 15 branched), rounded, caudal peduncle twice or more then twice as deep as long. Dark brownish, uniform or variegated with paler areas, of which the most conspicuous are a large patch behind the head and a series of 3 or 4 patches at upper and lower edges of body; in variegated examples the scales are all edged with dark brown, dorsal and anal fins each with 4 or 5 large, rounded, black or dark brown spots placed near the bases of the fins; generally some smaller and less distinct spots on the caudal; blind side often with small scattered brown spots, the large, rounded spots on the fins are much darker than on the ocular side; tip of caudal dusky.

TYPE - Leiden Museum.

DISTRIBUTION—Seas of southern Japan and northern China, southwards to Matsushima Bay and Chefoo.

SPECIMENS EXAMINED:

1 (255 mm.).	Japan.	—
1 (410 ").	"	Jamrach.
1 (170 ").	Tokyo Market.	Tokyo Imp. Univ.
1 (172 ").	Matsuyama Market.	"
2 (190, 215 mm.).	Inland Sea of Japan.	Smith.
1 (200 mm.).	Yokohama.	"Challenger."
1 (225 ").	Matsushima.	Jordan.
6 (120-143 mm.).	Port Arthur.	"
1 (390 mm.).	Chefoo.	Swinhoe.

2. VERASPER MOSERI, [Jordan and Gilbert] Jordan and Evermann.

Verasper moseri, (Jordan and Gilbert) Jordan and Evermann, 1898, Bull. U.S. Nat. Mus., xlvii (3), p. 2619; Jordan and Gilbert, 1899, Fur seals and fur-seal Is. N. Pacif., (3), p. 490, pl. lxxxv; Jordan and Snyder, 1901, Proc. U. S. Nat. Mus., xxxiii, p. 378; Jordan and Starks, 1906, Proc. U. S. Nat. Mus., xxxi, p. 185, fig. 7; Jordan, Tanaka and Snyder, 1913, J. Coll. Sci. Tokyo, xxxiii (1), p. 318, fig. 266.

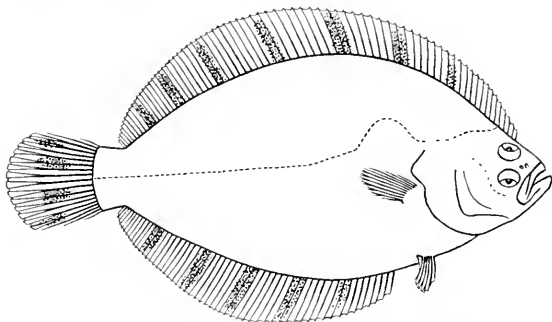


FIG. 232.—*Verasper moseri*. B.M. (N.H.) 1932. 2. 26. 574. 1.

Perhaps identical with the preceding species. Depth of body about twice in the length, length of head $3\frac{1}{4}$ to $3\frac{1}{2}$. Diameter of eye (in specimens of 105 to 130 mm.) about 6, length of maxillary $2\frac{1}{2}$ in length of head. About 85 scales in lateral line, 34 between lateral line and middle of back. Anterior curve of lateral line higher and more abrupt, its height $2\frac{1}{4}$ to $2\frac{1}{2}$ in its width. Dorsal 77-84. Anal 55-60. Length of pectoral of ocular side $2\frac{1}{4}$ to $2\frac{1}{2}$ in that of head. Brownish; scales sometimes edged with darker; body sometimes with a number of indistinct paler and darker spots; dorsal and anal fins each with 5 or 6 conspicuous dark bars, which are parallel with the rays, and, like the rounded spots of the preceding species, most evident on the blind side.

TYPE.—United States National Museum. No. 48797.

DISTRIBUTION.—Northern Japan; Kuril Islands.

SPECIMENS EXAMINED:

1 (130 mm.).	Paratype.	Hakodate, Japan.	Stanford Univ.
1 (105 ").		Same, Japan.	Jordan.

Also one from Japan (Mus. Comp. Zool.).

Genus 11. CLIDODERMA

Clidoderma, Bleeker, 1862, Versl. Akad. Wet. Amsterdam, XII, p. 425 [*Platessa asperrimum*, Temmink and Schlegel, Norman, 1933, Ann. Mag. Nat. Hist., (10) XI, p. 229].

Body rather deep, compressed. Eyes on the right side, separated by a low, narrow, scaled ridge, the upper close to edge of head, snout and upper parts of eyeballs densely tuberculate. Olfactory laminae in moderate number, parallel, without rachis. Mouth of moderate size, the length of the maxillary on ocular side less than $\frac{1}{3}$, on blind side nearly $\frac{1}{2}$ that of head, jaws and dentition much stronger on blind side of head, teeth stout, conical, somewhat enlarged anteriorly, in two distinct series in both jaws, those of the outer row stronger, vomer toothless. Gill-rakers short, stout, few in number, lower pharyngeals narrow, scarcely approximated anteriorly, each with 2 or 3 irregular series of teeth. Dorsal fin commencing at a short distance behind nostrils of blind side and above or a little in advance of eye, rays simple or bifid distally, scaled only on ocular side. Tip of first interhamal spine not projecting in front of anal fin. Pectoral fin of ocular side larger than that of blind side, middle rays branched. Pelvic fins short-based, subequal and subsymmetrical. Caudal fin with the middle rays longest, caudal peduncle short. No scales; ocular side (in adults) with close-set, rough, bony tubercles, most of which bear small spines; larger tubercles arranged in 6 more or less definite longitudinal rows, blind side quite smooth. Lateral line with a low curve above the pectoral fin, a supratermporal branch of moderate length. Vent median, between the pelvic fins, 4 pyloric appendages.

A single species from Japan.

The true position of this aberrant genus is somewhat doubtful, but it appears to be more nearly related to *Teraspes* than to *Platichthys*, with which it has previously been associated. In some respects it forms a connecting link between the large and symmetrical-mouthed genera and those in which the jaws and dentition are markedly asymmetrical.

1. CLIDODERMA ASPERRIMUM (Temmink and Schlegel)

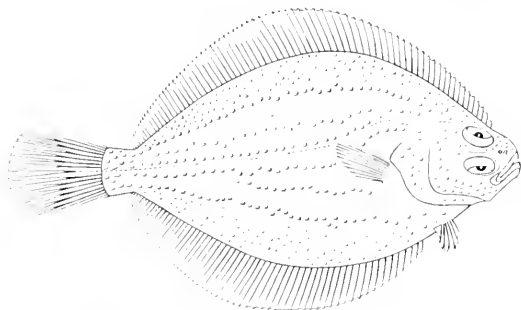


FIG. 2. — *Clidoderma asperrimum*. B.M. (N.H.) 1923.9.28.13. — 4.

- Platessa asperirma*, Temminck and Schlegel, 1846, in Siebold, F. Japon. (Pisces), p. 177, pl. xc1.
Pleuronectes asperirmus, Günther, 1862, Cat. Fish., iv, p. 453; Otaki, 1897, Journ. Fish. Bur. Tokyo, vi (1), p. 7, pl. viii, fig. 8.
Cludoderma asperirmum, Bleeker, 1862, Versl. Akad. Wet. Amsterdam, xiii, p. 425; Jordan and Snyder, 1900, Proc. U.S. Nat. Mus., xxiii, p. 379; Jordan and Starks, 1904, Bull. U.S. Com. Fish., xxii, (1902), p. 625; Jordan and Starks, 1906, Proc. U.S. Nat. Mus., xxxi, p. 221, fig. 20; Jordan, Tanaka and Snyder, 1913, J. Coll. Sci. Tokyo, xxxiii (1), p. 331, fig. 279; Hubbs, 1915, Proc. U.S. Nat. Mus., xlviii, p. 488; Jordan and Hubbs, 1925, Mem. Carnegie Mus., x, p. 300; Soldatov and Lindberg, 1930, Bull. Pac. Sci. Fish. Inst., v, p. 412; Schmidt, 1931, C.R. Acad. Sci. Russ., p. 317.

Depth of body $1\frac{1}{2}$ to nearly twice in the length, length of head $3\frac{1}{8}$ to $3\frac{1}{2}$. Snout shorter than eye, diameter of which is 4 to $4\frac{1}{2}$ in length of head; anterior margins of eyes about level. Maxillary extending to below anterior part of eye, length on ocular side $3\frac{1}{8}$ to $3\frac{1}{4}$, on blind side $2\frac{1}{8}$ to $2\frac{1}{4}$ in that of head; lower jaw scarcely projecting, $2\frac{3}{8}$ in head. Teeth of upper jaw largely confined to the blind side; sometimes 3 or 4 teeth between the two principal rows; 25 or 26 teeth on blind side of each jaw. 10 to 13 gill-rakers on lower part of anterior arch. Skin quite smooth on both sides in very young examples; older specimens densely tuberculated on ocular side. Dorsal 82-89. Anal 63-70. Pectoral of ocular side with 12 or 13 rays (9 or 10 branched), length about $\frac{1}{2}$ that of head. Caudal with 19 or 20 rays (14 or 15 branched), rounded; caudal peduncle deeper than long. Uniformly brownish; blind side greyish.

TYPE.—Leiden Museum.

DISTRIBUTION.—Coasts of Japan, chiefly northward.

SPECIMENS EXAMINED:

1 (310 mm.).	Hachinohe, Mutsu Prov., Japan.	Tokyo Imp. Univ.
1 (425 ").	Tokyo Market.	"

Genus 12. HYSOPSETTA.

Hysopsetta, Gill, 1863, Proc. Acad. Nat. Sci. Philad., xiv, (1862), p. 330 [*Pleuronichthys guttulatus*, Girard]; Jordan and Evermann, 1898, Bull. U.S. Nat. Mus., xlvii (3), p. 2639.

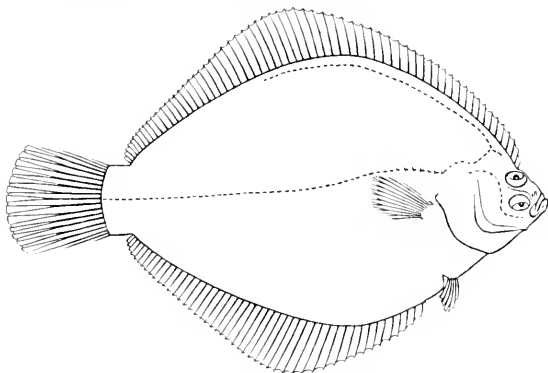
Body deep, rhomboidal, compressed. Head without spines or prominences. Eyes on the right side, separated by a narrow ridge, the upper close to edge of head. Olfactory laminae rather few in number, parallel, without rachis. Mouth very small, the length of the maxillary on blind side about $\frac{1}{2}$ that of head; jaws rather stronger on blind side; lips rather thick, not plicate; teeth small, slender, acute, forming broad villiform bands on blind side of both jaws; scarcely any teeth on ocular side; no canines; vomer toothless. Gill-rakers short, stout, very few in number; lower pharyngeals narrow, scarcely approximated anteriorly, each with 3 or 4 rows of small, slightly curved, acute teeth. Dorsal fin commencing on median line of head, just behind nostrils of blind side and above the eye; most of the rays simple, more or less scaled. Tip of first interhaemal spine projecting in front of anal fin. Pectoral fin of ocular side larger than that of blind side; middle rays branched. Pelvic fins short-based, subequal and subsymmetrical. Caudal fin with the middle rays longest, scaled on both sides; caudal peduncle rather short. Scales small, adherent, cycloid, anteriorly more or less embedded in the skin. Lateral line with a very low curve above the pectoral fin; a supratemporal branch, with a long posterior prolongation; tubules of anterior part of lateral line much branched. Vent on blind side, a little in front of anal fin; intestine of moderate length; 2 or 3 + 1 pyloric appendages. Vertebrae 35 (11 + 24).

A single species from California.

1 HYPSPÖSETTA GUTTULATA (Girard).

DIAMOND FLOUNDER.]

- Pleuronichthys guttulatus*, Girard, 1857, Proc. Acad. Nat. Sci. Philad., viii, (1856), p. 137; Boston J. Nat. Hist., vi, p. 542, pl. xxv, figs. 1-4; Girard, 1858, U.S. Pacif. R.R. Surv., x, Fishes, p. 152; Lockington, 1880, Proc. U.S. Nat. Mus., ii, (1879), p. 94.
- Pleuronectes guttulatus*, Gunther, 1862, Cat. Fish., iv, p. 445.
- Parophrys ayesii*, Gunther, 1862, *loc. cit.*, p. 456.
- Hypsopsetta guttulata*, Gill, 1863, Proc. Acad. Nat. Sci. Philad., xiv, (1862), p. 330; Jordan and Gilbert, 1887, Proc. U.S. Nat. Mus., iii, (1886), p. 453; Jordan and Gilbert, 1882, Proc. U.S. Nat. Mus., iv, (1881), p. 68; Jordan and Gilbert, 1883, Bull. U.S. Nat. Mus., xvi, p. 830; Jordan, 1884, Nat. Hist. Aquat. Anim. (Fisheries Fish. Indust. U.S.), i, p. 185; Jordan and Goss, 1886, Rep. U.S. Com. Fish., xiv, (1886), p. 283; Jordan and Evermann, 1898, Bull. U.S. Nat. Mus., xlvii (3), p. 2639; Starks and Morris, 1907, Univ. Calif. Pub. Zool., iii (11), p. 244; Starks, 1918, Calif. Fish Game, iv (4), p. 12, fig. 64.

FIG. 214.—*Hypsopsetta guttulata*. B.M. (N.H.) 90.11.15.24 1/2

Depth of body $1\frac{2}{3}$ to $1\frac{3}{4}$ in the length, length of head $3\frac{1}{2}$ to 4. Upper profile of head a little concave above eyes. Snout as long as or shorter than eye, diameter of which is 4 to $5\frac{1}{2}$ in length of head. Interorbital ridge naked or with a few scales, lower eye scarcely in advance of upper. Maxillary extending to below anterior edge or anterior part of eye, length on ocular side $4\frac{1}{4}$ to $4\frac{1}{2}$ in that of head; lower jaw scarcely projecting, 3 to $3\frac{1}{2}$ in head. 5 or 6 gill-rakers on lower part of anterior arch. Scales very small on head, feebly developed in opercular region; scales on body smaller on blind side than on ocular side; 83 to 95 in lateral line. Posterior prolongation of supratoral branch of lateral line extending to below fourth to fiftieth rays of dorsal fin. Dorsal 66-73, highest rays $\frac{1}{2}$ or more than $\frac{1}{2}$ length of head. Anal 48-54. Pectoral of ocular side with 11 to 13 rays (7 to 9 branched), length $1\frac{2}{3}$ to 2 in that of head. Caudal with 19 rays (13 branched), rounded or double truncate, caudal peduncle about twice as deep as long. More or less uniformly brownish, young with small pale spots. fins sometimes speckled with dark brown or black.

TYPE.—Not traced.

DISTRIBUTION.—Coast of California, from Cape Mendocino to Magdalena Bay.

SPECIMENS EXAMINED :

1 (93 mm.).	California.	U.S. Nat. Mus.
1 (215 ,,). Type of <i>Parophrys</i>	San Francisco.	Ayres.
<i>ayresii</i> .		
3 (205-260 mm.).	„	Eigenmann.
7 (60-232 ,,).	San Diego	Jordan.
1 (215 mm.).	„	U.S. Nat. Mus.
1 (245 ,,).	„	„
2 (205, 265 mm.).	„ Bay.	„

Attains to a length of 18 inches and a weight of 4 pounds.

Genus 13. PLEURONICHTHYS.

Pleuronichthys, Girard, 1856, Proc. Acad. Nat. Sci. Philad., vii, (1854), p. 139 [*Pleuronichthys canosus*, Girard]; Jordan and Evermann, 1898, Bull. U.S. Nat. Mus., xlvii (3), p. 2637; Starks and Thompson, 1910, Proc. U.S. Nat. Mus., xxxviii, p. 277.
Heteroprosopon, Bleeker, 1862, Versl. Akad. Wet. Amsterdam, xiii, p. 429 [*Platessa cornuta*, Temminck and Schlegel].

Closely related to *Hypsopsetta*, but with a very short, blunt snout, which is much shorter than the eye; eyes separated by a high, narrow, naked ridge, generally provided with one or more blunt spines or bony prominences; other prominences may be present round the orbits and above the operculum. Lips thick, their inner surfaces with a series of transverse plicæ, inside which is a series of short fringes. Lower pharyngeals each with one or two rows of slender, acute teeth. Dorsal fin with the anterior rays twisted on to blind side of head, its origin well below level of nostrils. Pelvic fin of blind side inserted a little anterior to and farther from median line than that of ocular side. Lateral line tubules not greatly branched. Intestine long or of moderate length; 2 or 3 + 1 pyloric appendages. Vertebrae 38 to 40 (13-14 + 25-26).

Seven species from the North Pacific.

SYNOPSIS OF THE SPECIES.

- I. Origin of dorsal a little below level of angle of mouth, 9 or more rays of fin on blind side of head; intestine of moderate length, not much coiled
 1. *decurvens*.
- II. Origin of dorsal above level of angle of mouth, 5 or 6 rays of fin on blind side of head.
 - A. Body and fins generally uniformly covered with small brown spots; intestine elongate, much coiled; no teeth on ocular side of lower jaw; 98 to 110 scales in lateral line [Asiatic species].
 2. *cornutus*.
 - B. Body and fins not uniformly covered with brown spots; intestine of moderate length or rather long, usually not much coiled [American species].
 1. Interorbital ridge high, sharply compressed, ending behind in a prominent, posteriorly-directed spine; anterior bony prominence overhanging mouth; no teeth on ocular side of lower jaw; 88 to 96 scales in lateral line.
 3. *verticalis*.
 2. Interorbital ridge less high and sharp; anterior bony prominence not overhanging mouth; a row of minute teeth on ocular side of lower jaw.
 - a. Less than 75 scales in lateral line; posterior spine of interorbital ridge feebly developed or wanting; colour dark.
 4. *nephelus*.

- b* 70 to 90 scales in lateral line, posterior spine of interorbital ridge usually well developed, colour paler
- a* Eye $3\frac{2}{3}$ to 4 in head, 10 or 11 gill-rakers on lower part of anterior arch; intestine of moderate length, not much coiled; spot on lateral line, if present, not conspicuously ocellated
- * No bony prominence on anterior end of interorbital ridge, dorsal 70-76, anal 50-53; pectoral with 11 rays, no distinct spot on middle of lateral line or below dorsal and anal fins 5 *canosus*
- ** Two bony prominences on anterior end of interorbital ridge, dorsal 61-66, anal 45-49; pectoral with 10 rays; a distinct black spot on middle of lateral line and a pair below hinder parts of dorsal and anal fins 6 *nitens*
- β* Eye $2\frac{2}{3}$ in head; 7 to 9 gill-rakers on lower part of anterior arch; intestine rather long, fairly well coiled; spot on lateral line conspicuously ocellated with white; two bony prominences on anterior end of interorbital ridge 7 *ocellatus*

Pleuronectes quadrifurcatus, Pallas,¹ from the Bering Sea, may be a species of *Pleuronichthys*, but the original diagnosis is too brief for a definite identification to be made.

1 PLEURONICHTHYS DECURRENS, Jordan and Gilbert.

? *Pleuronectes quadrifurcatus*, Pallas, 1814, Zoographia, III, p. 423.
Pleuronichthys canosus (non Girard), Lockington, 1880, Proc. U.S. Nat. Mus., II, (1879), p. 97.
Pleuronichthys quadrifurcatus, Jordan and Gilbert, 1881, Proc. U.S. Nat. Mus., III, (1880), p. 50.
Pleuronichthys decurrens, Jordan and Gilbert, 1881, Proc. U.S. Nat. Mus., III, (1880), p. 453; Jordan and Gilbert, 1882, Proc. U.S. Nat. Mus., IV, (1881), p. 69; Jordan and Gilbert, 1883, Bull. U.S. Nat. Mus., XVI, p. 820; Jordan and Goss, 1886, Rep. U.S. Com. Fish., XIV, (1886), p. 282; Jordan and Evermann, 1898, Bull. U.S. Nat. Mus., XLVII (3), p. 2637, pl. cccclxxv, fig. 926; Starks and Morris, 1907, Univ. Calif. Pub. Zool., III (11), p. 244; Starks and Thompson, 1910, Proc. U.S. Nat. Mus., XXXVIII, p. 278; Starks, 1918, Calif. Fish Game, IV (4), p. 9, fig. 90; Schultz, Hart and Gunderson, 1932, Copeia, No. 2, p. 67.

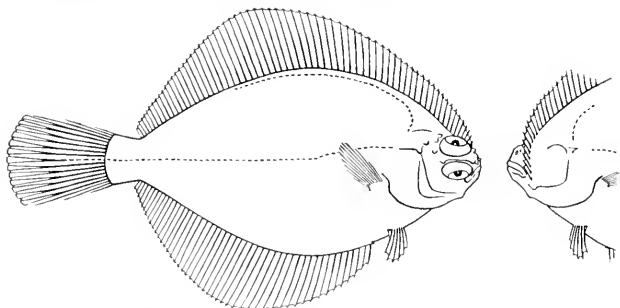


FIG. 218.—*Pleuronichthys decurrens*. B.M. (N.H.) 81, 7 11, 9. 1:5.

¹ 1814, 'Zoographia', III, p. 423.

Depth of body $1\frac{3}{4}$ to twice in the length, length of head $3\frac{3}{8}$ to 4. Upper eye slightly behind lower, entering dorsal profile of head, its diameter $3\frac{1}{2}$ in length of head; a prominent tubercle or blunt spine at either end of the interorbital ridge, a smaller tubercle in front of each eye, and others above and behind upper eye; some bony prominences above the operculum. Maxillary extending to below anterior part of eye, length on ocular side $3\frac{3}{8}$ to 4, on blind side $3\frac{3}{8}$ to $3\frac{1}{2}$ in that of head; lower jaw scarcely projecting, about 3 in head. Teeth in 3 rows on blind side of both jaws; a single row on ocular side of lower jaw. 8 or 9 gill-rakers on lower part of anterior arch. 80 to 86 scales in lateral line. Posterior prolongation of supratemporal branch of lateral line extending to below thirty-seventh to fiftieth rays of dorsal fin. Dorsal 70-75; origin a little below level of angle of mouth, at least 9 rays being on blind side of head; highest rays about $\frac{3}{8}$ length of head. Anal 47-50; tip of first interhæmal spine prominent. Pectoral of ocular side with 9 to 13 rays (5 to 10 branched), length $1\frac{3}{8}$ to $1\frac{1}{2}$ in that of head. Pelvics with 4 to 7 (generally 6) rays. Caudal with 19 rays (13 branched), rounded; caudal peduncle $1\frac{1}{2}$ to $1\frac{3}{4}$ times as deep as long. Intestine of moderate length, not much coiled. Brownish, sometimes with indefinite darker markings; rays of dorsal and anal fins tipped with white; distal part of caudal dusky, narrowly margined with white.

TYPE.—Not traced.

DISTRIBUTION.—Pacific coast of North America, from Alaska to the Santa Barbara Islands.

SPECIMENS EXAMINED:

1 (248 mm.).	San Francisco.	U.S. Nat. Mus.
2 (160, 182 mm.).	"	"
3 (240-295 ,,).	Pt. Reyes.	Eigenmann.
1 (170 mm.).	San Diego Bay.	Amer. Mus. Nat. Hist.
1 (225 ,,).	Monterey.	U.S. Nat. Mus.

The recent record (Schultz, Hart and Gunderson, 1932) of two examples of this species (37 and 207 mm.) from Prince William Sound and Wrangell, Alaska, extends its known distribution very much farther northwards. It is possible that this may prove to be the species described by Pallas as *Pleuronectes quadrilobulatus*.

2. PLEURONICHTHYS CORNUTUS (Temminck and Schlegel).

Platessa cornuta, Temminck and Schlegel, 1846, in Siebold, F. Japon. (Pisces), p. 179, pl. xcii, fig. 1; Bleeker, 1854, Verh. Batav. Gen., xxvi, Japan, p. 121.

Heteroprosopon cornutus, Bleeker, 1862, Versl. Akad. Wet. Amsterdam, xiii, p. 429.

Parophrosopon cornuta, Günther, 1862, Cat. Fish., iv, p. 455; Günther, 1880, Shore Fishes "Challenger," p. 70; Otake, 1897, Journ. Bur. Fish. Tokyo, p. 7, pl. viii, fig. 10.

Pleuronichthys cornutus, Steindachner, 1896, Ann. Natur. Hofmus. Wien, xi, p. 207; Rutter, 1897, Proc. Acad. Nat. Sci. Philad., xlix, p. 88; Jordan and Starks, 1904, Bull. U.S. Com. Fish., xxii, (1902), p. 623; Jordan and Starks, 1906, Proc. U.S. Nat. Mus., xxxi, p. 201; Starks and Thompson, 1910, Proc. U.S. Nat. Mus., xxxviii, p. 279; Jordan, Tanaka and Snyder, 1913, J. Coll. Sci. Tokyo, xxxiii(1), p. 325; Hubbs, 1915, Proc. U.S. Nat. Mus., xlviii, p. 475; Jordan and Hubbs, 1925, Mem. Carnegie Mus., x, p. 298; Oshima, 1927, Japan J. Zool., Trans. Abstr., i (5), p. 194; Schmidt, 1931, Trans. Pac. Com. Acad. Sci. U.S.S.R., ii, p. 126; Schmidt, 1931, C.R. Acad. Sci. Russ., p. 316.

Depth of body $1\frac{1}{2}$ to twice in the length, length of head $4\frac{1}{8}$ to 5. Upper eye scarcely behind lower, entering dorsal profile of head, its diameter 3 to 4 in length of head; interorbital ridge of moderate height, narrow, compressed, with a more or less prominent spine at either end, the anterior spine directed upwards, the posterior backwards; these spines sometimes obtuse or rounded; a small prominence in front of lower eye, a smaller one in front of upper eye, and usually one or two very small ones on hinder margin of upper orbit; no prominences above the operculum. Maxillary extending to below anterior part of eye, length on ocular side $3\frac{3}{8}$ to $4\frac{1}{8}$, on blind side $3\frac{1}{2}$ to 4 in that of head; lower jaw scarcely projecting,

$2\frac{1}{2}$ to 3 in head. Teeth in 2 or 3 rows on blind side of both jaws; no teeth on ocular side of either jaw. 5 to 8 gill-rakers on lower part of anterior arch. 98 to 110 scales in lateral line. Posterior prolongation of supratemporal branch of lateral line extending to below twenty-fifth to forty-eighth rays of dorsal fin. Dorsal 70-83, origin about level with nostrils, 3 to 6 rays being on blind side of head. Highest rays $1\frac{1}{2}$ to $1\frac{1}{2}$ in length of head. Anal 50-62; first interhamal spine not projecting, except in young. Pectoral of ocular side with 9 to 12 rays (6 to 8 branched), length $1\frac{1}{2}$ to 2 in that of head. Pelvics with 6 rays. Caudal with 10 rays (13 branched), rounded; caudal peduncle 2 to $2\frac{1}{2}$ times as deep as long. Intestine elongate, much coiled. Pale grey or reddish brown; head, body and fins generally uniformly covered with more or less rounded spots of dark brown, which are sometimes minute or almost entirely wanting; frequently some larger brown spots and blotches, especially in the young, and often a number of round, white spots, of which a row near upper and lower edges of body are most prominent; margins of median fins dusky or brownish on blind side; pectoral usually with a broad dark band distally and a narrow pale margin.

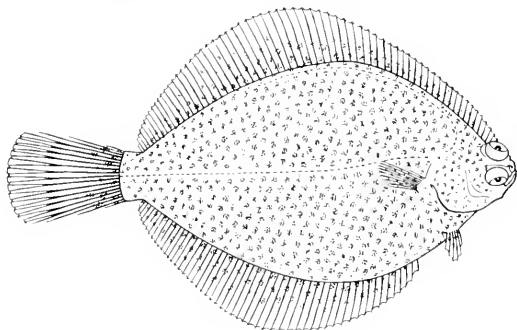


FIG. 230.—*Pleuronichthys cornutus*. B.M. (N.H.) 98. 12. 1. 23. $\cdot \frac{2}{3}$.

TYPE.—Leiden Museum

DISTRIBUTION.—Coasts of China and Japan, from Hakodate to Swatow; Formosa.

SPECIMENS EXAMINED:

2 (95-275 mm.).	Kobe.	Jordan.
1 (100 mm.).	"	" Challenger."
1 (245 ").	Bay of Mutsu.	Kishinouye.
3 (160-225 mm.).	Tokyo.	Jordan.
2 (200, 230 ").	"	Batson.
2 (195, 230 ").	Tokyo Market	Tokyo Imp. Univ.
1 (180 mm.).	Matsuyama Market.	"
1 (210 ").	Hiroshima.	Jordan.
1 (115 ").	Wakatoura.	"
2 (100, 120 mm.).	Inland Sea of Japan.	" Challenger."
1 (143 mm.).	Japan.	Smith.
1 (190-235 mm.).	"	Jamrach.
1 (210 mm.), skeleton.	"	"
1 (272 ").	Yenting, Chekiang.	Suene Soc. China.
15 (66-103 mm.).	Amoy.	Light.

As pointed out by Hubbs (1915), specimens from Amoy and other parts of southern China tend to differ somewhat from typical Japanese examples. In view of the great variation found among Japanese specimens, however, it seems inadvisable to recognise more than one species at present.

3 PLEURONICHTHYS VERTICALIS, Jordan and Gilbert.

Pleuronichthys verticalis, Jordan and Gilbert, 1881, Proc. U.S. Nat. Mus., iii, (1880), p. 49; Jordan and Gilbert, 1882, Proc. U.S. Nat. Mus., iv, (1881), p. 69; Jordan and Gilbert, 1883, Bull. U.S. Nat. Mus., xvi, p. 829; Jordan, 1884, Nat. Hist. Aquat. Anim. (Fisheries Fish. Indust. U.S., i), p. 189; Jordan and Goss, 1889, Rep. U.S. Com. Fish., xiv, (1886), p. 282; Jordan and Evermann, 1898, Bull. U.S. Nat. Mus., xvii (3), p. 2638; Starks and Morris, 1907, Univ. Calif. Pub. Zool., iii (11), p. 243; Starks and Thompson, 1910, Proc. U.S. Nat. Mus., xxxviii, p. 281; Hubbs, 1916, Univ. Calif. Pub. Zool., xvi (13), p. 168; Starks, 1918, Calif. Fish Game, iv (4), p. 10, fig. 91.

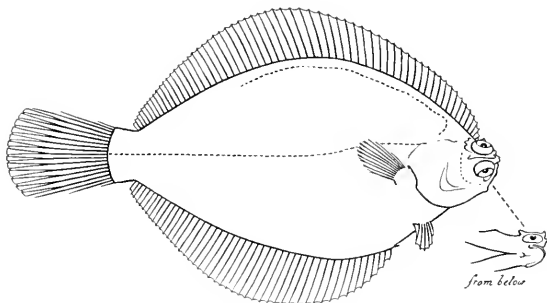


FIG. 237.—*Pleuronichthys verticalis*. B.M. (N.H.) 91.5.19.168. $\times \frac{1}{2}$.

Depth of body $1\frac{3}{4}$ to twice in the length, length of head $3\frac{7}{8}$ to $4\frac{1}{2}$. Upper eye scarcely behind lower, entering dorsal profile of head, its diameter $\frac{4}{8}$ to $4\frac{1}{4}$ in length of head; interorbital ridge high, sharply compressed, with a prominent spine directed upward and forward at its anterior end, and a strong, backwardly-directed spine at its posterior end; a strong tubercle on the anterior edge of the ridge, in front of the lower eye and overhanging the mouth; generally a smaller prominence in front of upper eye, another above it, and 2 or 3 behind, of which the lowest is most prominent; no distinct prominences above the operculum. Maxillary extending to below anterior part of eye, length on ocular side 4 to $4\frac{1}{2}$, on blind side 4 in that of head; lower jaw scarcely projecting, 3 to $3\frac{1}{4}$ in head. Teeth in 3 or 4 rows on blind side of both jaws; none on ocular side of either jaw. 6 or 7 gill-rakers on lower part of anterior arch. 88 to 96 scales in lateral line. Posterior prolongation of supratemporal branch of lateral line extending to below thirty-seventh to forty-seventh rays of dorsal fin. Dorsal 68–71; origin a little above level of angle of mouth, 5 or 6 rays being on blind side of head. Anal 45–48; tip of first interhæmal spine prominent. Pectoral of ocular side with 10 to 12 rays (8 or 9 branched), length $1\frac{1}{2}$ to $1\frac{3}{8}$ in that of head. Pelvics with 6 rays. Caudal with 19 rays (13 branched), rounded; caudal peduncle about twice as deep as long. Intestine of moderate length, not much coiled. Pale

brownish, with or without indistinct darker blotches, median fins with large brown blotches, the rays tipped with white, young with a distinct ocellus on middle of lateral line.

TYPE—United States National Museum, No. 26079.

DISTRIBUTION—Coast of California, from San Francisco to the Gulf of California.

SPECIMENS EXAMINED:

1 (195 mm.).	San Francisco.	Eigenmann.
1 (220 ").	Monterey.	U.S. Nat. Mus.
1 (285 ").	Monterey Bay.	Amer. Mus. Nat. Hist.
2 (55, 70 mm.).	Gulf of California (31° N., 114° W.).	U.S. Nat. Mus.

Also one from off San Martin Isd., Lower California (Calif. Acad. Sci.)¹

4. PLEURONICHTHYS NEPHELUS, Starks and Thompson

Pleuronichthys cenosus (part), Jordan and Gilbert, 1882, Proc. U.S. Nat. Mus., iv, (1881), p. 68; Jordan and Gilbert, 1883, Bull. U.S. Nat. Mus., xvi, p. 830; Jordan and Goss, 1886, Rep. U.S. Com. Fish., xiv, (1886), p. 282; Jordan and Evermann, 1898, Bull. U.S. Nat. Mus., xlvii (3), p. 293b.

Pleuronichthys nephelus, Starks and Thompson, 1910, Proc. U.S. Nat. Mus., xxxviii, p. 282, fig. 1.

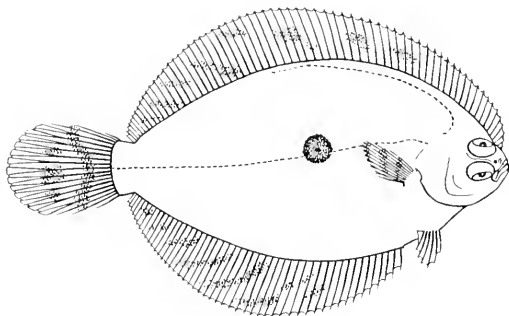


FIG. 238. — *Pleuronichthys nephelus*. B.M. (N.H.) 1930.8.6.18. ♂.

Depth of body twice in the length, length of head $4\frac{1}{2}$. Upper eye about level with lower, scarcely entering dorsal profile of head, which is evenly curved or very slightly notched; diameter of eye about $3\frac{1}{2}$ in length of head. Interorbital ridge low, without prominent spines, but with indications of tubercles at its anterior and posterior ends; no prominences round the eyes or above the operculum. Maxillary extending to below anterior part of eye, length on ocular side $3\frac{1}{2}$, on blind side $3\frac{3}{4}$ in that of head; lower jaw scarcely projecting, about $2\frac{1}{2}$ in head. Teeth in 3 or 4 rows on blind side of both jaws; a single row on ocular side of lower jaw. 9 to 11 gill-rakers on lower part of anterior arch. 66 (66 to 75) scales in lateral line. Posterior prolongation of supratermporal branch of lateral line extending to below thirty-ninth ray of dorsal fin. Dorsal (66) 70 (75), origin just below level of nostrils, about 6 rays being on

¹ I am indebted to Mr. Templeton Crocker for the opportunity of examining this fish.

blind side of head; highest rays about $\frac{2}{3}$ length of head. Anal (47) 53 (56); first interhæmal spine fairly prominent. Pectoral of ocular side with 11 rays (8 branched), length $1\frac{2}{3}$ in that of head. Pelvics with 6 rays. Caudal with 19 rays (13 branched), rounded; caudal peduncle twice as deep as long. Intestine of moderate length, not much coiled. Olive brown, irregularly mottled with darker; a large black spot, indistinctly ocellated, just in front of middle of lateral line; median fins mottled and spotted with darker, the rays narrowly tipped with white; caudal with a large round dusky spot, and with a dark bar across the bases of the rays; pectoral indistinctly barred.

TYPE.—United States National Museum. No. 74606.

DISTRIBUTION.—Puget Sound.

SPECIMEN EXAMINED:

1 (166 mm.). Paratype.

San Juan Is.

Amer. Mus. Nat. Hist.

5. PLEURONICHTHYS GENOSUS, Girard.

Pleuronichthys canosus, Girard, 1856, Proc. Acad. Nat. Sci. Philad., vii, (1854), p. 139; Girard, 1858, U.S. Pacif. R.R. Surv., x, Fishes, p. 151; Lockington, 1880, Proc. U.S. Nat. Mus., ii, (1879), p. 97; Jordan and Gilbert, 1881, Proc. U.S. Nat. Mus., iii, (1880), pp. 50, 453; Starks and Thompson, 1910, Proc. U.S. Nat. Mus., xxxviii, p. 284; Hubbs, 1916, Univ. Calif. Pub. Zool., xvi, (13) p. 169; Starks, 1918, Calif. Fish Game, iv (4), p. 11, fig. 92.

Parophrys canosa, Gunther, 1862, Cat. Fish., iv, p. 456.

Pleuronichthys canosus (part), Jordan and Gilbert, 1882, Proc. U.S. Nat. Mus., iv, (1881), p. 68; Jordan and Gilbert, 1883, Bull. U.S. Nat. Mus., xvi, p. 830; Jordan, 1884, Nat. Hist. Aquat. Anm. (Fisheries Fish. Indust. U.S., 1), p. 189; Jordan and Goss, 1889, Rep. U.S. Com. Fish., xiv, (1886), p. 282; Jordan and Evermann, 1898, Bull. U.S. Nat. Mus., xlvii (3), p. 2638.

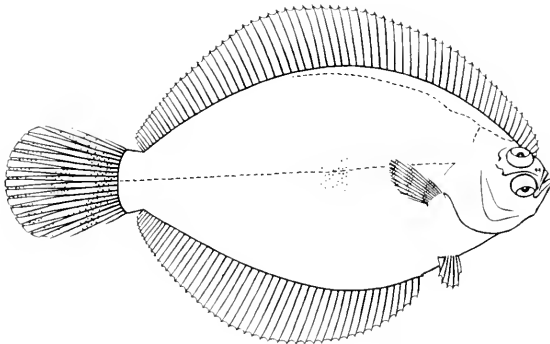


FIG. 239.—*Pleuronichthys canosus*. B.M. (N.H.) 91.5.10.166. $\times \frac{1}{2}$.

Depth of body about twice in the length, length of head 4. Upper eye a little behind lower, scarcely entering dorsal profile of head, which is nearly straight; diameter of eye 4 in length of head; interorbital ridge rather high, without spines, except for a blunt one at posterior end, directed backwards and somewhat downwards; generally no prominences round eyes or above operculum; sometimes a small blunt tubercle behind upper eye. Maxillary extending to below anterior part of eye,

length on ocular side $4\frac{1}{2}$, on blind side $3\frac{1}{2}$ in that of head; lower jaw a little projecting, $2\frac{1}{2}$ in head. Teeth in 3 or 4 rows on blind side of both jaws; a single row on ocular side of lower jaw. 10 or 11 gill-rakers on lower part of anterior arch. 80 to 90 scales in lateral line. Posterior prolongation of supratemporal branch of lateral line extending to below forty-fourth ray of dorsal fin. Dorsal (70) 70; origin about level with anterior part of maxillary, about 6 rays being on blind side of head; highest rays $1\frac{1}{2}$ in length of head. Anal (50) 53; first interhamal spine prominent. Pectoral of ocular side with 11 rays (8 branched), length $1\frac{3}{4}$ in that of head. Pelvics with 6 rays. Caudal with 10 rays (13 branched), rounded; caudal peduncle about $2\frac{1}{2}$ times as deep as long. Intestine of moderate length, not much coiled. Brownish, with some indistinct darker spots and blotches; a very indefinite dusky blotch at middle of lateral line; some irregular dark spots on dorsal and anal fins, and a large blotch across base of caudal; rays of median fins all tipped with white.

TYPE.—United States National Museum. No. 997.

DISTRIBUTION.—Coast of California¹.

SPECIMEN EXAMINED:

1 (270 mm.).

San Diego Bay.

Eigenmann.

6. PLEURONICHTHYS RITTERI. Starks and Morris

Pleuronichthys canosus (part), Jordan and Gilbert, 1882, Proc. U.S. Nat. Mus., iv, (1881), p. 68; Jordan and Gilbert, 1883, Bull. U.S. Nat. Mus., xvi, p. 830; Jordan and Goss, 1889, Rep. U.S. Com. Fish., xiv, (1886), p. 282; Jordan and Evermann, 1898, Bull. U.S. Nat. Mus., xlvii (3), p. 2038.

Pleuronichthys ritteri, Starks and Morris, 1907, Univ. Calif. Pub. Zool., iii (11), p. 243, pl. xxi; Starks and Thompson, 1910, Proc. U.S. Nat. Mus., xxxviii, p. 287; Hulbs, 1916, Univ. Calif. Pub. Zool., xvi (13), p. 169; Starks, 1918, Calif. Fish Game, iv (4), p. 12, fig. 93.

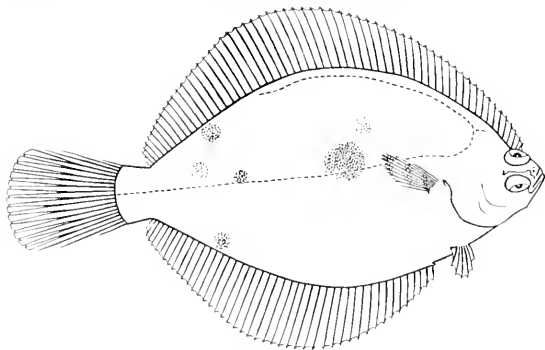


FIG. 246.—*Pleuronichthys ritteri*. B.M. (N.H.) 91.5.19.167. ♂, 3.

Close to *P. canosus*. Depth of body nearly twice in the length, length of head $4\frac{1}{4}$ to $4\frac{1}{2}$. Upper eye level with or a little behind lower, entering dorsal profile of head, which is distinctly concave; diameter of eye $3\frac{1}{4}$ to nearly 4 in length of head;

¹ Perhaps ranging northward.

interorbital ridge lower, with two prominences at the anterior end, of which the lower is smaller; usually a low, blunt spine on the posterior end, directed backwards and a little downwards; sometimes 2 or 3 small prominences round upper eye. Maxillary extending to below anterior edge of eye, length on ocular side about 4, on blind side $3\frac{2}{3}$ in that of head; lower jaw $2\frac{2}{3}$ to $2\frac{3}{4}$ in head. 10 or 11 gill-rakers on lower part of anterior arch. 79 to 85 scales in lateral line. Dorsal (61) 68-69; highest rays $\frac{2}{3}$ to $\frac{3}{4}$ length of head. Anal 45-49. Pectoral of ocular side with 10 rays (7 branched), length $1\frac{1}{2}$ to twice in that of head. Pelvic fin of ocular side rather more behind that of blind side than in *P. canosus*. Caudal peduncle $1\frac{2}{3}$ to $1\frac{3}{4}$ times deeper than long. Brownish, with irregular and indistinct darker shades; generally a small black spot on lateral line at or just behind middle of body, and a pair of well-marked spots below the posterior parts of the dorsal and anal fins; median fins coloured as in *P. canosus*; young with a series of pale spots at upper and lower edges of body.

TYPE.—Not traced.

DISTRIBUTION.—Bering Sea (?); coast of California, from San Pedro to Lower California.

SPECIMENS EXAMINED:

1 (260 mm.).	San Diego Bay.	Eigenmann.
2 (130, 132 mm.).	"	U.S. Nat. Mus.

Attains to a length of about 12 inches.

The following young specimen agrees very closely with the above and may belong to this species:

Depth of body twice in the length, length of head $4\frac{1}{3}$. Upper eye a little in advance of lower, entering dorsal profile, which is concave; two blunt prominences at anterior end of interorbital ridge, none posteriorly. Length of maxillary on ocular side $3\frac{2}{3}$, on blind side $3\frac{1}{2}$ in that of head; lower jaw $2\frac{2}{3}$ in head. 10 gill-rakers on lower part of anterior arch. 78 scales in lateral line. Dorsal 62. Anal 44. Length of pectoral $1\frac{1}{2}$ in that of head.

1 (110 mm.).	Bering Sea (54° N., 166° 31' W.).	U.S. Nat. Mus.
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7. *PLEURONICHTHYS OCELLATUS*, Starks and Thompson.

Pleuronichthys ocellatus, Starks and Thompson, 1910, Proc. U.S. Nat. Mus., xxxviii, p. 285, fig. 2.

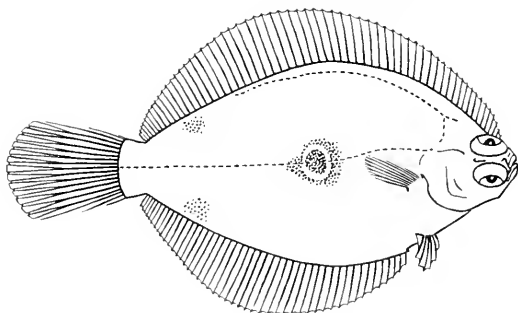


FIG. 241.—*Pleuronichthys ocellatus*. B.M. (N.H.) 1930.9.2. 1b. $\times \frac{1}{2}$.

Close to *P. caninus* and *P. nitens*. Depth of body twice in the length, length of head about 4. Upper eye entering dorsal profile of head, which is distinctly concave; diameter of eye $2\frac{2}{3}$ in length of head, interorbital ridge rather low, with two prominences anteriorly, close together and situated above front part of lower eye; a blunt spine posteriorly, which is rather low and directed straight backwards; two or three very small tubercles round upper eye. Length of maxillary on ocular side $3\frac{1}{4}$, on blind side $3\frac{2}{3}$ in that of head. Lower jaw $2\frac{1}{4}$ in head. 7 to 9 gill-rakers on lower part of anterior arch. About 80 scales in lateral line. Dorsal (61) 60 (72); highest rays $1\frac{1}{2}$ in length of head. Anal (44) 49. Pectoral of ocular side with 9 rays (5 or 6 branched), length $1\frac{2}{3}$ in that of head. Caudal peduncle $2\frac{1}{2}$ times as deep as long. Intestine rather elongate and well coiled. Pale brownish; a prominent dark spot ocellated with white in centre of lateral line; a pair of similar but very inconspicuous spots below posterior parts of dorsal and anal fins; body with some indefinite white spots of irregular size.

TYPE.—United States National Museum, No. 74605.

DISTRIBUTION.—Northern end of Gulf of California, in deep water.

SPECIMEN EXAMINED.

1 (132 mm). Paratype. Gulf of California. Stanford Univ.

Genus 14. ISOPSETTA

Isopsetta. (Lockington: Jordan and Gilbert, 1882, Bull. U.S. Nat. Mus., xvi, p. 832 [*Lepidopsetta isolepis*, Lockington]; Jordan and Evermann, 1898, Bull. U.S. Nat. Mus., xlvii (3), p. 2642.)

Body elliptical, strongly compressed. Eyes on the right side, rather small, separated by a rather narrow, flat, scaled space, the upper close to edge of head. Olfactory laminae rather few in number, parallel, without rachis. Mouth of moderate size, the length of the maxillary on blind side less than $\frac{1}{2}$ that of head, jaws and dentition stronger on blind side of head, teeth small, conical, fairly close-set, scarcely enlarged anteriorly, chiefly uniserial in both jaws, vomer toothless. Gill-rakers rather short, few in number, lower pharyngeals narrow, slender, scarcely approximated anteriorly, their inner edges evenly curved, each with two irregular rows of obtusely conical teeth. Dorsal fin commencing just behind posterior nostril of blind side and above anterior edge of eye, all the rays simple, scaled on both sides. Tip of first interhemal spine projecting in front of anal fin. Pectoral fin of ocular side larger than that of blind side, middle rays branched. Pelvic fins short-based, subequal and subsymmetrical. Caudal fin with the middle rays longest; caudal peduncle short. Scales small, adherent, closely imbricated, strongly ctenoid on ocular side, ctenoid or cycloid on blind side, no supplementary scales. Lateral line with a low curve above the pectoral fin; a supratergital branch present, with long posterior prolongation. Vent median, between the pelvic fins, intestine with about 2 simple coils, 3 + 1 rather long pyloric appendages. Vertebrae 42 (10 + 32).

A single species from the Pacific coast of North America.

1. ISOPSETTA ISOLEPIS (Lockington).

Lepidopsetta umbrosa (non Girard), Lockington, 1886, Proc. U.S. Nat. Mus., ii, (1876), p. 199.

Lepidopsetta isolepis, Lockington, 1881, Proc. U.S. Nat. Mus., iii, (1886), p. 325.

Paraphryx isolepis, Jordan and Gilbert, 1881, *loc. cit.*, p. 453; Jordan and Gilbert, 1882, Bull. U.S. Nat. Mus., xvi, p. 832; Jordan, 1884, Nat. Hist. Aquat. Annu. (Fisheries Fish. Indust. U.S.), p. 186.

Isopsetta isolepis, Jordan, 1887, Rep. U.S. Com. Fish., xiii, (1885), p. 923; Jordan and Goss, 1889, Rep. U.S. Com. Fish., xiv, (1886), p. 285; Jordan and Evermann, 1898, Bull. U.S. Nat. Mus., xlvii (3), p. 204; Starks, 1911, Ann. Carnegie Mus., vii, p. 204; Starks, 1918, Calif. Fish Game, iv (4), p. 14, fig. 96.

Depth of body $2\frac{2}{3}$ to $2\frac{3}{4}$ in the length, length of head $3\frac{1}{2}$ to 4. Snout about as long as eye, diameter of which is $4\frac{2}{3}$ to $5\frac{2}{3}$ in length of head and $2\frac{3}{4}$ to 4 times interorbital width; lower eye scarcely in advance of upper; post-ocular ridge not apparent. Maxillary extending to below anterior edge or anterior part of eye, length on ocular side about 4, on blind side $3\frac{1}{4}$ to $3\frac{3}{8}$ in that of head; lower jaw a little projecting, $2\frac{2}{3}$ to $2\frac{3}{8}$ in head, dental formula $\frac{9-14+17-25}{11-10+21-23}$; 7 or 8 gill-rakers on lower part of anterior arch. 85 to 88 scales in lateral line, 24 to 28 between lateral line and middle of back. Posterior prolongation of supratemporal branch of lateral line extending to below twenty-first to twenty-eighth rays of dorsal fin. Dorsal 82-91;

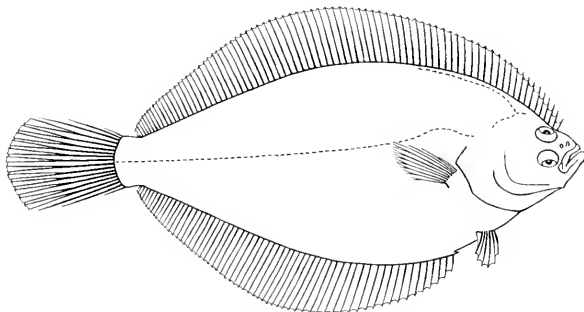


FIG. 242.—*Isopsetta isolepis*. B.M. (N.H.) 90.11.15.253. $\times \frac{1}{2}$.

highest rays about $\frac{1}{2}$ length of head. Anal 62-68. Pectoral of ocular side with 11 to 13 rays (6 to 10 branched), length $1\frac{1}{2}$ to $1\frac{2}{3}$ in that of head. Pelvics with 6 rays. Caudal with 18 rays (12 branched), rounded or double-truncate; caudal peduncle 2 to $2\frac{1}{2}$ times as deep as long. Pale brownish, sometimes mottled or blotched with darker.

TYPE.—United States National Museum (co-types). No. 27116.

DISTRIBUTION.—Pacific coast of North America, from Puget Sound to southern California.

SPECIMENS EXAMINED:

1 (188 mm.).	Puget Sound.	U.S. Nat. Mus.
1 (203 ").	San Francisco, Cal.	" "
3 (235-285 mm.).	Pt. Reyes, Cal.	Eigenniann.

This species grows to a length of about 15 inches and occurs in rather deep water. In general appearance it bears a marked resemblance to *Psettichthys melanostictus*, and it should perhaps be placed near that genus. The small, asymmetrical mouth and blunt teeth, however, indicate relationship with the Flounders.

Genus 15 PAROPHRYS.

Parophrys, Girard, 1850, Proc. Acad. Nat. Sci. Philad., vii, (1854), p. 139 [*Parophrys vetula*, Girard], Jordan and Evermann, 1898, Bull. U. S. Nat. Mus., xlvii (3), p. 2649.

Body rather elongate, compressed, head pointed. Eyes on the right side, large, separated by a somewhat high, narrow ridge, with a few scales, upper eye situated on top of head, with an almost vertical range. Olfactory laminae rather few in number, parallel, without rachis. Mouth rather small, the length of the maxillary on blind side less than $\frac{1}{3}$ length of head, jaws and dentition much stronger on blind side of head; teeth small, compressed and incisor-like, close-set, not enlarged anteriorly, uniserial in both jaws, vomer toothless. Gill-rakers rather short, few in number; lower pharyngeals narrow, moderately slender, a little approximated anteriorly, their inner edges somewhat angular, each with two widely separated rows of narrow, obtusely conical teeth, posterior teeth of inner row smaller and more close-set than the remainder. Dorsal fin commencing well behind posterior nostril of blind side and above eye, all the rays simple, not scaled. Tip of first interhaemal spine projecting in front of anal fin. Pectoral fin of ocular side a little larger than that of blind side; middle rays branched. Pelvic fins short-based, subequal and subsymmetrical. Caudal fin with the outer rays a little produced in adults, caudal peduncle of moderate length. Scales very small, adherent, more or less imbricated, mostly cycloid on both sides of body, no supplementary scales. Lateral line with a very low curve above the pectoral fin, a supratemporal branch present, with long posterior prolongation. Vent nearly median, between the pelvic fins, intestine with about two simple coils, 3 - 1 rather short pyloric appendages. Vertebrae 44 (11 + 33).

A single species from the Pacific coast of North America.

1 PAROPHRYS VETULA, Girard

["SOLE"; "CALIFORNIA SOLE".]

Parophrys vetula, Girard, 1850, Proc. Acad. Nat. Sci. Philad., vii, (1854), p. 140. Girard, 1858, U. S. Pacif. R.R. Surv., x, Fishes, p. 153; Gunther, 1862, Cat. Fish., iv, p. 455; Lockington, 1860, Proc. U. S. Nat. Mus., ii, (1879), p. 100. Jordan and Gilbert, 1881, Proc. U. S. Nat. Mus., iii, (1880), p. 453; Jordan and Gilbert, 1882, Proc. U. S. Nat. Mus., iv, (1881), p. 68; Jordan, 1884, Nat. Hist. Aquat. Anim. (Fisheries Fish. Indust. U. S.), i, p. 185; Jordan and Goss, 1889, Rep. U. S. Com. Fish., xiv, (1886), p. 284. Jordan and Evermann, 1898, Bull. U. S. Nat. Mus., xlvii (3), p. 2649; Starks and Morris, 1907, Univ. Calif. Pub. Zool., iii (11), p. 245; Evermann and Goldsborough, 1907, Bull. U. S. Bur. Fish., xxvi, (1906), p. 353; Starks, 1911, Ann. Carnegie Mus., vii, p. 204; Starks, 1918, Calif. Fish Game, iv (4), p. 3; fig. 95.

Pleuronectes digrammus, Gunther, 1862, Cat. Fish., iv, p. 445.

Parophrys hubbardi, Gill, 1863, Proc. Acad. Nat. Sci. Philad., xiv, (1862), p. 281.

Pleuronectes vetulus, Jordan and Gilbert, 1883, Bull. U. S. Nat. Mus., xvi, p. 831.

Depth of body $2\frac{1}{2}$ to $2\frac{3}{4}$ in the length, length of head $3\frac{1}{4}$ to $3\frac{3}{4}$. Anterior profile of head concave. Snout somewhat produced, as long as or longer than eye, diameter of which is $4\frac{1}{4}$ to $5\frac{1}{4}$ in length of head, lower eye a little in advance of upper, postocular ridge scarcely apparent. Maxillary extending to below anterior edge of eye or a little beyond, length on ocular side $4\frac{1}{4}$ to $4\frac{1}{2}$, on blind side $3\frac{3}{4}$ to $3\frac{1}{2}$ in that of head, lower jaw projecting, $2\frac{1}{2}$ to 3 in head, dental formula $\begin{matrix} 6-10 + 35-58 \\ 2-6 + 30-48 \end{matrix}$ 11 or 12 gill-rakers on lower part of anterior arch. Scales mostly cycloid, some of those on head and parts of body on ocular side with 2 or 3 spinules; 96 to 105 in a longitudinal series above lateral line. Posterior prolongation of supratemporal branch of lateral line extending to below twenty-second to thirty-first rays of dorsal fin. Dorsal 74-86, origin a little on blind side of head and above middle of eye, highest rays $2\frac{2}{3}$ to $2\frac{3}{4}$ in length of head. Anal 54-66. Pectoral of ocular side with 11 or 12 rays

(9 or 10 branched), length $1\frac{2}{3}$ to $2\frac{1}{2}$ in that of head. Pelvics with 6 rays. Caudal with 18 rays (12 branched), truncate or double-truncate in young, outer rays a little produced in adults; caudal peduncle as long as deep or a little longer than deep. Pale brownish or olivaceous; young irregularly spotted and mottled with blackish, and sometimes with a row of white spots at upper and lower edges of body.

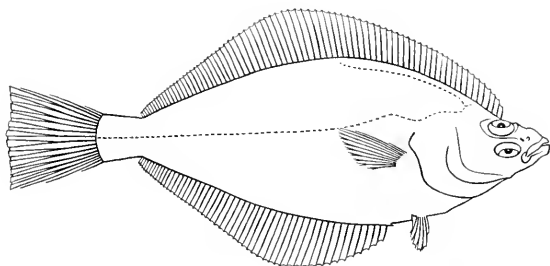


FIG. 243.—*Parophrys vetula*. B.M. (N.H.) 90.11.15.273. $\frac{1}{2}$.

TYPE.—Not traced.

DISTRIBUTION.—Pacific coast of North America, from Sitka to Santa Barbara.

SPECIMENS EXAMINED:

2 (170, 205 mm.), skins.	Types of	Victoria Harbour,	Russell.
	<i>Pleuronectes diagrammus</i> .	Vancouver Isd.	
7 (185-290 mm.).		Nanaimo, B.C.	Clemens.
1 (208 mm.).		Puget Sound.	U.S. Nat. Mus.
3 (116-138 mm.).		"	Jordan.
2 (98, 115 ,,).		Near Seattle.	U.S. Nat. Mus.
1 (77 mm.).		California.	Wright.
3 (150-165 mm.).		"	Ayres.
3 (325-410 ,,).		Pt. Reyes, Cal.	Eigenmann.

Attains to a length of about 18 inches.

Genus 16. LEPIDOPSETTA.

Lepidopsetta, Gill, 1864, Proc. Acad. Nat. Sci. Philad., xvi, p. 195 [*Platichthys umbrosus*, Girard]; Jordan and Evermann, 1898, Bull. U.S. Nat. Mus., xlvii (3), p. 2642.

Very close to *Limanda*, but supratermporal branch of lateral line with a posterior prolongation of moderate length.

Two species from the North Pacific.

SYNOPSIS OF THE SPECIES.

- I. Depth 2 to $2\frac{1}{2}$ in length; upper profile of head more or less concave; mucous pores on head scarcely apparent; 70 to 82 scales above lateral line
- II. Depth $1\frac{1}{2}$ to nearly twice in length; upper profile of head nearly straight; mucous pores on head prominent; 86 to 90 scales above lateral line

1. *bilineata*

2. *mochigarei*.

1. LEPIDOPSETTA BILINEATA (Ayres)

Platessa bilineata, Ayres, 1854, Proc. Acad. N.S. Calif., i, p. 40.

Platichthys umbrosus, Girard, 1857, Proc. Acad. Nat. Sci. Philad., viii, (1856), p. 70; Girard, 1858, U.S. Pacif. R.R. Surv., v, Fishes, p. 140.

Pleuronectes bilineatus, Günther, 1862, Cat. Fish., iv, p. 441; Jordan and Gilbert, 1883, Bull. U.S. Nat. Mus., xvi, p. 833.

Pleuronectes umbrosus, Günther, 1862, Cat. Fish., iv, p. 454.

Lepidopsetta umbrosa, Gill, 1864, Proc. Acad. Nat. Sci. Philad., xvi, p. 190.

Lepidopsetta bilineata, Gill, 1864, *tom. cit.*, p. 190; Lockington, 1880, Proc. U.S. Nat. Mus., ii, (1879), p. 193; Jordan and Gilbert, 1881, Proc. U.S. Nat. Mus., iii (1880), p. 453; Jordan and Gilbert, 1882, Proc. U.S. Nat. Mus., iv, (1881), p. 68; Bean, 1882, *tom. cit.*, p. 241; Bean, 1884, Proc. U.S. Nat. Mus., vi, (1883), p. 353; Jordan, 1884, Nat. Hist. Aquat. Anim., (Fisheries Fish. Indust. U.S.), i, p. 185, pl. 1; Jordan and Goss, 1889, Rep. U.S. Com. Fish., xiv, (1886), p. 280, pl. 3, fig. 11; Jordan and Evermann, 1898, Bull. U.S. Nat. Mus., xlvii (5), p. 2643, pl. cclxxxvi, figs. 927, 928; Evermann and Goldsborough, 1907, Bull. U.S. Bur. Fish., xxvi, (1906), p. 354, fig. 137; Starks, 1911, Ann. Carnegie Mus., vii, p. 294; Jordan, Tanaka and Snyder, 1913, J. Coll. Sci. Tokyo, xxxiii (1), p. 325, fig. 274; Gilbert, 1915, Proc. U.S. Nat. Mus., xlviii, p. 379; Hubbs, 1915, Proc. U.S. Nat. Mus., xlviii, p. 476; Starks, 1918, Calif. Fish Game, iv (1), p. 14, fig. 97; Villalobos, 1927, Ann. Carnegie Mus., xvii, p. 396, pl. xxxv, fig. 2; Soldatov and Lundberg, 1930, Bull. Pac. Sci. Fish. Inst., v, p. 309.

Pleuronectes perracatus, Cope, 1873, Proc. Amer. Phil. Soc., xii, p. 32.

Lepidopsetta bilineata (part), Schmidt, 1904, Pisc. Mar. Orient., p. 232.

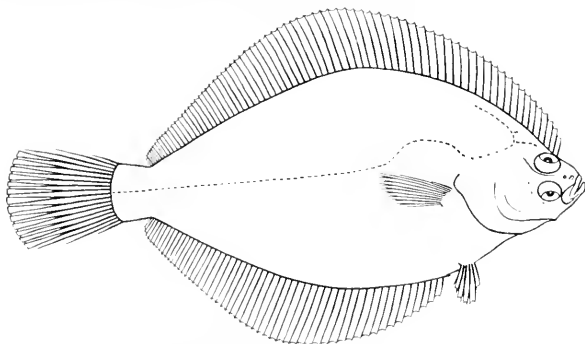


FIG. 244. *Lepidopsetta bilineata*. B.M. (N.H.) 95. 10. 28. 108. 4.

Depth of body 2 to 2½ in length, length of head 3½ to nearly 4. Upper profile of head more or less concave. Snout as long as or shorter than eye, diameter of which is 4 to 5½ in length of head, lower eye a little in advance of upper, which is very close to or touches edge of head; interorbital ridge rather high, narrow, covered with rough tuberculate scales; postocular ridge scarcely apparent. Maxillary extending to below anterior part of eye, length on ocular side 3½ to 4½, on blind side 3½ to 3¾ in that of head; lower jaw rather prominent, 2⅔ to 2½ in head. Teeth obtusely conical or with the tips truncated, rather close-set, dental formula $\begin{matrix} 2-8+15-24 \\ 3-13+17-32 \end{matrix}$. Gill-rakers short, stout, 5 to 8 on lower part of anterior arch. Scales varying from cycloid to roughly tuberculate on ocular side, nearly all cycloid on blind side; scales

on ocular side of head nearly always rough; in some specimens these tuberculate scales extend on to anterior part of body or even farther back; 70 to 82 scales in a longitudinal series above lateral line, 27 to 34 between lateral line and middle of back. Lateral line with a distinct curve above the pectoral fin; posterior prolongation of supratemporal branch extending to below fourteenth to eighteenth rays of dorsal fin; mucous pores on head scarcely apparent. Dorsal 68-81; origin above anterior edge or anterior part of eye; all the rays simple, scaled on ocular side; highest rays a little less than $\frac{1}{2}$ length of head. Anal 52-63. Pectoral of ocular side with 10 to 12 rays (8 to 10 branched), length $1\frac{2}{3}$ to twice in that of head. Pelvics with 6 rays. Caudal with 19 rays (13 branched), rounded or double-truncate; caudal peduncle $1\frac{1}{4}$ to $1\frac{1}{2}$ times as deep as long. Vertebrae 40 (11 + 29). Yellowish brown or olivaceous, sometimes greyish or blackish, with or without irregular darker spots and blotches; sometimes numerous round pale spots of varying size; median fins with darker spots and blotches, sometimes vertically elongated to form short bars.

TYPE.—Not traced.

DISTRIBUTION.—Pacific coast of North America, from Bering Strait to Monterey and San Nicolas Island; Bering Sea; Okhotsk Sea.

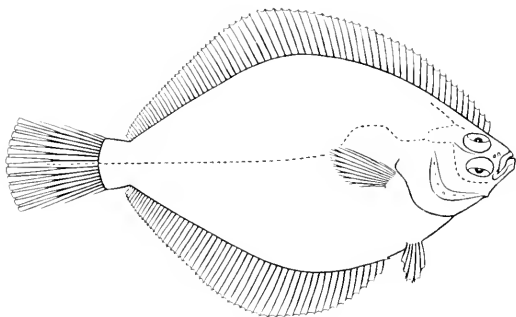
SPECIMENS EXAMINED:

1 (122 mm.).	Pt. Mulgrave, Yakutat Bay, Alaska.	U.S. Nat. Mus.
3 (104-385 mm.).	South of Alaska (54° 14' N., 164° 06' W.).	"
7 (235-350 ,,).	Nanaimo, B.C.	Clemens.
3 (150-290 ,,), skins.	Esquimalt Harbour, Vancouver Isd.	Russell.
3 (147-205 ,,).	Puget Sound.	Jordan.
1 (260 mm.).	San Francisco, Cal.	Eigenmann.
3 (200-312 mm.).	Pt. Reyes, Cal.	"
2 (100, 150 ,,).	Lucia Isd., Cal.	U.S. Nat. Mus.
1 (330 mm.).	Monterey, Cal.	"

Attains to a length of 20 inches and a weight of 5 or 6 pounds.

It seems probable that statistical investigation of a large series of specimens of this species will reveal the existence of two, or even three, distinct races or subspecies. Jordan and Evermann note that "specimens from Puget Sound and northward are rougher than southern specimens and constitute a slight geographical variety for which the name *Lepidopsetta bilineata umbrosa* may be used". Starks (1911) has also drawn attention to the marked differences between examples from Puget Sound and those from California. I find that Puget Sound specimens are very rough, having strongly ctenoid or tuberculate scales all over the ocular side of the head and body, but that examples from Alaska and Nanaimo are either intermediate in roughness between those from Puget Sound and California, or approximate closely to the latter. In addition to the rough squamation, Puget Sound specimens have a smaller head, generally fewer and larger scales on cheek on blind side, somewhat fewer teeth, and an average lower number of dorsal and anal rays (var. *umbrosa*). The measurements, etc., of specimens in the British Museum are shown in the subjoined table.

Locality.	Monterey (1).	Pt Reyes (3).	San Francisco (1).	Puget Sound (3).	Nanaimo (7).	S of Alaska (2).
Total length	330 mm.	260-312 mm.	260 mm.	147-245 mm.	235-350 mm.	228-385 mm.
Depth of body	2 $\frac{1}{2}$	2 to 2 $\frac{1}{2}$	2 $\frac{1}{2}$	2 $\frac{1}{2}$	2 to 2 $\frac{1}{2}$	2 $\frac{1}{2}$ to 2 $\frac{3}{4}$
Length of head	3 $\frac{1}{2}$	3 $\frac{1}{2}$ to 3 $\frac{3}{4}$	3 $\frac{1}{2}$	3 $\frac{1}{2}$ to 3 $\frac{3}{4}$	3 $\frac{1}{2}$ to 3 $\frac{3}{4}$	3 $\frac{3}{4}$
Diameter of eye	5 $\frac{1}{2}$	4 $\frac{3}{4}$ to 5	4 $\frac{1}{2}$	4 $\frac{1}{2}$ to 5	5 to 5 $\frac{1}{2}$	4 to 5 $\frac{1}{2}$
Gill-rakers	5	5 or 6	5	6 to 8	5 to 8	7
Dental formula	22+7 32+10	20-22 + 6-8 26-28 + 12-13	23+8	15-17 + 3-5 15-16 + 2-5	18-23 + 4-8 19-25 + 3-7	20-24 + 2-4 19-26 + 4-6
Dorsal rays	81	78-79	78	68-72	68-77	73-79
Anal rays	61	58-61	59	52-55	53-63	57-60
Length of pectoral	2	1 to 2 $\frac{1}{2}$	2	1 $\frac{1}{2}$ to 1 $\frac{3}{4}$	1 $\frac{1}{2}$ to 2	2

2. *LEPIDOPSETTA MOCHIGAREI*, Snyder.*Lepidopsetta bilineata* (part), Schmidt, 1904, *Pisc. Mar. Orient.*, p. 232.*Lepidopsetta mochigarei*, Snyder, 1911, *Proc. U.S. Nat. Mus.*, xi, p. 547; Snyder, 1912, *Proc. U.S. Nat. Mus.*, xlii, p. 440, pl. lvm, fig. 2; Jordan, Tanaka and Snyder, 1913, *J. Coll. Sci. Tokyo*, xxxiii (1), p. 326; Hubbs, 1915, *Proc. U.S. Nat. Mus.*, xlviii, p. 476; Tanaka, 1917, *Fish. Japan*, xsv, p. 450, pl. cxmii, fig. 352; Hubbs, 1918, *Annot. Zool. Japon.*, ix, p. 376; Jordan and Hubbs, 1925, *Mem. Carnegie Mus.*, x, p. 299; Soldatov and Lundberg, 1935, *Bull. Pac. Sci. Fish. Inst.*, v, p. 400.FIG. 245. *Lepidopsetta mochigarei*. B.M. (N.H.) 1927, 9, 28, 24. 1/2.

Close to the preceding species, but depth of body $1\frac{1}{2}$ to nearly twice in the length, upper profile of head nearly straight. Snout blunter, shorter than eye, diameter of which is $\frac{1}{4}$ to $\frac{1}{3}$ in length of head, interorbital ridge a little narrower. Teeth bluntly conical, dental formula $\frac{6-12 + 24-25}{11 + 27}$. Scales mostly cycloid on both sides of body, a number of ctenoid or tuberculate scales on ocular side of head and a few scattered ones on anterior part of body, 86 to 96 scales in longitudinal series above lateral line, 41 to 46 between lateral line and middle of back. Posterior prolongation of supratergoporal branch of lateral line extending to below tenth ray of dorsal fin. Mucous pores on head prominent. Dorsal 71-74 (80). Anal (57) 58 (61). Uniformly brownish.

TYPE - United States National Museum. No. 68245.

DISTRIBUTION - Gulf of Tartary and southern Sakhalin, southwards through the Sea of Japan to Corea.

SPECIMENS EXAMINED:

2 (255, 309 mm.)

1 (270 mm.)

1 (128 ")

Tokyo Market

Sea of Japan, off Tappan Prov.

Yensan, Corea

Tokyo Imp. Univ.

Berg "

Berg "

Genus 17. LIMANDA.

Limanda, Gotsche, 1835, Arch. Naturgesch., i (2), p. 136 [*Pleuronectes limanda*, Linnaeus].
Myzopsella, Gill, 1864, Proc. Acad. Nat. Sci. Philad., xvi, p. 217 [*Platessa ferruginea*, Storer].

Body ovate, compressed. Eyes on the right side, separated by a narrow ridge, which may be naked or scaled, the upper close to edge of head; postocular ridge, if present, rugose; snout and eye-balls not scaled. Olfactory laminae in moderate number, parallel, without rachis. Mouth of moderate size, the length of the maxillary on blind side less than $\frac{1}{2}$ that of head; jaws and dentition stronger on blind side of head, but at least 6 teeth on ocular side of both jaws; teeth bluntly conical, lanceolate or with truncated tips, usually not much compressed, not forming a continuous cutting edge; not enlarged anteriorly, uniserial in both jaws; vomer toothless. Gill-rakers few in number; lower pharyngeals narrow, their width $4\frac{2}{3}$ to 7 in the length, slender, scarcely or not much approximated anteriorly, their inner edges evenly curved, each with two widely separated rows of conical teeth. Dorsal fin with less than 85 rays, commencing behind posterior nostril of blind side and above eye; all the rays simple, some of them scaled, at least on ocular side. Tip of first inter-haemal spine projecting in front of anal fin, which has less than 65 rays. Pectoral fin of ocular side usually larger than that of blind side; middle rays branched. Pelvic fins short-based, subequal and subsymmetrical. Caudal fin with 11 or 12 branched rays, middle rays longest; caudal peduncle short or of moderate length. Scales small, adherent, imbricated (at least anteriorly), ctenoid or cycloid; spinules, if present, short, usually not numerous; no supplementary scales. Lateral line with a distinct and rather high curve above the pectoral fin; supratemporal branch, if present, without posterior prolongation. Vent median or a little on blind side, between the pelvic fins; intestine not very narrow, of moderate length, usually with 2 or 3 coils, nearly entirely contained within body-cavity of blind side; 3 + 1 pyloric appendages, of moderate length or rather elongate. Vertebrae 40 to 41 (10-11 + 29-30).

Five or six species from the North Atlantic and North Pacific.

SYNOPSIS OF THE SPECIES.

- I. Head $3\frac{2}{3}$ to $4\frac{1}{2}$ in length; eye $3\frac{1}{2}$ to $5\frac{1}{3}$ in head; maxillary on ocular side $3\frac{1}{2}$ to $3\frac{2}{3}$ in head.
- A. No distinct rugose postocular ridge; lateral line with short supratemporal branch; 73 to 90 scales in lateral line; 6 to 10 gill-rakers on lower part of anterior arch; no yellow streaks at edges of body on blind side.
1. 31 to 38 scales between lateral line and middle of back 1. *limanda*.
2. 25 to 31 scales between lateral line and middle of back.
- a. Depth 2 to $2\frac{1}{2}$ in length; upper jaw on ocular side more or less arched; scales on ocular side of body mostly with a single (sometimes 2 or 3) spinule 2. *aspera*.
- b. Depth $2\frac{1}{2}$ to $2\frac{3}{4}$ in length; upper jaw on ocular side nearly straight; scales on ocular side of body with a row of 3 to 10 rather feeble spinules 3. *sakhalinensis*.
- B. A distinct rugose postocular ridge; lateral line without supratemporal branch; 88 to 95 scales in lateral line; 10 to 12 gill-rakers on lower part of anterior arch; yellow streaks at edges of body on blind side 4. *ferruginea*.
- II. Head 3 to $3\frac{1}{2}$ in length; eye $5\frac{1}{3}$ to $6\frac{1}{2}$ in head; maxillary on ocular side $3\frac{2}{3}$ to $4\frac{1}{4}$ in head; a distinct rugose postocular ridge; lateral line without supratemporal branch; yellow streaks at edges of body on blind side.
- A. 65 scales in lateral line; maxillary on ocular side $3\frac{2}{3}$ to 4 in head; pectoral with 8 to 10 rays; fine dark streaks along series of scales 5. *punctatissima*.
- B. 95 scales in lateral line; maxillary on ocular side $4\frac{1}{4}$ in head; pectoral with 12 rays; no dark streaks along series of scales 6. *proboscidea*.

1. LIMANDA LIMANDA (Linnaeus).

[DAB.]

- Pleuronectes limanda*, Linnaeus, 1758, Syst. Nat., ed. 10, p. 270; 1760, ed. 12, p. 457; Bloch, 1783, Naturgesch. Fische Deutsch., II, p. 45, pl. xlvi, Lacepède, 1802, Hist. Nat. Poiss., IV, p. 621; Shaw, 1803, Gen. Zool., IV (2), p. 298; Quensel, 1806, Vet. Akad. Handl., xxvii, pp. 54, 220; Nilsson, 1832, Prodr. Ichth. Scand., p. 56; Nilsson, 1855, Skand. Faun., ed. 2, Fiskar., p. 627; Gunther, 1862, Cat. Fish., IV, p. 440; Collett, 1875, Vid.-Selsk. Forh., (1874), Till p. 140; Malm, 1877, Göteborgs Bohus. Fauna, p. 525; Day, 1880-4, Fish. Britain, II, p. 31, pl. civ; Gunther, 1888, Proc. Roy. Soc. Edinb., xv, p. 219; Lilljeborg, 1891, Sverig. Norg. Fiskar., II, p. 394; Smitth, 1893, Scand. Fish., I, p. 386, pl. xx, fig. 3; Collett, 1903, Vid.-Selsk. Forh., (1902), p. 98; Hock, 1903, Pub. Circ. Cons. Explor. Mer., III, p. 69, pl. vii; Schnakenbeck, 1925, Tier Nord Ostsee, L. II, XII (1), p. 7, fig. 6; Ehrenbaum, 1929, in Jouin, Faun. Ichth. Atlant. Nord., I (1), fig.
- Pleuronectes limandula*, Bonnaterra, 1788, Lucv. Meth. (Ich.), p. 75; Lacepède, 1802, Hist. Nat. Poiss., IV, pp. 595, 635.
- Platessa limanda*, Cuvier, 1817, R. Anim., II, p. 221; Fleming, 1828, Brit. Anim., p. 198; Yarrell, 1830, Brit. Fish., ed. 1, II, p. 219, fig.; Farnell, 1838, Mem. Werner Soc., VII, p. 365, pl. xxxvii; Yarrell, 1841, Brit. Fish., ed. 2, II, p. 307, fig.; Kroyer, 1843-5, Danmarks Fisk., II, p. 298; Yarrell, 1859, Brit. Fish., ed. 3, I, p. 628, fig.; Malmgren, 1864, Arch. Naturgesch., xxx (1), p. 295.
- Pleuronectes platessoides*, Faber, 1820, Natur. Fische Islands, p. 140.
- Limanda vulgaris*, Gottsche, 1835, Arch. Naturgesch., I (2), p. 160; Moreau, 1881, Hist. Nat. Poiss. France, III, p. 289.
- Limanda oceanica*, Bonaparte, 1849, Cat. method. Pesci Europ., p. 48; Bemmelen, 1866, in Herklots, Bouw. Faun. Nederland, III, p. 328.
- ? *Limanda pontica*, Bonaparte, 1849, Cat. method. Pesci Europ., p. 48.
- Pleuronectes linguatula*, Gray, 1854, Cat. Fish. Gronow, p. 88.
- Limanda limanda*, Jordan and Goss, 1889, Rep. U.S. Com. Fish., XIV, (1880), p. 288; Kurovich, 1926, Trans. Inst. Sci. Explor. North, xxvii, p. 142, fig. 107; Chabanaud, 1930, Bull. Mus. Hist. nat. Paris, (2) II, p. 627.
- Pleuronectes (Limanda) limanda*, Danois, 1913, Ann. Inst. oceanogr. Paris, V (5), p. 100, fig. 173.

EGGS, LARVAE AND YOUNG.

- Malm, 1868, K. Svensk. Vet. Akad. Handl., N. F., VI (4), p. 16, pl. II, figs. 10, 10a, 10b; Cunningham, 1888, Trans. Roy. Soc. Edinb., xxxiii (1), p. 100, pl. II, figs. 9-11, pl. III, figs. 1-6; McIntosh and Prince, 1890, Trans. Roy. Soc. Edinb., xxxv (3), pp. 791, 837, pl. v, figs. 3, 3a, 11, pl. xvi, figs. 3, 4, 6; Holt, 1893, Sci. Trans. R. Dublin Soc., (2) V, p. 80, pl. XIV, figs. 112-115; Canu, 1893, Ann. Stat. aquic. Bologne, I, p. 128, pl. VIII, figs. 1-4; Petersen, 1894, Rep. Danish Biol. Stat., IV, (1893), p. 126, pl. II, fig. 9; Cunningham, 1896, N.H. Market. Mar. Fish., p. 223; Hensen and Apstein, 1897, Wiss. Meeresuntersuch., Abt. Kiel, II (2), pp. 35, 45, 73, pl. II, figs. 14-17; McIntosh and Masterman, 1897, Brit. Mar. Food-fish., p. 374, figs.; Ehrenbaum, 1897, Wiss. Meeresuntersuch., Abt. Helgoland, II (1), p. 268, pl. III, figs. 1-5; Kyle, 1898, Rep. Fish. Board Scotland, XVI, (1897), p. 225, pl. X; Heineke and Ehrenbaum, 1900, Wiss. Meeresuntersuch., Abt. Helgoland, III, p. 245, pl. IX, figs. 1, 2; Hock, 1903, Publ. Circ. Cons. Explor. Mer., III, p. 73, pl. vii; Ehrenbaum, 1905, in Brandt and Apstein, Nordisches Plankton, I. Eier Larv. Fisch (1), p. 151, fig. 67; Petersen, 1906, Medd. Komm. Havundersog. Kjøb., Ser. Fisk., II (1), p. 4, pl. I, figs. 7-13; Schnakenbeck, 1928, Ber. d. Wiss. Komm. Meeresf., N.F., IV (4), p. 293, pls. 1, II; Ehrenbaum, 1929, in Jouin, Faun. Ichth. Atlant. Nord., II (2), figs.

Depth of body 2 to 2½ in length, length of head ¾ to 1½. Upper profile of head a little concave above eyes. Snout as long as or shorter than eye, diameter of which is ¾ to 5 in length of head; anterior margins of eyes level or lower very slightly in advance of upper. Interorbital ridge low, scaled, ½ to ⅓ diameter of eye. Postocular ridge scarcely apparent. Maxillary extending to below anterior edge or anterior part of eye, length on ocular side ¾ to ¾, on blind side ¾ to ¾ in that of head. Lower jaw a little projecting, 2½ to 2¾ in head. Teeth obtusely conical or lanceolate. Dental formula $\frac{5-13}{0-10} - \frac{15-20}{14-28}$. Gill-rakers rather short and stout. 6 to 10 on lower

¹ Consult for full list of references.

part of anterior arch; width of lower pharyngeals about 5 in length; teeth of inner row stronger than those of outer. Scales scarcely imbricated and partially embedded anteriorly, fairly well unbricated on hinder $\frac{2}{3}$ of body; mostly ctenoid on ocular side, cycloid or somewhat ctenoid on blind side; 73 to 90 scales in a longitudinal series above lateral line, 31 to 38 between lateral line and middle of back. Lateral line with a short supratemporal branch. Dorsal 65-81; origin well behind posterior nostril of blind side, above middle of eye or a little farther forward; most of the rays scaled, at least on ocular side; highest rays rather more than $\frac{1}{2}$ length of head. Anal 50-64. Pectoral of ocular side with 9 to 13 rays (6 to 9 branched); rays more or less scaled; length $1\frac{1}{2}$ to twice in that of head. Pelvics with 6 (occasionally 5 or 7) rays. Caudal with 17 or 18 rays (11 or 12 branched), rounded or double-truncate; caudal peduncle $1\frac{1}{4}$ to $1\frac{1}{2}$ times as deep as long. Intestine with about $2\frac{1}{2}$ simple coils; 3 + 1 rather short pyloric appendages. Vertebræ 40 to 41 (10-11 + 29-30). Brownish or greyish, with or without darker spots or other markings on body and fins; young and immature examples generally with small dark brown spots.

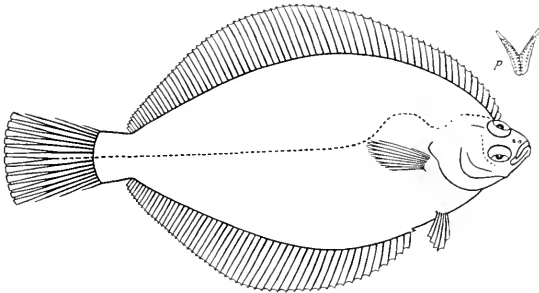


FIG. 246.—*Limanda limanda*. B.M. (N.H.) 1923. 11. 12. 10. $\times \frac{1}{2}$. p., lower pharyngeals.

TYPE.—Not traced.

DISTRIBUTION.—Coasts of north-western Europe, from the Murman Coast and White Sea to the Bay of Biscay; Iceland.

SPECIMENS EXAMINED:

1 (228 mm.).	Baltic.	Mar. Biol. Assoc.
1 (310 ,,), skin.	Firth of Forth.	Parnell Coll.
1 (150 ,,).	„ „ „ „ „ 25 fms.	Murray.
15 (77-250 mm.).	Off Sanda Isd., 30 fms.	„
3 (55-170 ,,).	Between Cumbrae and Wemys Point, 30-40 fms.	„
11 (105-325 mm.).	St. Andrew's Bay.	Fish. Board Scotland.
4 (35-72 mm.).	„ „ „ „ „	„
5 (80-90 ,,).	Blacksod Bay, Co. Mayo.	Grenfell.
2 (115, 133 mm.).	Bantry Bay, 33 fms.	Brunner.
4 (260-280 ,,).	Brighton.	Page.
1 (265 mm.), stuffed.	Plymouth.	Spence.
4 (245-265 mm.).	„ „ „ „ „	Mar. Biol. Assoc.
1 (325 mm.).	British Coast.	Day.
1 (295 ,,), skin.	„ „ „ „ „	Yarrell.
2 (230, 235 mm.).	London Market.	Oliffe.
2 (160, 175 ,,), skins. Types of <i>P. linguatula</i> .	—	Gronow Coll.

		ABNORMALITIES. ¹	
2 (245, 300 mm.)	Partial ambicolorates.	St. Andrew's Bay,	Fish. Board Scotland
2 (225, 230 "	"	E. of Liverpool Bar Lightship, 7 fms.	Jenkins.
1 (220 mm.)	"	N.N.E. of Puffin Isd., 14 fms.	"
2 (210, 216 mm.)	"	N.E. entrance of Menai Straits, 7 fms.	"
1 (140 mm.)	Albino	Great Yarmouth.	Patterson.
1 (160 "	"	Dymchurch, Kent.	Smith.

Attains to a length of about 12 to 15 inches

Day (1885, Proc. Zool. Soc., p. 620, pl. lxii) describes a supposed hybrid *Limanda limanda* × *Platichthys flesus*, 15 inches in length, from a fishmonger's shop in Cheltenham. The specimen was said to have come from Brixham.

Duncker (1892, Zool. Anz., xv, p. 451) describes a hybrid *Pleuronectes platessa* - *Limanda limanda*

2. LIMANDA ASPERA (Pallas)

ALASKA DAB !

Pleuronectes asper, Pallas, 1814, Zoographia, iii, p. 425; Günther, 1862, Cat. Fish., iv, p. 454; Steindachner and Kner, 1870, Sitzber. Akad. Wiss. Wien, lxi, Abt. 1, p. 425; Jordan and Gilbert, 1883, Bull. U.S. Nat. Mus., xvi, p. 835.

Limanda aspera, Bean, 1882, Proc. U.S. Nat. Mus., iv, (1881), p. 242; Bean, 1884, Proc. U.S. Nat. Mus., vi, (1883), p. 354; Jordan, 1884, Nat. Hist. Aquat. Anim. (Fisheries Fish. Indust. U.S.), v, p. 184, pl. xliii; Jordan and Goss, 1889, Rep. U.S. Com. Fish., xiv, (1886), p. 288, pl. v, fig. 13; Jordan and Evermann, 1898, Bull. U.S. Nat. Mus., xliii (3), p. 2645, pl. cccxxvii, fig. 930; Schmidt, 1904, Proc. Mar. Orient., p. 233, fig. 16; Jordan and Starks, 1906, Proc. U.S. Nat. Mus., xxxi, p. 204; Evermann and Goldsborough, 1907, Bull. U.S. Bur. Fish., xxxv, (1906), p. 354, fig. 138; Jordan, Tanaka and Snyder, 1913, J. Coll. Sci. Tokyo, xxxiii (1), p. 328; Soldatov and Lindberg, 1930, Bull. Pac. Sci. Fish. Inst., v, p. 401; Rendahl, 1931, Ark. Zool., xii, No. 18, p. 65.

¹ *Limanda aspera*, Hubbs, 1915, Proc. U.S. Nat. Mus., xlviii, p. 478²

Limanda asprella, Hubbs, 1915, *loc. cit.*, p. 482, pl. xxvii, fig. 7.

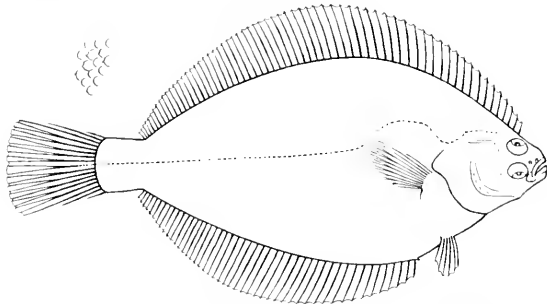


FIG. 247 — *Limanda aspera*. B.M. (N.H.) 1923 11.21.12.

¹ In all the specimens the mouth appears to be more symmetrical than usual. In ambicolorate examples the scales on the pigmented part of the blind side are more crowded than in normal specimens.

² In the examples described by Hubbs the scales are said each to have about 10 spinules.

Close to *L. limanda*. Depth of body 2 to 2½ in the length, length of head 3⅔ to 4. Upper profile of head straight or a little concave above eyes. Diameter of eye 4¼ to 5¼ in length of head; interorbital ridge low or of moderate height, usually scaled. Upper jaw on ocular side more or less arched; maxillary extending to below anterior half of eye, length on ocular side 3½ to 3¾, on blind side 2⅞ to 3¼ in that of head.

Teeth obtusely conical or with truncated tips; dental formula $\frac{7-12}{9-14} + \frac{17-29}{18-25}$ 8 to 10 gill-rakers on lower part of anterior arch. Scales ctenoid or cycloid on ocular side of body, mostly with a single spinule, but some on head and anterior part of body, as well as a few posteriorly, with 2 or 3 spinules; scales of blind side mostly cycloid; 74 to 81 scales in a longitudinal series above lateral line, 25 to 31 between lateral line and middle of back. Dorsal 67-74; origin a little behind posterior nostril of blind side; highest rays ½ or more than ½ length of head. Anal 48-56. Pectoral of ocular side with 10 to 12 rays (6 to 8 branched), length 1½ to 1⅞ in that of head. Caudal rounded; caudal peduncle as long as deep or a little deeper than long. Brownish; young with a number of small dark spots on head and body, disappearing in the adult; median fins uniform, or with small dark spots or streaks.

TYPE.—Zoologisches Museum der Universität, Berlin (?).

DISTRIBUTION.—Bering Sea, southwards to Vancouver Island and Corea.

SPECIMENS EXAMINED:

1 (120 mm.).	Bering Sea (58° 31' N., 157° 13' W.), 3½ fms.	U.S. Nat. Mus.
1 (172 ").	" (58° 23' N., 157° 42' W.), 7½ fms.	" "
1 (160 ").	" (58° 27' N., 157° 52' W.), 5 fms.	" "
1 (210 ").	" (58° 22' N., 159° 23' W.), 11½ fms.	Mus. Comp. Zool.
1 (270 ").	" (58° 30' N., 159° 35' W.), 14½ fms.	U.S. Nat. Mus.
1 (280 ").	Sitka, Alaska.	" "
2 (166, 180 mm.).	Alaska.	" "
1 (203 mm.).	Bering or Okhotsk Sea.	Popov.
1 (174 ").	Petropavlosk, Kamchatka.	U.S. Nat. Mus.
1 (130 ").	" "	Stanford Univ.
1 (200 ").	Decastris Bay. "	Berg.

3. LIMANDA SAKHALINENSIS, Hubbs.

Limanda sakhalinensis, Hubbs, 1915, Proc. U.S. Nat. Mus., xlviii, p. 480, pl. xxvi, fig. 6.

? *Limanda korigarei*, Hubbs, 1915, *loc. cit.*, p. 483, pl. xxvii, fig. 8.

? *Limanda aspera* var. *korigarei*, Rendahl, 1931, Ark. Zool., xxii, No. 18, p. 73.

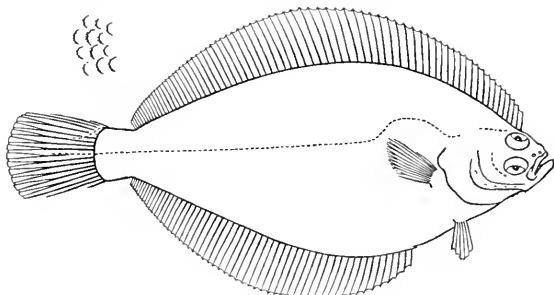


FIG. 248.—*Limanda sakhalinensis*. U.S.N.M. 75674. X 2.

Probably identical with *L. aspera*, but body rather more slender, its depth $2\frac{1}{2}$ in the length, upper jaw of ocular side nearly straight, scales of ocular side, if ctenoid, with a row of from 3 to 10 rather feeble spinules, coloration uniform.

TYPE — United States National Museum No. 75674

DISTRIBUTION — Kamchatka (?); Sakhalin Island

SPECIMEN EXAMINED:

?? ♀ (125 mm.).

Petro-pavlofsk Harbour, Kamchatka

Baden Powell.

Hubbs (1915) describes three new species of *Limanda* from the North Pacific (Sakhalin Island), all closely related to *L. aspera*, but some of the characters used to distinguish these do not appear to be tenable. The form of the scales, number of pores in the suborbital branch of the lateral line, and form of the anterior curve of the lateral line are all very variable. All the examples of *L. aspera* examined by me have ctenoid scales with one, or at the most two or three spinules, so that if Hubbs is correct in describing forms in which the scales have about 10 spinules, there would appear to be a second Pacific species. In one of my specimens of *aspera* the interorbital region is rather high and is not scaled, and the ridges of the head are somewhat prominent (as in *koizigaei*), but in other respects this appears to be a typical *aspera*, and was collected in the Bering Sea. Quite recently, Rendahl (1931, Ark. Zool., xxi, No. 18, p. 65) has discussed the status of these Pacific species of *Limanda* at some length.

4. LIMANDA FERRUGINEA (Storer).

[RUSTY DAB.]

Platessa ferruginea, Storer, 1839, Boston Journ. N.H., ii (3), p. 177; Rep. Ichth. Massach., p. 141, pl. ii; De Kay, 1842, N.H. New York, (Fish.), p. 297, pl. xliii, fig. 155; Storer, 1846, Synopsis Fish. N. Amer., p. 476; Storer, 1867, Hist. Fish. Massach., p. 198, pl. xxx, fig. 4.

Platessa rostrata, Storer, 1850, Boston Journ. N.H., vi (2), p. 268, pl. viii, fig. 2.

Myzopsetta rostrata, Gill, 1864, Proc. Acad. Nat. Sci. Philad., Suppl. (Cat. Fish. F. Coast N. Amer.), p. 51.

Pleuronectes ferrugineus, Gunther, 1862, Cat. Fish., iv, p. 147; Jordan and Gilbert, 1883, Bull. U.S. Nat. Mus., xvi, p. 834.

Myzopsetta ferruginea, Gill, 1864, Proc. Acad. Nat. Sci. Philad., xvi, p. 217.

Limanda rostrata, Gill, 1864, *loc. cit.*, p. 217.

Limanda ferruginea, Goode, 1881, Proc. U.S. Nat. Mus., iii, (1880), p. 472; Goode, 1884, Nat. Hist. Aquat. Anim. (Fisheries Fish. Indust. U.S.), i, pl. xlix; Jordan and Goss, 1889, Rep. U.S. Com. Fish., xiv, (1886), p. 287, pl. iii, fig. 12; Goode and Bean, 1895, Ocean Ichth., p. 427; Jordan and Evermann, 1898, Bull. U.S. Nat. Mus., xlvii (3), p. 2644, pl. cclxxvii, fig. 629; Bean, 1902, Ann. Rep. Forest Fish Game Comm. N.Y., vi, (1901), p. 474; Huntsman, 1922, Contr. Canad. Biol., 1921, No. iii, p. 21; Bigelow and Welsh, 1925, Bull. U.S. Bur. Fish., xl (1), p. 495, figs. 251-4; Nichols and Breder, 1927, Zoologica N.Y., ix, p. 178, fig.; Hildebrand and Schroeder, 1928, Bull. U.S. Bur. Fish., xliii (1), p. 168.

Depth of body $2\frac{1}{2}$ to $2\frac{2}{5}$ in the length, length of head $3\frac{1}{2}$ to 4. Upper profile of head concave above eyes. Snout shorter than eye, diameter of which is $4\frac{1}{2}$ to $5\frac{1}{2}$ in length of head; lower eye very slightly in advance of upper; interorbital ridge very narrow, scaled; postocular ridge not conspicuous, but distinctly rugose. Maxillary extending to below anterior edge or anterior part of eye, length on ocular side $3\frac{1}{2}$, on blind side $3\frac{1}{2}$ in that of head, lower jaw a little projecting, $2\frac{2}{5}$ to $2\frac{1}{2}$ in head. Teeth obtusely conical or with truncated tips, dental formula 11-14 : 39-34. Gill-rakers of moderate length, rather slender, 10 to 12 on lower part of anterior arch; width of lower pharyngeals about 5 in length, a few teeth forming an incomplete series between the two principal rows. Scales all more or less imbricated, nearly all ctenoid on ocular side, cycloid on blind side, 88 to 95 scales in a longitudinal series above lateral line, 36 to 42 between lateral line and middle of back. Lateral line without supratemporal branch. Dorsal 77-85, origin

just behind posterior nostril of blind side and above anterior part of eye; most of the rays scaled, at least on ocular side; highest rays 2 to $2\frac{2}{3}$ in length of head. Anal 58-63. Pectoral of ocular side with 10 to 12 rays (5 to 7 branched); rays not scaled; length 2 to $2\frac{1}{2}$ in that of head. Pelvics with 6 rays. Caudal with 18 rays (12 branched), rounded or double-truncate; caudal peduncle $1\frac{2}{3}$ to $1\frac{3}{4}$ times as deep as long. Intestine with 3 or 4 irregular coils; 3 + 1 rather long pyloric appendages. Reddish brown, generally with numerous darker spots and blotches on body and fins, especially in the young; blind side lemon yellow, with bright yellow areas at upper and lower edges of body.

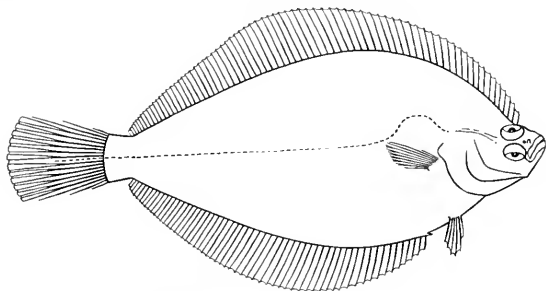


FIG. 249.—*Limanda ferruginea*. B.M. (N.H.) 1923.12.18.1. $\times \frac{1}{4}$.

TYPE.—Not traced.

DISTRIBUTION.—Atlantic coast of North America, from Labrador to New York.

SPECIMENS EXAMINED:

1 (280 mm.).	Halifax, Nova Scotia.	U.S. Nat. Mus.
2 (95, 127 mm.).	Off Cape Ann.	Wright."
1 (360 mm.).	Massachusetts Bay.	Amer. Mus. Nat. Hist.
1 (210 ").	Off New York.	

Goode and Bean have suggested that northern examples may represent a distinct subspecies (*rostrata*), distinguished by the lower number of dorsal and anal rays, and by the blunter, more prominent snout.

5. LIMANDA PUNCTATISSIMA (Steindachner).

Hippoglossoides (Hippoglossina) punctatissima, Steindachner, 1879, SitzBer. Akad. Wiss. Wien, lxxx, Abt. 1, p. 167.

Limanda iridorum, Jordan and Starks, 1906, Proc. U.S. Nat. Mus., xxxi, p. 206, fig. 14; Pavlenko, 1910, Trudui Obshch. Kazan, xlii, p. 57; Snyder, 1912, Proc. U.S. Nat. Mus., xlii, p. 440; Jordan, Tanaka and Snyder, 1913, J. Coll. Sci. Tokyo, xxxiii (1), p. 327, fig. 276; Hubbs, 1915, Proc. U.S. Nat. Mus., xlviii, p. 484; Soldatov and Lindberg, 1930, Bull. Pac. Sci. Fish. Inst., v, p. 403; Schmidt, 1931, C.R. Acad. Sci. Russ., p. 317; Rendahl, 1931, Ark. Zool., xxii, No. 18, p. 73.

Limanda punctatissima, Jordan and Hubbs, 1925, Mem. Carnegie Mus., x, p. 299.

Depth of body 2 to $2\frac{1}{2}$ in the length, length of head 3 to $3\frac{1}{2}$. Snout produced; upper profile of head distinctly notched above anterior margins of eyes. Snout with a prominent projection formed by the ascending processes of the premaxillaries,

longer than eye, diameter of which is $5\frac{1}{4}$ to $6\frac{1}{2}$ in length of head, lower eye a little in advance of upper, interorbital ridge narrow, high, not scaled, postocular ridge forming a broad, irregular rugose area, and a similar rough area following ridge of praeperculum, a rough ridge running along blind side of head from snout to origin of lateral line, ridge of praeperculum a little roughened. Maxillary scarcely extending to below anterior edge of eye, length on ocular side $3\frac{3}{4}$ to 4, on blind side $3\frac{3}{4}$ to $3\frac{5}{8}$ in that of head, lower jaw projecting $2\frac{1}{5}$ to 3 in head. Teeth obtusely conical, dental formula $\frac{14+28}{14+28}$. Gill-rakers rather slender, finely tapering distally, 10 or 11 on lower part of anterior arch, width of lower pharyngeals $5\frac{1}{2}$ in length. Scales more or less embedded anteriorly, fairly well imbricated posteriorly, scales of body cycloid on both sides, some ctenoid scales on ocular side of head, 65 scales in lateral line, 24 to 25 between lateral line and middle of back. Lateral line without distinct supratemporal branch. Dorsal (57) 60-62 (65); origin just behind posterior nostril of blind

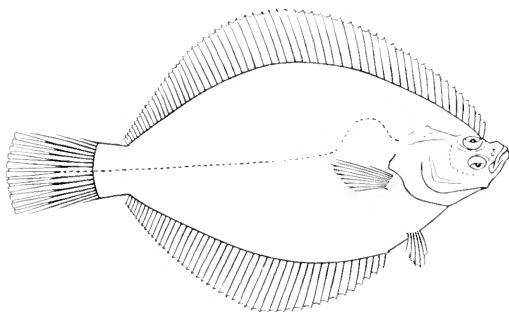


FIG. 250.—*Limanda punctatissima*. B.M. (N.H.) 1923: 9, 28, 17. $\frac{2}{3}$.

side, above anterior edge or a little in front of eye, some of the middle rays scaled on ocular side, highest rays about $2\frac{1}{4}$ in length of head. Anal (42) 45-50. Pectoral of ocular side with 8 to 10 rays (5 or 6 branched), length $1\frac{1}{2}$ to twice in that of head. Pelvics with 6 rays. Caudal with 18 or 19 rays (11 or 12 branched), rounded, caudal peduncle $1\frac{1}{2}$ to $1\frac{3}{4}$ times as deep as long. Intestine with about 2 simple coils; 3 + 1 long pyloric appendages. Greyish brown, speckled with dark brown dots, body with fine dark streaks along the series of scales, fins spotted and speckled with darker.¹

TYPE.—Vienna Museum.

DISTRIBUTION.—Southern Okhotsk Sea, Northern Japan, Sea of Japan, northwards to Corea.

SPECIMENS EXAMINED:

1 (1900 mm.)	Bay of Mitsu, Japan.	Kishinouye.
1 (215 ")	Otari, Japan.	U. S. Nat. Mus.
1 (255 ")	Tokyo Market.	Tokyo Imp. Univ.

¹ "In life a band of bright orange extends along bases of dorsal, caudal and anal on the blind side" (Snyder).

6. LIMANDA PROBOSCIDEA, Gilbert

Limanda proboscidea, Gilbert, 1895, Rep. U.S. Com. Fish., xix, (1893), p. 400, pl. xxxiii; Jordan and Evermann, 1898, Bull. U.S. Nat. Mus., xvii (3), p. 2645, pl. cccclxxviii, p. 931; Schmidt, 1904, Pisc. Mar. Orient., p. 236; Jordan and Starks, 1906, Proc. U.S. Nat. Mus., xxxi, p. 295; Evermann and Goldsborough, 1907, Bull. U.S. Bur. Fish., xxvi, (1906), p. 355, fig. 139; Pavlenko, 1910, Trudui Obshch. Kazan, xlii, p. 57; Jordan, Tanaka and Snyder, 1913, J. Coll. Sci. Tokyo, xxxiii (1), p. 328; Soldatov and Lindberg, 1930, Bull. Pac. Sci. Fish. Inst., v, p. 494. *Limanda punctatissima proboscidea*, Rendahl, 1931, Ark. Zool., xxii, No. 18, p. 73.

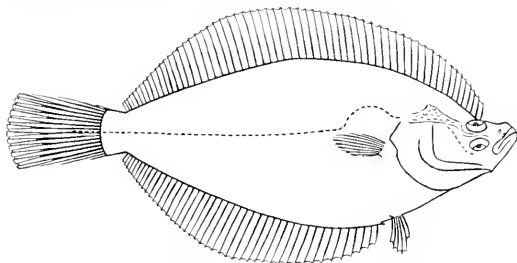


FIG. 251.—*Limanda proboscidea*. M.C.Z. 28220. ♂, ♀.

Depth of body $2\frac{1}{4}$ to $2\frac{1}{2}$ in the length, length of head 3 to $3\frac{1}{2}$. Upper profile of head a little concave above eyes. Snout produced, longer than eye, diameter of which is about $6\frac{1}{2}$ in length of head; lower eye markedly in advance of upper; interorbital ridge narrow, naked or with a single row of scales; postocular ridge with irregular rugose patches; a similar but less developed rough area on blind side of head. Maxillary scarcely extending to below anterior edge of eye, length on ocular side about $4\frac{1}{2}$, on blind side $3\frac{1}{2}$ in that of head; lower jaw a little projecting, about 3 in head. Teeth very small, obtusely conical; dental formula $\frac{15-18}{16-17} + \frac{30-36}{33-37}$. Gill-rakers rather slender, finely pointed distally; 9 or 10 on lower part of anterior arch; width of lower pharyngeals about 7 in length. Scales feebly imbricated and more or less embedded anteriorly, feebly ctenoid or cycloid on ocular side, cycloid on blind side; about 95 scales in lateral line. Lateral line without distinct supratemporal branch. Dorsal (62) 65-69; origin just behind posterior nostril of blind side, above anterior part of eye; some of the middle rays scaled, at least on ocular side, highest rays about $2\frac{1}{2}$ in length of head. Anal 46-50. Pectoral of ocular side with 12 rays (7 branched), length $2\frac{2}{3}$ to nearly 3 in that of head. Pelvics with 6 rays. Caudal with 18 rays (12 branched), a little rounded; caudal peduncle $1\frac{1}{2}$ to $1\frac{3}{4}$ times as deep as long. Intestine with about 2 simple coils; 3 + 1 long pyloric appendages. Pale brownish, thickly covered with small, indistinct whitish spots; some indefinite darker blotches and shades; median fins greyish, with an occasional dark brown ray; blind side lemon yellow, with bright yellow areas at upper and lower edges of body; tips of some of the rays of the median fins bright yellow.

TYPE.—United States National Museum. No. 48620.

DISTRIBUTION.—Bering Sea; Okhotsk Sea; Sakhalin Island; Peter the Great Bay.

SPECIMENS EXAMINED:

1 (145 mm.).	Paratype.	Bering Sea (58° 22' N., 159° 23' W.), 114 fms.	U.S. Nat. Mus.
1 (152 ").		Baikal Bay, Sakhalin.	Popov.

Genus 18. PSEUDOPLEURONECTES.

- Pseudopleuronectes*, Bleeker, 1862, Versl. Akad. Wet. Amsterdam, xiii, p. 428 [*Pleuronectes planius*, Mitchell; Norman, 1933, Ann. Mag. Nat. Hist., (10) xi, p. 220].
Limanda, Jordan and Starks, 1900, Proc. U.S. Nat. Mus., xxxi, p. 204 [*Pleuronectes yokohamae*, Günther].

Close to *Limanda*, differing in having the teeth compressed and incisor-like, close-set, sometimes forming a continuous cutting edge; never more than 6 teeth on ocular side of either jaw; caudal fin with 13 or 14 branched rays; intestine narrow, elongate, with 3 or more coils.

Three species, one from the Atlantic coast of North America, two from Japan.

SYNOPSIS OF THE SPECIES.

- I. Eyes separated by a ridge, which is naked or scaled, width less than $\frac{1}{4}$ diameter of eye; postocular ridge rugose.
 A. Interorbital ridge nearly naked; tips of gill-rakers sharply pointed;
 68 to 75 scales in lateral line; dental formula $\begin{matrix} 0 & + & 14-23 \\ 2-6 & + & 19-24 \end{matrix}$ 1 *herzensteini*.
 B. Interorbital ridge scaled; tips of gill-rakers rounded or obtusely pointed;
 75 to 90 scales in lateral line; dental formula $\begin{matrix} 0-3 & + & 8-16 \\ 0-4 & + & 12-20 \end{matrix}$ 2 *yokohamae*.
 II. Interorbital space flat, scaled, width $\frac{1}{4}$ to $\frac{1}{2}$ diameter of eye; postocular ridge not rugose; 78 to 86 scales in lateral line 3 *americanus*.

1. PSEUDOPLEURONECTES HERZENSTEINI (Jordan and Snyder).

- Pleuronectes japonicus* (non Houttuyn), Herzenstein, 1861, [Mél. Biol., xii (1)] Bull. Ac. Imp. Sci. St. Petersburg, xxxiv (S.S. 10), p. 52.
Limanda herzensteini, Jordan and Snyder, 1901, Proc. U.S. Nat. Mus., xxiii, p. 746; Jordan and Starks, 1904, Bull. U.S. Com. Fish., xxii, (1902), p. 623.
Limanda japonica, Schmidt, 1904, Pisc. Mar. Orient., p. 234.
Limanda angustirostris, (Kitahara) Jordan and Starks, 1906, Proc. U.S. Nat. Mus., xxxi, p. 208, fig. 15; Jordan, Tanaka and Snyder, 1913, J. Coll. Sci. Tokyo, xxxiii (1), p. 326, fig. 275; Jordan and Thonipson, 1914, Mem. Carnegie Mus., vi, p. 309, fig. 82; Hubbs, 1915, Proc. U.S. Nat. Mus., xlviii, p. 485; Soldatov and Lindberg, 1930, Bull. Pac. Sci. Fish. Inst., v, p. 405.
Limandella angustirostris, Jordan and Hubbs, 1925, Mem. Carnegie Mus., x, p. 299.

Depth of body $2\frac{1}{4}$ to $2\frac{3}{4}$ in the length, length of head $3\frac{1}{4}$ to $4\frac{1}{4}$. Upper profile of head more or less concave (nearly straight in young) above eyes. Snout as long as or shorter than eye, diameter of which is $\frac{1}{4}$ to $5\frac{1}{4}$ in head; lower eye a little in advance of upper; interorbital ridge high, narrow, naked or with a few rudimentary scales, width less than $\frac{1}{4}$ diameter of eye; postocular ridge inconspicuous, with an irregular series of rugose areas; similar but less developed rugose areas on blind side of head in the same region. Maxillary extending to below anterior edge of eye or not quite as far, length on ocular side $4\frac{2}{3}$ to $4\frac{3}{4}$, on blind side $3\frac{2}{3}$ to 4 in that of head; lower jaw a little projecting, $2\frac{1}{3}$ to 3 in head; a fleshy projection on ocular side of lower jaw fits into a distinct concavity in the upper. Teeth close-set, but not forming a continuous cutting edge; dental formula $\begin{matrix} 0 & + & 14-23 \\ 2 & 6 & + & 19-24 \end{matrix}$. Gill-rakers rather short and broad, with sharply pointed tips; 6 to 8 on lower part of anterior arch; width of lower pharyngeals about 5 in length, the anterior teeth, especially those of inner row, strong and obtusely conical, the remainder smaller and more sharply pointed. Scales more or less embedded anteriorly, imbricated posteriorly, ctenoid or cycloid on ocular side, the ctenoid scales being developed chiefly on head and posterior part

of body, cycloid or feebly ctenoid on blind side; 68 to 75 scales in a longitudinal series above lateral line, 20 to 26 between lateral line and middle of back. Lateral line with a distinct curve above pectoral fin; a short supratemporal branch. Dorsal (67) 69-75; origin a short distance behind posterior nostril of blind side, above middle of eye or a little farther forward; middle rays scaled on ocular side; highest rays $1\frac{2}{3}$ to twice in length of head. Anal (51) 54-57. Pectoral of ocular side with 10 or 11 rays (5 to 8 branched), length $1\frac{1}{2}$ to twice in that of head. Caudal with 19 rays (13 branched), a little rounded; caudal peduncle $1\frac{1}{10}$ to $1\frac{1}{3}$ times as deep as long. 3 + 1 rather long pyloric appendages. Brownish; uniform or with irregular dark spots and blotches; median fins sometimes with a series of dark spots or bars, not developed on blind side of fins.

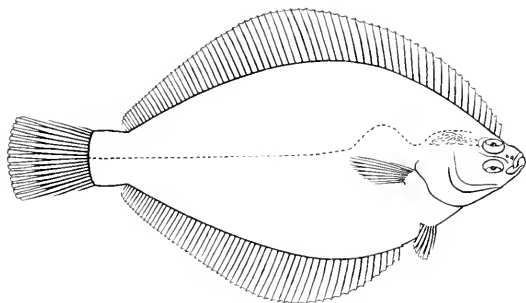


FIG. 252.—*Pseudopleuronectes herzensteini*. B.M. (N.H.) 1923.9.28.18. $\times \frac{3}{2}$.

TYPE.—Zoological Museum, Leningrad. Nos. 1583, 6143, 8730.

DISTRIBUTION.—Shores of Hondo Id., Japan; Sea of Japan.

SPECIMENS EXAMINED:

2 (200, 278 mm.).	Aomori.	Jordan.
1 (175 mm.).	Sea of Japan (38° 16' N., 138° 52' E.).	U.S. Nat. Mus.
3 (253-260 mm.).	Tokyo Market.	Tokyo Imp. Univ.
1 (225 mm.).	Sea of Japan, off Nagato Prov.	"

2. PSEUDOPLEURONECTES YOKOHAMÆ (Günther).

Pleuronectes yokohamæ, Günther, 1877, Ann. Mag. Nat. Hist., (4) xx, p. 442; Günther, 1880, Shore Fishes "Challenger", p. 69.

Limanda yokohamæ, Jordan and Snyder, 1901, Proc. U.S. Nat. Mus., xxiii, p. 379; Jordan and Starks, 1906, Proc. U.S. Nat. Mus., xxxi, p. 209; Franz, 1910, Abh. Bayer. Akad. Wiss., Suppl. iv, Abh. 1, p. 64; Jordan, Tanaka and Snyder, 1913, J. Coll. Sci. Tokyo, xxxiii (1), p. 327; Jordan and Thompson, 1914, Mem. Carnegie Mus., vi, p. 309; Hubbs, 1915, Proc. U.S. Nat. Mus., xlviii, p. 485; Soldatov and Lindberg, 1930, Bull. Pac. Sci. Fish. Inst., v, p. 404; Schmidt, 1931, C.R. Acad. Sci. Russ., p. 317.

Limanda japonica, Schmidt, 1904, Pisc. Mar. Orient., p. 234.

Limanda schrenki, Schmidt, 1904, *tom. cit.*, p. 235; Popta, 1911, Jahres. Ver. Natur. Württ., p. 343.

Limanda schrencki, Jordan and Starks, 1906, Proc. U.S. Nat. Mus., xxxi, p. 207; Soldatov and Lindberg, 1930, Bull. Pac. Sci. Fish. Inst., v, p. 404.

Limanda angustirostris var. *maculosa*, Pavlenko, 1910, Trudui Obshch. Kazan, xlii, p. 58, fig. 12.

Limanda yokohama, Pavlenko, 1910, *tom. cit.*, p. 58.

Limandella yokohama, Jordan and Hulbs, 1925, Mem. Carnegie Mus., v, p. 299.

Limanda (Limandella) yokohama, Schmidt, 1931, Trans. Pac. Com. Acad. Sci. U.S.S.R., ii, p. 426.

Close to *P. herzensteini*. Depth of body $2\frac{1}{2}$ to $2\frac{3}{4}$ in the length, length of head $3\frac{2}{3}$ to $4\frac{1}{4}$. Upper profile of head straight or a little concave above eyes. Diameter of eye $4\frac{1}{2}$ to $6\frac{1}{2}$ in length of head, interorbital ridge lower, narrow, scaled, width usually less than $\frac{1}{4}$ diameter of eye; rugose areas less developed on blind side of head. Length of maxillary on ocular side 4 to $4\frac{1}{2}$, on blind side $3\frac{2}{3}$ to nearly 4 in length of head, fleshy projection on lower jaw and concavity in upper less marked.

Teeth forming a more or less continuous cutting edge, dental formula $\frac{0-3+8-10}{6+1+12-20}$.

Gill-rakers short, broad, with rounded or obtusely pointed tips; 6 to 8 on lower part of anterior arch, width of lower pharyngeals 6 or 7 in length. Scales

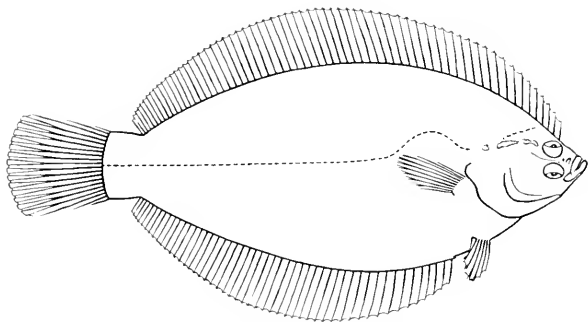


FIG. 2. *Pseudopleuronectes yokohama* (B.M. (N.H.) 192; 2.20.6.) $\frac{1}{2}$

very variable, generally more or less imbricated, at least posteriorly, often embedded anteriorly, usually moderately or strongly ctenoid on ocular side, occasionally almost entirely cycloid, varying from cycloid to strongly ctenoid on blind side; 75 to 90 scales in a longitudinal series above lateral line, 30 to 43 between lateral line and middle of back. Lateral line with a moderate or rather low curve above pectoral fin. Dorsal 61-73, origin just above posterior nostril of blind side, above anterior part of eye. Anal 48-59. Pectoral of ocular side with 6 to 12 rays (3 to 8 branched), length $1\frac{1}{2}$ to twice in that of head. Caudal with 18 or 19 rays (13 or 14 branched), a little rounded or double truncate, caudal peduncle $1\frac{1}{4}$ to twice as deep as long. 5 or 6 + 2 + 4 pyloric appendages of moderate length. Vertebrae 35 to 37 (11 + 24-26). Generally uniformly brownish or greyish, but sometimes blotched or spotted with paler and darker, occasionally some more distinct blackish spots, blotches or annular markings, more evident in young examples. Blind side sometimes with brownish spots, median fins uniform, or dorsal and anal with a row of indistinct dark spots or bars, these being also present on blind side of fins, margin of caudal blackish on blind side.

TYPE - British Museum (Nat. Hist.) - Reg. No. 79.5.14.91.

DISTRIBUTION - All shores of Japan, Sea of Japan, Gulf of Tartary, Korea

SPECIMENS EXAMINED :

2 (160, 300 mm.). ¹	Types.	Yokohama Bay, 15 fms.	"Challenger."
1 (270 mm.).		Tokyo.	Joyner.
1 (215 ").		"	Jordan.
1 (185 ").		Tokyo Market.	Tokyo Imp. Univ.
1 (192 "). ²		"	"
1 (150 ").		Matsuyama Market, Iyo Prov.	"
2 (255, 300 mm.).		Bay of Mutsu.	Kishinouye.
3 (220-240 ").		Hakata.	Jordan.
3 (185-300 ").		Mororan.	"
4 (68-90 mm.).		Otaru.	"
10 (103-320 mm.).		Hondo Isd.	"
1 (280 mm.).		Hakodate.	U.S. Nat. Mus.
1 (155 ").		St. Oiga Bay, Sea of Japan.	Popov.
1 (120 ").		C. Tchiachof, Tartar Strait.	Berg.
10 (90-340 mm.).		Port Arthur.	Jordan.

Also one from Japan (Mus. Comp. Zool.).

3. PSEUDOPLEURONECTES AMERICANUS (Walbaum).

[WINTER FLOUNDER.]

- Pleuronectes*, Schoepf, 1788, *Schrift. Ges. nat. Freunde Berlin*, viii, p. 148.
Pleuronectes americanus, Walbaum, 1792, *Artedi Ichth.*, (3), ed. 2, p. 113; Schneider, 1801, in Bloch, *Syst. Ichth.*, p. 150; Günther, 1862, *Cat. Fish.*, iv, p. 443; Jordan and Gilbert, 1883, *Bull. U.S. Nat. Mus.*, xvi, p. 837; Stearns, 1884, *Proc. U.S. Nat. Mus.*, vi, (1883), p. 125.
Pleuronectes planus, Mitchell, 1814, *Rept. Fishes N. York*, p. 8; Mitchell, 1815, *Trans. Lit. Phil. Soc. N.Y.*, i, p. 387.
Platessa plana, Storer, 1839, *Boston J. Nat. Hist.*, ii, p. 475; *Rep. Ichth. Massach.*, p. 140; De Kay, 1842, *N.H. New York (Fish.)*, p. 295, pl. xlviii, fig. 154, pl. xlix, fig. 158; Storer, 1867, *Hist. Fish. Massach.*, p. 195, pl. xxx, fig. 2.
Platessa pusilla De Kay, 1842, *tom. cit.*, p. 296, pl. xlvii, fig. 153; Storer, 1846, *Synopsis Fish. N. Amer.*, p. 477.
Pseudopleuronectes planus, Bleeker, 1862, *Versl. Akad. Wet. Amsterdam*, xiii, p. 428.
Pseudopleuronectes americanus, Gill, 1864, *Proc. Acad. Nat. Sci. Philad.*, xvi, p. 216; Goode, 1884, *Nat. Hist. Aquat. Anim. (Fisheries Fish. Indust. U.S.)*, i, p. 182, pl. xlv; Jordan and Goss, 1889, *Rep. U.S. Com. Fish.*, xiv, (1886), p. 289, pl. vi, fig. 14; Jordan and Evermann, 1898, *Bull. U.S. Nat. Mus.*, xlvii (3), p. 2647, pl. cclxxix, fig. 933; Bean, 1902, *Ann. Rep. Forest Fish Game Comm. N.Y.*, vi, (1901), p. 475; Huntsman, 1922, *Contr. Canad. Biol.*, (1921), No. iii, p. 22; Bigelow and Welsh, 1925, *Bull. U.S. Bur. Fish.*, xl (1), (1924), p. 501, fig. 256; Nichols and Breder, 1927, *Zoologica N.Y.*, ix, p. 178, fig.; Hildebrand and Schroeder, 1928, *Bull. U.S. Bur. Fish.*, xliii (1), (1927), p. 169, fig. 87.
Pseudopleuronectes dignabilis, Kendall, 1912, *Bull. U.S. Bur. Fish.*, xxx, (1910), p. 392, pl. lvii; Bigelow and Welsh, 1925, *tom. cit.*, p. 507, fig. 261.

EGGS, LARVÆ AND YOUNG.

- Agassiz, 1878, *Proc. Amer. Acad.*, xiv, p. 1, figs.; Breder, 1923, *Bull. U.S. Bur. Fish.*, xxxviii, (1921-22), p. 312, fig. 275; Bigelow and Welsh, 1925, *tom. cit.*, p. 501, figs. 257-260.

Depth of body 2 to 2½ in the length, length of head 3½ to 4½. Upper profile of head straight or a little concave above eyes. Snout as long as or shorter than eye, diameter of which is 4½ to 6 in length of head; anterior margins of eyes level or lower very little in advance of upper; interorbital space rather flat, scaled, width ½ to ⅓ diameter of eye, postocular ridge low and inconspicuous, not rugose. Maxillary extending to below anterior edge of eye or a little beyond, length on ocular side 3½

¹ The larger is selected as the holotype.

² This specimen, received as *L. schrenki*, has a general coloration very similar to that shown in Pavlenko's figure of the type of *L. angustirostris* var. *maculosa*.

to $4\frac{1}{2}$, on blind side $3\frac{1}{2}$ to $3\frac{3}{4}$ in that of head, lower jaw a little projecting, about 3 in head. Teeth forming a continuous cutting edge. Dental formula $\begin{matrix} 0 & 2 & + & 10-15 \\ 0 & 2 & + & 10-17 \end{matrix}$. Gill-rakers short, stout, 7 or 8 on lower part of anterior arch; width of lower pharyngeals nearly 6 in length, teeth of inner row stronger than those of outer. Scales all imbricated, none embedded, ctenoid on ocular side, cycloid on blind side, 78 to 80 scales in a longitudinal series above lateral line, 31 to 38 between lateral line and middle of back. Lateral line with a very low curve above pectoral fin; a short supratemporal branch. Dorsal 50-71 (73), origin just behind posterior nostril of blind side, above anterior half of eye, most of the rays scaled, at least on ocular side; highest rays nearly $\frac{2}{3}$ length of head. Anal (46) 47-54. Pectoral of ocular side with 10 or 11 rays (5 to 7 branched), length $1\frac{1}{2}$ to twice in that of head. Caudal with 10 rays (13 branched), rounded or double-truncate; caudal peduncle $1\frac{1}{4}$ to $1\frac{2}{3}$ times as deep as long. 3 + 1 pyloric appendages. Vertebrae 36 (10 + 26). Brownish; uniform or with rather indistinct dark spots and blotches; young sometimes spotted with paler and darker.

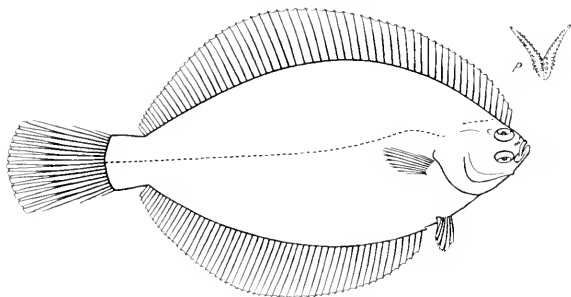


FIG. 254.—*Pseudopleuronectes americanus*. B.M. (N.H.) 79:10:9, 59. $\frac{1}{2}$.
p., lower pharyngeals.

TYPE -- Not traced

DISTRIBUTION -- Atlantic coast of North America, from Labrador to Chesapeake Bay

SPECIMENS EXAMINED.

3 (255-295 mm.), skins.	New York.	Parnell Coll.
2 (120, 135 mm.).	New York City.	Amer. Mus. Nat. Hist.
1 (85 mm.).	Long Island, N.Y.	"
1 (220 ").	Prince Edward Isd.	"
1 (270 ").	Massachusetts Bay.	Wright.
2 (142, 240 mm.).	Noank, Conn.	U. S. Nat. Mus.
1 (195 mm.).	"	"
1 (295 ").	"	"

ABNORMALITIES.

2 (200, 224 mm.) Partial ambicolorates.	Rhode Isd.	U. S. Nat. Mus.
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Attains to a length of 15 inches.

Specimens from deeper water off the New England coast may represent a distinct race (*dignabilis*), with a different spawning season. The characters used by Kendall in describing this form as a new species (i. e. size of head, number of dorsal and anal rays, coloration) do not appear to be constant.

Nichols (1918, Copeia, iv, p. 37) describes a fish from New York Market, believed to be a hybrid *Pseudopleuronectes americanus* × *Limanda ferruginea*

Genus 19. DEXISTES.

Devistes, Jordan and Starks, 1904, Bull. U.S. Com. Fish., xxii, (1902), p. 624 [*Devistes rikuzenius*, Jordan and Starks].

Araias, Jordan and Starks, 1904, *tom. cit.*, p. 624 [*Araias ariommus*, Jordan and Starks].

Close to *Limanda* and *Pseudopleuronectes*. Eyes separated by a high, narrow ridge, which is naked or scaled, the upper entering dorsal profile of head; parts of snout and upper surfaces of eye-balls scaled. A strong bony protuberance at symphysis of lower jaw. Teeth small, obtusely conical, not very close-set, uniserial in both jaws. Dorsal fin commencing well behind posterior nostril of blind side and above middle of eye. Caudal fin with 12 branched rays. Scales thin, rather deciduous, ctenoid on ocular side, the spinules slender and numerous, cycloid on blind side. Lateral line conspicuous, rising a little but without distinct curve about pectoral fin; supra-temporal branch present. Intestine not very narrow, of moderate length, with about $2\frac{1}{2}$ coils; 3 or 4 + 1 rather short pyloric appendages.

A single species from Japan.

1 DEXISTES RIKUZENIUS, Jordan and Starks.

Devistes rikuzenius, Jordan and Starks, 1904, Bull. U.S. Com. Fish., xxii, (1902), p. 624, pl. vi, fig. 1; Jordan and Starks, 1906, Proc. U.S. Nat. Mus., xxxi, p. 212, fig. 17; Jordan, Tanaka and Snyder, 1913, J. Coll. Sci. Tokyo, xxxiii (1), p. 324, fig. 273; Jordan and Thompson, 1914, Mem. Carnegie Mus., vi, p. 310, fig. 83; Hubbs, 1915, Proc. U.S. Nat. Mus., xlviii, p. 487; Jordan and Hubbs, 1925, Mem. Carnegie Mus., x, p. 298.

Araias ariommus, Jordan and Starks, 1904, Bull. U.S. Com. Fish., xxii, (1902), p. 624, pl. vi, fig. 2; Jordan and Starks, 1906, Proc. U.S. Nat. Mus., xxxi, p. 214, fig. 18.

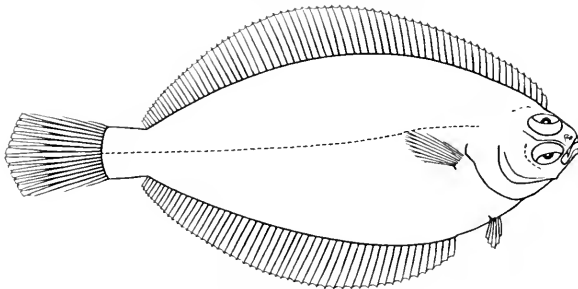


FIG. 255.--*Dexistes rikuzenius*. B.M. (N.H.) 1923.9.28.22. × $\frac{3}{2}$.

Depth of body $2\frac{1}{2}$ to $2\frac{1}{2}$ in the length, length of head 4 to $4\frac{1}{2}$. Upper profile of head a little concave. Snout much shorter than eye, diameter of which is $2\frac{2}{3}$ to $3\frac{1}{3}$ in length of head; lower eye a little in advance of upper, which enters dorsal profile of head; postocular ridge scarcely apparent. Maxillary extending to below anterior part of eye, length on ocular side $3\frac{1}{4}$ to $3\frac{2}{3}$, on blind side about 3 in that of head; lower jaw scarcely projecting, $2\frac{1}{3}$ to $2\frac{1}{2}$ in head. Dental formula $\begin{matrix} 3-6 & + & 20-23 \\ 10-11 & + & 23-25 \end{matrix}$. Gill-rakers short, stout; 6 to 8 on lower part of

anterior arch, width of lower pharyngeals more than 6 times in length; teeth of inner row stronger than those of outer. 57 to 64 scales in lateral line, 18 to 20 between lateral line and middle of back. Dorsal 65-72; some of the middle rays scaled, highest rays less than $\frac{1}{2}$ length of head. Anal 55-58 (60). Pectoral of ocular side with 10 or 11 rays (7 or 8 branched), length $1\frac{1}{2}$ to twice in that of head. Pelvics with 6 rays. Caudal with 18 rays (12 branched), rounded or double-truncate; caudal peduncle about as long as deep. Greyish or brownish, with or without some irregular darker spots.

TYPE — United States National Museum. No. 51423.

DISTRIBUTION — Shores of central Japan.

SPECIMENS EXAMINED:

1 (162 mm l.)	Dago Isl.	U.S. Nat. Mus.
2 (150, 188 mm l.)	Tokyo Market	Tokyo Imp. Univ.
1 (215 mm l.)	Sea of Japan, off Nagato Prov.	"

Genus 20. PLEURONECTES.

Pleuronectes, [Arted, 1738, Ichth., gen. xiv, p. 16] Linnaeus, 1758, Syst. Nat., ed. 10, p. 268; 1760, ed. 12, p. 455. *Pleuronectes platessa*, Linnaeus]. Swainson, 1829, X II. Fishes etc., II, p. 302. Bleeker, 1862, Verh. Akad. Wet. Amsterdam, xiv, p. 427; Norman, 1933, Ann. Mag. Nat. Hist., (10) xi, p. 222.

Platessa, Cuvier, 1817, R. Ann., II, p. 220 [*Pleuronectes platessa*, Linnaeus]; Gottsche, 1835, Arch. Naturgesch., 1 (2), p. 135; Jordan and Goss, 1880, Rep. U.S. Com. Fish., XIV, (1880), p. 299.

Related to *Limanda*, but postocular ridge broken up into a series of 4 to 7 bony prominences, extending from behind the eyes to commencement of lateral line, their bases sometimes connected by a low keel. Teeth compressed, molar-like, forming a more or less continuous cutting edge. Lower pharyngeals narrow or of moderate width, their width $2\frac{1}{2}$ to nearly 5 in the length, rather massive, more or less approximated anteriorly, each with about two rows of obtusely pointed or molariform teeth. Scales small, adherent, all more or less embedded in the skin, but imbricated on posterior part of body, cycloid or sometimes rather feebly ctenoid in the male. Lateral line with a very low curve above the pectoral fin; a short suprtemporal branch. Intestine with 2 or $2\frac{1}{2}$ coils, pyloric appendages rather short or of moderate length, 2 or $3 + 1$. Vertebrae 42 to 43 (13 + 29-30).

Two species from Arctic and temperate seas.

SYNOPSIS OF THE SPECIES

- I. 5 high, regular, conical prominences behind the eyes, $0-3 + 12-19$ teeth in upper jaw, lower pharyngeals slender, inner edges evenly curved, not much approximated, the teeth obtusely pointed, more or less compressed. 1 *pallasii*.
- II. 4 to 7 irregular, bony prominences behind the eyes, $0-6 + 18-32$ teeth in upper jaw, lower pharyngeals rather massive, inner edges angular, approximated anteriorly, the teeth coarse, blunt, molariform. 2 *platessa*.

1. PLEURONECTES PALLASII, Steindachner.

Pleuronectes pallasii, Steindachner, 1880, SitzBer. Akad. Wiss. Wien, lxxx (1), (1879), p. 163, pl. ii, fig. 3.

Pleuronectes quadrivertebulatus (non Pallas), Bean, 1882, Proc. U.S. Nat. Mus., iv, (1881), p. 241; Jordan and Gilbert, 1883, Bull. U.S. Nat. Mus., xvi, p. 836; Jordan and Evermann, 1898, Bull. U.S. Nat. Mus., xlvii (3), p. 2648; Jordan and Gilbert, 1899, Fur seals and fur-seal Is. N. Pacif., (3), p. 491; Schmidt, 1904, Pisc. Mar. Orient., p. 239, figs. 17, 18; Jordan and Starks, 1906, Proc. U.S. Nat. Mus., xxxi, p. 216; Evermann and Goldsborough, 1907, Bull. U.S. Bur. Fish., xxvi, (1906), p. 355, fig. 140; Soldatov and Lindberg, 1930, Bull. Pac. Sci. Fish. Inst., v, p. 406.

Platessa quadrivertebulata, Jordan and Goss, 1889, Rep. U.S. Com. Fish., xiv, (1886), p. 292; Jordan, Tanaka and Snyder, 1913, J. Coll. Sci. Tokyo, xxxiii (1), p. 329.

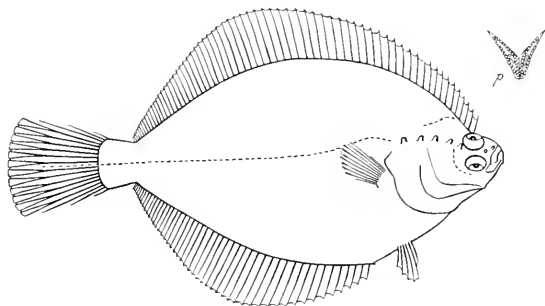


FIG. 256.—*Pleuronectes pallasii*. B.M. (N.H.) 96.7.23.238. $\times \frac{2}{3}$. p., lower pharyngeals.

Depth of body $1\frac{1}{2}$ to twice in the length, length of head about $3\frac{1}{2}$. Upper profile of head distinctly concave. Snout as long as or shorter than eye, diameter of which is $4\frac{1}{2}$ to $5\frac{1}{2}$ in length of head; lower eye a little in advance of upper; interorbital ridge low, narrow, with a few embedded scales posteriorly; behind the eyes a row of 5 high, regular, conical (lower and obtusely rounded in young) bony prominences, the first just behind upper eye, closely followed by the second, the last just in front of upper angle of gill-opening. Maxillary extending to below anterior edge or anterior part of eye, length on ocular side a little more than 4, on blind side $3\frac{2}{3}$ to $3\frac{1}{2}$ in that of head; lower jaw scarcely projecting, about 3 in head. Dental formula $\frac{0-3 + 12-19}{3-4 + 14-21}$. 7 gill-rakers on lower part of anterior arch; lower pharyngeals slender, not much approximated anteriorly, width nearly 5 in length, their inner edges more or less evenly curved; each with 2 widely separated rows of obtusely pointed, somewhat compressed teeth, those of the inner row larger than those of the outer; one or two small teeth between the two rows. Scales all cycloid; about 100 in a longitudinal series above lateral line; 80 pores in lateral line. Dorsal (63) 68-72; origin above middle of eye; middle rays sometimes with a series of embedded scales on ocular side; highest rays about $\frac{1}{2}$ length of head. Anal (48) 50-53. Pectoral of ocular side with 11 rays (5 branched), length $2\frac{2}{3}$ to $2\frac{3}{4}$ in that of head. Pelvics with 6 rays.

Caudal with 18 or 19 rays (12 or 13 branched), more or less rounded, caudal peduncle deeper than long 2 ($\frac{2}{3}$) pyloric appendages of moderate length and one shorter appendage further down the intestine. Brownish, indistinctly spotted with darker, the spots apparently symmetrically arranged; young marbled with paler and darker.

TYPE — Vienna Museum

DISTRIBUTION — Bering Sea, on both coasts, southwards to southern Sakhalin and Kodiak Island

SPECIMENS EXAMINED.

1 (255 mm.)	Herendeen Bay, Alaska	U. S. Nat. Mus.
1 (195 ..)	" "	Stanford Univ.
1 (195 ..)	Barkal Bay, Sakhalin.	Popov.

This fish cannot be the *Pleuronectes quadrilobatus* of Pallas, which may be a species of *Pleuronichthys*. Pallas describes the bony prominences on the head as being four in number, thus: "tuberculis quatuor ossis, conicis, obtusis, prominentissimis, serie linea laterali continua, quorum duo approximata anteriori, tertium orbitae superioris postico margini contiguum, quartum maximum sinu branchiali adsidet". He makes no mention of the form of the teeth.

2. PLEURONECTES PLATESSA, Linnaeus¹

[PLAICE.]

Pleuronectes plattessa, Linnaeus, 1758, Svst. Nat., ed. 10, p. 269; 1766, ed. 12, p. 456; Bloch, 1783, Naturgesch. Fische Deutsch., ii, p. 31, pl. xli; Schneider, 1801, in Bloch, Syst. Ichth., p. 144; Lacepede, 1802, Hist. Nat. Poiss., iv, p. 628; Donovan, 1806, N.H. Brit. Fish., iv, pl. vi; Quensel, 1806, Vet. Akad. Handl., xxvii, p. 211; Pallas, 1814, Zoographia, iii, p. 423; Faber, 1828, Isis, xxi, p. 866; Faber, 1829, Naturg. Fische Isl., p. 135; Nilsson, 1832, Prodr. Ichth. Scand., p. 54; Nilsson, 1855, Scand. Faun., ed. 2, Fiskar, p. 612; Gunther, 1862, Cat. Fish., iv, p. 440; Collett, 1875, Vid.-Selsk. Forh., (1874), Till. p. 144; Malm, 1877, Göteborgs Bohus Fauna, p. 525; Day, 1880-84, Fish. Britain, ii, p. 25, pl. c1; Günther, 1888, Proc. Roy. Soc. Edinb., xv, p. 218; Lalleborg, 1891, Sverig. Norg. Fiskar, ii, p. 358; Smitt, 1893, Scand. Fish., i, p. 392, pl. xxi, fig. 2; Levander, 1894, Medd. Soc. Faun. Fenn., xx, p. 92; Collett, 1903, Vid.-Selsk. Forh., (1902), p. 95; Hoek, 1903, Pub. Circ. Cons. Explor. Mer., iii, p. 57, pl. vi; Fage, 1907, Arch. Zool. exper. gen., (4) vii, p. 74; Pietschmann, 1909, Ann. naturh. Mus. Wien, xxi, (1907-8), p. 300; Schnakenbeck, 1926, in Tier. Nord Ostsee, I, ii, xu (1), p. 5, fig. 3; Buen, 1926, Cat. ictiol. Medit. Españ. Marruecos, p. 99; Knipovich, 1926, Trans. Inst. Sci. Explor. North, xxvii, p. 143, fig. 108; Saemundsson, 1927, Vit. Visind Island, ii, p. 37; Schnakenbeck, 1929, in Jouin, Faun. Ichth. Atlant. Nord, iii, figs.; Chabanaud, 1930, Bull. Mus. Hist. nat. Paris, (2) ii, p. 627; Chabanaud, 1931, Riviera Sci., Suppl. Mem. ii, p. 24.

Solea plattessa, Rafinesque, 1810, Ind. itt. Sicil., p. 14

Plattessa plattessa, Cuvier, 1817, R. Anm., ii, p. 220; Jordan and Goss, 1889, Rep. U.S. Com. Fish., xiv, (1889), p. 291, pl. vi, fig. 15.

Plattessa vulgaris, Cloquet, 1826, Dict. Sci. Nat., xli, p. 403; Fleming, 1828, Brit. Anim., p. 198; Gottsche, 1835, Arch. Naturgesch., i (2), p. 136; Yarrell, 1836, Brit. Fish., ed. 1, i, p. 209, fig.; Parnell, 1838, Mem. Werner Soc., vii, p. 361, pl. xxxvi; Krøyer, 1843-5, Danmarks Fisk., ii, p. 347, fig.; Bonaparte, 1846, Cat. metod. Pesci Europ., p. 48; Yarrell, 1850, Brit. Fish., ed. 3, i, p. 605, fig.; Moreau, 1881, Hist. Nat. Poiss. France, iii, p. 291.

Pleuronectes borealis, Faber, 1828, Tidsskr. for Naturvid., (14), p. 244; Isis, xxi, p. 868.

Plattessa lata, Cuvier, 1829, R. Anm., ed. 2, ii, p. 339.

Pleuronectes latus, (Cuvier) Valenciennes, 1836-49, in R. Anm., Discip. Ed., Poiss., p. 300; Gunther, 1862, Cat. Fish., iv, p. 442.

Plattessa lata, Bonaparte, 1846, Cat. metod. Pesci Europ., p. 48.

Pleuronectes plattessa var. *baltica*, Nilsson, 1855, Scand. Faun., ed. 2, Fiskar, p. 610.

² *Pleuronectes plattessa*, Trois, 1878, Atti Ist. Venet., (5) iv, (3), p. 321.

Pleuronectes (Plattessa) plattessa, Danois, 1913, Ann. Inst. oceanogr. Paris, v (5), p. 101, fig. 174.

¹ A monograph of this species, dealing with the anatomy, biology and economics, has been published by Cole and Johnstone (1902, Proc. L'pool. Biol. Soc., xvi, pp. 145-309, 14 pls.)

EGGS, LARVÆ AND YOUNG.

Schodde, 1868, Naturhist. Tidsskrift, (3) v, p. 269, pl. xi, figs. 2-4; Cunningham, 1888, Trans. Roy. Soc. Edinb., xxiii (1), p. 99, pl. ii, figs. 1-3; McIntosh and Prince, 1890, Trans. Roy. Soc. Edinb., xxxv (3), p. 840, pl. i, fig. 20, pl. v, fig. 6, pl. vi, fig. 7, pl. xii, fig. 7, pl. xiv, fig. 5, pl. xvi, fig. 5; Fullarton, 1891, Rep. Fish. Board Scotland, ix (iii), (1890), p. 311, pls. vii-ix; Fullarton, 1893, Rep. Fish. Board Scotland, xi (iii), (1892), p. 274, pls. xiii-xvi; Holt, 1893, Sci. Trans. R. Dublin Soc., (2) v, p. 76, pl. xiv, figs. 107-111; Canu, 1893, Ann. Stat. aquic. Boulogne, i, p. 130, pl. ix, fig. 2; Petersen, 1894, Rep. Danish Biol. Stat., iv, (1893), pp. 2, 125, pl. ii, fig. 10; Cunningham, 1896, N.H. Market. Mar. Fish., p. 213, figs. 106-7; Ehrenbaum, 1897, Wiss. Meeresuntersuch., Abt. Helgoland, N.F., ii (1), p. 260, pl. iv, figs. 12-15; McIntosh and Masterman, 1897, Brit. Mar. Food-fish., p. 356, figs.; Hensen and Apstein, 1897, Wiss. Meeresuntersuch., Abt. Kiel, N.F., ii (2), pp. 34, 43, 69, pl. ii, figs. 7-10; Dannevig, 1897, Rep. Fish. Board Scotland, xv (iii), (1896), p. 175, pl. iv; Kyle, 1898, Rep. Fish. Board Scotland, xvi (iii), (1897), p. 225, pl. x; Heinicke and Ehrenbaum, 1900, Wiss. Meeresuntersuch., Abt. Helgoland, N.F., iii, p. 223, pl. ix, figs. 5, 6¹; Hock, 1903, Pub. Circ. Cons. Explor. Mer., iii, p. 57, pl. vi; Ehrenbaum and Strodtmann, 1904, Wiss. Meeresuntersuch., Abt. Helgoland, N.F., vi, p. 84; Ehrenbaum, 1905, in Brandt and Apstein, Nordisches Klabok, I. Eier Larv. Fisch. (1), p. 156, fig. 68¹; Petersen, 1906, Medd. Komm. Havundersog. Kjob., Ser. Fisk., ii (1), p. 4, pl. i, figs. 1-6; Schnakenbeck, 1929, in Joubin, Faun. Ichth., Atlant. Nord, iii, figs.

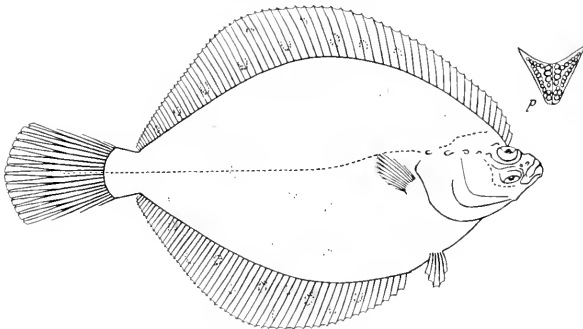


FIG. 257.—*Pleuronectes platessa*. B.M. (N.H.) 1923. II. 12. 6. $\times \frac{2}{3}$. p., lower pharyngeals.

Depth of body $1\frac{1}{2}$ to $2\frac{1}{4}$ in the length, length of head 3 to $3\frac{3}{5}$. Upper profile of head distinctly concave. Snout (in adults) longer than eye, diameter of which is 4 (young) to 8 in length of head; lower eye a little in advance of upper; interorbital ridge low, narrow, naked or with a few embedded scales; a bony prominence in front of lower eye and often a trace of another before upper eye; a row of 4 to 7 irregular bony prominences extending from behind the eyes to commencement of lateral line, their bases sometimes connected by a low keel. Maxillary extending to below anterior part of eye, length on ocular side $4\frac{1}{4}$ to $4\frac{3}{4}$, on blind side $3\frac{3}{4}$ to 4 in that of head; lower jaw a little projecting, $2\frac{1}{2}$ to $2\frac{3}{4}$ in head. Dental formula $\frac{0-6+18-32}{2-7+18-35}$. 6 to 9 gill-rakers on lower part of anterior arch; lower pharyngeals broader, width $2\frac{1}{4}$ to $3\frac{1}{2}$ in length, massive, approximated for more than half their length, their inner edges angular;

¹ Consult for full list of references.

each with 3 rows of large, obtuse, often flat, molariform teeth, arranged close together along the inner, outer and posterior edges of the pharyngeal bone, those of the inner row being larger than the remainder; sometimes 1 to 3 small teeth in the space between the rows. Scales mostly cycloid, but often more or less spinulate in the male; occasionally a few spinulate scales present in the female; 88 to 115 scales in a longitudinal series above lateral line. 85 to 102 pores in lateral line. Dorsal 65-70; origin above or a little in front of middle of eye; middle rays frequently with a series of embedded scales on ocular side; highest rays about $\frac{1}{2}$ length of head. Anal 18-59. Pectoral of ocular side with 6 to 13 rays (3 to 6 branched), length 2 to 3 in that of head. Pelvics with 6 (occasionally 7) rays. Caudal with 19 to 21 rays (12 to 15 branched), rounded or double-truncate; caudal peduncle generally deeper than long, 2 or 3 rather short pyloric appendages and one smaller appendage farther down the intestine. Vertebrae 12 to 43 (13 + 29-36). Brownish or greyish, with large, rounded, red or orange (often becoming white in spirit) spots, sometimes margined with brown, scattered over the body; a series of similar spots along dorsal and anal fins and frequently 2 or 3 at base of caudal.

TYPE.—Not traced.

DISTRIBUTION.—Coasts of north-western Europe, from the White Sea to the Gulf of Cadiz.¹ Iceland; Adriatic (?) see note on p. 353.

SPECIMENS EXAMINED:

4 (370-430 mm.)	Ireland.	Distr. Inspect. Fish., Hull.
1 (600 mm.) = 14½ lb.	"	Minist. Agric. Fish.
2 (580, 620 mm.)	"	Mar. Biol. Assoc.
1 (625 mm.), skeleton.	"	"
1 (690 ..).	Off Ingheshoef, Ireland.	"
1 (390 ..).	Lapponia.	Popov.
2 (325, 650 mm.)	Norway.	Fisheries Exhib.
1 (215 mm.).	Bohuslan.	Malm.
1 (665 ..), stuffed	Danish Coast.	Gerrard.
8 (210-330 mm.)	Baltic	Mar. Biol. Assoc.
1 (890 mm.), stuffed. 18 lb.	Faroe Is.	Gerrard.
1 (65-78 mm.), skins.	Firth of Forth.	Farnell.
1 (560 mm.), stuffed.	"	"
4 (21-37 mm.)	"	—
4 (270-410 mm.).	Kilbreunan Sound, 26 fms.	Murray.
3 (24-27 mm.).	Off Ardrossan, 10-15 fms.	"
4 (240-255 mm.).	St. Andrew's Bay.	Fish Board Scotland.
4 (30-90 mm.).	St. Andrews.	McIntosh.
1 (30 mm.).	"	"
1 (780 ..), stuffed	Dogger Bank.	Gerrard.
1 (420 ..), skeleton.	North Sea.	Gunther.
1 (650 ..), stuffed.	"	Gerrard.
1 (55 ..).	Wales.	Gray.
1 (120 ..).	Blacksod Bay, Co. Mayo.	Grenfell.
1 (84 ..).	Lough-on-Sea.	Lambert.
5 (285-375 mm.).	Brighton.	Page.
3 (71-120 ..).	"	Gerrard.
5 (77-140 ..).	Weymouth.	Brunner.
4 (330-395 ..).	Plymouth.	Mar. Biol. Assoc.
1 (118 mm.), skin.	"	Yarrell.
9 1; 7 ..).	Mevagissey.	Day.
1 (270 ..), stuffed	British Coast.	—
2 (390, 595 mm.), skates.	"	—
1 (285 mm.).	"	Yarrell.
1 (520 ..), skeleton.	"	"
1 (395 ..).	"	—

¹ Apparently entering the western Mediterranean at times. Page (1907) records the Place from the Balearic Islands.

1 (98 mm.).	Naples (?).	Day.
1 (300 ,,).	Trieste.	Mus. Comp. Zool.
1 (625 ,,), stuffed.	—	—
2 (250, 260 mm.), skins.	—	Gronow Coll.
ABNORMALITIES. ¹		
1 (240 mm.). Unusual coloration.	Denmark.	Hattersley.
1 (425 ,,). Semi-albino.	Aberdeen Market.	Cooke.
1 (390 ,,). Albino.	Grimsby Market.	Fishmongers' Co.
3 (195-255 mm.). Blind side stained.	3 miles N.E. of Liverpool Bar Light-ship, 7 fms.	Jenkins.
2 (210, 230 ,,).	Entrance to Menai Straits.	„
3 (195-232 ,,).	Off Moelfre Is., Anglesea, 13 fms.	„
2 (315, 320 ,,).	„	„
3 (225-275 ,,).	N.N.E. of Puffin Isd., 14 fms.	„
1 (260 mm.). Unusual coloration.	Great Yarmouth.	Patterson.
1 (295 ,,). Blind side stained.	„	„
1 (300 ,,). Partial ambicolorate.	„	„
1 (360 ,,).	„	„
1 (280 ,,). Blind side stained.	„	„
1 (200 ,,). Semi-albino.	„	„
1 (425 ,,). Ambicolorate.	„	„
1 (280 ,,). "Piebald."	Lowestoft.	Davis.
1 (265 ,,). Nearly complete ambicolorate.	„	Minist. Agric. Fish.
1 (170 ,,). Partial ambicolorate.	Southwold, Suffolk.	Collings.
1 (375 ,,).	„	„
1 (420 ,,). Albino.	Dogger Bank.	Stookes.
1 (460 ,,).	Off Terschelling.	Borley.
1 (245 ,,).	British Coast.	Minist. Agric. Fish.
1 (560 ,,). Lemon-coloured.	England.	Sunshine.
1 (360 ,,). Partial ambicolorate.	London Market.	Rhodin.
1 (320 ,,).	„	Norman.
1 (350 ,,).	„	Fishmongers' Co.
1 (405 ,,). Unusual coloration.	„	Hattersley.
1 (460 ,,). Blind side stained.	„	„
1 (350 ,,). Very deep body.	„	Fishmongers' Co.
1 (375 ,,). Abnormal fins.	„	Towse.
1 (430 ,,). Ambicolorate.	—	Fishmongers' Co.
1 (300 ,,). Partial ambicolorate.	—	Harger.
1 (300 ,,). Blind side stained.	—	Norman.

Said to attain to a length of about 3 feet. The occurrence of the Plaice in the Adriatic is difficult to credit and requires confirmation. In 1878, Trois found two specimens in the fish-market at Venice, and the only other record of the species being found in this region is the statement by Jordan and Goss (1889) that they had examined examples from Trieste (Coll. Salmu). One of these specimens has been sent to the British Museum by the Museum of Comparative Zoology, through the courtesy of Prof. T. Barbour, and proves to be a typical *Pleuronectes platessa*.

¹ The following papers describe abnormalities of the Plaice: Malm, 1882, Göteborgs. Mus. Årsskr., (1881), p. 23; Cunningham and McMunn, 1894, Phil. Trans. Royal Soc., B. clxxxiv, pp. 802, 804; Bateson, 1894, Proc. Zool. Soc., p. 249; Lunnberg, 1894, Overs. Vet.-Akad. Forh., li, p. 581; Cunningham, 1895, J. Mar. Biol. Ass., (2) iii, p. 271; Gadeau de Kerville, 1895, Bull. Soc. zool. Fr., xx, p. 155; McIntosh, 1895, Rep. Fish. Board Scotland, xiii (iii), (1894), p. 234; McIntosh, 1902, Ann. Mag. Nat. Hist., (7) ix, p. 291; (7) x, p. 252; Boulenger, 1908, Proc. Zool. Soc., p. 161, figs; Elmhurst, 1911, Ann. Scot. Nat. Hist., p. 77; Franz, 1925, Biol. Zentralbl., xlv, p. 675, figs; Demel, 1927, Kosmos Lemburg, li, p. 228, figs.

Statistical studies of Plaice from the Barents Sea, Baltic, Helgoland, East Scotland, and the south-western North Sea, have been made by Duncker and others¹. The Baltic Plaice would appear to form a distinct race, characterised by the reduced numbers of dorsal and anal rays (average about 5 rays in each fin), and consequently a slight increase in the length of the caudal peduncle; a small reduction in the number of vertebrae (average about 75); and in the number of rays of the pectoral fin (average about 5 to 75); in addition, the spination of the males is generally much more marked, and the fish mature at a smaller size. The Plaice of the Cattegat agree with those of the North Sea in the numbers of vertebrae and dorsal and anal rays, and with those of the Baltic in the number of pectoral rays, differing from both in having a deeper body. Slight differences have been demonstrated between samples from various localities in the North Sea and Channel, but these are regarded as merely "Lokalformen" by Duncker. Large series of specimens from Iceland and from the White Sea have not yet been investigated.

The following table shows the numbers of dorsal, anal and pectoral rays in specimens in the British Museum collection from four selected regions:

Locality.	Dorsal rays.	Anal rays.	Pectoral rays
Baltic (8)	67-74	48-56	9-11 (3-7)
North Sea (25)	70-78	51-58	10-13 (5-7)
Channel (20)	69-79	50-57	10-13 (5-7)
Iceland (8)	70-77	53-59	10-12 (5-9)

It is possible that the Baltic race will eventually come to be regarded as a distinct subspecies—*Pleuronectes platessa baltica*, Nilsson.

Lonnberg (1894, Overs. Vet.-Akad. Forh., li, p. 582) has described a supposed hybrid *Pleuronectes platessa* × *Glyptocephalus cynoglossus* from the Cattegat.

HYBRID PLAICE AND FLOUNDER

Pleuronectes flesus (part), Nilsson, 1832, Prodr. Ichth. Scand., p. 55.

Platessa pseudoflesus,² Gottsche, 1835, Arch. Naturgesch., i (2), p. 143; Mobius and Heineke, 1883, Fische Ostsee, p. 92; Lenz, 1891, Fische Travemünder Bucht, p. 10; Smitt, 1893, Scand. Fish., i, pp. 393, 493; Lonnberg, 1894, Overs. Vet.-Akad. Forh., li, p. 579; Duncker, 1896, Wiss. Meeresuntersuch., Abt. Kiel, 8 f. 1 (2), p. 76.

Depth of body about twice in the length, length of head $3\frac{1}{2}$ to $3\frac{3}{4}$. Snout as long as or a little longer than eye, diameter of which is $6\frac{1}{4}$ to 7 in length of head, inter-orbital ridge naked or with some rudimentary scales, postocular ridge consisting of several small, obtuse prominences, more or less joined together to form a rugose ridge, which ends in a larger prominence above the operculum and a smaller one just behind it. Maxillary extending to below anterior part of eye, length on ocular side 4, on blind side $3\frac{1}{2}$ to $3\frac{3}{4}$ in that of head; lower jaw about 3 in head. Teeth somewhat compressed, truncate, close-set, but not forming a continuous cutting edge, dental formula $\frac{0+15-19}{7-10+19-21}$. 9 gill-rakers on lower part of anterior arch, lower pharyngeals rather broad and massive, width about 3 in length, each with 3 rows of obtuse teeth, one along each side of the pharyngeal bone, with some odd.

¹ See Malm, 1882, Goteb. Nat. Mus. Zool. Afdel., Arsskr., iii, (1881), p. 23; Holt, 1894, J. Mar. Biol. Ass., (2) iii, p. 194; Duncker, 1895, Zool. Anz., xviii, p. 53; Duncker, 1896, Wiss. Meeresuntersuch., Abt. Kiel, 8 f. 1 (2), p. 47; Cunningham, 1897, J. Mar. Biol. Ass., (2) iv, p. 315; Kyle, 1901, Rep. Fish. Board Scotland, xvii (iii) (1900), p. 189; Duncker, 1913, Jahrb. Hamburg Wiss. Anst., xxx (2), (1912), p. 197; Keilhack, 1913, Wiss. Meeresuntersuch., Abt. Helgoland, 8 f. x, p. 168; Redeker, 1915, Rapp. proc.-verb. explor. mer., xxii, p. 4; Ssytisch-Awerinzewa, 1929, Zool. Anz., lxxxv, p. 149; Ruchuanowa, 1929, Zool. Anz., lxxxv, p. 139.

² Some of the descriptions of *P. pseudoflesus* may refer to the spinated males of the Baltic race of *P. platessa*.

teeth between these rows; teeth along the posterior edge more or less compressed and incisor-like. Scales mostly embedded, not imbricated, except on hinder part of body, some of those at bases of dorsal and anal fins, along the region of the lateral line, on the postocular part of the head, and on the abdominal region ctenoid. Dorsal (62) 67-74. Anal 46-54. Pectoral of ocular side with 11 or 12 rays (7 or 8 branched), length about twice in that of head. Caudal with 18 to 20 rays (12 to 14 branched); caudal peduncle about as long as deep. Intestine similar to that of *Platichthys flesus*. Brownish or olivaceous, with or without orange spots on body and fins.

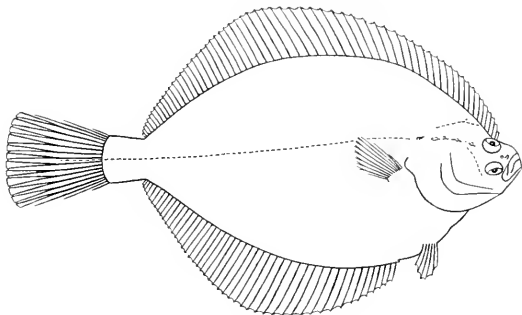


FIG. 258.—Hybrid *Pleuronectes platessa* × *Platichthys flesus*. B.M. (N.H.) 1922.12.20.1.
× $\frac{1}{2}$.

DISTRIBUTION.—Baltic; south-western Cattegat; Folkestone.

SPECIMENS EXAMINED:

1 (305 mm.).	The Sound, off Skovshoved.	Johansen.
1 (390 ,,).	Folkestone.	Haynes.

In most respects these specimens seem to be roughly intermediate between the two parent species, but in the size of the mouth, form of the interorbital ridge, and in the form of the intestine, they approach *Platichthys flesus*.

Genus 21. MICROSTOMUS.

- Microstomus*,¹ Gottsche, 1835, Arch. Naturgesch., i (2), p. 136 [*Microstomus latidens*, Gottsche]; Jordan and Evermann, 1898, Bull. U.S. Nat. Mus., xlvii (3), p. 2653.
Cynoglossus, Bonaparte, 1837, Icon. Faun. Ital., iii, Pesci, (19), sign. 97. 3, descr. of *Platessa passer* [*Pleuronectes cynoglossus*, Nilsson].
Cynoglossa, Bonaparte, 1846, Cat. metod. Pesci Europ., p. 48 [*Pleuronectes microcephalus*, Donovan].
Brachyprosopon, Bleeker, 1862, Versl. Akad. Wet. Amsterdam, xiii, p. 428 [*Pleuronectes microcephalus*, Donovan].
Veraqua, Jordan and Starks, 1904, Bull. U.S. Com. Fish., xxii, (1902), p. 625; Jordan and Starks, 1906, Proc. U.S. Nat. Mus., xxxi, p. 210 [*Veraqua achne*, Jordan and Starks].

¹ Not to be confused with *Microstoma*, Cuvier (1817), a genus of Saluonoid fishes.

Related to *Pseudopleuronectes*, but with an increased number of dorsal and anal rays and vertebrae. Lips thick, never more than 3 teeth on ocular side of either jaw. Gill-opening scarcely extending above axil of pectoral. Dorsal with 80 to 100 rays, commencing rather close to posterior nostril of blind side. Anal with 65 to 88 rays, tip of first interhemal spine not projecting in front of fin. Rays of median fins stout, more or less densely scaled on both sides. Caudal peduncle very short. Skin rather thick; scales often more or less embedded, not well imbricated, cycloid; supplementary scales generally present in region of pores of lateral line. Intestine with 2 coils, the second loop long and extending backwards well into the secondary body-cavity of the ocular side; 2 or 3 + 1 pyloric appendages. Vertebrae about 48 to 52 (12-13 + 35-40).

Three species from the North Atlantic and North Pacific

SYNOPSIS OF THE SPECIES

- I Snout, eye-balls and interorbital space naked or with very few scales; anterior nostril of ocular side with a short tube, with rather short posterior flap; head $4\frac{1}{2}$ to $5\frac{1}{2}$ in length, origin of dorsal at a distance behind posterior nostril which is less than $\frac{1}{2}$ diameter of eye.
- A 110 to 125 scales in lateral line 1 *kitt*.
 B 135 to 142 scales in lateral line 2, *achne*.
- II Snout, eye-balls and interorbital space well scaled; anterior nostril of ocular side with a short tube, with long posterior flap; head $4\frac{1}{2}$ to $4\frac{3}{4}$ in length; origin of dorsal at a distance behind posterior nostril which is at least $\frac{1}{2}$ diameter of eye; 144 to 149 scales in lateral line 3 *pacificus*.

I. MICROSTOMUS KIIT (Walbaum).

SMEAR DAB; LEMON DAB; LEMON SOLE

- Pleuronectes kiit* (part), Walbaum, 1792, *Artedi Ichth.* (3), ed. 2, p. 120.¹
Pleuronectes kiit, Schneider, 1801, in Bloch, *Syst. Ichth.*, p. 102.
Pleuronectes microcephalus, Donovan, 1803, *N. H. Brit. Fish.*, ii, p. xlii; Fries, 1839, *Vet. Akad. Handl.*, lix, (1838), p. 173; Nilsson, 1855, *Skand. Faun.*, ed. 2, *Fiskar*, p. 609; Gunther, 1862, *Cat. Fish.*, iv, p. 447; Collett, 1875, *Vid. Selsk. Forh.*, (1874), *Fil.*, p. 145; Malm, 1877, *Goteborgs Bohus. Fauna*, p. 526; Steindachner, 1880, *Sitzber. Akad. Wiss. Wien*, lxxx (1), (1879), p. 105; Day, 1880-84, *Fish. Britain*, ii, p. 28, pl. cv; Gunther, 1888, *Proc. Roy. Soc. Edinb.*, xv, p. 219; Lalleborg, 1891, *Sverig. Norg. Fiskar*, ii, p. 402; Smitth, 1893, *Scand. Fish.*, i, p. 383, pl. xx, fig. 1; Schnakenbeck, 1925, in *Fier. Nord Ostsee*, L. ii, xii (1), p. 5, fig. 4; Saemundsson, 1927, *Vit. Visend. Island*, ii, p. 37; Schnakenbeck, 1929, in Joubin, *Faun. Ichth. Atlant. Nord*, i, fig.
- Pleuronectes levis*, Shaw, 1803, *Gen. Zool.*, iv (2), p. 299.
Pleuronectes quonshu, Hollberg, 1824, *N. Handl. Goteborg Wett. Witt. Samh.*, iv, p. 59.
Pleuronectes quadridentis, Fabricius, 1824, *Athandl. K. Danske Vid. Selsk.*, i, p. 39, pl. 1, figs. 10, 11; Faber, 1829, *Fische Isl.*, p. 138.
Pleuronectes microstomus, Faber, 1828, *Tidsskr. for Naturvid.* (14), p. 245; Nilsson, 1832, *Prodr. Ichth. Scand.*, p. 53.
Platessa microcephala, Fleming, 1828, *Hist. Brit. Annu.*, p. 198; Yarrell, 1839, *Brit. Fish.*, ed. 1, ii, p. 221, fig. 1; Parnell, 1838, *Mem. Werner Soc.*, vii, p. 306, pl. xxxvii; Yarrell, 1841, *Brit. Fish.*, ed. 2, ii, p. 309, fig. 1; Krøyer, 1843-5, *Danmarks Fisk.*, ii, p. 319; Yarrell, 1859, *Brit. Fish.*, ed. 3, i, p. 622, fig. 1; Moreau, 1881, *Hist. Nat. Poiss. France*, iii, p. 294.
Platessa pola, Cuvier, 1829, *R. Annu.*, ed. 2, ii, p. 339.
Pleuronectes cynoglossus, Nilsson, 1832, *Prodr. Ichth. Scand.*, p. 53.
Microstomus latidens, Gottsche, 1835, *Arch. Naturgesch.* (1) (2), p. 150.
² *Microstomus groenlandicus*, Reinhardt, 1839, *Overs. K. Danske Vid. Selsk. Forh.*, p. 9.
³ *Cynoglossus microcephala*, Bonaparte, 1846, *Cat. method. Pisci Europ.*, p. 48.

¹ After Jago, in Ray, 'Syn. Pisc.', p. 162, pl. 1, fig. 1 (1713). The description in part confused with that of *Zeugopterus punctatus*.

- Platessa lavus*, White, 1851, List. Brit. Anim., Fish., p. 99.
Pleuronectes gilli, Steindachner, 1868, SitzBer. Akad. Wiss. Wien, lvi (1), p. 1004.
Microstomus kitt, Jordan and Goss, 1889, Rep. U.S. Com. Fish., xiv, (1886), p. 299; Jordan and Evermann, 1898, Bull. U.S. Nat. Mus., xlvii (3), p. 2654.
Cynicoglossus microcephalus, Collett, 1903, Vid.-Seisk. Forh., (1902), p. 102.
Pleuronectes (Microstomus) microcephalus, Danois, 1913, Ann. Inst. oceanogr. Paris, v (5), p. 99, fig. 101.
Microstomus microcephalus, Knipovich, 1926, Trans. Inst. Sci. Explor. North, xxvii, p. 141, fig. 100.

EGGS, LARVÆ AND YOUNG.

- Cunningham, 1889, J. Mar. Biol. Ass., (2) i, p. 13, figs. 6-9; McIntosh, 1891, Rep. Fish. Board Scotland, ix (iii), (1890), p. 327, pl. x, figs. 1-5, pl. xi, figs. 1, 4, 7; Holt, 1891, Sci. Trans. R. Dublin Soc., (2) iv, p. 453, figs. 19-21, 39; Holt, 1893, Sci. Trans. R. Dublin Soc., (2) v, p. 89, figs. 120-122; Canu, 1893, Ann. Stat. aquic. Boulogne, 1, p. 130, pl. ix, figs. 3-5; Petersen, 1894, Rep. Danish Biol. Stat., iv, (1893), p. 129, pl. ii, fig. 13; Cunningham, 1896, N. H. Market. Mar. Fish., p. 236, figs. 110, 111; McIntosh and Masterman, 1897, Brit. Mar. Food-fish., p. 366, figs.; Kyle, 1898, Rep. Fish. Board Scotland, xvi (iii), (1897), p. 236, pl. xi, figs. 27-32; Heincke and Ehrenbaum, 1900, Wiss. Meeresuntersuch., Abt. Helgoland, N.F., iii, p. 226, pl. x, figs. 32-34; Petersen, 1904, Medd. Komm. Havundersog. Kjob., Ser. Fisk., i (1), p. 9, pl. ii, figs. 15-21; Ehrenbaum, 1905, in Brandt and Apstein, Nordisches Plankton, I. Eier Larv. Fisch. (1), p. 166, fig. 70¹; Allen, 1917, J. Mar. Biol. Ass., (2) xi, p. 229; Clark, 1920, J. Mar. Biol. Ass., (2) xii, p. 195, fig. 2; Schnakenbeck, 1928, Ber. d. wiss. Komm. Meeresf., N.F., iv (4), p. 208, pls. iii, iv; Schnakenbeck, 1929, in Joubin, Faune Ichth. Atlant. Nord, iii, figs.

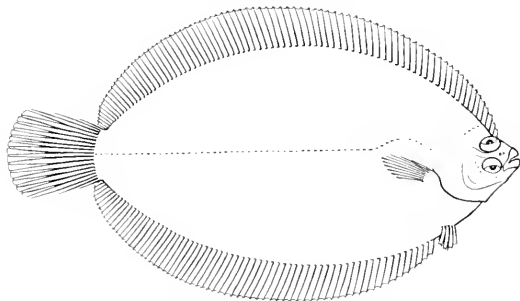


FIG. 259.—*Microstomus kitt*. B.M. (N.H.) 88.4.3.96. $\times \frac{1}{2}$.

Depth of body 2 to 3 in the length, length of head $4\frac{1}{4}$ to $5\frac{1}{2}$. Upper profile of head generally a little concave. Snout naked, shorter than eye, diameter of which is 3 to $4\frac{1}{2}$ in length of head; lower eye scarcely in advance of upper; interorbital ridge and eye-balls not scaled; postocular ridge scarcely apparent; anterior nostril of ocular side with a short tube with rather short posterior flap. Mouth distinctly asymmetrical, maxillary extending to below anterior edge of eye or not quite as far, length on ocular side $3\frac{1}{2}$ to $4\frac{1}{2}$, on blind side $3\frac{1}{2}$ to $3\frac{3}{4}$ in that of head; lower jaw not projecting, $3\frac{1}{2}$ to $3\frac{3}{4}$ in head. Teeth forming a continuous cutting edge; dental formula $\frac{1-2 + 6-16}{1-3 + 8-15}$. Gill-rakers of moderate length, rather stout; 10 to 12 on lower part of anterior arch; width of lower pharyngeals 5 to 6 in length; each with one or two

¹ Consult for full list of references.

irregular series of conical teeth. Scales rather feebly imbricated, some more or less embedded; 110 to 125 in a longitudinal series above lateral line; some supplementary scales in region of pores of lateral line. Lateral line with a distinct but rather low curve above the pectoral fin, a short supratoral branch. Dorsal 85-97; origin a little on blind side of head at a distance behind posterior nostril which is less than $\frac{1}{2}$ diameter of eye, above anterior edge or anterior part of eye, highest rays $1\frac{2}{3}$ to twice in length of head. Anal 60-70. Pectoral of ocular side with 9 to 11 rays (5 to 8 branched), length $1\frac{1}{3}$ to $1\frac{2}{3}$ in that of head. Pelvics with 5 or 6 rays. Caudal with 18 or 19 rays (13 to 15 branched), rounded, more or less densely scaled; caudal peduncle 3 to $3\frac{1}{2}$ times as deep as long. Pyloric appendages of moderate length. Vertebrae 48 (13 + 35). Brownish or greyish, often spotted, blotched or marbled with paler and darker, the markings being very variable; usually some dark spots or blotches on median fins; base of pectoral dusky, remainder of fin with cloudy markings.

TYPE.—Not traced.

DISTRIBUTION.—Coasts of north-western Europe, from the White Sea to the Bay of Biscay; Iceland.

SPECIMENS EXAMINED :

1 (350 mm.).	Bergen.	U.S. Nat. Mus.
1 (410 ").	Scapa Flow, Orkneys.	Cowan.
1 (19 ").	Shetland.	Nelson.
1 (370 ").	Scotland.	Gunther.
1 (295 "), stuffed.	"	—
1 (535 "), "	E. coast of Scotland.	Gerrard.
2 (435-445 mm.), stuffed.	Firth of Forth.	Parnell Coll.
1 (415 mm.), skin.	"	"
1 (400 ").	Loch Fyne.	Duke of Argyll.
1 (125 ").	Mouth of Loch Fyne, 50-60 fms.	Murray.
1 (195 ").	Firth of Clyde, 10 fms.	"
8 (70-325 mm).	S.E. of Sanda Isd., 30-35 fms.	"
1 (180 ").	Sound of Sanda, 22 fms.	"
2 (181, 182 mm.).	Kilbrennan Sound, 50 fms.	"
1 (102 mm.).	S.W. Ireland.	Grenfell.
1 (142 ").	Off S.W. Ireland, 130 fms.	Brunner.
1 (330 "), skeleton.	British coast.	—
1 (380 "), stuffed.	England.	—
3 (280-445 mm.), skins.	"	Yarrell.
1 (350 mm.).	English coast.	Gray.
2 (250, 330 mm.), "	Plymouth.	Yarrell.
2 (300, 350 "), "	S. Devon.	"
1 (340 mm.), stuffed.	Polperro.	—
1 (185 ").	—	Gunther.

ABNORMALITY.

1 (370 mm.).	Orange and black.	N. Shields.	Dunn.
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Attains to a length of 12 to 15 inches.

2. *MICROSTOMUS ACHNE* (Jordan and Starks).

- Veraqua achne*, Jordan and Starks, 1904, Bull. U.S. Com. Fish., xxii, (1902), p. 625, pl. vii, fig. 1; Jordan and Starks, 1906, Proc. U.S. Nat. Mus., xxxi, p. 210, fig. 16; Jordan, Tanaka and Snyder, 1913, J. Coll. Sci. Tokyo, xxxiii (1), p. 328, fig. 277.
- Microstomus stelleri*, Jordan and Starks, 1906, Proc. U.S. Nat. Mus., xxxi, p. 225, fig. 22; Snyder, 1912, Proc. U.S. Nat. Mus., xlii, p. 449; Jordan, Tanaka and Snyder, 1913, J. Coll. Sci. Tokyo, xxxiii (1), p. 331, fig. 289; Hubbs, 1915, Proc. U.S. Nat. Mus., xlviii, p. 489; Tanaka, 1916, Fish. Japan, xxii, p. 309, pl. cvi, fig. 326; Hubbs, 1918, Annot. Zool. Japon., ix, p. 371; Jordan and Hubbs, 1925, Mem. Carnegie Mus., x, p. 306; Schmidt, 1929, C.R. Acad. Sci. Russ., p. 706; Soldatov and Lindberg, 1930, Bull. Pac. Sci. Fish. Inst., v, p. 412.

Microstomus achne, Hubbs, 1918, Annot. Zool. Japon., ix, p. 371; Hubbs, 1932, Occ. Pap. Mus. Zool. Univ. Mich., 249, p. 6.

Microstomus sp., Schmidt, 1931, C. R. Acad. Sci. Russ., p. 318.

Very close to *M. kitt*. Depth of body $2\frac{1}{2}$ to 3 in the length, length of head $4\frac{2}{3}$ to 5. Upper profile of head evenly curved or a very little concave. Diameter of eye $2\frac{1}{2}$ to $4\frac{1}{2}$ in length of head; lower eye very slightly in advance of upper; interorbital ridge sometimes with a few rudimentary scales. Length of maxillary on ocular side $3\frac{1}{2}$ to 4, on blind side $3\frac{1}{2}$ to $3\frac{2}{3}$ in that of head; lower jaw $3\frac{1}{4}$ to $3\frac{1}{2}$ in head. Dental formula $\frac{0}{0} + \frac{8-11}{8-12}$. Gill-rakers short, rather stout; 9 or 10 on lower part of anterior arch; lower pharyngeals each with two even rows of sharp teeth. Scales scarcely

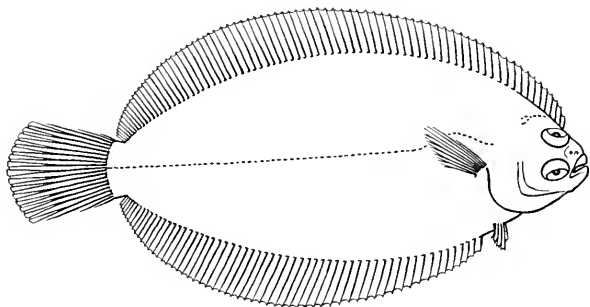


FIG. 260.—*Microstomus achne*. B.M. (N.H.) 1931.11.26.4. $\frac{1}{2}$.

imbricated; 135 to 142 in a longitudinal series just above lateral line. Lateral line sometimes with a short supratemporal branch. Dorsal (79) 84-95; origin above middle of eye or a little farther forward; highest rays 2 to $2\frac{1}{4}$ in length of head. Anal (65) 97-77 (79). Pectoral of ocular side with 10 or 11 rays (6 to 8 branched), length $1\frac{1}{2}$ to $1\frac{2}{3}$ in that of head. Caudal with 21 or 22 rays (16 branched); caudal peduncle 2 to $2\frac{2}{3}$ times as deep as long. Pyloric appendages rather long. Brownish, with traces of darker markings; blind side sometimes spotted or blotched with brown; median fins more or less dusky on blind side; pectoral greyish or blackish.

TYPE.—United States National Museum. No. 51448.

DISTRIBUTION.—Coasts of China and Japan.

SPECIMENS EXAMINED:

1 (230 mm.).
1 (290 ,,).
1 (210 ,,).
1 (250 ,,).

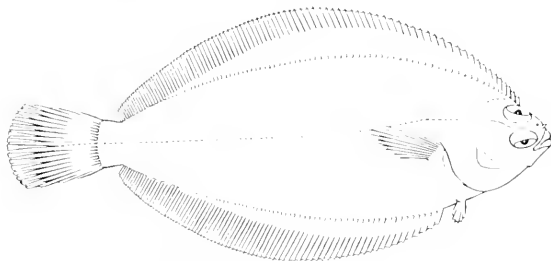
China.
Japan.
Tokyo Market.
Hakata.

Wu.
U.S. Nat. Mus.
Tokyo Imp. Univ.
Jordan.

3. MICROSTOMUS PACIFICUS (Lockington).

[SLIPPERY SOLE.]

- Glyptocephalus pacificus*, Lockington, 1878-9, Rep. Cal. Com. Fisheries, p. 43; Lockington, 1880, Proc. U. S. Nat. Mus., II, (1879), p. 86; Jordan, 1884, Nat. Hist. Aquat. Anim. (Fisheries Fish. Indust. U. S., II), p. 188.
- Cynoglossus pacificus*, Jordan and Gilbert, 1881, Proc. U. S. Nat. Mus., III, (1880), p. 453; Jordan and Gilbert, 1882, Proc. U. S. Nat. Mus., IV, (1881), p. 98; Jordan and Gilbert, 1883, Bull. U. S. Nat. Mus., XVI, p. 838.
- Microstomus pacificus*, Jordan and Goss, 1889, Rep. U. S. Com. Fish., XIV, (1886), p. 299; Jordan and Evermann, 1898, Bull. U. S. Nat. Mus., XLVI (3), p. 2955; Evermann and Goldsborough, 1907, Bull. U. S. Bur. Fish., XXVI, (1906), p. 357; Starks and Morris, 1907, Univ. Calif. Pub. Zool., III (11), p. 245; Starks, 1911, Ann. Carnegie Mus., VII, p. 269; Starks, 1918, Calif. Fish Game, IV (1), p. 19, fig. 99.

FIG. 204. *Microstomus pacificus*. B.M. (N.H.) 96.2 10.91. 1/2.

Depth of body $2\frac{1}{2}$ to $3\frac{1}{4}$ in the length, length of head $4\frac{1}{4}$ to $4\frac{2}{3}$. Upper profile of head more or less evenly curved. Snout scaled, shorter than eye, diameter of which is 3 to 4 in length of head, lower eye a little in advance of upper, interorbital ridge and upper surfaces of eye-balls more or less scaled, postocular ridge scarcely apparent, anterior nostril of ocular side with a short tube, with long posterior flap. Mouth rather asymmetrical, maxillary extending to below anterior part of eye, length on ocular side 4 to $4\frac{1}{2}$, on blind side $3\frac{1}{2}$ to $3\frac{1}{3}$ in that of head, lower jaw scarcely projecting, 3 to $3\frac{1}{2}$ in head. Teeth forming a continuous cutting edge, dental formula $\frac{0}{0} - \frac{13-15}{13-16}$. Gill-rakers rather short and stout, 9 to 11 on lower part of anterior arch, width of lower pharyngeals about 7 or 8 in length; each with an inner row of strong conical teeth, and anteriorly an outer series of 5 to 7 much smaller teeth. Scales fairly well imbricated; about 140 in a longitudinal series above lateral line, no supplementary scales. Lateral line with a very low curve above the pectoral fin, a short supratemporal branch. Dorsal 94-106, origin at a distance behind posterior nostril which is at least $\frac{1}{2}$ diameter of eye, a little behind middle of eye, highest rays about twice in length of head. Anal 80-88. Pectoral of ocular side with 9 or 10 rays (6 or 7 branched), length $1\frac{1}{3}$ to $1\frac{1}{2}$ in that of head. Pelvics with 5 or 6 rays. Caudal with 21 rays (15 branched), rounded, densely scaled, caudal peduncle nearly twice as deep as long. Vertebrae 52 (12 + 40). Brownish, indistinctly mottled with darker, all the fins blackish towards their edges on both sides.

TYPE.—Not traced.

DISTRIBUTION.—Pacific coast of North America, from Alaska to southern California.

SPECIMENS EXAMINED :

1 (325 mm.).	Puget Sound.	U.S. Nat. Mus.
2 (88, 160 mm.).	San Juan Is., Washington.	Amer. Mus. Nat. Hist.
1 (245 mm.).	Off central California (37° 49' N., 123° 23' W.), 191 fms.	U.S. Nat. Mus.
1 (138 ,,).	Off central California (37° 05' N., 122° 24' W.), 43 fms.	„
1 (305 ,,).	Off southern California (33° 55' N., 120° 28' W.), 376 fms.	„
3 (205-230 mm.).	Pt. Reyes, Cal.	Eigenmann.

Attains to a length of 15 to 18 inches.

Genus 22. EMBASSICHTHYS.

Embassichthys, Jordan and Evermann, 1896, Rep. U.S. Com. Fish., xxi, (1895), p. 506 [*Cynicoglossus bathybius*, Gilbert].

Apparently closely related to *Microstomus*, differing in having the teeth nearly equally developed on both sides of jaws, with at least 7 teeth on ocular side of each jaw. Dorsal with 111 to 117 rays, commencing at a distance behind posterior nostril of blind side nearly equal to diameter of eye; anal with 96 to 98 rays; dorsal and anal fins densely covered with scales. Skin thick. Vertebrae 63 (14 + 49).

A single species from the coast of California.

1. EMBASSICHTHYS BATHYBIUS (Gilbert).

Cynicoglossus bathybius, Gilbert, 1891, Proc. U.S. Nat. Mus., xiii, (1890), p. 123.

Embassichthys bathybius, Jordan and Evermann, 1896, Rep. U.S. Com. Fish., xxi, (1895), p. 506; Jordan and Evermann, 1898, Bull. U.S. Nat. Mus., xlvii (3), p. 2655; Townsend and Nichols, 1925, Bull. Amer. Mus. Nat. Hist., li (1), p. 17, pl. iv, fig. 3.

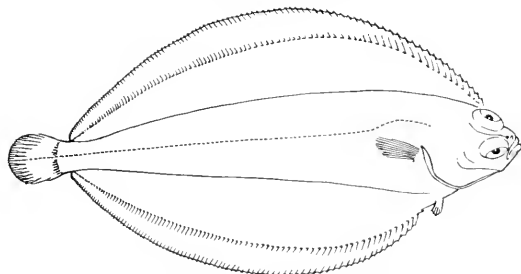


FIG. 262.—*Embassichthys bathybius*. U.S.N.M. 87581. $\times \frac{1}{2}$.

Body oval, thin. Depth of body 2 to $2\frac{1}{2}$ in the length, length of head 4 to $4\frac{1}{2}$. Upper profile of head very abruptly angulated opposite hinder margin of pupil of upper eye, the anterior half of the head conspicuously protruding beyond general outline.

Diameter of eye $2\frac{3}{4}$ to $2\frac{1}{2}$ in length of head, lower eye well in advance of upper, which enters largely into dorsal profile of head; eyes separated by a high, rather sharp, S-shaped, scaled ridge; postocular ridge not apparent. The length of the maxillary about $\frac{1}{4}$ or $\frac{1}{2}$ that of head; lower jaw a little projecting. Teeth broad, incisor-like, slightly notched at tip; dental formula on blind side $\frac{10}{21}$. Gill-rakers weak, rather short, 10 or 11 on lower part of anterior arch. Scales cycloid, about 105 in lateral line. Dorsal 111-117; origin above posterior part of eye; highest rays $\frac{2}{3}$ length of head. Anal 66-98. Pectoral with 11 rays, length about $\frac{1}{2}$ that of head. Pelvics with 5 rays, small. Caudal small, rounded; caudal peduncle short. Brownish, darker towards margins, becoming black on median fins; body and fins coarsely blotched with pale blue, the marks so arranged on upper and lower thirds of sides as to form 5 broad bluish bars, alternating with those of the ground-colour and corresponding above and below; lips and branchiostegal membranes black; blind side dusky brownish.

TYPE.—United States National Museum. No. 87581 (paratype).

DISTRIBUTION.—Coast of California, from south of Monterey to Santa Barbara Isd., in deep water.

The species was originally described from two specimens from the Santa Barbara Channel ($33^{\circ} 49' N.$, $119^{\circ} 24' W.$), in 603 fathoms. Other examples were recorded by Townsend and Nichols from 440 to 659 fathoms.

Genus 23. TANAKIUS.

Tanakius, Hubbs, 1918, Annot. Zool. Japon., ix, p. 370. [*Microstomus kitaharæ*, Jordan and Starks]; Hubbs, 1932, Occ. Pap. Mus. Zool. Univ. Mich., 249, p. 2.

Apparently related to *Devistes*, but with an increased number of dorsal and anal rays and vertebrae. Body elongate-elliptical. Upper surfaces of eye-balls scaled. Lips not thick, teeth well developed on both sides of jaws, compressed and incisor-like, close-set. Gill-opening extending above axil of pectoral. Dorsal with 84 to 102 rays, commencing well behind posterior nostril of blind side. Anal with 75 to 81 rays, tip of first interhaemal spine not projecting in front of fin. A few rays at hinder ends of dorsal and anal fins branched; fin-rays not stout. Skin thin; scales well imbricated, not embedded, cycloid; no supplementary scales in region of lateral line, no mucous cavities on blind side of head. Intestine with two coils, the second loop long and extending backwards into the secondary body-cavity of the ocular side; 2 or 3 + 3 or 4 pyloric appendages.

A single species from Japan.

Hubbs (1918) has pointed out the general similarity in appearance between this genus and *Devistes*, and originally placed the two in the same genus. *Devistes* would appear to be more nearly related to *Lumanda* and *Pseudopleuronectes*.

1. TANAKIUS KITAHARÆ (Jordan and Starks).

Pleurocentrus cyanoglossus (non Linnaeus), Okai, 1897, Journ. Fish. Bur. Tokyo, vi (1), p. 7, pl. vi, fig. 7.

Microstomus kitaharæ, Jordan and Starks, 1904, Bull. U.S. Com. Fish., xxii, (1902), p. 625, pl. vii, fig. 2; Jordan and Starks, 1906, Proc. U.S. Nat. Mus., xxxi, p. 223, fig. 21; Jordan, Tanaka and Snyder, 1913, J. Coll. Sci. Tokyo, xxxiii (1), p. 332; Hubbs, 1915, Proc. U.S. Nat. Mus., xlviii, p. 400; Soldatov and Lundberg, 1930, Bull. Pac. Sci. Fish. Inst., v, p. 413.

Devistes (*Tanakius*) *kitaharæ*, Hubbs, 1918, Annot. Zool. Japon., ix, p. 371.

Tanakius kitaharæ, Jordan and Hubbs, 1925, Mem. Carnegie Mus., x, p. 300; Hubbs, 1932, Occ. Pap. Mus. Zool. Univ. Mich., 249, p. 6.

Glyptocephalus kitaharæ (part), Schmidt, 1929, C. R. Acad. Sci. Russ., p. 367.

Glyptocephalus kitaharæ, Schmidt, 1931, C. R. Acad. Sci. Russ., p. 318.

Glyptocephalus (*Tanakius*) *kitaharæ*, Schmidt, 1931, Trans. Pac. Com. Acad. Sci. U.S.S.R., ii, p. 127.

Depth of body 3 to $3\frac{1}{2}$ in the length, length of head $4\frac{2}{3}$ to nearly 5. Upper profile of head more or less evenly curved. Snout naked, much shorter than eye, diameter of which is 3 to $3\frac{1}{4}$ in length of head; lower eye a very little in advance of upper; interorbital ridge rather high, very narrow, more or less scaled; postocular ridge scarcely apparent. Mouth not markedly asymmetrical, the maxillary extending to below anterior $\frac{1}{4}$ of eye, length on ocular side $3\frac{1}{2}$ to 4, on blind side $3\frac{2}{3}$ to $3\frac{5}{8}$ in that of head; lower jaw scarcely projecting, $2\frac{1}{2}$ to $2\frac{3}{4}$ in head. Teeth forming a continuous cutting edge, rather smaller on ocular side of jaws; dental formula $12-14 + 14-16$. Gill-rakers rather short and stout; 7 or 8 on lower part of anterior arch; width of lower pharyngeals more than 5 in length; teeth of inner row much larger than those of outer. About 100 scales in a longitudinal series above lateral

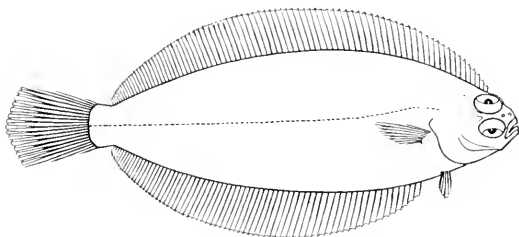


FIG. 203.—*Tanakius kitaharæ*. B.M. (N.H.) 1923.11.21.19. $\times \frac{1}{2}$.

line. Lateral line with a very slight curve above the pectoral fin; a very inconspicuous, short supratemporal branch. Dorsal (84) 87-93 (102); origin just behind middle of eye; highest rays about twice in length of head. Anal 75-81. Pectoral of ocular side with 10 or 11 rays (8 branched), length $1\frac{1}{2}$ to $1\frac{3}{4}$ in that of head. Pelvics with 6 rays. Caudal with 23 rays (15 branched), rounded or obtusely pointed; caudal peduncle $1\frac{2}{3}$ to $1\frac{3}{4}$ times as deep as long. Reddish brown; distal parts of pectoral and caudal fins blackish.

TYPE.—United States National Museum No. 51418.

DISTRIBUTION.—Southern Japan; Corea.

SPECIMENS EXAMINED:

1 (205 mm.).	Japan.	U.S. Nat. Mus.
1 (170 ,,). Paratype.	Tokyo.	Stanford Univ.
2 (135, 220 mm.).	Tokyo Market.	Tokyo Imp. Univ.

Genus 24. GLYPTOCEPHALUS.

Glyptocephalus, Gottsche, 1835, Arch. Naturgesch., i (2), p. 136 [*Pleuronectes saxicola*, Faber]; Gill, 1873, Proc. Acad. Nat. Sci. Philad., xxv, p. 360; Norman, 1933, Ann. Mag. Nat. Hist., (10) xi, p. 221.

Errex, Jordan, 1919, Proc. Acad. Nat. Sci. Philad., lxx, (1918), p. 343 [*Glyptocephalus zachirus*, Lockington].

Close to *Tanakius*. Snout and eye-balls naked or more or less scaled. All the rays of the dorsal and anal fins simple; tip of first interhamal spine projecting in front of anal fin, sometimes very small and hidden in the skin. Blind side of head with large mucous cavities in the skull. 2 or 3 + 2 to 5 pyloric appendages. Vertebrae 58 to 65 (12 + 4 + 45-52).

Three species from the North Atlantic and North Pacific.

SYNOPSIS OF THE SPECIES

- I Pectoral of ocular side shorter than head; snout not scaled; 58 to 60 vertebrae; anal spine rather small. GLYPTOCEPHALUS¹
- A Dorsal (95) 97-115 (120), anal 85-99 (102); 2 + 4 or 5 pyloric appendages. 1. *cynoglossus*
- B Dorsal (83) 88-99 (97), anal (72) 75-80; 3 or 4 + 2 or 3 pyloric appendages. 2. *stellatus*
- II Pectoral of ocular side much longer than head; snout more or less scaled; 65 vertebrae; anal spine strong [EKREK]. 3. *zachvatii*

1. GLYPTOCEPHALUS CYNOGLOSSUS (Linnaeus).

[WITCH, POLE FLOUNDER]

- Pleuronectes cynoglossus*, Linnaeus, 1758, Syst. Nat., ed. 10, p. 269; 1766, ed. 12, p. 156; Fries, 1839, Vet. Akad. Handl., ix, (1838), p. 160; Nilsson, 1855, Skand. Faun., ed. 2, Fiskar, p. 623; Gunther, 1862, Cat. Fish., iv, p. 449; Collett, 1875, Vid. Selsk. Forh., (1874), Till, p. 147; Malm, 1877, Göteborgs Bohus. Fauna, p. 527; Day, 1880-84, Fish. Britain, ii, p. 30, pl. viii; Gunther, 1887, Deep-Sea Fish., "Challenger", p. 160; Gunther, 1888, Proc. Roy. Soc. Edinb., xv, p. 219; Lilljeborg, 1891, Sverig. Norg. Fiskar, ii, p. 389; Smit, 1893, Scand. Fish., 4, p. 378, pl. xix, fig. 3; Holt and Calderwood, 1895, Sci. Trans. K. Dublin Soc., (ii) v, p. 509; Schnaakenbeck, 1925, in Tier. Nord Ostsee, L. ii, xii (1), p. 6, fig. 5; Saemundsson, 1927, Vid. Visind. Island, ii, p. 37; Schnaakenbeck, 1929, in Joulou, Faun. Ichth. Atlant. Nord, iii, fig. 7; *Solea cynoglossa*, Rafinesque, 1810, Ind. Ich. Sicil., p. 53.
- Pleuronectes saxicola*, Fabor, 1828, Tidsskr. for Naturvid., (4), p. 244.
- Pleuronectes niger-mimus*, Nilsson, 1829, Isis (Oken), p. 401; Nilsson, 1832, Prodr. Ichth. Scand., p. 85; Valenciennes, 1838-51, in Gaimard, Voy. Isl. Groenl., Atlas, Poiss. pl. xiii.
- Glyptocephalus saxicola*, Gottsche, 1835, Arch. Naturgesch., 1 (2), p. 159.
- Platessa polo*, Jenyns, 1835, Man. Brit. Anim., p. 458; Yarrell, 1836, Brit. Fish., ed. 1, ii, p. 227, fig. 4; Bonaparte, 1840, Cat. Method. Poesi. Europ., 1 (2), p. 48.
- Platessa elongata*, Yarrell, 1849, Brit. Fish., ed. 1, ii, Suppl., p. 33; Yarrell, 1841, Brit. Fish., ed. 2, ii, p. 318.
- Platessa saxicola*, Krøyer, 1847-5, Danmarks Fisk., ii, p. 338, fig.
- Pleuronectes domatus*, Gunther, 1862, Cat. Fish., iv, p. 450; Day, 1879, Proc. Zool. Soc., p. 755, pl. lxi.
- Glyptocephalus elongatus*, Gill, 1873, Proc. Acad. Nat. Sci. Philad., xxv, p. 362.
- Glyptocephalus acedonius*, Gill, 1873, *loc. cit.*, p. 360.
- Glyptocephalus cynoglossus*, Gill, 1873, *loc. cit.*, p. 360; Goode and Bean, 1879, Proc. U.S. Nat. Mus., 1, (1878), p. 21; Collett, 1879, Vid. Selsk. Forh., (1878), p. 98; Collett, 1880, Vid. Selsk. Forh., (1879), p. 52; Collett, 1880, Norske Nordhavs Exped., Zool., Fiske, p. 150; Goode, 1881, Proc. U.S. Nat. Mus., iii, (1880), p. 475; Jordan and Gilbert, 1883, Bull. U.S. Nat. Mus., xvi, p. 838; Goode, 1884, Nat. Hist. Aquat. Anim. (Fisheries Fish. Indust. U.S.), p. 198, pl. lvii; Jordan and Goss, 1889, Rep. U.S. Com. Fish., xiv, (1889), p. 309, pl. viii, fig. 19; Goode and Bean, 1893, Ocean. Ichth., p. 319, pl. cii, fig. 350; Collett, 1896, Res. Camp. Sci. Monaco, x, p. 101; Jordan and Evermann, 1898, Bull. U.S. Nat. Mus., xxiv (3), p. 2657; Collett, 1903, Vid. Selsk. Forh., (1902), p. 102; Johnsen, 1919, Bergens Mus. Aarb., 1918-1919, No. 6, p. 47; Huntsman, 1922, Contr. Canad. Biol., 1921, No. iii, p. 22; Bigelow and Welsh, 1925, Bull. U.S. Bur. Fish., xl (1), (1924), p. 511, figs. 291, 297; Купович, 1929, Trans. Inst. Sci. Explor. North, xxviii, p. 141, fig. 165; Chidamand, 1930, Bull. Mus. Hist. Nat. Paris, (2) ii, p. 627.
- Platessa cynoglossa* Moreau, 1881, Hist. Nat. Poiss. France, iii, p. 296.

EGGS, LARVÆ AND YOUNG.

Cunningham, 1887, Trans. Roy. Soc. Edinb., xxxiii (1), p. 101, pl. iii, figs. 7-9, pls. iv, v; McIntosh and Prince, 1890, Trans. R. Soc. Edinb., xxxv (3), p. 839, pl. xviii, figs. 7-9; Holt, 1891, Sci. Trans. R. Dublin Soc., (2) iv, p. 455; Holt, 1893, Sci. Trans. R. Dublin Soc., (2) v, p. 84, pl. ix, figs. 71-75, pl. xv, figs. 123-4; Petersen, 1894, Rep. Danish Biol. Stat., iv, (1893), p. 130, pl. ii, figs. 14, 20; Cunningham, 1896, N. H. Market. Mar. Fish., p. 233, figs. 108, 109; McIntosh and Masterman, 1897, Brit. Mar. Food-fish., p. 372, figs.; Hencke and Ehrenbaum, 1900, Wiss. Meeresuntersuch., Abt. Helgoland, N.F., iii, p. 229; Holt and Byrne, 1903, Rep. Fish. Ireland, (1901), H. Sci. Invest., iv, p. 67, pl. iii; Kyle, 1903, J. Mar. Biol. Ass., N.S., vi, p. 618, pl. iii, fig. 2; Williamson, 1904, Rep. Fish. Board Scotland, xxii (iii), (1903), p. 270, pl. xvi; Petersen, 1904, Medd. Komm. Havundersog. Kjob., Ser. Fisk., 1 (1), p. 9, pl. ii, figs. 22-28; Ehrenbaum, 1905, in Brandt and Apstein, Nordisches Plankton, I. Eier Larv. Fisch. (1), p. 171, fig. 71; Schnakenbeck, 1928, Ber. d. wiss. Komm. Meeresf., N.F., iv (4), p. 211, pl. v; Schnakenbeck, 1929, in Jonbin, Faun. Ichth. Atlant. Nord, iii, figs.

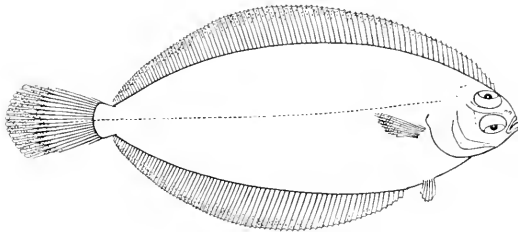


FIG. 264.—*Glyptocephalus cynoglossus*. B.M. (N.H.) 88.3.16.2. $\times \frac{1}{2}$.

Depth of body $2\frac{2}{3}$ to $3\frac{1}{2}$ in the length, length of head $4\frac{1}{2}$ to $5\frac{1}{2}$. Upper profile of head more or less evenly convex. Snout not scaled, shorter than eye, diameter of which is $3\frac{1}{4}$ to $4\frac{1}{2}$ in length of head; lower eye a little in advance of upper; interorbital ridge rather low, narrow, scaled; postocular ridge scarcely apparent; eye-balls not scaled. Maxillary extending to below anterior edge or anterior part of eye, length on ocular side $4\frac{1}{2}$ to 5, on blind side $3\frac{1}{2}$ to $4\frac{1}{2}$ in that of head; lower jaw a little projecting, about 3 in head. Teeth somewhat compressed, with incisor-like edges, forming a subcontinuous cutting edge; bluntly conical and separated on ocular side in young; dental formula $\frac{8-15}{9-16} + \frac{17-26}{20-26}$. Gill-rakers short, rather stout; 6 to 9

on lower part of anterior arch; width of lower pharyngeals more than 5 times in length; teeth of inner row distinctly larger than those of outer. Scales varying in size, somewhat irregularly arranged, mostly cycloid, but sometimes a few feebly tenoid on ocular side; 110 to 140 in a longitudinal series just above lateral line. Lateral line nearly straight or with a very low curve above pectoral fin; a short supratemporal branch. Dorsal (95) 97-115 (120); origin on median line, well behind posterior nostril of blind side and above anterior part of eye; highest rays about $\frac{1}{2}$ length of head. Anal 85-99 (102); interhaemal spine rather small. Pectoral of ocular side with 9 to 13 rays (6 to 10 branched), length $1\frac{1}{2}$ to $2\frac{1}{8}$ in that of head. Pelvics with 6 rays. Caudal with 20 to 24 rays (12 to 16 branched), rounded; caudal peduncle $1\frac{1}{2}$ times to twice as deep as long. $2 + 4$ or 5 rather long pyloric appendages. Vertebrae 58 to 60 (12-14 + 45-46). Brownish or greyish brown; body and fins thickly speckled with minute black dots, which are generally fewer, larger and more scattered on blind side; median fins more or less dusky towards their margins on both sides; anterior rays of dorsal and anal sometimes tipped with paler; distal part of pectoral blackish.

TYPE — Not traced

DISTRIBUTION — North Atlantic, southwards to Cape Cod and the Bay of Biscay¹

SPECIMENS EXAMINED.

1 (400 mm)	Christianiafjord	Collett
1 (390 ..)	Westray Sands, Orkney.	Cowan
1 (450 ..) stuffed.	Firth of Forth.	—
1 (335-410 mm).	Off Skate Isd., Loch Fyne, 100 fms.	Murray
2 (340-420 ..)	Lower Loch Fyne, 80 fms.	"
1 (400 mm.)	Loch Houn, 70 fms.	"
1 (430 ..)	Loch Canon, 60 fms.	"
1 (430 ..)	Kilbrennan Sound, 60-70 fms.	"
5 (175-350 mm.)	" 46 fms.	"
1 (225 mm.)	" 46 fms.	"
8 (90-360 mm.)	" 20 fms.	"
2 (225, 375 mm.)	" 40-45 fms.	"
1 (356 mm.)	Between Sanda Isd. and Ailsa Craig, 24 fms.	"
5 (410-295 mm.)	Loch Strivan, 40 fms.	"
1 (350 mm.), stuffed.	Ireland.	Thompson.
2 (176, 180 mm.)	Off S W Ireland, 150 fms.	Brunner.
1 (430 mm.)	Yarmouth.	Patterson.
3 (295-475 mm.), skins.	Plymouth.	Yarrell.
2 (330, 450 ..) ..	S. Devon.	"
1 (270 mm.) skins.	Brixham.	Parnell Coll.
3 (295-490 mm.) skins.	British coast.	Yarrell.
1 (320 mm.) skins	"	Gronow Coll.
1 (220 ..)	Gloucester, Mass	U.S. Nat. Mus.
1 (285 ..)	37° 10' 15" N, 74° 32' 00" W	"
1 (270 ..)	39° 53' N, 70° 17' W.	"

Attains to a length of 12 to 18 inches.

Lonnberg (1894, Overs. Vet.-Akad. Forh., li, p. 582) describes a fish from the Cattegat, which he believes to be a hybrid *Pleuronectes platessa* × *Glyptocephalus cynoglossus*.

2. GLYPTOCEPHALUS STELLERI (Schmidt).

Microstomus stelleri, [Schmidt, 1903, Bull. Imp. Russ. Geogr. Soc., xxxviii (51), (1902), p. 522];

Schmidt, 1904, Pisc. Mar. Orient., p. 247.

Glyptocephalus, Jordan and Starks, 1906, Proc. U.S. Nat. Mus., xxxi, p. 226.*Glyptocephalus ostroumovi*, Pavlenko, 1910, Trudy Obshch. Kazan, xlii, p. 50, pl. II, fig. 13; Hubbs, 1915, Proc. U.S. Nat. Mus., xlvii, p. 491; Jordan and Hubbs, 1925, Mem. Carnegie Mus., x, p. 301.*Glyptocephalus saxæ*, Snyder, 1911, Proc. U.S. Nat. Mus., xl, p. 548; Snyder, 1912, Proc. U.S. Nat. Mus., xlii, p. 440, pl. xlix, fig. 1; Jordan, Tanaka and Snyder, 1913, J. Coll. Sci. Tokyo, xxxiii (1), p. 332.*Microstomus hureguo*, Tanaka, 1910, Dobuts. Zasshi (Zool. Mag.), xxviii, p. 67 (in Japanese); Tanaka, 1917, Fish. Japan, xxv, p. 447, pl. cxvii, fig. 351.*Glyptocephalus kutaharæ* (part), Schmidt, 1920, C. R. Acad. Sci. Russ., p. 307.*Glyptocephalus ostroumovi*, Soldatov and Lindberg, 1930, Bull. Pac. Sci. Fish. Inst., v, p. 414.*Glyptocephalus stelleri*, Hubbs, 1932, Occ. Pap. Mus. Zool. Univ. Mich., 249, p. 7.

Close to *G. cynoglossus*. Depth of body $2\frac{1}{2}$ to $3\frac{1}{4}$ in the length, length of head $4\frac{1}{2}$ to $4\frac{1}{2}$. Diameter of eye $3\frac{1}{2}$ to 4 in length of head; interorbital ridge high, narrow, apparently not scaled. Maxillary extending to a little beyond anterior edge of eye, length on ocular side $4\frac{2}{3}$ to nearly 5, on blind side $3\frac{1}{2}$ to 4 in that of head. Teeth compressed, incisor-like, forming a continuous cutting edge; dental formula $\begin{matrix} 7+10 \\ 13+20 \end{matrix}$ or 8 (10) gill-rakers on lower part of anterior arch. Scales all cycloid, about 115 (?)

¹ This species appears to be found in rather deeper water than related forms, but specimens have been collected at all depths from 10 to 730 fathoms.

in a longitudinal series above lateral line. Dorsal (83) 88-96 (97), origin above middle of eye. Anal (72) 75-80. Pectoral of ocular side with 10 to 12 rays (7 or 8 branched), length $1\frac{1}{2}$ to $1\frac{3}{4}$ in that of head. Caudal with 22 or 23 rays (14 or 15 branched), double-truncate or a little rounded; caudal peduncle about $1\frac{3}{4}$ times as deep as long. 3 or 4 + 2 or 3 rather long pyloric appendages.

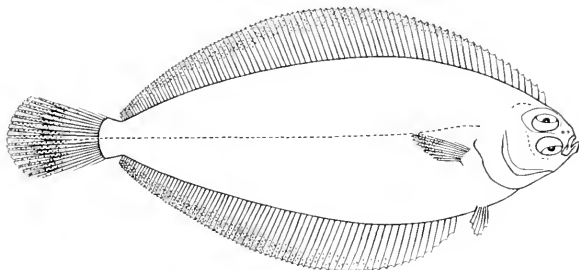


FIG. 265.—*Glyptocephalus stelleri*. B.M. (N.H.) 1923.9.28.28. $\times \frac{1}{2}$.

TYPE.—Zoological Museum, Leningrad. No. 12347-52.

DISTRIBUTION.—Shores of Japan, from southern Sakhalin to southern Honshu; Sea of Japan; Peter the Great Bay; Korea

SPECIMENS EXAMINED:

1 (230 mm.).	Obama, Wakasa Prov., Japan.	Tokyo Imp. Univ.
1 (260 ,,).	Sea of Japan, off Kasumi Prov.	" "
1 (180 ,,).	45° 25' N., 140° 53' W.	U.S. Nat. Mus.

3. GLYPTOCEPHALUS ZACHIRUS, Lockington.

[LONG-FINNED SOLE.]

Glyptocephalus zachirus, Lockington, 1878-9, Rep. Cal. Com. Fisheries, p. 42; Lockington, 1880, Proc. U.S. Nat. Mus., ii, (1879), p. 88; Jordan and Gilbert, 1881, Proc. U.S. Nat. Mus., iii, (1880), p. 453; Jordan and Gilbert, 1882, Proc. U.S. Nat. Mus., iv, (1881), p. 68; Jordan and Gilbert, 1883, Bull. U.S. Nat. Mus., xvi, p. 838; Jordan, 1884, Nat. Hist. Aquat. Anim. (Fisheries Fish. Indust. U.S., i), p. 188; Jordan and Goss, 1889, Rep. U.S. Com. Fish., xiv, (1886), p. 301; Jordan and Evermann, 1898, Bull. U.S. Nat. Mus., xlvii (3), p. 2658; Evermann and Goldsborough, 1907, Bull. U.S. Bur. Fish., xxvi, (1906), p. 357; Starks and Morris, 1907, Univ. Calif. Pub. Zool., iii (11), p. 246; Starks, 1911, Ann. Carnegie Mus., vii, p. 206; Starks, 1918, Calif. Fish Game, iv (4), p. 16, fig. 100.

Errex zachirus, Jordan, 1919, Proc. Acad. Nat. Sci. Philad., lxx, (1918), p. 343.

Depth of body 3 to $3\frac{1}{2}$ in the length, length of head $4\frac{2}{3}$ to $5\frac{1}{4}$. Upper profile of head distinctly convex. Snout scaled, shorter than eye, diameter of which is $3\frac{1}{2}$ to $3\frac{3}{4}$ in length of head; lower eye a little in advance of upper; interorbital ridge narrow, scaled; postocular ridge scarcely apparent; eye-balls not scaled. Maxillary extending to below anterior edge of eye or a little beyond, length on ocular side $4\frac{1}{2}$ to $5\frac{1}{4}$, on blind side about 4 in that of head; lower jaw a little projecting, 3 to $3\frac{1}{2}$ in head. Teeth compressed, incisor-like, forming a more or less continuous cutting edge; dental formula $\begin{matrix} 12-16 + 20-27 \\ 10-18 + 20-28 \end{matrix}$. Gill-rakers rather short and stout; 7 or 8 on lower part of anterior arch; width of lower pharyngeals 7 or 8 in length; teeth of inner row

much larger than those of outer. Scales all cycloid; about 140 in a longitudinal series above lateral line. Lateral line nearly straight; no supratemporal branch. Dorsal 04-107; origin well behind posterior nostril of blind side, above middle or anterior part of eye; highest rays about $\frac{1}{2}$ length of head. Anal 70-80 (80); interhaemal spine strong. Pectoral of ocular side with 11 or 12 rays (4 or 5 branched), fourth ray longest, length $2\frac{1}{2}$ to 3 in that of fish (without caudal)¹; pectoral fin of blind side not produced. Pelvics with 6 rays. Caudal with 23 or 24 rays (14 or 15 branched), rounded, caudal peduncle $1\frac{2}{3}$ to $1\frac{1}{2}$ times as deep as long. 2 or 3 + 3 pyloric appendages of moderate length. Vertebrae 65 (13 + 52). Brownish or greyish; both sides of body and fins speckled with fine black dots, which are fewer, larger and more scattered on blind side; all the fins dusky towards their edges.

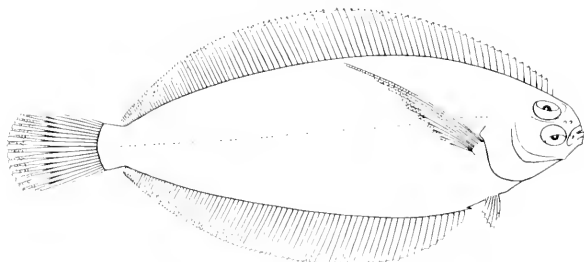


FIG. 266.—*Glyptocephalus zachirus*. B.M. (N.H.) 99.11.15.249. ♂ ♀.

TYPE.—Not traced.

DISTRIBUTION.—Pacific coast of North America, from the Bering Sea to San Francisco; in rather deep water.

SPECIMENS EXAMINED:

1 (320 mm.).	40° 09' N., 124° 22' W.	U. S. Nat. Mus.
1 (230 ").	Off central California (37° 21' N., 121° W.)	"
3 (305-340 mm.).	Pt. Reyes, Cal.	Eugenmann
1 (260 ").	"	U. S. Nat. Mus.

Rarely exceeds a length of 12 inches.

Genus 25. LIOPSETTA.

Liopsetta, Gill, 1864, Proc. Acad. Nat. Sci. Philad., xvi, p. 217 [*Platessa glabra*, Storer]; Jordan and Evermann, 1898, Bull. U. S. Nat. Mus., xlvii (3), p. 2049; Norman, 1913, Ann. Mag. Nat. Hist., (10) xi, p. 221.

Fuchalarodus, Gill, 1864, *loc. cit.*, pp. 216, 221 [*Fuchalarodus putnami*, Gill].

Gareus, Hubbs, 1915, Proc. U. S. Nat. Mus., xlviii, p. 486 [*Pleuronectes obscurus*, Herzenstein].

Body oblong, compressed. Eyes on the right side, separated by a low, narrow ridge, which may be naked or scaled, the upper close to edge of head; snout and eye-balls not scaled, postocular ridge rugose. Olfactory laminae few in number, nearly parallel, without rachis. Mouth rather small, the length of the maxillary on blind side less than $\frac{1}{2}$ that of head; jaws and dentition stronger on blind side of head, teeth compressed, incisor-like, forming a more or less continuous cutting

¹ Shorter in the young.

edge, not enlarged anteriorly, uniserial in both jaws; vomer toothless. Gill-rakers rather short, stout, few in number; lower pharyngeals of moderate width or rather broad, their width 2 to $4\frac{1}{4}$ in the length, generally massive, approximated for at least $\frac{1}{2}$ their length, their inner edges more or less angular; teeth coarse, obtusely conical, rounded or molariform, arranged in two or more rows. Dorsal fin with less than 70 rays; commencing just behind posterior nostril of blind side and above eye; all the rays simple, many of them scaled, at least on ocular side. Tip of first inter-hæmal spine projecting in front of anal fin, which has less than 50 rays. Pectoral fin of ocular side a little larger than that of blind side; middle rays branched. Pelvic fins short-based, subequal and subsymmetrical. Caudal fin with 12 or 13 branched rays, middle rays longest; caudal peduncle short or of moderate length. Scales small, adherent, more or less imbricated posteriorly, generally embedded anteriorly, ctenoid or cycloid; the male with rougher scales than the female; no supplementary scales. Lateral line nearly straight or with a low curve above the pectoral fin; a supratemporal branch, without posterior prolongation. Vent median, between the pelvic fins; intestine not narrow, of moderate length, with 3 or 4 simple coils, nearly entirely contained within body-cavity of blind side; 2 very short pyloric appendages. Vertebræ (38) 40 (13 + 27).

Four species from Arctic and subarctic seas.

SYNOPSIS OF THE SPECIES.

- I. Lateral line with low but distinct curve above pectoral fin; lower pharyngeals rather narrow, width $3\frac{1}{2}$ to $4\frac{1}{4}$ in length, not very massive, each with 2 rows of obtusely conical teeth; dorsal 59-67, anal 44-49 [GAREUS] 1. *obscura*.
- II. Lateral line straight or with very slight curve above pectoral fin; lower pharyngeals broad, width 2 to 3 in length, massive, each with more than 2 rows of rounded or molariform teeth; dorsal 48-59, anal 35-42 [LIOPSETTA].
 - A. Head $3\frac{1}{2}$ to $3\frac{3}{4}$ in length; pectoral about twice in head in male, shorter in female; width of lower pharyngeals about 3 in the length, teeth rounded, not entirely confluent.
 1. Dorsal and anal without blackish bars 2. *glacialis*.
 2. Dorsal and anal each with a row of blackish bars 3. *pinnifasciata*.
 - B. Head $3\frac{1}{2}$ to $3\frac{3}{4}$ in length; pectoral about $1\frac{1}{2}$ in head in male, shorter in female; width of lower pharyngeals 2 to $2\frac{1}{2}$ in length, the teeth more or less flattened and confluent 4. *putnami*.

These species form a natural group, which appears to connect *Limanda* and *Pseudopleuronectes* on the one hand with *Platichthys* on the other. *L. obscura* is, in many respects, very similar to *Pseudopleuronectes*, the lower pharyngeals being narrower and less massive than in the other species of *Liopsetta*, and their teeth conical and arranged in two rows. It agrees with the remaining species of *Liopsetta*, however, in having the scales rougher in the male than in the female.¹

Liopsetta glacialis, *pinnifasciata* and *putnami* are very closely related, and it would perhaps be better to regard these as subspecies of a single variable species. I have hesitated to adopt this course, however, as the material at my disposal is far from adequate.

I. LIOPSETTA OBSCURA (Herzenstein).

- Pleuronectes obscurus*, Herzenstein, 1891, [Mél. Biol., xiii (1)] Bull. Ac. Imp. Sci. St. Pétersbourg, xxxiv (N.S. II), p. 49.
- Liopsetta obscura*, Jordan and Evermann, 1898, Bull. U.S. Nat. Mus., xlvii (3), p. 2651; Jordan and Gilbert, 1899, Fur Seals and fur-seal Is. N. Pacif., (3), p. 492; Schmidt, 1904, Pisc. Mar. Orient., p. 244, fig. 20; Jordan and Starks, 1906, Proc. U.S. Nat. Mus., xxxi, p. 217; Pavlenko, 1920, Trudui Obsheh. Kazan, xlii, p. 59; Jordan, Tanaka and Snyder, 1913, J. Coll. Sci. Tokyo, xxxiii (1), p. 329; Soldatov and Lindberg, 1930, Bull. Pac. Sci. Fish. Inst., v, p. 407.
- Liopsetta (Gareus) obscura*, Hubbs, 1915, Proc. U.S. Nat. Mus., xlviii, p. 486.

¹ Unfortunately, it has been impossible to ascertain the form of the pyloric cæca in this species.

Depth of body $2\frac{1}{4}$ to $2\frac{3}{4}$ in the length, length of head $3\frac{3}{4}$ to 4. Upper profile of head nearly straight. Snout as long as or somewhat shorter than eye, diameter of which is $4\frac{1}{2}$ to 6 in length of head and 3 or 4 times interorbital width, which is scaled, anterior margins of eyes level; postocular ridge rather inconspicuous, rugose. Maxillary extending to below anterior edge of eye or a little beyond, length on ocular side 4 to $4\frac{1}{2}$, on blind side $3\frac{3}{4}$ in that of head; lower jaw a little projecting, $2\frac{1}{2}$ to $3\frac{1}{4}$ in head. Dental formula $\begin{matrix} 0-2 + 12-13 \\ 0-2 + 15-16 \end{matrix}$. 6 or 7 (10) gill-rakers on lower part of anterior arch, lower pharyngeals not very massive, their width $3\frac{3}{4}$ to $4\frac{1}{4}$ in length, each with 2 rows of obtusely conical teeth, the anterior teeth of the inner row larger than the remainder¹. Scales mostly imbricated, those on head and extreme anterior part of body more or less embedded; strongly ctenoid on ocular side and nearly all ctenoid on blind side in the male, cycloid on both sides of body in the female; preoperculum and operculum naked on blind side of head, 78 to 83 scales in a longitudinal series

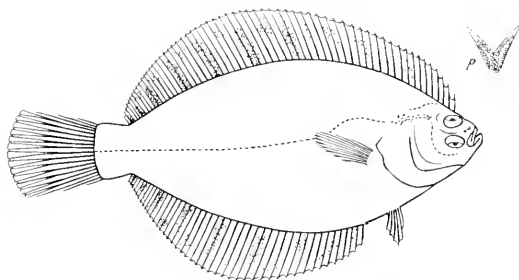


FIG. 267.—*Llopsetta obscura*. B.M. (N.H.) 1923.12.18 6 $\times \frac{1}{2}$. p., lower pharyngeals.

above lateral line, 37 to 39 between lateral line and middle of back. Lateral line with a low but distinct curve above pectoral fin. Dorsal (59) 60-63 (67); origin above anterior $\frac{1}{2}$ of eye, highest rays about $1\frac{3}{4}$ in length of head. Anal 44-48 (49). Pectoral of ocular side with 11 rays (6 or 7 branched), length $1\frac{1}{2}$ to $2\frac{1}{4}$ in that of head. Pelvics with 5 or 6 rays. Caudal with 10 rays (13 branched), rounded; caudal peduncle $1\frac{1}{2}$ to nearly twice as deep as long. Uniformly dark brownish; young with darker markings and numerous small pale spots; dorsal with 10 or 11, anal with 7 indistinct dark vertical bars, visible on blind side of fins, rays of median fins sometimes tipped with yellow.

TYPE.—Zoological Museum, Leningrad. Nos. 8725-29.

DISTRIBUTION.—Alaska (?), Okhotsk Sea; Sakhalin Isd., Sea of Japan; Yellow Sea.

SPECIMENS EXAMINED:

1 (330 mm.)

1 (112 ")

2 (169, 157 mm.)

Alaska (?)

Iturup Isd., Kurile Is.

Vladivostok Harbour.

Popov,

Stanford Univ.

Amer. Mus. Nat. Hist.

¹ The inner series of teeth is partly differentiated into an inner row and a posterior row.

2. LIOPSETTA GLACIALIS (Pallas).

[ARCTIC FLOUNDER.]

Pleuronectes glacialis, Pallas, 1776, Reise Russ., iii, p. 706; Schneider, 1801, in Bloch, Syst. Ichth., p. 150; Pallas, 1814, Zoographia, iii, p. 424; De Kay, 1842, N. H. New York, (Fish.), p. 302; Bean, 1882, Proc. U.S. Nat. Mus., iv, (1881), p. 241; Jordan and Gilbert, 1883, Bull. U.S. Nat. Mus., xvi, p. 837; Jordan, 1884, Nat. Hist. Aquat. Anim. (Fisheries Fish. Indust. U.S.), i, p. 184, pl. xlvi; Lilljeborg, 1891, Sverig. Norg. Fiskar, ii, p. 410; Smitt, 1893, Scand. Fish., i, p. 405, figs. 110, 111; Gratsianov, 1904, Zap. Russ. Georg. Obšč. St. Petersburg, xli (1), p. 227; Berg, 1916, Poiss. eaux douces Russ., p. 470, fig. 354; Knipovich, 1926, Trans. Inst. Sci. Explor. North, xxvii, p. 144, fig. 110; Lindberg and Dulkeit, 1929, Bull. Pac. Sci. Fish. Res. Stat., iii (1), p. 51.

Pleuronectes cucatricosus, Pallas, 1814, Zoographia, iii, p. 424.

Pleuronectes (Rhombus) glacialis, Richardson, 1836, Faun. Bor. Amer., iii, Fish., p. 258.

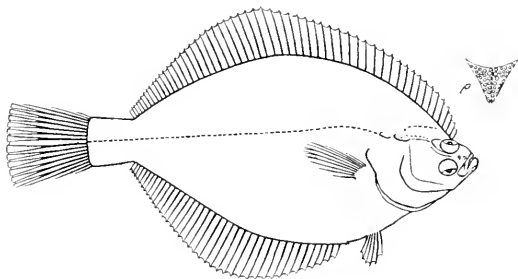


FIG. 268.—*Liopsetta glacialis*. B.M. (N.H.) 1932.12.31.35. $\times \frac{1}{2}$. *p.*, lower pharyngeals.

Platessa glacialis, Richardson, 1852, Zool. Voy. "Herald", Fish., p. 166, pl. xxxii, fig. 4.

Platessa du[r]u[m]ensis, Lilljeborg, 1851, Öfvers. K. Vet. Ac. Forh., vii (1), (1850), p. 5; Lilljeborg, 1852, Vet. Akad. Handl., lxxi, (1850), p. 306, pl. xx, figs. 1, 2; Nilsson, 1855, Skand. Faun., ed. 2, Fiskar, p. 617; Malmgren, 1864, Arch. Naturgesch., xxx (1), p. 295.

Pleuronectes franklinii, Günther, 1862, Cat. Fish., iv, p. 442; Bean, 1882, Proc. U.S. Nat. Mus., iv (1881), p. 241.

Pleuronectes divinenensis, Mela, 1882, Vertebr. Fennica, p. 307.

Liopsetta divinenensis, Jordan and Goss, 1889, Rep. U.S. Com. Fish., xiv, (1886), p. 294.

Liopsetta glacialis, Jordan and Goss, 1889, *tom. cit.*, p. 294, pl. vii, fig. 17; Jordan and Evermann, 1898, Bull. U.S. Nat. Mus., xlvii (3), p. 2649, pl. cccclxxx, fig. 935; Evermann and Goldsborough, 1907, Bull. U.S. Bur. Fish., xxvi, (1906), p. 356, fig. 141; Gilbert and Burke, 1912, Bull. U.S. Bur. Fish., xxx, (1910), p. 96; Hubbs, 1915, Proc. U.S. Nat. Mus., xlviii, p. 487; Soldatov and Lindberg, 1930, Bull. Pac. Sci. Fish. Inst., v, p. 407, fig. 61.

Depth of body $1\frac{3}{4}$ to $2\frac{1}{4}$ in the length, length of head $3\frac{1}{4}$ to $3\frac{1}{2}$. Upper profile of head more or less concave. Snout about as long as eye, diameter of which is $5\frac{3}{8}$ to 7 in length of head and more than 4 times width of interorbital ridge, which is naked or occasionally with 2 or 3 scales; lower eye a little in advance of upper; postocular

ridge prominent, rugose, terminating in a rounded protuberance above operculum, behind which is a smaller prominence on the post-temporal. Maxillary extending to below anterior edge of anterior part of eye, length on ocular side 4 to $4\frac{1}{2}$, on blind side $3\frac{1}{2}$ to 4 in that of head; lower jaw a little projecting, about 3 in head; dental formula $\frac{3}{4} \frac{0}{10} \pm \frac{12}{15} \frac{21}{22}$. 7 to 9 gill-rakers on lower part of anterior arch; lower pharyngeals massive, rather broad, width about 3 in length; teeth of inner edge of each pharyngeal 4 or 5 in number, large, rounded or flattened; those of outer edge similar but smaller, 7 to 10 in number, 5 or 6 more compressed teeth with truncated tips along hinder margin; several teeth, similar to those of the outer row, between the three principal rows. Scales in the male feebly imbricated, at least on ocular side, scarcely imbricated and largely embedded (at least anteriorly) in the female; in the male the scales are mostly ctenoid on both sides of body, but in the abdominal region of the blind side they tend to be cycloid and embedded, in the female the scales are nearly all smooth or rather feebly ctenoid, but narrow strips of distinctly ctenoid scales are present at upper and lower edges of body; head generally entirely naked on blind side, 73 to 79 pores in lateral line. Lateral line rising a little or with a very low curve above pectoral fin. Dorsal 52-59, origin above anterior half or middle of eye, highest rays 2 to $2\frac{1}{2}$ in length of head. Anal 30-42. Pectoral of ocular side with 10 or 11 (occasionally 12) rays (1 to 7 branched), length $1\frac{3}{4}$ to $2\frac{1}{4}$ in head (about twice in the male). Pelvics with 6 rays. Caudal with 18 rays (12 branched), rounded or subtruncate; caudal peduncle as long as deep or a little deeper than long. Brownish or blackish, without distinctive markings, fins paler, sometimes with traces of darker spots.

TYPE.—Zoologisches Museum der Universität Berlin (?).

DISTRIBUTION.—Arctic shores of Russia, Siberia and Alaska, Arctic North America; entering fresh water.

SPECIMENS EXAMINED:

1 (212 mm.).	Kowda, White Sea.	Popov.
1 (127 ..).	" "	" —
2 (199, 205 mm.).	Kolguev Isd., N. Russia.	"
1 (192 mm.).	Petropaulski Harbour, Alaska.	Stanford Univ.
1 (182 ..).	Kotzebue Sound, Alaska.	U. S. Nat. Mus.
1 (155 ..).	Eschschooltz Bay, ..	"
2 (174, 178 mm.).	" "	"
2 (170, 180 ..).	Nushagak R., Alaska.	"
1 (170 mm.).	Alaska.	"
1 (225 ..).	Arctic America.	Rae Coll.
1 (210 ..).	" "	Haslar Coll.

Two forms of this species may be recognised, differing from one another in the shape of the body. Among the specimens listed above, deep-bodied examples occur in Arctic America and in Kolguev Isd., north-east of the White Sea; slender-bodied examples in Alaska and the Pacific coast of Siberia. According to Smitt, however, the slender form is common in the White Sea, and the specimen of *divinensis* figured by Lilleborg is of this type. Both types, therefore, appear to occur together, at least in northern Eurasia, and, for this reason, and because I am unable to detect any constant differences apart from the depth of the body, I have been unwilling to regard these as other than varieties. If it is later found necessary to apply different names to the two forms, the deep-bodied form will stand as *glacialis* (= *franklini*), the slender form as *circaticosus* (= *divinensis*).

Ssytsch-Awerinzewa¹ has recently made an important statistical study of this species in the White Sea, in which she compares the numbers of fin-rays and vertebrae with those found in samples of *Platichthys flesus* from the same locality and of *Pleuronectes platessa* from the Barents Sea.

¹ 1929, 'Zool. Anz.', xvi, p. 159.

3. LIOPSETTA PINNIFASCIATA ([Kner] Steindachner and Kner).

Pleuronectes pinnifasciatus, (Kner) Steindachner and Kner, 1870, SitzBer. Akad. Wiss. Wien, lxi, Abt. 1, p. 422, pl. 1, fig. 1.

Pseudopleuronectes pinnifasciatus, Jordan and Goss, 1880, Rep. U.S. Com. Fish., xiv, (1886), p. 290; Jordan and Evermann, 1898, Bull. U.S. Nat. Mus., xlvii (3), p. 2647.

Liopsetta pinnifasciata, Schmidt, 1904, Pisc. Mar. Orient., p. 245, fig. 21; Jordan and Starks, 1906, Proc. U.S. Nat. Mus., xxxi, p. 217; Jordan, Tanaka and Snyder, 1913, J. Coll. Ser. Tokyo, xxxiii (1), p. 330; Hubbs, 1915, Proc. U.S. Nat. Mus., xlviii, p. 487; Soldatov and Lindberg, 1930, Bull. Pac. Sci. Fish. Inst., v, p. 408.

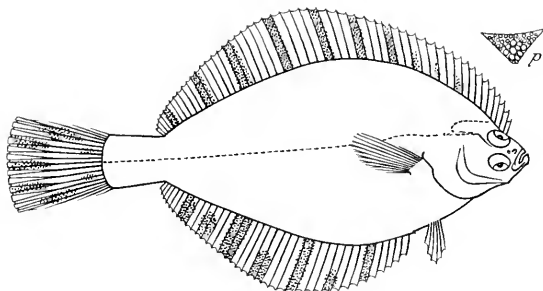


FIG. 269.—*Liopsetta pinnifasciata*. B.M. (N.H.) 1924.7.26.3. ♀. p., lower pharyngeals.

Very close to *L. glacialis*, but depth of body $2\frac{1}{2}$ in the length; postocular ridge not quite so prominent, the protuberances less marked; teeth of lower pharyngeals rather more flattened. Dorsal 55-57; anal 39-40. Pectoral of ocular side with 12 rays (5 or 6 branched), length $1\frac{1}{2}$ to $1\frac{3}{4}$ in that of head. Brownish, with vague dusky markings; dorsal and anal fins each with 6 or 7 blackish vertical bars; some horizontal elongate blotches on caudal.

TYPE.—Vienna Museum.

DISTRIBUTION.—Okhotsk Sea; northern Japan.

SPECIMENS EXAMINED¹:

1 (260 mm.).

Imperator Bay.

Popov.

1 (178 ").

Mouth of R. Amur.

Berg.

4. LIOPSETTA PUTNAMI (Gill).

[EEL-BACK FLOUNDER.]

Platessa glabra (non Rathke), Storer, 1844-5, Proc. Boston Soc. N. H., i (2-3), p. 130; Storer, 1861, Mem. Amer. Acad., n.s., viii, p. 393, pl. xxxi, fig. 1; Putnam, 1875, Bull. Essex Inst., vi, (1874), p. 12.

Euchalarodus putnami, Gill, 1864, Proc. Acad. Nat. Sci. Philad., xvi, pp. 216, 222; Gill, 1873, Rep. U.S. Com. Fish., i, (1871-2), p. 794; Goode and Bean, 1877, Amer. J. Sci. Arts, (3) xiv, p. 476.

¹ Both specimens are females. The larger is less smooth than the females of *glacialis*, and has ctenoid scales over the greater part of the body on both sides.

Loopsetta glabra, Gill, 1864, *tom. cit.*, p. 217.

Pleuronectes glaber, Gill, 1873, Rep. U. S. Com. Fish., 1, (1871-2), p. 794. Goode and Bean, 1877, Amer. J. Sci. Arts, (3) xiv, p. 470; Goode and Bean, 1879, Amer. J. Sci. Arts, (3) xvii, p. 49; Bean, 1879, Proc. U. S. Nat. Mus., 1, (1878), p. 347; Jordan and Gilbert, 1883, Bull. U. S. Nat. Mus., xvi, p. 830; Goode, 1884, Nat. Hist. Aquat. Ann. (Fisheries Fish. Indust. U. S., 1), p. 187, pl. xiv.

Loopsetta putnami, Jordan and Goss, 1889, Rep. U. S. Com. Fish., xiv, (1886), p. 294, pl. vii, fig. 10; Jordan and Evermann, 1898, Bull. U. S. Nat. Mus., xvii (3), p. 2650, pl. cccclxxx, fig. 930; Huntsman, 1922, Contr. Canad. Biol., 1921, No. 3, p. 22; Bigelow and Welsh, 1925, Bull. U. S. Bur. Fish., xl (1), (1924), p. 509, fig. 262.

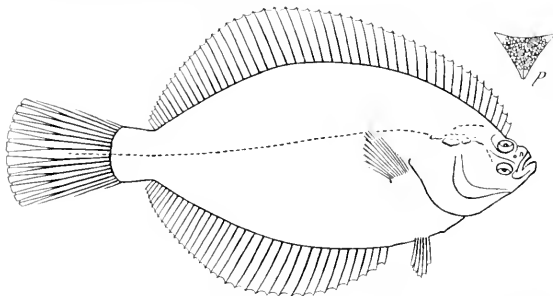


FIG. 270.—*Loopsetta putnami*. B.M. (N.H.) 79, 10 to 944. {, p, lower pharyngeals.

Close to *L. glacialis*. Depth of body $1\frac{1}{16}$ to $2\frac{1}{2}$ in the length, length of head $3\frac{1}{2}$ to $3\frac{3}{8}$. Snout a little longer than eye, diameter of which is $6\frac{1}{2}$ to $7\frac{1}{2}$ in length of head; interorbital ridge scaled ($\frac{5}{8}$) or naked ($\frac{4}{8}$). Length of maxillary on ocular side 4 to $4\frac{1}{2}$, on blind side $3\frac{1}{2}$ to nearly 4 in that of head. Lower pharyngeals broader, width 2 to $2\frac{1}{2}$ in length, completely covered with flat molariform teeth, only those along hinder edge rounded or a little compressed. Scales more or less imbricated in the male, distinctly ctenoid on ocular side, ctenoid or cycloid on blind side; in the female the scales are scarcely imbricated, nearly all cycloid, but a few ctenoid scales at upper and lower edges of body and in region of lateral line. Dorsal 48-58; highest rays about twice in length of head. Anal 35-40. Pectoral of ocular side with 10 or 11 rays (4 to 6 branched), length $1\frac{1}{2}$ or $1\frac{3}{4}$ ($\frac{5}{8}$) to about twice ($\frac{7}{8}$) in that of head. Greyish or brownish, sometimes mottled with darker; fins with large dusky spots.

TYPE—United States National Museum, No. 5368.

DISTRIBUTION—Atlantic coast of North America, from Labrador to Cape Cod.

SPECIMENS EXAMINED:

1 (97 mm.)	Labrador.	Mus. Comp. Zool.
1 (275 ")	Bucksport, Maine	U. S. Nat. Mus.
1 (275 ")	Portland, "	"
2 (215, 225 mm.)	Gloucester, Mass.	Jordan.

Also one from Labrador (Mus. Comp. Zool.)

This species may prove to be identical with *L. glacialis*, but appears to have a larger head, broader pharyngeals with more flattened teeth, and a somewhat longer pectoral fin. The small specimen from Labrador approaches the deep-bodied type of *glacialis*, and is not very unlike the types of *franklini* in the British Museum.

Genus 26. INOPSETTA.

Inopsetta. (Jordan and Goss) Jordan, 1887, Rep. U.S. Com. Fish., xii, (1885), p. 924 [*Parophrys ischyryus*, Jordan and Gilbert]; Jordan and Evermann, 1898, Bull. U.S. Nat. Mus., xlvii (3), p. 2641; Norman, 1933, Ann. Mag. Nat. Hist., (10) xi, p. 221.

Apparently related to *Liopsetta* and *Platichthys*. Teeth close-set, incisor-like. Lower pharyngeals each with 2 rows of coarse, blunt teeth, the inner row partly differentiated into an inner and a posterior series. Scales similar in both sexes, strongly ctenoid on both sides of body, those on head nearly tuberculate. Supratemporal branch of lateral line with a short posterior prolongation.

A single species from Puget Sound.

This genus has been associated by American authors with *Parophrys*, *Isopsetta* and *Lepidopsetta*, on account of the short posterior prolongation of the supratemporal branch of the lateral line. It is possible that the single known "species" of *Inopsetta* from Puget Sound may prove to be a hybrid between *Lepidopsetta bilineata* and *Platichthys stellatus*.

1. INOPSETTA ISCHYRA (Jordan and Gilbert).

Parophrys ischyryus, Jordan and Gilbert, 1881, Proc. U.S. Nat. Mus., iii, (1880), p. 276.

Pleuronectes ischyryus, Jordan and Gilbert, 1882, Bull. U.S. Nat. Mus., xvi, p. 832.

Isopsetta (Inopsetta) ischyra, Jordan, 1887, Rep. U.S. Com. Fish., xii, (1885), p. 924.

Inopsetta ischyra, Jordan and Goss, 1889, Rep. U.S. Com. Fish., xiv, (1886), p. 284; Jordan and Evermann, 1898, Bull. U.S. Nat. Mus., xlvii (3), p. 2641; Villalobid, 1927, Ann. Carnegie Mus., xvii, p. 395, pl. xxxv, fig. 1.

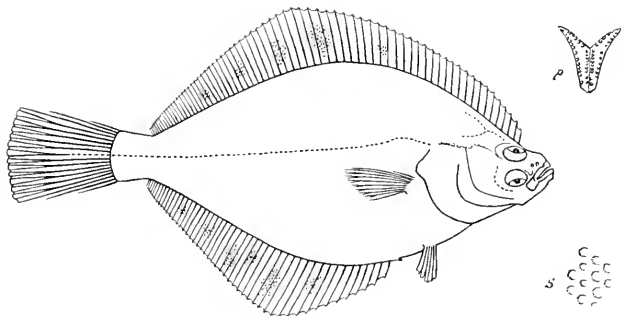


FIG. 271.—*Inopsetta ischyra*. U.S.N.M. 27266. $\times \frac{1}{2}$. p., lower pharyngeals; s., scales.

Depth of body 2 to nearly $2\frac{1}{2}$ in the length, length of head $3\frac{1}{4}$ to $3\frac{1}{2}$. Upper profile of head distinctly concave above eyes. Snout a little longer than eye, diameter of which is $5\frac{1}{4}$ to $5\frac{1}{2}$ in length of head; lower eye a little in advance of upper; interorbital ridge narrow, with minute rough scales; postocular ridge prominent, rather rugose. Maxillary extending to below anterior part of eye, length on ocular side about $\frac{1}{4}$ in that of head; lower jaw not projecting, $2\frac{1}{4}$ to 3 in head; dental formula $\frac{5+25}{10+22}$.

Gill rakers rather short, pointed, 10 or 12 on lower part of anterior arch. Scales imperfectly imbricated, strongly ctenoid on both sides of body, those on head nearly tuberculate, 70 to 80 scales in a longitudinal series above lateral line. Lateral line with a low curve above the pectoral fin; a supratemporal branch, with short posterior prolongation, extending to below tenth ray of dorsal fin. Dorsal 68-76; origin above middle of eye. All the rays scaled, highest less than $\frac{1}{2}$ length of head. Anal 50-57, first interhemal spine projecting in front of fin. Length of pectoral of ocular side about $\frac{1}{2}$ that of head. Pelvics with 6 rays. Caudal with 18 or 19 rays (12 or 13 branched), truncate; caudal peduncle about as long as deep or longer than deep. Vertebrae 41. Olive brown, vaguely clouded with paler and darker, a few black blotches on ocular side; median fins with faint black bars.

TYPE.—United States National Museum, No. 27266.

DISTRIBUTION.—Puget Sound.

This species was originally described from 4 examples taken by Dr. Jordan at Seattle in 1880. In 1920, 3 more specimens were collected by Mr. Villadohd, 2 from the fish-market at Seattle and 1 from Holmes Harbour, Puget Sound.

Genus 27. PLATICHTHYS.

Pesse upon Brisson, 1769. (Klein) Walbaum, 1792, *Arted. Ichth.*, (3), ed. 2, p. 582.

Platichthys, Girard, 1859, *Proc. Acad. Nat. Sci. Philad.*, vii, (1854), p. 139 [*Platichthys rugosus*, Girard]; Norman, 1933, *Ann. Mag. Nat. Hist.*, (10) xi, p. 222.

Flesus, Moreau, 1881, *Hist. Nat. Poiss. France*, iii, p. 258 [*Pleuronectes flesus*, Linnaeus].

Karcus, Jordan and Snyder, 1901, *Proc. U.S. Nat. Mus.*, xxiii, p. 379 [*Pleuronectes scutiger*, Steindachner].

Close to *Liopsetta*, but with obtusely conical or somewhat incisor-like teeth, not usually forming a continuous cutting edge. Lower pharyngeals massive, broad, their width $2\frac{1}{2}$ to $3\frac{1}{2}$ in length, approximated for at least $\frac{1}{2}$ their length, each with several rows of obtusely conical or molariform teeth. Scales similar in both sexes, cycloid, embedded in the skin, largely replaced by bony tubercles or rugose plates.

Three species from Arctic and temperate seas.

SYNOPSIS OF THE SPECIES AND SUBSPECIES.

- I. Body with a varying number of small bony tubercles, nearly always a series at bases of dorsal and anal fins, dorsal 52-67, anal 30-46.

PLATICHTHYS.

 - A. Embedded cycloid scales present all over body between tubercles, dorsal and anal without distinct dark bars 1 *flesus*
 1. 9 to 13 gill-rakers on lower part of anterior arch, pectoral $1\frac{1}{2}$ to $2\frac{2}{3}$ in head, postocular ridge generally ending in a rounded prominence, no tubercles on rays of dorsal and anal 1a *flesus flesus*
 2. 8 gill-rakers on lower part of anterior arch, pectoral $1\frac{1}{2}$ to 2 in head, postocular ridge ending in a sharp prominence, no tubercles on rays of dorsal and anal 1b *flesus italicus*
 3. 8 gill-rakers on lower part of anterior arch, pectoral $1\frac{3}{4}$ to $1\frac{1}{2}$ in head, postocular ridge ending in a sharp prominence, usually some tubercles on middle rays of dorsal and anal 1c *flesus luscus*
 - B. Embedded cycloid scales present only on hinder part of body, dorsal and anal each with 4 or 5 distinct dark bars 2 *stellatus*.
- II. Body with rugose bony plates, but few rounded tubercles, no series of tubercles at bases of dorsal and anal fins, dorsal 63-74, anal 47-55.

KARCUS 3 *bicolonatus*

1. PLATICHTHYS FLESUS (Linnaeus).

[Synonymy under *Subspecies*.]

Depth of body $1\frac{1}{2}$ to $2\frac{1}{2}$ in the length, length of head $3\frac{1}{2}$ to $3\frac{3}{4}$. Upper profile of head a little concave. Snout as long as or longer than eye, diameter of which is 5 to 7 in length of head; lower eye a little in advance of upper; interorbital ridge low, rather narrow, naked (occasionally with a few tubercles); postocular ridge irregular, more or less rugose, ending in a prominence above the operculum, which is followed by a smaller and flatter projection lying just behind. Maxillary extending to below anterior edge or anterior part of eye, length on ocular side $3\frac{1}{2}$ to $4\frac{1}{2}$, on blind side $3\frac{1}{2}$ to $3\frac{3}{4}$ in that of head; lower jaw a little projecting, $2\frac{1}{2}$ to $3\frac{1}{4}$ in head. Teeth generally uniserial in both jaws, but occasionally irregularly biserial anteriorly; dental formula $7-15 + 15-26$. Gill-rakers rather short, the tips pointed; 7 to 13 on lower part of anterior arch. Embedded cycloid scales present all over the body between the spinous scales or bony tubercles, which are variously developed, ranging from ordinary ctenoid scales with spinules only on their posterior margins to complete rounded tubercles; nearly always a series of tubercles at bases of dorsal and anal fins, except at the anterior and posterior ends, where the tubercles may be very small or even absent altogether. About 80 pores in lateral line. Lateral line with a very low curve above the pectoral fin; a short supratemporal branch.¹ Dorsal 52-67; origin above anterior edge or anterior part of eye; highest rays $1\frac{1}{2}$ to $2\frac{1}{2}$ in length of head. Anal 36-46. Pectoral of ocular side with 9 to 12 rays (5 to 7 branched), length $1\frac{1}{2}$ to $2\frac{1}{2}$ in that of head. Pelvics with 6 rays. Caudal with 18 or 19 rays (11 or 12 branched), a little rounded or truncate; caudal peduncle variable, generally about as deep as long. Intestine of more or less uniform diameter throughout, with 3 or 4 irregular coils; 2 very short pyloric appendages. Vertebræ 36 (11-12 + 24-25). Brownish, greyish or olivaceous, uniform or variously blotched and mottled with darker; sometimes with rounded black or orange spots; blind side usually chalky white; fins with darker spots or short indistinct bars.

DISTRIBUTION.—Coasts of Europe, from the White Sea to the Black Sea; entering fresh water.

Three subspecies may be recognised.

1a. PLATICHTHYS FLESUS FLESUS (Linnaeus).

[FLOUNDER; FLUKE.]

Pleuronectes flesus, Linnaeus, 1758, Syst. Nat., ed. 10, p. 270; 1766, ed. 12, p. 457; Bloch, 1783, Naturgesch. Fische Deutschl., ii, p. 39, pl. xlv; Schneider, 1801, in Bloch, Svst. Ichth., p. 146; Lacepède, 1802, Hist. Nat. Poiss., iv, p. 633; Shaw, 1803, Gen. Zool., iv (2), p. 301; Quensel, 1806, Vet. Akad. Handl., xxvii, p. 214; Donovan, 1806, N. H. Brit. Fish., iv, pl. xciv; Faber, 1828, Isis, xxi, p. 874; Faber, 1829, Naturg. Fische Isl., p. 144; Nilsson, 1855, Skand. Faun., ed. 2, Fiskar, p. 618; Günther, 1862, Cat. Fish., iv, p. 450; Malmgren, 1864, Arch. Naturgesch., xxi (1), p. 220; Steindachner, 1868, Sitzber. Akad. Wiss. Wien, lvii (1), p. 719; Collett, 1875, Vid.-Selsk. Forh., (1874), Till. p. 146; Malm, 1877, Goteborgs Bohus. Fauna, p. 530; Collett, 1880, Vid.-Selsk. Forh., (1879), p. 82; Day, 1880-84, Fish. Britain, ii, p. 33, pl. cv; Liljeborg, 1891, Sverig. Norg. Fiskar, ii, p. 377; Smitt, 1893, Scand. Fish., i, p. 398, pl. xxi, fig. 1; Collett, 1903, Vid.-Selsk. Forh., (1902), p. 99; Gratsianov, 1904, Zap. Russ. Georg. Obsč. St. Petersburg, xli (1), p. 220; Schnakenbeck, 1925, in Tier. Nord Ostsee, L. ii, xii (1), p. 4; Knipovich, 1926, Trans. Inst. Sci. Explor. North, xxvii, p. 144, fig. 109; Schnakenbeck, 1929, in Joubin, Faun. Ichth. Atlant. Nord, i, fig.; Ehrenbaum, 1929, in Demoll and Maer, Handb. Binnenfisch. Mitteleurop., iii (3), p. 111, figs.; Ssytsch-Awerinzewa, 1930, Wiss. Meeresuntersuch., Abt. Helgoland, xvii (5), p. 1, figs.; Berg, 1932, Not. Rés. Inst. Españ. Ocean., (ii), No. 58, p. 2.

¹ In one ambicolorate example this has a fairly long posterior prolongation.

- Pleuronectes passer*, Linnaeus, 1758, Svst. Nat., ed. 10, p. 271; 1766, ed. 12, p. 459; Bloch, 1783, Naturgesch. Fische Deutsch., ii, p. 57, pl. 1; Quensel, 1806, Vet. Akad. Handl., xxvii, p. 218; Risso, 1810, Ichth. Nice, p. 316.
- Pleuronectes flevoides*, Pontoppidan, 1765, Kunz. Nachr. N.-H. Dannemark, p. 188, pl. xv.
- Pleuronectes roseus*, Shaw, 1790, Nat. Misc., vii, pl. 238; Shaw, 1803, Gen. Zool., iv (2), p. 302, pl. 43*.
- Pleuronectes flevus* var., Delaroche, 1800, Ann. Mus. H. N., xiii, p. 357.
- Scophthalmus diurus*, Rathnesque, 1810, Ind. itt. Sicil., pp. 14, 5;.
- Platessa flevus*, Cuvier, 1817, R. Anm., ii, p. 220; Flenning, 1828, Brit. Anm., p. 198; Gottsche, 1835, Arch. Naturgesch., 1 (2), p. 146; Yarrell, 1836, Brit. Fish., ed. 1, ii, p. 215, fig.; Parnell, 1838, Mem. Werner Soc., vii, p. 303, pl. xxxvii; Kroyer, 1843-5, Danmarks Fisk., ii, p. 276; Yarrell, 1850, Brit. Fish., ed. 3, i, p. 612, fig.
- Platessa passer*, Cloquet, 1826, Dict. Sci. Nat., xli, p. 405; Canestrini, 1862, Arch. Zool. Anat. Fisiol. Genova, i, (1861), p. 8, pl. 4, fig. 1.
- Platessa carmaria*, Brown, 1839, Edinb. J. Nat. Geogr. Sci., ii, p. 99, pl. iii.
- Platessa melanogaster*?, Higgins, 1855, Zoologist, xii, pp. 4596, 4914; 1856, xiv, p. 4998; 1857, xv, p. 5098.

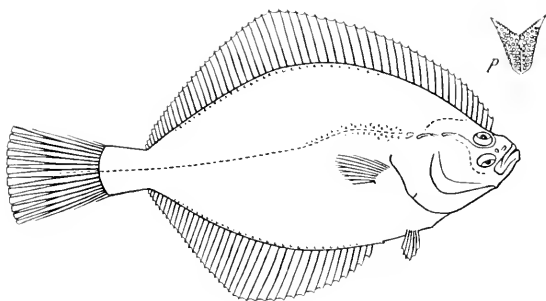


FIG. 272. *Platichthys flesus flesus*. B.M. (N.H.) 1924.8.23.3. p, lower pharyngeals.

- Pleuronectes bogdanovi*, Sandberg, 1878, Bull. Soc. Imp. Nat. Moscow, lvi, p. 236, fig.
- Fleus vulgaris*, Moreau, 1881, Hist. Nat. Poiss. France, iii, p. 299.
- Fleus passer*, Moreau, 1881, *tom cit.*, p. 291.
- Platessa flevus* var. *flevus*, Jordan and Goss, 1889, Rpt. U.S. Com. Fish., xiv, (1889), p. 292.
- Pleuronectes flevus* (part), Carus, 1889-93, Prodr. Faun. Medit., ii, p. 590.
- Pleuronectes flevus* var. *leiuus*, Duncker, 1892, Schrift. Nat. Vereins f. Schleswig-Holstein, ix, p. 291.
- Pleuronectes flevus* var. *trachurus*, Duncker, 1892, *tom cit.*, p. 291; Berg, 1932, Not. Res. Inst. Españ. Ocean., (ii), No. 58, p. 4, fig. 2.
- Pleuronectes (Fleus) flevus*, Danois, 1913, Ann. Inst. oceanogr. Paris, v (5), p. 102, fig. 175.
- Pleuronectes flevus balticus*, Suvorov, 1925, Ann. State Inst. Exper. Agron., iii, p. 280; Suvorov, 1927, Trans. Inst. Explor. North, No. 38, p. 63.
- Pleuronectes flevus septentrionalis*, Suvorov, 1925, *tom cit.*, p. 280; 1927, *tom cit.*, p. 63; Berg, 1932, *tom cit.*, p. 5, fig. 3.
- Fleus flevus*, Bineu, 1929, Cat. u. titol. Medit. Españ. Marruecos, p. 99; Chabanand, 1931, Bull. Mus. Hist. nat. Paris, (2) ii, (1930), p. 627.
- Pleuronectes flevus caennensis*, Suvorov, 1929, Trans. Inst. Explor. North, No. 43, p. 131.
- Fleus glaber*, Chabanand, 1931, Riviera Sci., Suppl. Mem. ii, p. 25.
- Pleuronectes flevus bogdanovi*, Berg, 1932, *tom cit.*, p. 6, fig. 4.

EGGS, LARVÆ AND YOUNG.

Malm, 1868, K. Svensk. Vet. Akad. Handl., N.F., vii (4), p. 15, figs. 3-6; Cunningham, 1888, Trans. Roy. Soc. Edinb., xxxiii (1), p. 99, pl. ii, figs. 4-8; McIntosh and Prince, 1890, Trans. Roy. Soc. Edinb., xxxv (3), p. 841, pl. x, fig. 10, pl. xii, fig. 6, pl. xv, figs. 3, 8, pl. xvi, fig. 1, pl. xix, fig. 5; Canu, 1893, Ann. Stat. aquic. Boulogne, i, p. 129, pl. viii, figs. 5-9, pl. ix, fig. 1; Petersen, 1893, Rep. Danish Biol. Stat., iii, (1892), pp. 2, 18; Petersen, 1894, Rep. Danish Biol. Stat., iv, (1893), p. 126, pl. ii, figs. 11, 12; Cunningham, 1896, N. H. Market. Mar. Fish., p. 227; Ehrenbaum, 1897, Wiss. Meeresuntersuch., Abt. Helgoland, N.F., ii (1), p. 273, pl. iii, figs. 6-10, pl. vi, fig. 11; McIntosh and Masterman, 1897, Brit. Mar. Food-fish., p. 380, figs.; Hensen and Apstein, 1897, Wiss. Meeresuntersuch., Abt. Kiel, N.F. ii (2), pp. 34, 43, 71, pl. ii, figs. 1-6; Kyle, 1898, Rep. Fish. Board Scotland, xvi, (1897), pp. 236, 246, pl. x, fig. 14; Heinicke and Ehrenbaum, 1900, Wiss. Meeresuntersuch., Abt. Helgoland, N.F., iii, p. 217, pl. ix, figs. 3, 4; Ehrenbaum, 1905, in Brandt and Apstein, Nordisches Plankton, I. Eier Larv. Fisch. (1), p. 161, fig. 69¹; Petersen, 1906, Medd. Komm. Havundersøg. Kjob., Ser. Fisk., ii (1), p. 4, pl. i, figs. 14-19; Schnaakenbeck, 1929, in Joubin, Faun. Ichth. Atlant. Nord, iii, figs.

Principal characters those of the species. Depth of body $1\frac{1}{2}$ to $2\frac{1}{2}$ in the length. Prominence on postocular ridge above operculum usually pear-shaped or rounded, not compressed. 9 to 13 (occasionally 8) gill-rakers on lower part of anterior arch; width of lower pharyngeals $2\frac{1}{2}$ to $2\frac{3}{4}$ in length, their inner edges entirely approximated; the teeth arranged in several rows, those of the inner row larger than the remainder, those along posterior edge small, close set, obtusely pointed, cylindrical and curved a little forward; occasionally 2 or 3 rows of such teeth overlapping each other along posterior edge of each pharyngeal. Spinous tubercles variously developed; nearly always present at commencement of lateral line, and developed to a varying extent along the region of the anterior half or even the greater part of the lateral line; sometimes the remainder of the body as well as the head largely without tubercles (*leirus*); sometimes tubercles are strongly developed on head, region of lateral line, abdomen, anterior part of back, caudal peduncle, and may even extend over the greater part of the body (*trachurus*); blind side naked, or with bony tubercles variously developed, chiefly at bases of dorsal and anal fins and along anterior part of lateral line; no tubercles on either side of rays of dorsal and anal fins. Dorsal 52-67. Anal 36-40. Length of pectoral $1\frac{1}{2}$ to $2\frac{3}{4}$ in that of head. Caudal a little rounded or truncate; caudal peduncle about as deep as long or rather longer than deep; sometimes a little deeper than long. Body sometimes with orange spots, which usually disappear in spirit; blind side sometimes with a few brown spots or irregularly stained with brownish; dorsal and anal fins often with a series of large indistinct dusky spots or short indistinct vertical bars.

TYPE.—Not traced.

DISTRIBUTION.—Coasts of Europe, from the White Sea to the western Mediterranean.²

SPECIMENS EXAMINED:

1 (270 mm.).	Kandalaksha Bay, White Sea.	Berg.
1 (145 ,,).	R. Dvina at Archangel.	Popov.
3 (150-295 mm.).	Nr. Kola, Murman Coast.	Berg.
1 (262 mm.).	Kola Bay,	"
1 (240 ,,).	Lapponia. "	"
5 (230-370 mm.).	Herdla Isd., nr. Bergen.	Popov.
3 (345-400 ,,).	N.E. Cattedgat at Kobbergrund.	Bergen Mus.
1 (245 mm.).	S.W. Cattedgat at Grenaa.	Johansen.
2 (143, 165 mm.).	Bohuslan.	"
2 (295, 380 ,,).	Baltic.	Malm.
2 (225, 420 ,,).	Ringkobing Fiord.	Mar. Biol. Assoc.
5 (195-360 ,,).	St. Andrew's Bay.	Johansen.
		Fish. Board Scotland.

¹ Consult for full list of references.

² Of very doubtful occurrence in Iceland.

1 (25 mm.)	St. Andrews	McIntosh.	
1 (180 mm.), skin.	Firth of Forth.	Farnell Coll.	
2 (280, 380 mm.), stuffed.	"	"	
1 (315 mm.)	Dalbeattie	Armistead.	
1 Skull.	North Sea.	Gunther.	
1 (400 mm.)	Liverpool.	—	
1 (57 ")	Wales.	Gray.	
4 (220-275 mm.)	Great Yarmouth	Patterson.	
1 (200 mm.)	Southwold, Suffolk.	Collings.	
1 (195 ")	Canvey Isd., Essex.	Lambert.	
1 (230 ")	Leigh Creek, "	"	
3 (120-178 mm.)	Leigh-on-Sea, "	"	
5 (8-10 mm.)	" "	"	
11 (22-78 ")	" "	"	
1 (140 mm.), stuffed.	" "	Palmer.	
4 (305-355 mm.)	Brighton.	Page.	
1 (330 mm.)	Hastings.	Newton.	
4 (205-375 mm.)	Plymouth	Mar Biol. Assoc.	
4 (172-200 "), skins	"	Yarrell Coll.	
1 (110 mm.), skin.	"	Spence.	
1 (235 "), stuffed.	Cornwall.	—	
1 (110 ")	British Coast.	Day.	
3 (180-220 mm.), skeletons.	"	—	
1 (225-270 ")	Nr. mouth of Eguis R., Portugal	Ramalho.	
1 (182 mm.)	Arcachon, France.	Paris Mus.	
1 (102 ")	Cette, "	"	
4 (345-395 mm.)	" "	Monaco Ocean Inst.	
1 (190 mm.), skin	—	—	
3 (150-170 mm.), skins	—	Gronow Coll.	
ABNORMALITIES¹			
1 (220 mm.)	Ambicolorate.	Dalbeattie	Armistead.
1 (215 ")	Albino.	Great Yarmouth	Patterson.
1 (240 ")	Unusual coloration	"	"
1 (270 ")	Ambicolorate.	Lowestoft.	Mnist. Agric. Fish
1 (245 ")	Semi-albino.	Essex coast.	'Field.'
1 (220 ")	"	Leigh-on-Sea, Essex.	Lambert.
1 (280 ")	Spotted on blind side.	London Market.	Gunther.
1 (395 ")	Ambicolorate.	British Coast	Day.
1 (270 ")	"	—	Webster.
1 (225 ")	"	—	—

The eastern extent of the range of this subspecies in the Mediterranean is not definitely known. Examples have been described from Genoa and Naples, but I am unable to say whether they belong to this subspecies or to *italicus*.

Valuable statistical studies of Flounders from the Murman Coast, White Sea, Baltic, Helgoland, North Sea, English Channel, etc., have been made by Duncker, Rekeke and Ssytsch-Awerinzewa². These have led to the definition of a number of

¹ The following papers describe abnormalities of the Flounder: Cunningham and McMunn, 1894, 'Phil. Trans. Roy. Soc.', B. CXXXIV, p. 801; Gadeau de Kerville, 1895, 'Bull. Soc. zool. Fr.', XX, p. 156; Sacchi, 1899, 'Bull. Mus. zool. anat. comp. Genova', No. 82; McIntosh, 1902, 'Ann. Mag. Nat. Hist.', (7) IX, p. 292; Johnstone, 1906, 'Proc. L'pool. Biol. Soc.', XX, p. 334, fig.; Elmhurst, 1911, 'Ann. Scot. Nat. Hist.', p. 79; Demel, 1927, 'Kosmos Lemburg', li, p. 228, figs. Other references are included in the synonymy of the subspecies.

² Duncker, 1892, 'Schrift. Nat. Vereins f. Schleswig-Holstein', IX, p. 201; Duncker, 1895, 'Zool. Anz', XLIII, p. 53; Duncker, 1896, 'Wiss. Meeresuntersuch.', 8 1, 1 (2), p. 47; Duncker, 1898, 'J. Mar. Biol. Assoc.', (2) V, p. 172; Duncker, 1900, 'Wiss. Meeresuntersuch., Abt. Helgoland', 8 4, III, p. 333, figs.; Duncker, 1900, 'Zool. Anz', XXIII, p. 141; Rekeke, 1915, 'Rapp. proc.-verb. explor. mer', XIII, p. 25; Ssytsch-Awerinzewa, 1930, 'Wiss. Meeresuntersuch., Abt. Helgoland', 9 1, F, XVII (18), pp. 1, 6, 6.

local forms, which cannot be dealt with here. Duncker defines two distinct races: *trachurus*, from the Baltic and probably also from a part of the northern Arctic Ocean; and *leivurus*, from the North Sea. He finds that the latter race includes a number of local forms. The difference between the races *trachurus* and *leivurus* is mainly concerned with the extent to which the spinous tubercles are developed on the head and body, but that from the Baltic is said to have a higher number of caudal vertebrae, smaller number of gill-rakers, fewer dorsal and anal rays, relatively higher caudal peduncle and (generally) deeper body. Judging by the specimens in the British Museum collection, as a general rule the body tends to become rougher proceeding northwards from the Channel to the White Sea, but examples from Cette in the Mediterranean are quite as rough as some of those from the Baltic. Of two small specimens from Bohuslän, one is moderately rough, with 62 dorsal and 44 anal rays, and the caudal peduncle a little longer than deep; the other is much rougher, with 57 dorsal and 40 anal rays, and the caudal peduncle deeper than long. The following table shows the number of dorsal and anal rays and gill-rakers in specimens from selected localities:

Locality.	Dorsal rays.	Anal rays.	Gill-rakers.
White Sea (2)	56	38-40	10
Murman Coast (4)	55-61	40-43	10-11
Cattegat (4)	55-65	40-43	10-12
Baltic (4)	55-62	39-44	10-11
North Sea (20)	55-65	40-45	10-13
Channel (10)	60-64	43-45	10-12
Portugal (4)	57-67	41-46	10-12
South of France (5)	57-62	40-44	10-13

Sandberg (1878) gave the name *Pleuronectes bogdanovi* to the Flounder common in the White Sea, and Suvorov (1925, 1929) applied names to races from the Murman Coast (*Pleuronectes flesus septentrionalis*, *P. flesus caninensis*). In a recent paper, Berg¹ recognises five subspecies of *Platichthys flesus*, namely, *flesus*, *bogdanovi*, *trachurus*, *septentrionalis* and *luscus*, differentiated chiefly by the number of dorsal and anal rays and the number of gill-rakers. He includes *italicus* with *luscus*, and *leivurus* with *flesus*.

My own work, admittedly based on a comparatively small number of specimens, leads me to conclude that there is only one subspecies ranging from the White Sea to the western Mediterranean. Local races do undoubtedly occur and can be recognised, but it seems inadvisable to apply the system of trinomial nomenclature to these at present.

This subspecies grows to a length of about 16 inches and a weight of 4 to 6 lb.

Reversed examples, with the eyes and colour on the left side, are very common (see note on p. 28).

1b. PLATICHTHYS FLESUS ITALICUS (Günther).

Pleuronectes hypoglossus (non Linnæus), Naccari, 1822, Ittiol. Adriat., p. 11.

Pleuronectes flesus var., Nardo, 1827, Prodr. Adriat. Ichth., p. 15, No. 131.

? *Platessa passer* (non Linnæus), Bonaparte, 1837, Icon. Faun. Ital., (10), fig.; Bonaparte, 1840,

Cat. metod. Pesci Europ., p. 48; Costa, 1847, Faun. R. Napoli, ii, Fasc. 55-8, p. 7.

? *Pleuronectes passerinus*, Nardo [ex Chierighmi MS.], 1847, Sin. mod. spec. Lag. Veneto, p. 121.

Pleuronectes italicus, Günther, 1862, Cat. Fish., iv, p. 452; Faber, 1883, Fisheries Adriatic, p. 210.

Pleuronectes flesus var. *glabra*, Jordan and Goss, 1889, Rep. U.S. Com. Fish., xiv, (1886), p. 293.

Pleuronectes flesus (part), Carus, 1889-93, Prodr. Faun. Medit., ii, p. 590.

Principal characters those of the species. Prominence on postocular ridge above operculum usually more or less sharp and compressed. 8 gill-rakers on lower part of anterior arch; width of lower pharyngeals about $3\frac{1}{2}$ in length, their inner edges less

¹ 1932, 'Not. Résüm. Inst. Españ. Ocean.,' (ii), No. 58.

angular and less entirely approximated than in the preceding subspecies, posterior edge of each pharyngeal with 3 or 4 rows of curved teeth overlapping each other. Spinous tubercles very feebly developed, reduced to the rows at bases of dorsal and anal fins, and occasionally one or two behind eyes or at commencement of lateral line, blind side quite smooth; no tubercles on rays of dorsal and anal fins. Dorsal 58-62. Anal 41-43. Length of pectoral $1\frac{1}{2}$ to twice in that of head. Caudal rounded; caudal peduncle as deep as long, or a little deeper than long. Greyish or brownish; uniform or marbled with darker.

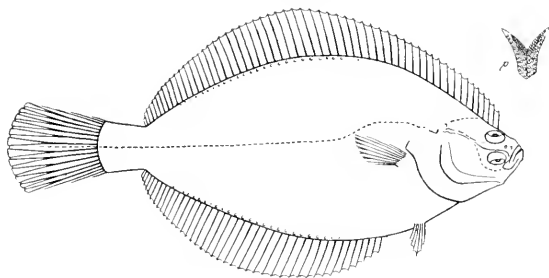


FIG. 273.—*Platichthys flesus italicus*. B.M. (N.H.) 42.6.7.3. $\times \frac{2}{3}$. *p.*, lower pharyngeals.

TYPE—British Museum (Nat. Hist.). Reg. No. 42.6.7.3.

DISTRIBUTION—Adriatic.

SPECIMENS EXAMINED:

4 (175-235 mm.).	Trieste.	Vinciguerra.
1 (195 mm.). Holotype.	Dalmatia.	Heckel.
2 (135, 202 mm.). Paratypes.	„	Milan Mus.

Ninni (1905, *Atti Soc. Ital. sc. nat. Milano*, xlv, p. 193; 1932, *Bull. Soc. zool. Fr.*, lvn, p. 76, fig.) describes ambicolorate individuals of this subspecies.

1c PLATICHTHYS FLESUS LUSCUS (Pallas).

Pleuronectes luscus, Pallas, 1814, *Zoographia*, iii, p. 427; Rathke, 1837, *Mem. Pres. Acad. Imp. Sci. St. Petersburg*, iii, p. 347; Günther, 1862, *Cat. Fish.*, iv, p. 452.

Platessa glabra, Rathke, 1837, *tom. cit.*, p. 352.

Platessa luscus, Nordmann, 1840, in Denudov, *Voy. Russ. mériad.*, iii, p. 532, pl. xxvii; Kessler, 1859, *Bull. Soc. Imp. Nat. Moscou*, xxxii (2), p. 439.

Platessa flesus var. *marmorata*, Nordmann, 1840, *tom. cit.*, pl. xxviii, fig. 1.

Pleuronectes flesus, Antipa, 1909, *Publ. Fond. Adamachi Acad. Român.*, iii, No. 10, p. 89, pl. vi, fig. 30.

Pleuronectes flesus luscus, Berg, 1898, *Dnevnik Sert. Zool. Soc. Anns Sci. Nat. Moscou*, ii (8), p. 34; Berg, 1910, *Poiss. eaux douces Russ.*, p. 469, fig. 353; Berg, 1932, *Not. Res. Inst. Españ. Ocean.*, (ii), No. 58, p. 3, fig. 1.

Principal characters those of the species. Depth of body $1\frac{1}{10}$ to $2\frac{1}{4}$ in the length. Prominence on postocular ridge above operculum rather compressed. 7 or 8 gill-rakers on lower part of anterior arch; lower pharyngeals similar to those of *P. flesus*. Spinous tubercles moderately or feebly developed, sometimes reduced to rows

at bases of dorsal and anal fins (var. *glaber*), sometimes also present on head and along region of lateral line (var. *luscus*); blind side nearly entirely smooth; usually a few tubercles or ctenoid scales on middle rays of dorsal and anal fins. Dorsal 57-65. Anal 42-46. Length of pectoral $1\frac{3}{8}$ to $1\frac{5}{8}$ in that of head. Caudal peduncle as long as deep or deeper than long. Greyish or brownish, with or without darker blotches or other markings; sometimes some round dark spots edged with white on body; fins generally with darker spots or blotches; blind side often with irregular dark spots.

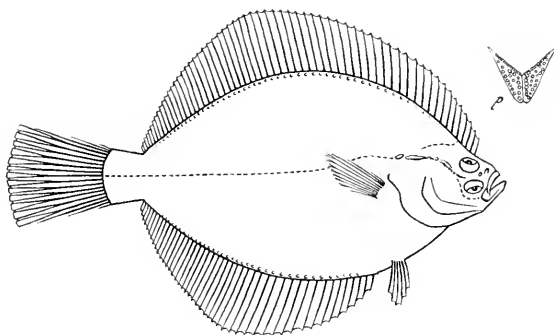


FIG. 274.—*Platichthys flesus luscus*. B.M. (N.H.) 1930.5.9.14. $\times \frac{1}{2}$.
p., lower pharyngeals.

TYPE.—Zoologisches Museum der Universität, Berlin (?).

DISTRIBUTION.—Sea of Marmora; Black Sea.

SPECIMENS EXAMINED:

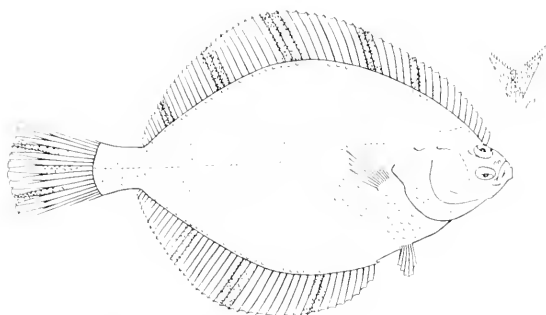
2 (290, 345 mm.).	Constantinople.	Dickson.
3 (265-280 ..).	Bosphorus.	Millingen.
3 (105-140 ..).	Black Sea.	Spratt.
3 (128-218 ..).	L. Karadja, Crimea.	Popov.
2 (240, 245 ..).	Sebastopol.	"
3 (35-40 mm.).	"	"
1 (115 ..).	"	"

2. PLATICTHYS STELLATUS (Pallas).

Pleuronectes stellatus, Pallas, 1787, Nova Acta Ac. Sci. Petrop., i, (1783), p. 347, pl. ix, fig. 1; Pallas, 1814, Zoographia, iii, p. 416; Günther, 1862, Cat. Fish., iv, p. 443; Steindachner and Kner, 1870, SitzBer. Akad. Wiss. Wien, lxi (1), p. 421; Jordan and Gilbert, 1881, Proc. U.S. Nat. Mus., iii, (1880), p. 453; Jordan and Gilbert, 1882, Proc. U.S. Nat. Mus., iv, (1881), p. 68; Jordan and Gilbert, 1883, Bull. U.S. Nat. Mus., xvi, p. 835; Jordan, 1884, Nat. Hist. Aquat. Anim. (Fisheries Fish. Indust. U.S.), p. 184, pl. xlvi; Otaki, 1897, Journ. Fish. Bur. Tokyo, vi (1), p. 7, pl. vi, fig. 6; Schmidt, 1904, Pisc. Mar. Orient., p. 240.

Platessa stellata, De Kay, 1842, N.H. New York, (Fish.), p. 301; Richardson, 1852, Zool. Voy. "Herald", Fish., p. 164, pl. xxxii.

- Platichthys nigricans*, Girard, 1856, Proc. Acad. Nat. Sci. Philad., vii, (1851), pp. 139, 155; Girard, 1858, U.S. Pacif. R. R. Surv., x, Fish., p. 148.
Platichthys stellatus, Lockington, 1878-9, Rep. Com. Fish. Calif., p. 43; Lockington, 1886, Proc. U.S. Nat. Mus., ii, (1879), p. 91; Jordan and Goss, 1889, Rep. U.S. Com. Fish., xiv, (1886), p. 269, pl. viii, fig. 18; Jordan and Evermann, 1898, Bull. U.S. Nat. Mus., xlvii (1), p. 2952, pl. cccxxxii, figs. 937, 937a; Jordan and Starks, 1906, Proc. U.S. Nat. Mus., xxxii, p. 218, fig. 19; Evermann and Goldsborough, 1907, Bull. U.S. Bur. Fish., xxvi (1), p. 356, figs. 142, 143; Jordan, Tanaka and Snyder, 1913, J. Coll. Sci. Tokyo, xxxii (1), p. 339, fig. 278; Hubbs, 1918, Proc. U.S. Nat. Mus., xlviii, p. 488; Starks, 1918, Calif. Fish Game, iv (4), p. 15, fig. 98; Berg, 1916, Poiss. eaux douces Russ., p. 472, fig. 185; Soldatov and Lundberg, 1919, Bull. Pac. Sci. Fish. Inst., v, p. 499, fig. 64; Schmidt, 1921, C. R. Acad. Sci. Russ., p. 31.



116. 275.—*Platichthys stellatus*. B.M. (N.H.) 81.3.44.13. $\frac{1}{2}$ p., lower pharyngeals.

Very close to *P. flesus*. Interorbital ridge always with tubercles, postocular ridge ending in a sharp bony prominence above the operculum. 8 to 10 gill-rakers on lower part of anterior arch; width of lower pharyngeals $3\frac{1}{2}$ to $3\frac{3}{4}$ in length; their inner edges angular, approximated; teeth obtusely conical, arranged in several rows, those along the posterior edge of each pharyngeal rather higher and more close-set than the remainder. Scales nearly all replaced by tubercles, only a few embedded cycloid scales on both sides of hinder part of body; spinous tubercles scattered and generally more widely separated than in *P. flesus*; in addition to the series at bases of dorsal and anal fins, they are developed on the head and over the greater part of the body, being mainly absent, however, towards its edges; on the blind side the tubercles are mainly confined to the bases of the fins and the region of the lateral line. 66 to 76 pores in lateral line. Dorsal 56-62. Anal 46-56. Length of pectoral 2 to $2\frac{1}{2}$ in that of head. Caudal peduncle generally longer than deep. Vertebrae 35 (12 + 23). Brownish or blackish, with or without some paler markings; dorsal and anal fins each with 4 or 5 deep black vertical bars, which are more distinct on blind side of fins; posterior part of caudal with 3 or 4 black horizontal bars.

TYPE.—Zoologisches Museum der Universität, Berlin (?).

DISTRIBUTION.—North Pacific, southwards to Tokyo, Corea, and southern California.

SPECIMENS EXAMINED :

1 (85 mm.).	Sitka, Alaska.	U.S. Nat. Mus.
1 (245 ,,).	Kodiak, Alaska.	Bretherton.
1 (212 ,,).	Coronation Gulf, Bering Straits.	Haslar Coll.
1 (220 ,,).	Bering Is., Bering Sea.	Popov.
1 (210 ,,), skin.	Esquimalt Harbour, Vancouver Isd.	Russell.
4 (37-75 mm.).	Fraser's R., British Columbia.	Plumper.
1 (160 mm.).	Pacific coast of America.	Gruber.
1 (153 ,,).	Puget Sound.	Jordan.
2 (205, 215 mm.).	Yaguana Bay, Oregon.	Bretherton.
1 (198 mm.).	San Luis Obispo, Cal.	U.S. Nat. Mus.
1 (370 ,,).	Pt. Reyes, Cal.	Eigenmann.
2 (135, 153 mm.).	San Francisco, Cal.	U.S. Nat. Mus.
3 (235-242 ,,).	California.	Ayres.
1 (174 mm.).	Petropaulski Harbour, Kamchatka.	Powell.
2 (240, 270 mm.).	Tokyo, Japan.	Tokyo Imp. Univ.
2 (115, 280 ,,).	Bay of Mutsu, Japan.	Kishinouye.
2 (225, 250 ,,).	—	Rae Coll.

This species grows to a weight of 15 to 20 pounds.

Reversed examples of this species are very common, the percentage of individuals with eyes and colour on the left side being about 50 in Californian samples, 75 in samples from Alaska, and in Japan all the individuals appear to be reversed [see note on p. 28].

3. PLATICHTHYS BICOLORATUS (Basilewsky).

Platessa bicolorata, Basilewsky, 1855, Nouv. Mém. Soc. Nat. Moscou, x, p. 260.

Pleuronectes scutifer, Steindachner, 1870, SitzBer. Akad. Wiss. Wien, lxi (1), p. 628, p. ii.

Pleuronectes bicoloratus, Herzenstein, 1891, [Mel. Biol., xii (1)] Bull. Ac. Imp. Sci. St. Pétersbourg, xxxiv (N.S. 11), p. 55.

Kareus scutifer, Jordan and Snyder, 1901, Proc. U.S. Nat. Mus., xxiii, p. 379.

Kareus bicoloratus, Jordan and Snyder, 1901, *tom. cit.*, p. 769; Schmidt, 1904, Pisc. Mar. Orient., p. 243, fig. 19; Jordan and Starks, 1906, Proc. U.S. Nat. Mus., xxxi, p. 220; Jordan, Tanaka and Snyder, 1913, J. Coll. Sci. Tokyo, xxxiii (1), p. 330; Tanaka, 1913, Fish. Japan, xi, p. 192, pl. III, fig. 198; Hubbs, 1915, Proc. U.S. Nat. Mus., xlviii, p. 488; Jordan and Hubbs, 1925, Mem. Carnegie Mus., x, p. 300; Soldatov and Lindberg, 1930, Bull. Pac. Sci. Fish. Inst., v, p. 410; Schmidt, 1931, C.R. Acad. Sci. Russ., p. 317.

Depth of body 2 to 2½ in the length, length of head 3 to 3½. Upper profile of head a little concave. Snout longer than eye (except in young), diameter of which is 4½ to 7 in length of head and 3 or 4 times interorbital width; anterior margins of eyes level or lower very little in advance of upper; interorbital ridge low, narrow, naked or with a few small rugose plates; postocular ridge irregular, rugose, no marked prominence above the operculum. Maxillary extending to below anterior part of eye, length on ocular side 3½ to 4, on blind side 3½ to 3¾ in that of head; lower jaw a little projecting, 2½ to 3 in head. Teeth obtusely conical or rather incisor-like; dental formula 5-16 + 16-27. Gill-rakers rather short, the tips pointed; 5 or 6 on lower part of

anterior arch; width of lower pharyngeals 2¾ to 3 in length, their inner edges united to form a solid triangular plate, entirely covered with closely approximated, rounded, molariform teeth. Scales very much reduced and embedded deeply in the skin in young and half-grown specimens, apparently absent, or at least invisible, in adults; a longitudinal row of more or less contiguous rugose plates between the lateral line and the back, usually a similar row of rather smaller plates between lateral line and anterior part of anal fin, sometimes reduced to 1 or 2 plates or absent altogether; an irregular series of small plates, often widely separated from one another, above and below the lateral line; a dermal groove connects the separate plates of the lateral line

series of small plates irregularly scattered over preoperculum and operculum, just behind the eyes, and sometimes on the interorbital ridge; other plates on edges of caudal peduncle, on base of pectoral, and scattered irregularly over the body; no tubercles at bases of dorsal and anal fins; blind side in adults and both sides of body in young quite smooth. Lateral line nearly straight or with a very low curve above the pectoral fin; a short supratemporal branch; 73 to 82 pores. Dorsal 63-74, origin above anterior edge or a little in advance of eye; highest rays a little less than $\frac{1}{2}$ length of head. Anal 47-55. Pectoral of ocular side with 11 to 13 rays (5 to 6 branched), length 2 to $2\frac{1}{2}$ in that of head. Pelvics with 6 rays. Caudal with 18 rays (12 branched), a little rounded or double-truncate; caudal peduncle as long as deep, longer than deep, or a little deeper than long. Intestine of uniform diameter throughout, with about 2 simple coils; 2 very short pyloric appendages. Brownish or greyish,

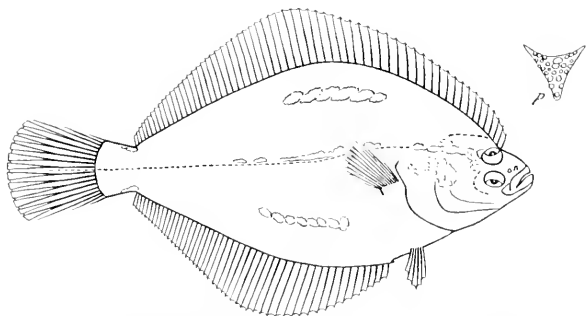


FIG. 270.—*Platicthys bicoloratus*. B.M. (N.H.) 1905. 6. 6. 232. $\frac{1}{2}$ p, lower pharyngeals.

uniform or irregularly flecked with small dark spots or other markings, more conspicuous and probably always present in young; generally a series of from 3 to 6 rounded white spots following the upper and lower outlines of the body near the bases of the dorsal and anal fins; sometimes other pale spots scattered irregularly over body.

TYPE—Zoological Museum, Leningrad. No. 9354.

DISTRIBUTION—Coasts of Japan, Korea, and northern China.

SPECIMENS EXAMINED

2 (225, 250 mm.).	Inland Sea of Japan.	Smith.
1 (330 mm.).	Bay of Mitsu.	Krishinowé.
17 (105-350 mm.).	Hakodate.	Jordan.
5 (150-195 " ").	Tokyo.	"
1 (190 mm.).	Matsuyama Market.	Tokyo Imp. Univ.
1 (120 " ").	Mororan.	Jordan.
1 (98, 160 mm.).	Otaru.	"
1 (130 mm.).	Chefoo, China.	Swinhoe.

Subfamily 2. PÆCILOPSETTINÆ.

Close to the Pleuronectinæ, but the olfactory laminae are expanded distally and radiate from a short central rachis; lateral line rudimentary or absent on blind side of body.

Three genera from tropical and subtropical seas. Mostly fishes of small size and rather fragile appearance.

SYNOPSIS OF THE GENERA.

- I. None of the anterior rays of dorsal or pelvics prolonged; male similar to female.
- A. No orbital tentacles 28. PÆCILOPSETTA
- B. Each eye with a tentacle 29. NEMATOPS.
- II. Anterior rays of dorsal and of pelvic of ocular side more or less prolonged in both sexes, very long in male; male with strong rostral spines, and with the teeth on ocular side of upper jaw extending on to outer surface of jaw 30. MARLEYELLA

Neotropus may belong to this subfamily (see p. 283).

Genus 28. PÆCILOPSETTA.

- Pæcilopsetta*, Gunther, 1880, Shore Fishes "Challenger", p. 48 [*Pæcilopsetta colorata*, Gunther]; Hubbs, 1919, Proc. Biol. Soc. Washington, xxxii, p. 163; Norman, 1931, Treubia, xiii, p. 423.
- Boopsella*, Alcock, 1896, J. Asiat. Soc. Bengal, lxx (2), p. 305; Alcock, 1899, Cat. Indian Deep-Sea Fish., p. 126 [*Boopsella umbrarum*, Alcock].
- Alacops*, Jordan and Starks, 1904, Bull. U.S. Com. Fish., xxii, (1902), p. 623; Jordan and Starks, 1906, Proc. U.S. Nat. Mus., xxxi, p. 198 [*Alacops plinthus*, Jordan and Starks].
- Paralimanda*, Breder, 1927, Bull. Bingham Ocean. Coll., 1 (1), p. 86 [*Paralimanda inermis*, Breder].

Male similar to female. Body ovate or rather elongate, strongly compressed, often fragile. Eyes on the right side, contiguous or separated by a very narrow space. Male without rostral spines. Mouth rather small, nearly symmetrical, the length of the maxillary less than $\frac{1}{2}$ that of head; teeth small, villiform, in one or two rows or in narrow bands in the jaws; dentition better developed on blind side of jaws; vomer toothless. Gill-rakers rather short, pointed, few in number; lower pharyngeals rather narrow, separated for the greater part of their length, each with 2 or 3 rows of sharply pointed teeth. Dorsal fin with 56 to 68 rays, commencing well behind nostrils of blind side and above eye; nearly all the rays simple, not scaled; anterior rays not prolonged; a low scaly sheath covering basal part of fin on ocular side. Anal with 45 to 58 rays; similar to dorsal; tip of first interhaemal spine not projecting in front of fin. Pectoral fins unequal, that of ocular side larger, with 7 to 12 rays. Pelvic fins with 6 rays, short-based, subequal, but somewhat asymmetrical, that of ocular side further forward and closer to median line than that of blind side; none of the rays prolonged. Scales of moderate or small size, rather feebly ctenoid or cycloid on ocular side, cycloid on blind side. Lateral line on ocular side well developed, extending on to the caudal fin, with a large flat-topped curve above the pectoral fin; no supratemporal or suborbital branches; lateral line of blind side rudimentary or absent. Vent median.

Seven species from deep water in the North Atlantic and Indo-Pacific.

SYNOPSIS OF THE SPECIES

- I. Teeth in one or two rows. Atlantic species.
- A. Scales ctenoid on ocular side, about 80 in lateral line; maxillary about $2\frac{2}{3}$ in head; dorsal 63-68, anal 54-59 1. *beanii*.
- B. Scales cycloid on ocular side, about 68 in lateral line; maxillary about $3\frac{2}{3}$ in head; dorsal 62, anal 53 2. *inermis*.
- II. Teeth in narrow bands, at least in adults [Indo-Pacific species].
- A. 60 to 65 scales in lateral line.
1. Depth $1\frac{9}{16}$ to $2\frac{1}{2}$ in length; maxillary 3 to $3\frac{1}{2}$ in head; eyes separated by a low narrow ridge.
- a. Dorsal 59-61, anal 49-50; some of middle rays of right pectoral branched 3. *colorata*
- b. Dorsal 62-67, anal 53-58; all rays of right pectoral simple 4. *hawaiiensis*.
2. Depth $2\frac{2}{3}$ to 3 in length; maxillary $3\frac{2}{3}$ to $3\frac{3}{4}$ in head; eyes contiguous; dorsal 59-65, anal 50-54 5. *praelonga*.
- B. 60 to 70 scales in lateral line.
1. Eye about $3\frac{1}{4}$ in head; 60 to 65 scales in lateral line; dorsal 60-64, anal 48-53 6. *plunthus*.
2. Eye $2\frac{1}{2}$ in head; about 70 scales in lateral line; dorsal 62, anal 54 7. *natalensis*.

1. POECILOPSETTA BEANII (Goode).

Limanda beanii, Goode, 1881, Proc. U. S. Nat. Mus., III, (1880), p. 473; Jordan and Goss, 1889, Rep. U. S. Com. Fish., XIV, (1886), p. 288; Goode and Bean, 1895, Ocean. Ichth., p. 428, pl. CII, figs. 355a-d; Jordan and Evermann, 1898, Bull. U. S. Nat. Mus., XLVI (3), p. 2049, pl. cccxxviii, fig. 932.

Pleuonectes beanii, Jordan and Gilbert, 1883, Bull. U. S. Nat. Mus., XVI, p. 835.

Poecilopsetta beanii, Hubbs, 1919, Proc. Biol. Soc. Washington, XXXII, p. 163; Norman, 1931, Freubia, XIII, p. 425.

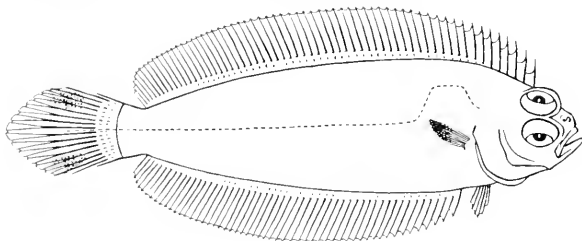


FIG. 277.—*Poecilopsetta beanii*. B.M. (N.H.) 1931 8. 19 11.

Depth of body $2\frac{2}{3}$ to $3\frac{2}{3}$ in the length, length of head $4\frac{1}{4}$ to about $5\frac{1}{2}$. Snout much shorter than eye, diameter of which is $2\frac{2}{3}$ to nearly 3 in length of head; eyes separated by a very narrow ridge, the lower scarcely in advance of upper, which enters dorsal profile of head. Maxillary extending to a little beyond anterior margin of eye, length about $2\frac{2}{3}$ in that of head; lower jaw $2\frac{1}{2}$ in head. Teeth apparently in two rows, barely discernible in upper jaw—10 or 11 gill-rakers on lower part of anterior arch. Scales ctenoid on ocular side, cycloid on blind side; about 80 in lateral line. Dorsal

(63) 64 (68). Anal 54 (56). Pectoral of ocular side with 10 simple (?) rays, length about $2\frac{1}{2}$ in that of head. Caudal rounded or pointed; caudal peduncle nearly twice as deep as long. Brownish, with indistinct darker markings, of which a series at upper and lower edges of body are most conspicuous; a pair of conspicuous black blotches at middle of upper and lower margins of caudal; pectoral blackish distally; young with several series of rather faint dark spots on blind side.

TYPE.—United States National Museum No. 26102.

DISTRIBUTION.—Of the coast of New England; Gulf of Mexico: 111 to 896 fathoms.

SPECIMEN EXAMINED:

1 (84 mm.).

28° 41' N., 86° 07' W., 169 fms.

U.S. Nat. Mus.

2. PŒCILOPSETTA INERMIS (Breder).

Paralimanda inermis, Breder, 1927, Bull. Bingham Ocean. Coll., i (1), p. 87, fig. 36.

Pœciloipsetta inermis, Norman, 1931, Treubia, xiii, p. 425.

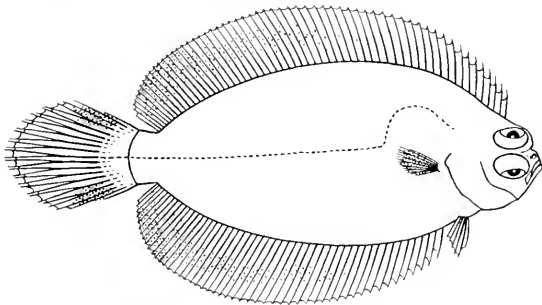


FIG. 278.—*Pœciloipsetta inermis*. [After Breder.] · 1.

Depth of body about $2\frac{1}{2}$ in the length, length of head about $4\frac{1}{2}$. Snout much shorter than eye, diameter of which is a little more than $2\frac{1}{2}$ in length of head; eyes separated by a narrow ridge, the lower scarcely in advance of upper, which enters dorsal profile of head. Maxillary extending to below anterior edge of eye, length $3\frac{2}{3}$ in that of head; lower jaw $2\frac{1}{2}$ in head. Teeth more or less uniserial, developed only on blind side of jaws. 11 gill-rakers on lower part of anterior arch. Scales cycloid on both sides of body; about 68 in lateral line. Dorsal 62. Anal 53. Pectoral of ocular side with 9 rays (6 branched), length about $2\frac{1}{2}$ in that of head. Caudal rounded; caudal peduncle about twice as deep as long. More or less uniformly brownish; distal parts of dorsal, anal and caudal fins dusky; a pair of black blotches at middle of upper and lower margins of caudal; pectoral nearly black; blind side pale, with four longitudinal series of faint dusky spots.

TYPE.—Bingham Oceanographic Collection; Peabody Museum of Natural History, Yale University. No. 510.

DISTRIBUTION.—Glover Reef, off British Honduras; 484 fathoms.

The single known specimen is 111 mm. in total length.

3. *PACHLOPSETTA COLORATA*, Gunther.

Pachlopsetta colorata, Gunther, 1880, Shore Fishes "Challenger", p. 48, pl. xxii, fig. 6; Norman, 1927, Rec. Ind. Mus., xxix, p. 41; Weber and Beaufort, 1929, Fish. Indo-Austral. Arch., v, p. 136; Norman, 1931, Freubia, xiii, p. 425.

Pachlopsetta maculosa, Alcock, 1894, J. Asiatic Soc. Bengal, lxi (2), p. 139, pl. vii, fig. 1; Alcock, 1895, Illust. Zool. "Investigator", Fishes, pl. xv, fig. 1; Alcock, 1896, J. Asiatic Soc. Bengal, lxxii, p. 328.

Pachlopsetta maculosa, Alcock, 1899, Cat. Indian Deep-Sea Fish., p. 127.

Pachlopsetta praelonga, Brauer, 1906, "Valdivia" Tiefsee-Fische, p. 205.

Pachlopsetta praelonga (part), Sewell, 1912, Rec. Ind. Mus., vii, p. 10.

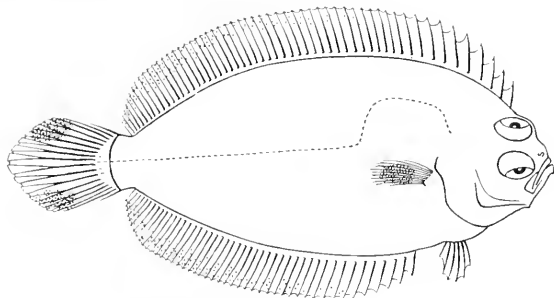


FIG. 279.—*Pachlopsetta colorata*. B.M. (N.H.) 79.5.14.97. ♂.

Depth of body $1\frac{1}{10}$ to $2\frac{1}{5}$ in the length, length of head $3\frac{1}{2}$ to $4\frac{1}{5}$. Snout much shorter than eye, diameter of which is about $\frac{1}{3}$ in length of head; eyes separated by a low, narrow ridge, which is scaled in adults, the lower very little in advance of upper, which enters dorsal profile of head. Maxillary extending to below anterior part of eye, length $3\frac{1}{4}$ to $3\frac{1}{2}$ (young) or about 3 times (adult) in that of head; lower jaw about $2\frac{2}{3}$ in head. Teeth in narrow bands (at least in adults); 10 or 11 gill-rakers on lower part of anterior arch. Scales of ocular side rather feebly ctenoid in adults, cycloid in young; those of blind side cycloid; 60 to 65 in lateral line. Dorsal 56-61, origin above or a little behind middle of eye. Anal 46-50. Pectoral of ocular side with 11 or 12 rays, the middle rays branched (at least in adults); length of pectoral of blind side 2 to $2\frac{1}{2}$ in that of head. Caudal pointed; caudal peduncle about $2\frac{2}{3}$ times as deep as long. Pale brownish, head and body with numerous blackish dots; blind side whitish, with traces of black spots; pectoral with a large dark spot covering greater part of fin; a pair of conspicuous black spots at middle of upper and lower margins of caudal fin; young pale yellowish brown, with a series of 6 or 7 black blotches or short bars situated at upper and lower edges of body, and with two series of rather larger blotches on middle of body, one on either side of the lateral line; on the blind side these markings are very distinct, those on the middle of the body being smaller and arranged in four rows.

TYPE.—British Museum (Nat. Hist.) Reg. No. 79.5.14.97.

DISTRIBUTION.—Gulf of Manar, Andaman Sea, Keel Islands, north-west of Sumatra (?); 120 to 600 fathoms.

SPECIMENS EXAMINED :

1 (143 mm.). Holotype.
2 (88, 105 mm.).

Kei Is., 129 fms.
Andaman Sea, 185 fms.

"Challenger."
Ind. Mus.

Also 4 from the Gulf of Manar and the Andaman Sea (Ind Mus.), including the holotype of *P. maculosa*.

4 PŒCILOPSETTA HAWAIIENSIS, Gilbert.

Pacilopsetta hawaiiensis, Gilbert, 1905, Bull. U.S. Com. Fish., xxiii (2), (1903), p. 679, pl. xcvi;
Fowler, 1928, Mem. B. P. Bishop Mus., x, p. 93; Norman, 1931, Treubia, xiii, p. 425.

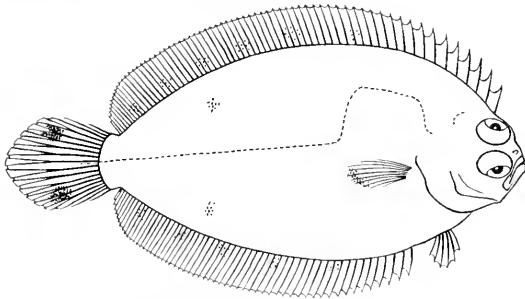


FIG. 280.—*Pacilopsetta hawaiiensis*. B.M. (N.H.) 1931.8.19.7. $\times \frac{1}{2}$.

Very close to *P. colorata*, but dorsal with (62) 67 rays; anal with (53) 58 rays; pectoral of ocular side with 10 rays, all simple; caudal peduncle a little more than twice as deep as long. Brownish, with traces of darker markings, those near the edges of the body being more conspicuous; a series of brown blotches along dorsal and anal fins; a pair of conspicuous black spots at middle of upper and lower margins of caudal; pectoral with a narrow black margin; faint traces of the rows of black spots on middle of body on blind side.

TYPE.—United States National Museum. No. 51638.

DISTRIBUTION.—Hawaiian Islands; 128 to 238 fathoms.

SPECIMEN EXAMINED :

1 (121 mm.). Paratype.

Hawaiian Is.

U.S. Nat. Mus.

The holotype is a male, 126 mm in total length.

5. PŒCILOPSETTA PRÆLONGA, Alcock.

Pacilopsetta prælonga, Alcock, 1894, J. Asiat. Soc. Bengal, lxxii (2), p. 139, pl. vii, fig. 2; Alcock, 1895, Illust. Zool. "Investigator", Fishes, pl. xv, fig. 2; Alcock, 1896, J. Asiat. Soc. Bengal, lxx (2), p. 328; Alcock, 1898, Ann. Mag. Nat. Hist., (7) ii, p. 156; Norman, 1927, Rec. Ind. Mus., xxix, p. 40, fig. 11; Norman, 1931, Treubia, xiii, p. 425.

Boopsetta umbrarum, Alcock, 1896, J. Asiat. Soc. Bengal, lxx (2), p. 395; Alcock, 1897, Illust. Zool. "Investigator", Fishes, pl. xvii, fig. 5.

Boopsetta prælonga, Alcock, 1899, Cat. Indian Deep-Sea Fish., p. 126.

Boopsetta pralonga (1901), Sewell, 1912, Rec. Ind. Mus., VII, p. 10.

Boopsetta maculosa, Weber, 1913, "Silonga" Exped., Fische, p. 434.

Pacilopsetta maculosa, Weber and Beaufort, 1929, Fish. Indo-Austral. Arch., V, p. 137, fig. 33.

Close to *P. colorata*, but depth of body $2\frac{3}{4}$ to 3 in the length, length of head $3\frac{1}{2}$ to 4. Eyes nearly contiguous. Length of maxillary $3\frac{2}{3}$ to $3\frac{3}{4}$ (young) or $3\frac{2}{3}$ to $3\frac{3}{4}$ (adults) in that of head. Dorsal 50-65, origin above posterior part of eye. Anal 50-54. Pectoral with 8 to 10 rays, all simple, length of fin of blind side about 2 in that of head. Yellowish brown, with some darker blotches, median fins brownish, with paler margins, pectoral brown, with blackish extremity, blind side whitish, with traces of black spots, young coloured as in *P. colorata*.

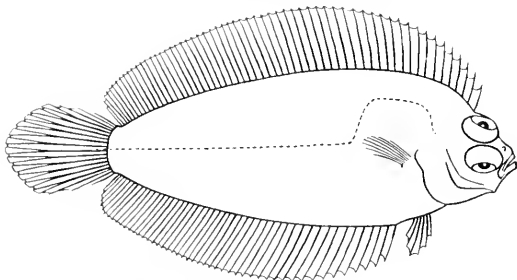


FIG. 281.—*Pacilopsetta pralonga*. B.M. (N.H.) 98.7 13.17. — 3.

TYPE: Indian Museum, No F 61/4.

DISTRIBUTION:—Bay of Bengal, Andaman Sea, Timor Sea; 120 to 250 fathoms.

SPECIMENS EXAMINED:

1 (145 mm.)	Bay of Bengal.	Ind. Mus.
1 (94 " ")	Andaman Sea (11° 17' N., 93° 16' E.), 185 fms.	" "

Also 7 from the Bay of Bengal and the Andaman Sea, including the holotype of the species and that of *Boopsetta umbrarum* (Ind. Mus.)

This species, which has an almost exactly similar distribution, may prove to be identical with *P. colorata*.

6. PŒCLOPSETTA PLINTHUS (Jordan and Starks)

Macops plinthus, Jordan and Starks, 1904, Bull. U.S. Com. Fish., XXII, (1902), p. 623, pl. V, fig. 2; Jordan and Starks, 1906, Proc. U.S. Nat. Mus., XXXI, p. 109, fig. 12; Franz, 1910, Abh. Bayer. Akad. Wiss., Suppl. IV, Abh. 1, p. 91; Jordan, Tanaka and Snyder, 1913, J. Coll. Sci. Tokyo, XXXII (1), p. 323, fig. 272.

Pœclopsetta plinthus, Hubbs, 1913, Proc. U.S. Nat. Mus., XLVIII, p. 474; Hubbs, 1919, Proc. Biol. Soc. Washington, XXXI, p. 197; Norman, 1931, *Treubia*, VIII, p. 429.

Depth of body $2\frac{1}{4}$ to $2\frac{1}{2}$ in the length, length of head $4\frac{1}{2}$ to $4\frac{1}{4}$. Snout much shorter than eye, diameter of which is about $3\frac{1}{4}$ in length of head, eyes separated by a narrow, naked ridge, the lower scarcely in advance of upper, which enters dorsal profile of head. Maxillary extending to below anterior part of eye, length $3\frac{1}{3}$ to $3\frac{1}{2}$ in that of head, lower jaw $2\frac{1}{2}$ in head. Teeth in rather narrow bands, 10 or 11 gill-rakers

on lower part of anterior arch. Scales ctenoid on ocular side, cycloid on blind side; 60 to 65 in lateral line. Dorsal 60-64. Anal (45) 50-53. Pectoral of ocular side with 8 or 9 rays, middle rays branched, length $1\frac{2}{3}$ to twice in that of head. Caudal pointed; caudal peduncle about 3 times as deep as long. Brownish, usually mottled with black; a pair of conspicuous black spots at upper and lower edges of body

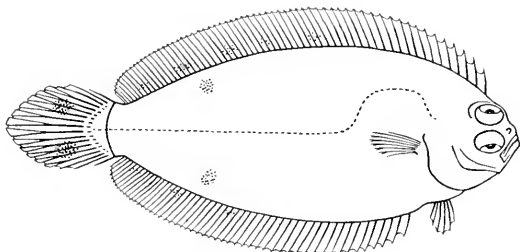


FIG. 282.—*Pæciloopsetta plinthus*. B.M. (N.H.) 1931.8.19.8. $\times \frac{1}{2}$.

below posterior parts of dorsal and anal, situated a head's length in front of base of caudal; median fins irregularly spotted and mottled with black; caudal with a pair of black blotches, often united to form a black blotch or bar across middle of fin.

TYPE.—United States National Museum. No. 51406.

DISTRIBUTION.—Japan.

SPECIMENS EXAMINED:

1 (130 mm.).	Suruga Bay.	U.S. Nat. Mus.
1 (95 ").	Omae Saki Lt.	" "
1 (90 ").	Yokohama.	Zool. Samml., Munich.
1 (90 ").	Tanabe, Kit Prov.	Tokyo Imp. Univ.

7. PÆCILOPSETTA NATALENSIS, Norman.

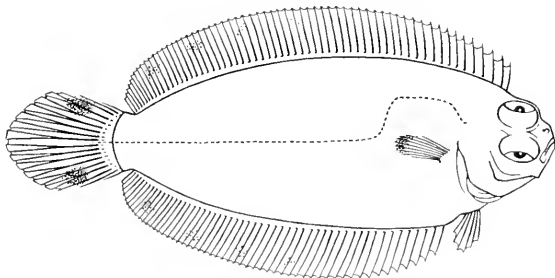


FIG. 283.—*Pæciloopsetta natalensis*. B.M. (N.H.) 1922.3.27.7. $\times \frac{1}{2}$.

Limanda beanii (non Goode), Von Bonde, 1922, Rep. Fish. Mar. Biol. Surv. S. Afr. (1921), Spec. Rep. 1, p. 16; Barnard, 1925, Ann. S. Afr. Mus., xvi, p. 395.
Pacilopsetta natalensis, Norman, 1931, Freubia, xiii, p. 429.

Depth of body $2\frac{1}{2}$ in the length, length of head $4\frac{2}{3}$. Snout much shorter than eye, diameter of which is $2\frac{1}{2}$ in length of head. Eyes nearly contiguous, the lower scarcely in advance of upper, which enters dorsal profile of head. Maxillary extending to a little beyond anterior margin of eye, length about $3\frac{1}{2}$ in that of head. Lower jaw $2\frac{1}{2}$ in head. Teeth in narrow bands. 11 gill-rakers on lower part of anterior arch. Scales ctenoid on ocular side, cycloid on blind side, about 70 in lateral line. Dorsal 62 (?). Anal 54. Pectoral of ocular side with 10 rays, all simple, length twice in that of head. Caudal pointed; caudal peduncle more than 3 times as deep as long. Greyish brown, with darker patches, dorsal and anal fins with irregular black markings, a pair of conspicuous black blotches at middle of upper and lower margins of caudal, pectoral blackish distally.

TYPE.—British Museum (Nat. Hist.), Reg. No. 1922.3.27.7.

DISTRIBUTION.—Off Natal and Delagoa Bay, 180 to 230 fathoms.

SPECIMENS EXAMINED:

1 (45 mm.)—Holotype. Off Natal, 188 fms. Gilchrist.

Genus 29. NEMATOPS.

Nematops, Gunther, 1880, Shore Fishes "Challenger", p. 57 [*Nematops microstoma*, Gunther]; Weber and Beanfot, Fish. Indo-Austral. Arch., v, p. 134.

Very close to *Pacilopsetta*, but each eye with a tentacle.

Three species from deep water in the Indo-Australian Archipelago.

SYNOPSIS OF THE SPECIES

- I. Depth $2\frac{1}{2}$ in length, eye $2\frac{1}{2}$ in head, about 60 scales in lateral line; dorsal 67, anal 55; pectoral shorter than head. 1 *microstoma*.
 II. Depth $2\frac{1}{2}$ to $2\frac{3}{4}$ in length; eye $2\frac{1}{2}$ to $2\frac{1}{2}$ in head, 44 to 48 scales in lateral line, dorsal 52-50, anal 45-48; pectoral shorter than head. 2 *grandisquama*.
 III. Depth nearly 3 in length; eye $2\frac{1}{4}$ in head, 68 scales in lateral line, dorsal 65, anal 55, pectoral a little longer than head. 3 *macrochirus*.

1. NEMATOPS MICROSTOMA, Gunther

Nematops microstoma, Gunther, 1880, Shore Fishes "Challenger", p. 57, pl. xxiv, fig. c. Fowler, 1925, Mem. B.P. Bishop Mus., x, p. 92.

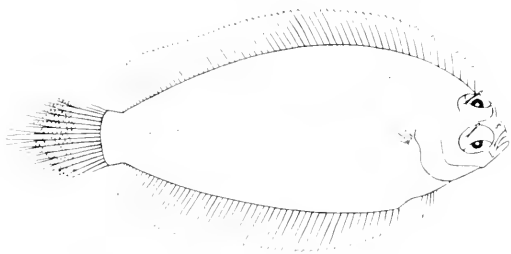


FIG. 284.—*Nematops microstoma*. B.M. (N.H.) 7.6.51.4.91. 1/1.

Depth of body $2\frac{1}{2}$ in the length, length of head $4\frac{1}{4}$. Snout much shorter than eye, diameter of which is about $2\frac{1}{2}$ in length of head; eyes nearly contiguous, their anterior margins about level; length of tentacle a little less than $\frac{2}{3}$ diameter of eye. Maxillary extending to below anterior part of eye, length $3\frac{1}{4}$ in that of head; lower jaw $2\frac{1}{2}$ in head. Teeth apparently in 2 or 3 rows in each jaw. 12 gill-rakers on lower part of anterior arch. Scales ctenoid on ocular side, cycloid on blind side; about 66 in lateral line. Dorsal 67. Anal 55. Pectoral of ocular side about $\frac{1}{2}$ as long as head. Caudal pointed; caudal peduncle more than twice as deep as long. Brownish, with indistinct darker markings; rays of dorsal and anal fins dotted with dark brown; caudal with a large transverse dark blotch and with a broad whitish posterior margin.

TYPE.—British Museum (Nat. Hist.). Reg. No. 79.5.14.91.

DISTRIBUTION.—Admiralty Islands; 152 fathoms.

SPECIMEN EXAMINED:

1 (95 mm.). Holotype. Nares Harbour, Admiralty Is., 152 fms. "Challenger."

2. NEMATOPS GRANDISQUAMA, Weber and Beaufort.

Nematops grandisquama, Weber and Beaufort, 1929, Fish. Indo-Austral. Arch., v, p. 134, fig. 32.

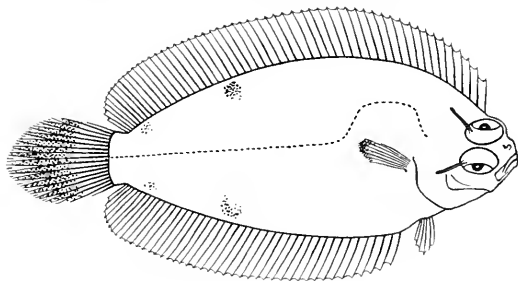


FIG. 285.—*Nematops grandisquama*. B.M. (N.H.) 1933.2.18.6. 14.

Depth of body $2\frac{1}{2}$ to $2\frac{2}{3}$ in the length, length of head $3\frac{2}{3}$ to 4. Snout much shorter than eye, diameter of which is $2\frac{1}{2}$ to $2\frac{1}{2}$ in length of head; eyes nearly contiguous, their anterior margins nearly level; tentacle nearly as long as eye. Maxillary extending to a little beyond anterior margin of eye, length $2\frac{1}{2}$ to 3 in that of head. Teeth in one or two rows. 12 gill-rakers on lower part of anterior arch. Scales ctenoid on ocular side, cycloid on blind side; 44 to 48 in lateral line. Dorsal 52-59. Anal 45-48. Pectoral of ocular side with 7 to 9 rays, length about $\frac{1}{2}$ that of head. Caudal obtusely pointed. Brownish red, with irregular black blotches on upper and lower edges of body, one below commencement of last third of dorsal and a corresponding one above anal more distinct than the others; fins with dark margins; caudal with large transverse black blotches on its hinder half; tip of pectoral blackish.

TYPE.—Amsterdam Museum.

DISTRIBUTION.—St. Nikolaas Bay, Bali; 60 to 90 fathoms.

SPECIMEN EXAMINED:

1 (78 mm.). Paratype. St. Nikolaas Bay, Bali, 60-90 fms. Amsterdam Mus.

The holotype is 87 mm in total length.

3. NEMATOPS MACROCHIRUS, Norman

Nematops macrochirus, Norman, 1931, *Treubia*, xiii, p. 421, fig. 1.

Depth of body nearly $\frac{3}{4}$ in the length, length of head $4\frac{1}{2}$. Snout much shorter than eye, diameter of which is about $2\frac{1}{4}$ in length of head; eyes nearly contiguous, their anterior margins about level; length of tentacle about $\frac{1}{4}$ or $\frac{1}{2}$ that of eye. Maxillary extending to below anterior margin of eye, length about $\frac{3}{4}$ in that of head, lower jaw $2\frac{1}{4}$ in head. Teeth in bands, 10 gill-rakers on lower part of anterior arch. Scales ctenoid on ocular side, cycloid on blind side, 68 in lateral line. Dorsal

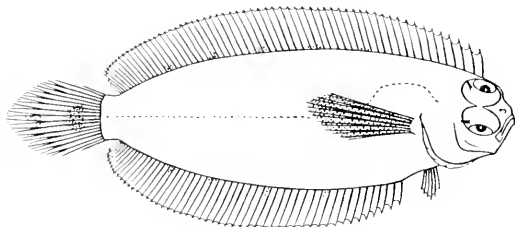


FIG. 286.—*Nematops macrochirus*. B.M. (N.H.) 1931.7.23.1. 1.

65. Anal 55. Pectoral of ocular side with 7 rays, all more or less branched, length a little greater than that of head. Caudal pointed; caudal peduncle about twice as deep as long. Brownish; some small dark spots and streaks on dorsal and anal fins, a dusky blotch on basal part of caudal; pectoral dusky, with an indistinct darker blotch distally.

TYPE—British Museum (Nat. Hist.) Reg. No. 1931.7.23.1

DISTRIBUTION—Bali Strait, 109 fathoms.

SPECIMEN EXAMINED:

1 (106 mm.). Holotype. Bali Strait (8° 29' S., 114° 40' E.), Hardenberg, 109 fms.

Genus 30. MARLEYELLA

Marleyella, Fowler, 1925, *Proc. Acad. Nat. Sci. Philad.*, lxxvii, p. 203; *Pacilopssetta bicolorata*, Von Bonde.

Close to *Pacilopssetta*, but male with strong rostral spines, and with the teeth on the ocular side of the upper jaw extending on to the outer surface of the jaw; anterior rays of dorsal and of pelvic of ocular side more or less prolonged in both sexes, very long in the male.

A single species from Natal.

1. MARLEYELLA BICOLORATA (Von Bonde)

Pacilopssetta bicolorata, Von Bonde, 1922, *Rep. Fish. Mar. Biol. Surv. S. Afr.*, (1921), *Spec. Rep.* p. 11, pl. 5, fig. 2; Barnard, 1925, *Ann. S. Afr. Mus.*, xxi, p. 390.

Pacilopssetta (*Marleyella*) *bicolorata*, Fowler, 1926, *Proc. Acad. Nat. Sci. Philad.*, lxxvii, p. 203.

Marleyella bicolorata, Norman, 1931, *Treubia*, xiii, p. 423.

Body ovate. Depth of body about twice in the length, length of head about 4. Snout shorter than eye, diameter of which is nearly $\frac{1}{4}$ in length of head; eyes separated by a low scaled ridge, its width less than $\frac{1}{2}$ diameter of eye; anterior margins of eyes about level, the upper entering dorsal profile of head. A strong rostral spine overhanging the upper jaw of the ocular side in the male, and a similar but rather smaller spine on blind side; in the female the spine on the ocular side is represented by a small prominence, and that of the blind side is absent. Maxillary extending nearly to below middle of eye, length $2\frac{1}{4}$ to $2\frac{1}{2}$ in that of head; lower jaw about twice in head. Teeth

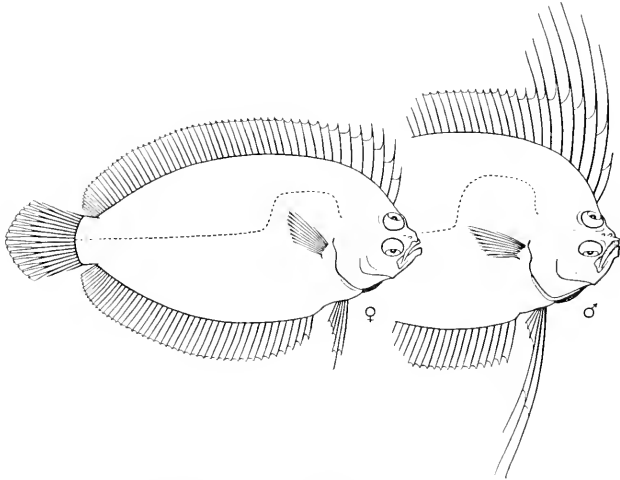


FIG. 287.—*Marleyella bicolorata*. B.M. (N.H.) 1927.3.27-5, 6. $\times \frac{1}{2}$.

irregularly biserial or in narrow bands, extending on to outer surface of upper jaw on ocular side in the male. 12 gill-rakers on lower part of anterior arch. Scales rather feebly ctenoid on ocular side, cycloid on blind side; 70 to 75 in lateral line. Dorsal 55-57; origin above middle of eye; second to eighth rays greatly prolonged in the male, highest nearly twice length of head; second to fourth or fifth rays a little longer than those which follow in the female. Anal 46-47. Pectoral of ocular side with 11 rays (9 or 10 branched), length $1\frac{2}{3}$ to $1\frac{3}{4}$ in that of head. Pelvics with first three rays prolonged in both sexes, longest rays $\frac{1}{2}$ (2) or about twice (5) length of head. Caudal obtusely pointed; caudal peduncle short. Dark brownish, spotted and blotched with black, the dark blotches tending to form irregular cross-bars; branchiostegal membranes azure blue below; median fins with smaller and larger black spots; caudal with a dark vertical bar near its base; pectoral and pelvic spotted with darker; blind side dark brown, with indistinct darker markings; head with small round black spots.

TYPE—British Museum (Nat. Hist.), Reg. No. 1922.3.27.5

DISTRIBUTION—Natal coast; 30 to 223 fathoms.

SPECIMENS EXAMINED¹

(78, 188 mm) Types 4

Natal, 70–223 fms.

Gilchrist.

Subfamily 3. PARALICHTHODINÆ.

Dorsal fin extending forward on the snout above the nasal organ of the blind side; pelvic fins short-based, subequal, that of ocular side median and somewhat advanced, the fins supported by the pelvic bones behind the cleithra; pectoral radials present; hypocoracoids narrowed forward below. Last five precaudal vertebrae with parapophyses, of which the last pair are connected by a bridge. Olfactory laminae arranged transversely to or radiating from a central radius. Lateral line equally developed on both sides of body.

A single genus.

Genus 31. PARALICHTHODES.

Paralichthodes, Gilchrist, 1902, Mar. Invest. S. Afr., ii, p. 108. *Paralichthodes algoensis*, Gilchrist, Regan, 1929, Ann. Durban Mus., ii, p. 214.

Body rather elongate, compressed. Eyes on the right side, separated by a flat space of moderate width. Mouth rather large, the length of the maxillary nearly $\frac{1}{2}$ that of head; jaws and dentition about equally developed on both sides; teeth small, pointed, in 2 or 3 series in both jaws; vomer toothless. Gill-membranes separate; gill-rakers of moderate length, rather close-set, not numerous; lower pharyngeals very narrow and slender, not approximated, each with 3 or 4 rows of pointed teeth. Dorsal fin commencing in front of nostrils of blind side and well in advance of eye; most of the rays forked distally, scaled at their bases. Anal similar to dorsal; tip of first interhemal spine not projecting in front of fin. Pectoral fins unequal, that of ocular side larger; middle rays branched. Pelvic fins with 6 rays. Caudal peduncle very short. Scales small, adherent, imbricated; all cycloid. Lateral line with a distinct curve above the pectoral fin; a supratermporal branch. Vertebrae 31 (10 + 21). Vent on blind side, above first ray of anal fin; intestine with 2 or 3 coils; 2 + 2 pyloric appendages of moderate length.

A single species from South Africa.

1. PARALICHTHODES ALGOENSIS, Gilchrist

Paralichthodes algoensis, Gilchrist, 1902, Mar. Invest. S. Afr., ii, p. 108, pl. viii; Gilchrist and Thompson, 1909, Ann. S. Afr. Mus., vi, p. 292; Gilchrist and Thompson, 1917, Ann. Durban Mus., i, p. 397; Regan, 1929, Ann. Durban Mus., ii, p. 214; Barnard, 1925, Ann. S. Afr. Mus., xxi, p. 398.

Depth of body about $2\frac{1}{2}$ in the length, length of head 4 to $4\frac{1}{2}$. Snout about as long as eye, diameter of which is $4\frac{1}{2}$ to nearly 5 in length of head and more than twice the interorbital width; anterior margins of eyes about level or upper a little in advance of lower. Maxillary extending to below middle or posterior part of eye, length nearly $\frac{1}{2}$ that of head; lower jaw projecting. 10 to 21 gill-rakers on lower part of anterior arch. 110 to 125 scales in lateral line. Dorsal (67) 72–74; anterior rays much branched and more or less free from membrane. Anal (47) 51–54. Pectoral of ocular side with 12 rays (0 or 1 branched), length $1\frac{2}{3}$ to $1\frac{1}{2}$ in that of head. Caudal with 16 rays (12 branched), rounded or obtusely pointed. Brownish or greyish, with small dark spots on head and anterior part of body.

¹ The larger specimen, a male, is selected as the holotype.

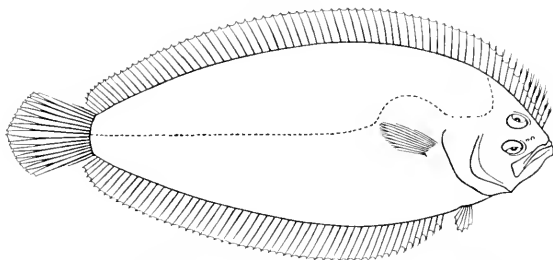


FIG. 288.—*Paralichthodes algoensis*. B.M. (N.H.) 1906. 11. 19. 113. $\times \frac{1}{2}$.

TYPE.—South African Museum.

DISTRIBUTION.—South-east Africa (Algoa Bay, East London, Natal).

SPECIMENS EXAMINED :

1 (180 mm.).	Durban, Natal.	Warren.
1 (250 ").	"	Marley and Robinson.

Attains to a length of 15 to 18 inches.

Subfamily 4. SAMARINÆ.

Dorsal fin extending forward on the snout below the nasal organ of the blind side, which is nearly on median line of head; pelvic fins short-based or rather elongate, that of ocular side median and somewhat advanced, the fins supported by the pelvic bones behind or below the cleithra; pectoral radials present; hypocoracoids expanded. Parapophyses of præcaudal vertebrae united to form closed hæmal arches, bearing the slender ribs at their extremities. Olfactory organ rather feebly developed, the laminae slightly raised, parallel, without central rachis. Lateral line rudimentary and scarcely apparent on blind side of body.

Four genera from the tropical Indo-Pacific.

SYNOPSIS OF THE GENERA.

- I. Bases of pelvics short; mouth large, the maxillary $\frac{1}{2}$ or more than $\frac{1}{2}$ head, both pectorals developed; lateral line with distinct curve above pectoral; gill-rakers long, slender, denticulated.
 - A. Scales deciduous, less than 35 in lateral line; snout, jaws, interorbital space and upper parts of eye-balls not scaled 32. BRACHYPLEURA.
 - B. Scales firm, more than 50 in lateral line; snout, jaws, interorbital space and upper parts of eye-balls scaled 33. LEPIDOBLEPHARON.
- II. Bases of pelvics rather elongate; mouth small, the maxillary generally less than $\frac{1}{2}$ head; pectoral of blind side absent; lateral line nearly straight; gill-rakers (if present) short, not denticulated; scales rather small, firm.
 - A. Some of the anterior dorsal rays and those of pelvic of ocular side prolonged and filamentous; all the caudal rays simple 34. SAMARIS.
 - B. Anterior rays of dorsal and those of pelvic of ocular side not much prolonged; middle caudal rays branched 35. SAMARISCUS.

Genus 32 BRACHYPLEURA.

Brachypleura, Gunther, 1862, Cat. Fish., iv, p. 419 [*Brachypleura novæ-zeelandiæ*, Gunther] *Lauopteryx*, Weber, 1913, "Siboga" Exped., Fische, p. 422 [*Brachypleura vanthosticta*, Alcock].

Body elliptical, compressed. Eyes on the right side, separated by a very narrow ridge; snout, jaws, interorbital space and upper parts of eye-balls not scaled; nasal organ of blind side above first ray of dorsal fin. Mouth large, the length of the maxillary $\frac{1}{2}$ or more than $\frac{1}{2}$ that of head; jaws and dentition about equally developed on both sides; teeth pointed, anterior teeth of upper jaw enlarged, biserial; teeth in lower jaw biserial almost throughout, those of the outer series larger; head of vomer prominent, with a patch of conical teeth. Gill-membranes more or less united below the throat; gill-rakers rather long, slender, denticulated, not numerous. Dorsal fin commencing on blind side, in front of eye, some of the anterior rays prolonged and filamentous in the male; most of the rays simple, not scaled; no sheath covering basal part of fin. Anal similar to dorsal, tip of first interhamal spine not projecting in front of fin. Pectoral fins equally developed on both sides; middle rays branched. Pelvic fins with 6 rays, short-based, that of ocular side well in advance of that of blind side. Caudal fin with the middle rays branched; caudal peduncle very short. Scales rather large, deciduous, imbricated, ctenoid or cycloid; less than 35 scales in lateral line. Lateral line with a distinct curve above the pectoral fin; no supratermporal branch. Vent nearly median.

A single species from the Indo-Pacific.

1. BRACHYPLEURA NOVÆ-ZEELANDIÆ, Gunther.

- Brachypleura novæ-zeelandiæ*, Gunther, 1862, Cat. Fish., iv, p. 419; Gunther, 1880, Shore Fishes "Challenger", p. 49; Phillipps, 1927, N.Z. Mar. Dept., Fish. Bull., 1, p. 27; Norman, 1927, Rec. Ind. Mus., xxix, p. 43, fig. 12; Fowler, 1928, Mem. B. P. Bishop Mus., x, p. 43; Weber and Beanfort, 1929, Fish. Indo-Austral. Arch., v, p. 145, fig. 37.
- Brachypleura vanthosticta*, Alcock, 1889, J. Asiatic Soc. Bengal, lxxiii (2), p. 281, pl. xvii, fig. 3; Alcock, 1899, J. Asiatic Soc. Bengal, lxxv (2), p. 327; Alcock, 1898, Illust. Zool. "Investigator", Fishes, pl. xxiii, fig. 2; Regan, 1908, Trans. Linn. Soc. London, Zool., xii, p. 232; Jenkins, 1910, Mem. Ind. Mus., iii, p. 27; Boodin, 1930, Bull. Vanderbilt Mar. Mus., 1 (2), p. 40.
- Lauopteryx vanthosticta*, Weber, 1913, "Siboga" Exped., Fische, p. 423.

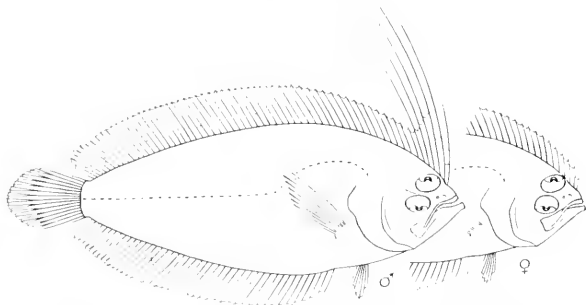


FIG. 259. *Brachypleura novæ-zeelandiæ*. ♂ B.M. (N.H.) 55.9.19.1234. ♀ B.M. (N.H.) 1927.1.9.73. — 1.

Depth of body $2\frac{2}{3}$ to $2\frac{3}{4}$ in the length, length of head $3\frac{1}{2}$ to $3\frac{3}{4}$. Snout shorter than eye, diameter of which is $3\frac{1}{2}$ to $4\frac{1}{4}$ in length of head; upper eye well in advance of lower and close to edge of head. Cleft of mouth curved, a convexity of the mandible fitting into a concavity of the upper jaw; maxillary extending to below middle of eye or beyond; lower jaw a little projecting. 8 to 10 gill-rakers on lower part of anterior arch. Scales ctenoid on ocular side, cycloid or rather feebly ctenoid on blind side; 29 to 32 in lateral line. Dorsal 65-74; a few rays in posterior part of fin forked distally, remainder all simple. Anal (41) 43-49. Pectoral of ocular side with 10 to 12 rays, length $\frac{2}{3}$ to $\frac{1}{2}$ that of head. Caudal with 17 to 19 rays (13 branched), rounded. Yellowish or greyish brown, sometimes with some indistinct darker markings; median fins often with small dark spots.

TYPE.—British Museum (Nat. Hist.). Reg. No. 55.9.19.1234.

DISTRIBUTION.—Indian Ocean and Archipelago; Philippines; New Zealand (?)¹; in deep water.

SPECIMENS EXAMINED :

2 (67, 115 mm.).	Maldive Is.	Gardiner.
1 (100 mm.).	Off Gopalpur, Ganjam Coast.	Ind. Mus.
3 (90-105 mm.).	Off Ganjam Coast, 25-35 fms.	"
3 (70-98 ").	" "	"
1 (90 mm.).	Bay of Bengal, 12 fms.	"
1 (78 ").	Off Tenasserim Coast, Burma, 50 fms.	"
3 (70-93 mm.).	Andaman Is., 53 fms.	"
2 (80, 90 ").	Java Sea (5° 44' S., 113° 54' E.).	Hardenberg.
1 (105 mm.).	" "	"
2 (88, 122 mm.).	Arafura Sea, 35-49 fms.	" Challenger."
1 (105 mm.), skeleton.	" "	"
1 (95 mm.). Paratype.	New Zealand. "	Richardson.
1 (89 "). Holotype.	" "	Haslar Coll.

Also numerous specimens from the Ganjam coast, Bay of Bengal, Burmese coast, and Andaman Islands (Ind. Mus.).

Genus 33. LEPIDOBLEPHARON.

Lepidoblepharon, Weber, 1913, "Siboga"-Exped., Fische, p. 421 [*Lepidoblepharon ophthalmolepis*, Weber].

Close to *Brachypleura*, but snout, jaws, interorbital space and upper parts of eye-balls covered with scales. Nasal organ of blind side below first ray of dorsal fin. Teeth small, in bands in the jaws, the bands becoming broader anteriorly; vomer toothless or with a few teeth on its posterior border. None of the dorsal rays prolonged; rays simple or forked distally, scaled; a low scaled sheath covering basal part of fin. Posterior rays of anal fin more distinctly forked. Scales of moderate size, firm, imbricated, ctenoid on ocular side, cycloid on blind side; more than 50 in lateral line.

A single species from the Indo-Australian Archipelago.

1. LEPIDOBLEPHARON OPHTHALMOLEPIS, Weber.

Lepidoblepharon ophthalmolepis, Weber, 1913, "Siboga"-Exped., Fische, p. 422, pl. vi, fig. 7; Weber and Beaufort, 1929, Fish. Indo-Austral. Arch., v, p. 143, fig. 36.

Depth of body $2\frac{2}{3}$ in the length, length of head a little more than 3. Snout shorter than eye, diameter of which is $3\frac{1}{2}$ in length of head; anterior margins of eyes level, upper close to edge of head. Maxillary extending to below middle of eye, length about 2 in that of head; lower jaw projecting, $1\frac{2}{3}$ in head. 13 gill-rakers on lower part of anterior arch. 56 scales in lateral line. Dorsal 62. Anal 46. Pectoral of ocular side with 11 rays, length a little more than $\frac{1}{2}$ that of head, that of blind

¹ It is possible that the type-locality of this species is incorrect.

side longer. Pelvics with 6 rays. Caudal with 10 rays (15 branched), rounded. Brownish, with a darker brown band below base of dorsal and above that of anal; blind side paler.

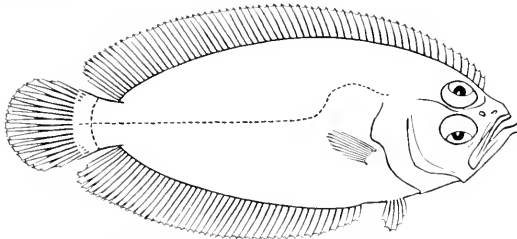


FIG. 290.—*Lepidoblepharon ophthalmolepis*. Holotype. 1

TYPE.—Amsterdam Museum.

DISTRIBUTION.—Near Kei Islands, Aratura Sea; 175 fathoms.

SPECIMEN EXAMINED.

The holotype, 122 mm in total length (Amsterdam Mus.)

Genus 34. SAMARIS.

Samaris, Gray, 1831, Zool. Miscell. (Gray), (1), p. 4. *Samaris cristatus*, Gray.

Body elliptical, compressed. Eyes on the right side, nearly contiguous or separated by a very narrow, scaled ridge; snout, jaws and upper parts of eye-balls not scaled; nasal organ of blind side above first ray of dorsal fin. Mouth small, the length of the maxillary not much more than $\frac{1}{2}$ that of head; jaws and dentition about equally developed on both sides; teeth small, villiform, in narrow bands; teeth not enlarged anteriorly; vomer toothless. Gill membranes broadly united below the throat; gill-rakers rudimentary. Dorsal fin commencing on blind side, in front of eye; anterior rays greatly prolonged and filamentous; all the rays simple, not scaled; no sheath covering basal part of fin. Anal similar to dorsal; tip of first interhemal spine not projecting in front of fin. Only the pectoral fin of ocular side developed; all the rays simple. Pelvic fins with 5 rays, bases rather elongate; that of ocular side placed a little farther forward than that of blind side, and with the rays prolonged. Caudal fin with the rays all simple; caudal peduncle very short. Scales rather small, adherent, imbricated, strongly ctenoid on ocular side, cycloid or moderately ctenoid on blind side; more than 50 scales in lateral line. Lateral line nearly straight, bifurcated behind upper eye; no supratermporal branch. Vent nearly median.

About five species from the Indo-Pacific.

SYNOPSIS OF THE SPECIES

- I. 63 or more scales in lateral line, dorsal with more than 73 rays, at least 13 of which are prolonged, and 50-59.
- | | | |
|---|---|--------------------|
| A. Dorsal 73-77-80 (81), anal 50-54 (57), 68 to 76 scales in lateral line | 1 | <i>cristatus</i> |
| B. Dorsal 80, anal 57, 80 scales in lateral line | 2 | <i>ornatus</i> |
| C. Dorsal 78, anal 55, 84 scales in lateral line | 3 | <i>delagoensis</i> |
| D. Dorsal 80, anal 59, 63 scales in lateral line | 4 | <i>caeruleus</i> |
- II. 55 scales in lateral line, dorsal with 60 rays, of which 8 only are prolonged, anal 47
- | | | |
|--|---|-------------------|
| | 5 | <i>macrolepis</i> |
|--|---|-------------------|

1. SAMARIS CRISTATUS, Gray.

Samaris cristatus, Gray, 1831, Zool. Miscell. (Gray), (1), p. 5; Günther, 1862, Cat. Fish., iv, p. 420; Alcock, 1889, J. Asiat. Soc. Bengal, lviii (2), p. 291, pl. xvii, fig. 4; Alcock, 1896, J. Asiat. Soc. Bengal, lxxv (2), p. 327; Alcock, 1898, Illust. Zool. "Investigator", Fishes, pl. xxiii, fig. 2; Norman, 1927, Rec. Ind. Mus., xxix, p. 44; Weber and Beaufort, 1929, Fish. Indo-Austral. Arch., v, p. 138, fig. 34.

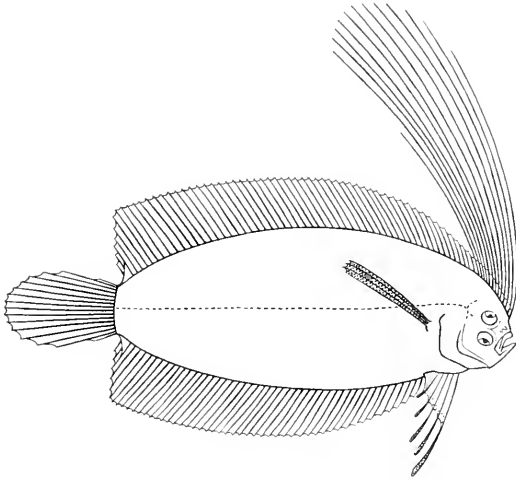


FIG. 291.—*Samaris cristatus*. B.M. (N.H.) [750]. ♂ ♀.

Depth of body $2\frac{1}{2}$ to 3 in the length, length of head $3\frac{3}{4}$ to $5\frac{1}{2}$. Snout shorter than eye, diameter of which is $2\frac{1}{2}$ to 4 in length of head; anterior margins of eyes level. Maxillary extending to below anterior edge of eye or a little beyond, length $2\frac{3}{4}$ to $3\frac{1}{2}$ in that of head; lower jaw a little projecting, $1\frac{3}{4}$ to 2 in head. Scales ctenoid on ocular side, cycloid or rather feebly ctenoid on blind side; 68 to 76 in lateral line. Dorsal (73), 77-80 (81); first 13 or 14 rays greatly prolonged (except in very young), highest rays 4 or 5 times length of head. Anal 50-54 (57). Pectoral with 4 rays, length $1\frac{1}{4}$ to $1\frac{1}{2}$ times that of head. Caudal with 16 simple rays, rounded. Brownish, variegated with paler and darker in the young, spotted and blotched with blackish in adults; generally a series of more distinct dark blotches along upper and lower edges of body; snout pale; anterior dorsal rays white, some of them blackish at their bases; rest of dorsal and anal fins brownish, freckled with small white spots, and darker towards their edges; tip of caudal often dark brown or black; pectoral dark brown.

TYPE.—British Museum (Nat. Hist.). Reg. No. [750].

DISTRIBUTION.—Indian Ocean and Archipelago; Chinese seas; in rather deep water.

SPECIMENS EXAMINED:

1 (45 mm.).	S. of Ceylon (6° 0' N., 81° 23' E.), 32 fms.	Ind. Mus.
1 (53 ").	" (6° 01' N., 81° 16' E.), 34 fms.	"
1 (22 ").	Ross Isd., Andaman Is., 3-4 fms.	"
2 (123, 102 mm.).	Malay Peninsula.	Skeats.
1 (116 mm.).	Java Sea (4° 16' S., 106° 41' E.).	Hardenberg.
1 (135 ").	" (4° S., 113° E.).	"
1 (70 ").	China Seas.	Beleher.
1 (100 ").	China.	Hardwicke.

Also 6 specimens from off Ceylon and from the Andaman Islands (Ind. Mus.).

2. SAMARIS ORNATUS, Von Bonde.

Samaris ornatus, Von Bonde, 1922, Rep. Fish. Mar. Biol. Surv. S. Afr., II, (1921), Spec. Rep. 1, p. 13, pl. vi; Barnard, 1925, Ann. S. Afr. Mus., XXI, p. 396.

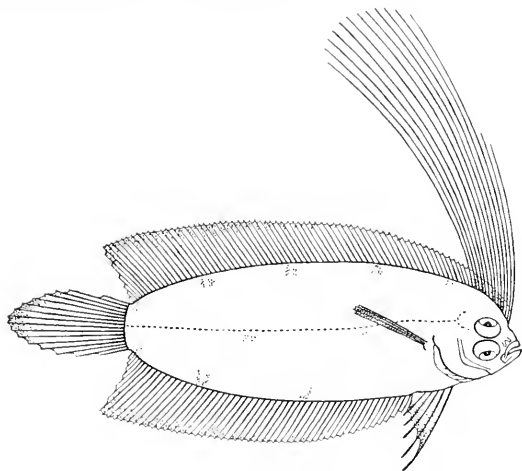


FIG. 292.—*Samaris ornatus*. B.M. (N.H.) 1922. 3.27.8. 1.

Perhaps identical with *S. cristatus*, but length of maxillary $3\frac{2}{3}$ in that of head; about 80 scales in lateral line, dorsal 86, anal 57; pectoral a little shorter than head. Deep brown, with irregularly scattered black spots; a row of 5 large blotches along upper edge, 4 along lower edge of body, and 2 on lateral line; dorsal and anal fins dusky, darker towards their edges; anterior rays of dorsal white distally; caudal with small pale spots, pectoral blackish, both pelvis dusky, darker distally.

TYPE—British Museum (Nat. Hist.) Reg. No. 1922.3.27.8

DISTRIBUTION—Natal, 33 fathoms

SPECIMEN EXAMINED:

1 (103 mm.).	Holotype.	Natal, 33 fms.	Galchrist.
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3. SAMARIS DELAGOENSIS, Von Bonde.

Samaris delagoensis, Von Bonde, 1925, Trans. Roy. Soc. S. Afr., xii, p. 289.

Perhaps identical with *S. cristatus*, but scales ctenoid on both sides of body, the spinules stronger on those of ocular side; 94 scales in lateral line; dorsal 78, first 15 rays prolonged; anal 55; pectoral a little shorter than head; caudal with 15 rays. Dark brown, with blotches of various sizes scattered all over body and fins; third, fifth, sixth and tenth elongated dorsal rays have their bases blackish; posterior parts of dorsal and anal and whole of caudal mottled with paler; pectoral dark, mottled with black; pelvics very dark, tips of first 3 rays of that of ocular side black.

TYPE.—Government Marine Survey of South Africa collection.

DISTRIBUTION.—Delagoa Bay, S. Africa.

Originally described from 3 specimens, 150 to 170 mm. in total length. No other specimens known.

4. SAMARIS CACATUÆ (Ogilby).

Arnoglossus cacatua, Ogilby, 1910, New Fish. Queensland Coast, p. 130.

Samaris cacatua, McCulloch and Whitley, 1925, Rec. Aust. Mus., xiv, p. 348, pl. xlix; Norman, 1926, Biol. Res. "Endeavour", v, p. 255.

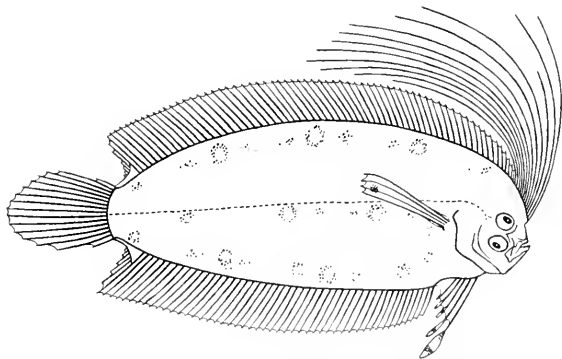


FIG. 293.—*Samaris cacatua*. [After McCulloch and Whitley.] $\times \frac{2}{3}$.

Perhaps identical with *S. cristatus*, but with 63 scales in lateral line; dorsal 86, anal 59. Pale brown, with scattered dark flecks, which coalesce to form irregular markings on head and body; a row of 5 circular dark spots along upper edge, 4 along lower edge of body, and 3 just below the lateral line; median fins with oblique greyish-brown bars, tending to form angular markings; filamentous dorsal rays white; pectoral with a black ocellus on its distal portion and with irregular cross-bars; pelvics with brown bars, most pronounced on their terminal expansions.

TYPE — Queensland Museum

DISTRIBUTION — 20 miles N.E. of Gloucester Head, Queensland; 35 fathoms.
The unique holotype is 171 mm. in total length

5. SAMARIS MACROLEPIS, Norman.

Samaris macrolepis, Norman, 1927, *Reu. Ind. Mus.*, xxix, p. 45, pl. vi.

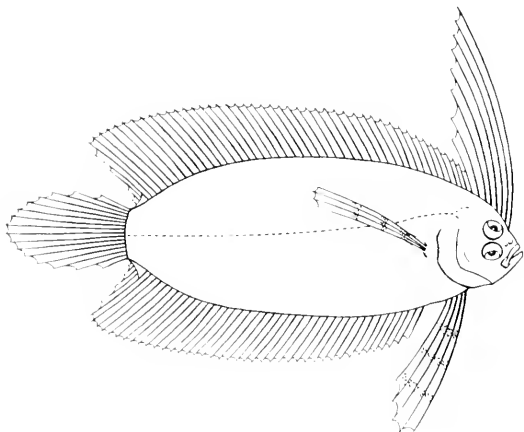


FIG. 244. — *Samaris macrolepis*. B.M. (N.H.) 88.12.1.32. 2.

Close to *S. cristatus*. Depth of body $2\frac{1}{2}$ in the length, length of head $4\frac{2}{3}$. Snout shorter than eye, diameter of which is $3\frac{1}{2}$ in length of head; eyes nearly contiguous, their anterior margins about level. Maxillary extending to a little beyond anterior edge of eye, length about 3 in that of head. Scales ctenoid on both sides of body, about 55 in lateral line. Dorsal 60; first 8 rays moderately prolonged, decreasing in height from the first, which is $2\frac{1}{2}$ times length of head. Anal 47. Pectoral with 4 rays, length $1\frac{1}{2}$ times that of head. Rays of pelvic of ocular side prolonged, longest nearly twice head; rays of that of blind side short. Caudal with 16 rays, pointed. Brownish, mottled and spotted with paler and darker, median fins with brown spots; pelvic of ocular side with 3 narrow cross-bars.

TYPE — British Museum (Nat. Hist.) Reg. No. 88.12.1.32.

DISTRIBUTION — Gulf of Martaban.

SPECIMEN EXAMINED:

(145 mm.) Holotype.

Gulf of Martaban.

Oates.

Genus 35. SAMARISCUS.

Samariscus, Gilbert, 1905, Bull. U.S. Com. Fish., xxii, (1903), p. 682 [*Samariscus corallinus*, Gilbert]; Norman, 1931, Ann. Mag. Nat. Hist., (10) viii, p. 602.
Plagiopsetta, Franz, 1910, Abh. Bayer. Akad. Wiss., Suppl. iv, Abh. i, p. 64 [*Plagiopsetta glossa*, Franz].

Closely related to *Samaris*, but none of the rays of the dorsal or pelvic fins greatly prolonged; caudal with the middle rays branched.

Six or seven species from the Indo-Pacific.

SYNOPSIS OF THE SPECIES.

- I. Depth $2\frac{2}{3}$ in length; maxillary $3\frac{1}{2}$ to $3\frac{2}{3}$ in head; pectoral longer than head
 1. *inornatus*.
- II. Depth $2\frac{2}{3}$ to $3\frac{2}{3}$ in length; maxillary 2 to 3 in head.
- A. Pectoral shorter than, or a little longer than head.
1. Head $3\frac{3}{4}$ in length; eye $3\frac{1}{2}$, maxillary 3, pectoral $1\frac{1}{4}$ in head; 62 scales in lateral line 2. *maculatus*.
2. Head $4\frac{2}{3}$ to $4\frac{1}{4}$ in length; eye 4, maxillary 2 to $2\frac{1}{2}$ in head; pectoral a little longer than head; 70 to 75 scales in lateral line 3. *huysmani*.
3. Head $4\frac{1}{4}$ to 5 in length; eye $3\frac{1}{2}$ to about 4, maxillary $2\frac{1}{2}$ in head; pectoral nearly as long as head; about 100 scales in lateral line 4. *corallinus*.
- B. Pectoral twice or more than twice as long as head.
1. Head 4 to $4\frac{3}{4}$ in length; eye $2\frac{3}{4}$ to a little more than 3, maxillary $2\frac{1}{2}$ to $2\frac{2}{3}$ in head; 68 to 74 scales in lateral line 5. *sunievi*.
2. Head $3\frac{1}{2}$ to $3\frac{2}{3}$ in length; eye $3\frac{1}{2}$ to $3\frac{3}{4}$, maxillary about 3 in head; 55 to 60 scales in lateral line 6. *longimanus*.

1. SAMARISCUS INORNATUS (Lloyd).

Samaris inornata, Lloyd, 1909, Mem. Ind. Mus., ii, p. 160, pl. xlvii, figs. 7, 7a.
Samariscus inornatus, Norman, 1927, Rec. Ind. Mus., xxix, p. 46.

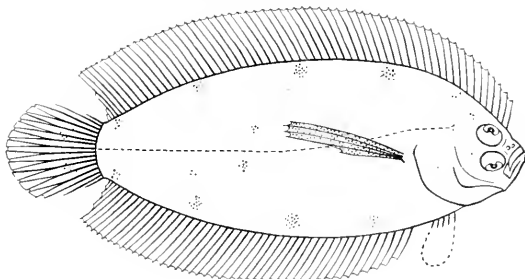


FIG. 295.—*Samariscus inornatus*. B.M. (N.H.) 1927.1.6.67. . . 1.

Depth of body about $2\frac{2}{3}$ in the length, length of head $3\frac{3}{4}$ to 4. Snout shorter than eye, diameter of which is nearly 4 in length of head; eyes separated by a narrow,

scaled space, their anterior margins about level. Maxillary extending to below anterior $\frac{1}{4}$ of eye, length $3\frac{1}{2}$ to $3\frac{3}{8}$ in that of head; lower jaw about $2\frac{1}{2}$ in head. 8 or 6 short, tubercular gill-rakers on lower part of anterior arch. Scales more or less ctenoid on both sides of body, the denticulations much stronger on those of ocular side, about 63 scales in lateral line. Dorsal (61) 63-67. Anal 48-50. Pectoral with 5 rays, longer than head. Caudal with 16 rays, rounded. Brownish, with darker spots and blotches on head, body and fins; pectoral blackish.

TYPE — Indian Museum.

DISTRIBUTION — Gulf of Aden, 130 fathoms.

SPECIMENS EXAMINED:

1 (107 mm.), Paratype, 13° 30' N., 47° 32' E., 130 fms. Ind. Mus.

Also another example (130 mm.), from the same locality (Ind. Mus.)

2. SAMARISCUS MACULATUS (Günther).

Samariscus maculatus, Günther, 1880, Shore Fishes "Challenger", p. 47, pl. XXI, fig. 3; Regan, 1902, in Gardner, Faun. Maldive Laccadive Arch., 1, p. 277; Regan, 1908, Trans. Linn. Soc. London, Zool., XL, p. 212.

Samariscus maculatus, Norman, 1927, Rec. Ind. Mus., XXIX, p. 47; Weber and Beaufort, 1929, Fish Indo-Austral. Arch., v, p. 141.

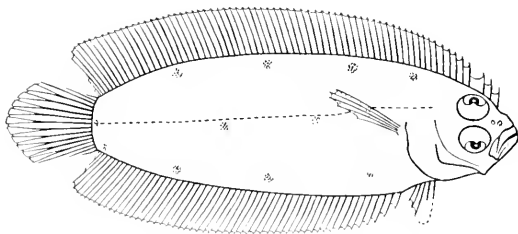


FIG. 296.—*Samariscus maculatus*. B.M. (N.H.) 79.5.14.84. 1

Depth of body 3 to $3\frac{1}{2}$ in the length, length of head about $3\frac{1}{2}$. Snout a little shorter than eye, diameter of which is $3\frac{1}{2}$ in length of head, eyes separated by a narrow ridge, the lower in advance of upper. Maxillary extending to a little beyond anterior edge of eye, length 3 in that of head, lower jaw about twice in head. No gill-rakers. Scales strongly ctenoid on ocular side, cycloid or moderately ctenoid on blind side, 62 in lateral line. Dorsal 73. Anal 57. Pectoral with 5 rays, length $1\frac{1}{4}$ in that of head. Caudal with 16 rays, obtusely pointed. Pale brownish, with a series of 5 well separated black spots along upper edge of body, a similar row along lower edge, and a third, composed of 3 spots, along the lateral line, median fins with irregular blackish dots and blackish margins, pectoral variegated with black.

TYPE — British Museum (Nat. Hist.) Reg. No. 79.5.14.84.

DISTRIBUTION — Maldive Islands, Kei Islands; 129 fathoms.

SPECIMENS EXAMINED:

1 (27 mm.) Maldives, Gardner.

1 (100 mm.) Holotype, Kei Is., 129 fms. "Challenger"

3. SAMARISCUS HUYSMANI, Weber.

Samariscus huysmani, Weber, 1913, "Siboga"-Exped., Fische, p. 420, pl. vi, fig. 6; Norman, 1927, Rec. Ind. Mus., xxix, p. 47; Weber and Beaufort, 1929, Fish. Indo-Austral. Arch., v, p. 142, fig. 35.

Depth of body $2\frac{3}{4}$ to $2\frac{1}{2}$ in the length, length of head $4\frac{3}{8}$ to $4\frac{1}{4}$. Snout about as long as eye, diameter of which is 4 in length of head; eyes separated by a narrow, scaled ridge, the lower in advance of upper. Maxillary extending to below anterior part of eye, length 2 to $2\frac{1}{2}$ in that of head; lower jaw about $1\frac{1}{2}$ in head. 6 rather short gill-rakers on lower part of anterior arch. Scales ctenoid on ocular side, ctenoid or cycloid on blind side; 70-75 in lateral line. Dorsal 68-72. Anal 55-57. Pectoral with 5 rays, length a little greater than that of head. Caudal with 16 rays, rounded or obtusely pointed. Pale brownish, with a number of darker spots and rings, of which a row of 5 rings along upper edge and 4 along lower edge of body are most conspicuous; median fins paler, with traces of small brown spots; pectoral brown, its distal portion darker.

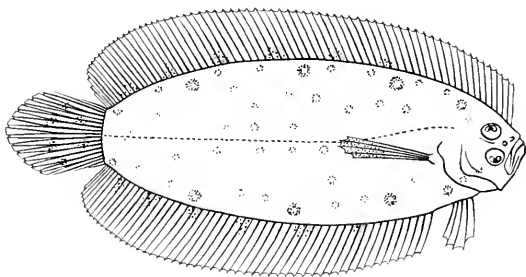


FIG. 297.—*Samariscus huysmani*. Holotype. $\times 1$.

TYPE.—Amsterdam Museum.

DISTRIBUTION.—Gulf of Martaban; Java Sea: 40 to 61 fathoms.

SPECIMENS EXAMINED:

One (95 mm.) from the Gulf of Martaban ($14^{\circ} 46' N.$, $95^{\circ} 52' E.$), 61 fathoms [Ind. Mus.]; the holotype (100 mm.) from the Java Sea, 48 fathoms, and one other, also from the Java Sea ($6^{\circ} 26' S.$, $112^{\circ} 41' E.$) [Amsterdam Mus.].

4 SAMARISCUS CORALLINUS, Gilbert.

Samariscus corallinus, Gilbert, 1905, Bull. U.S. Com. Fish., xxiii (2), (1903), p. 682, pl. xcvi.

Samaris corallinus, Gunther, 1909, Fische Südsee, viii, p. 341; Fowler, 1925, Mem. B. P. Bishop Mus., x, p. 93.

Depth of body $2\frac{3}{4}$ in the length, length of head $4\frac{1}{2}$ (5). Snout a little longer than eye, diameter of which is ($3\frac{1}{2}$) about 4 in length of head; eyes separated by a narrow, scaled ridge, the lower a little in advance of upper. Maxillary extending to below anterior part of eye, length $2\frac{1}{2}$ in that of head; lower jaw $1\frac{1}{2}$ in head. Gill-rakers nearly obsolete. Scales ctenoid on both sides of body, the spinules stronger on those

of ocular side; about 100 scales in lateral line¹. Dorsal 75 (77). Anal 93 (95). Pectoral with 4 rays, nearly as long as head. Caudal with 16 rays, rounded or obtusely pointed. Coralline red, mottled and spotted with blackish, pearly grey and pinkish white; a pair of round black spots with small orange centres situated at upper and lower edges of hinder part of body; fins mottled and spotted like the body, but in inner pattern.

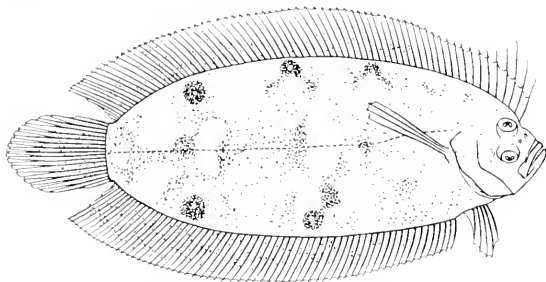


FIG. 298—*Samariscus corallinus*. U.S.N.M. 51076. ♂.

TYPE.—United States National Museum. No. 51500.

DISTRIBUTION.—Hawaiian Islands, 43 to 73 fathoms.

SPECIMENS EXAMINED:

A paratype (83 mm) U.S. Nat. Mus. No. 51076¹.

The holotype is 110 mm in total length.

5. SAMARISCUS SUNIERI, Weber and Beaufort

Samariscus sunieri, Weber and Beaufort, 1929, Fish Indo Austral Arch., v, p. 141.

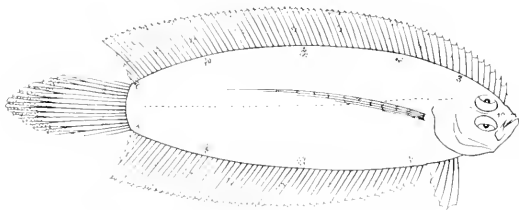


FIG. 299—*Samariscus sunieri*. B.M. (N.H.) 1933.2.48.1. ♂.

¹ Gilbert describes the integument of the ocular side as "thickly beset with minute cup-shaped organs, possibly glandular in function".

Depth of body $2\frac{9}{10}$ to $3\frac{2}{5}$ in the length, length of head 4 to nearly $4\frac{3}{4}$. Snout shorter than eye, diameter of which is $2\frac{3}{4}$ to a little more than 3 in length of head; eyes separated by a somewhat elevated, scaled ridge, the lower a little in advance of upper. Maxillary extending to below anterior part of eye, length $2\frac{1}{5}$ to $2\frac{2}{5}$ in that of head. Gill-rakers short or rudimentary, knob-like. Scales ctenoid on both sides of body, 68 to 74 in lateral line. Dorsal 70-76. Anal 54-61. Pectoral with 5 rays, more than twice as long as head. Caudal with 16 rays, rounded or pointed. Dark brownish, with 5 dark blotches or incomplete rings along upper edge and 4 along lower edge of body; body and fins variegated with dark spots; median fins with a dark border; pectoral regularly ringed grey and black.

TYPE.—Amsterdam Museum.

DISTRIBUTION.—Bali, 59 to 138 fathoms.

SPECIMEN EXAMINED:

1 (128 mm.). Paratype.

St. Nikolaas Bay, Bali, 60-90 fms.

Amsterdam Mus.

6. SAMARISCUS LONGIMANUS, Norman.

Samariscus longimanus, Norman, 1927, Rec. Ind. Mus., xxix, p. 46, pl. vii.

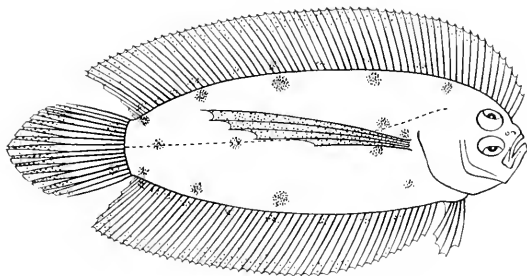


FIG. 300.—*Samariscus longimanus*. Holotype. ♂.

Depth of body $2\frac{2}{3}$ to nearly 3 in length, length of head $3\frac{1}{2}$ to $3\frac{3}{4}$. Snout shorter than eye, diameter of which is $3\frac{1}{2}$ to $3\frac{3}{4}$ in length of head; eyes separated by a narrow ridge, their anterior margins level. Maxillary extending to below anterior $\frac{1}{4}$ of eye, length about 3 in that of head; lower jaw $2\frac{1}{4}$ to $2\frac{1}{2}$ in head. Gill-rakers rudimentary. Scales ctenoid on both sides of body, the denticulations stronger on those of ocular side; 55 to 60 (?) scales in lateral line. Dorsal 60-71. Anal 50-54. Pectoral with 5 rays, length twice that of head. Caudal with 16 rays, pointed. Greyish brown, with a series of 5 black blotches along upper edge, and 3 or 4 along lower edge of body; a group of black blotches round anterior part of lateral line, and one or two smaller ones on the straight portion; dorsal and anal fins pale, with a narrow dark margin and a series of dark spots; distal part of caudal dusky, two small dark spots near base of fin; pectoral blackish.

TYPE.—Indian Museum

DISTRIBUTION.—West of Ceylon, 102 to 105 fathoms.

SPECIMENS EXAMINED:

1 (100 mm). Paratype. West of Ceylon, 102-105 fms. Ind. Mus.

Also the holotype (130 mm), from the same locality.

DOUBTFUL SPECIES.

SAMARISCUS (?) GLOSSA (Franz).

Platyssetta glossa, Franz, 1910, Abh. Bayer. Akad. Wiss., Suppl. iv, Abh. 1, p. 64, pl. viii, fig. 58.
Samariscus glossa, Norman, 1931, Ann. Mag. Nat. Hist., (10) viii, p. 603.

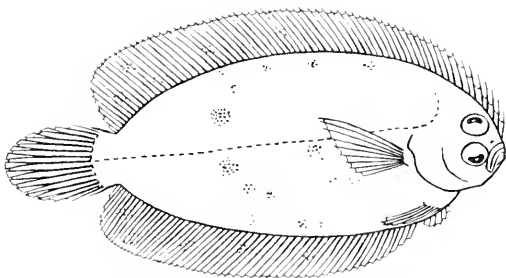


FIG. 58.—*Samariscus (?) glossa*.—After Franz. 1.

Depth of body $2\frac{1}{2}$ in the length, length of head $3\frac{1}{2}$. Snout shorter than eye, diameter of which is $3\frac{1}{2}$ in length of head, eyes separated by a narrow, scaled ridge, their anterior margins about level. Maxillary extending to below anterior edge of eye. Scales ctenoid, 60 in lateral line. Lateral line with accessory branches.¹ Dorsal 70. Anal 53. Pectoral with about 10 (?) rays, a little longer than head. Caudal obtusely pointed. Brownish, spotted and blotched with black on head, body and fins, dorsal and anal fins with dark edges, pectoral with small dark spots.

TYPE.—Not traced.²

DISTRIBUTION.—Japan (Yagoshima), 82 fathoms.

The unique holotype was 110 mm in total length.

¹ Franz describes the lateral line as follows: "Laterallinie ganz gestreckt, an der Augenseite hat sie einen kurzen, antwärts strebenden Ast, ausserdem findet sich ein abgesprengtes Stück Laterallinie dorsal vom Opercularwinkel, vielleicht abnormerweise. Auf der Blindseite ist der kurze, aufsteigende Ast ebenfalls vorhanden und von ihm zieht eine Laterallinie, um Augenlinie von der Basis der Dorsalen entfernt, der letzteren parallel über, der Länge des ganzen Tieres."

² Dr. O. Schindler, of the Zoologische Sammlung des Bayerischen Staates, München, informs me that the type specimen cannot now be found.

Subfamily 5. RHOMBOSOLEINÆ.

Dorsal fin commencing just behind the nasal organ of the blind side or extending forward on the snout above it; pelvic fins asymmetrical, that of ocular side median, elongate, extending forward to the urohyal, supported by a cartilaginous plate placed in advance of the cleithra, its anterior ray well in advance of first ray of that of blind side, which, if present, is small, with the base short or of moderate length; no pectoral radials, the rays inserted on the hypercoracoid; hypocoracoids narrowed forward below. Parapophyses of præcaudal vertebræ not united. Olfactory laminae with or without a central rachis. Lateral line equally developed on both sides of body. Dentition stronger on blind side of jaws. Gill-membranes united. No pyloric appendages.

Eight genera from southern South America, southern Australia, and from New Zealand.

SYNOPSIS OF THE GENERA.

I. Both pelvic fins developed.

A. Pelvic of ocular side free from anal.

1. Lateral line with distinct curve above pectoral; pelvic of ocular side with 6 rays.

a. Jaws stronger on blind side; branchial septum with a large foramen between lower pharyngeals and urohyal; first ray of dorsal much modified, contained in a groove on blind side of head; lateral line with several transverse accessory branches

36. ONCOPTERUS.

b. Jaws stronger on ocular side; branchial septum entire; first ray of dorsal fin not modified; lateral line with a supratemporal branch, but no other accessory branches

37. PSAMMODISCUS.

2. Lateral line with very low curve above pectoral; pelvic of ocular side with 10 or 11 rays

38. AZYGOPUS.

B. Pelvic of ocular side united with anal.

1. Origin of dorsal above eye; snout not produced; nasal organ of blind side nearly on edge of head; jaws nearly symmetrical

39. PELOTRETIS.

2. Origin of dorsal in front of eye; snout produced to form a fleshy hook; nasal organ of blind side nearly opposite to that of ocular side; jaws stronger on blind side

a. Mouth visible on ocular side; none of the pectoral rays prolonged; lower lip of ocular side fringed.

a. Olfactory laminae parallel, without rachis; dorsal and anal rays scaled, without basal sheath; gill-rakers tubercular, few in number

40. AMMOTRETIS.

β. Olfactory laminae radiating from a short central rachis; dorsal and anal rays not scaled, a low scaled sheath at bases of fins on ocular side; gill-rakers short, rather numerous

41. COLISTIUM.

b. Mouth nearly or quite hidden on ocular side by a membranous flap; second upper ray of pectoral of ocular side prolonged, filamentous; lower lip of ocular side not fringed

42. PELTORHAMPHUS.

II Pelvic fin of ocular side only developed, united with anal 43. RHOMBOSOLEA.

Genus 36. ONCOPTERUS.

Oncopterus, Steindachner, 1875, SitzBer. Akad. Wiss. Wien, lxx (1), p. 363 (*Oncopterus darwini*, Steindachner).

Body ovate, compressed. Eyes on the right side, separated by a slightly concave space of moderate width, the upper at some distance from edge of head; snout, jaws, interorbital space and upper parts of eye-balls not scaled; nasal organ of blind side nearly opposite to that of ocular side, olfactory laminae rather numerous, arranged transversely to or radiating from a long central rachis. Mouth of moderate width, the jaws stronger on blind side and rather curved; teeth small, pointed, not enlarged anteriorly, in narrow bands in both jaws, better developed on blind side; vomer toothless. Gill-rakers of moderate length, rather stout, few in number; lower pharyngeals rather broad, scarcely approximated, each with several rows of small pointed teeth, branchial septum perforated by a large foramen between the lower pharyngeals and urohyal. Dorsal fin commencing above nostrils of blind side and well in front of eye, first ray enlarged, stiff, curved, movable, connected with first strongly developed basal bone of the fin, contained in a deep groove on blind side of head level with upper eye, most of the other rays forked distally, not scaled, no sheath covering basal part of fin. Anal similar to dorsal, tip of first interhæmal spine projecting in front of fin. Pectoral fins unequal, that of ocular side larger; middle rays branched. Both pelvic fins developed, each with 6 rays; that of ocular side elongate, free from anal, the rays widely spaced, the last in advance of first ray of that of blind side, which has a very short base. Caudal with the middle rays branched, caudal peduncle short. Scales small, adherent, not very well imbricated, cycloid. Lateral line with a distinct curve above the pectoral fin; several supra-temporal accessory branches and others running transversely from main lateral line to dorsal edge of body. Vent on blind side, just in front of anal fin; intestine short.

A single species from south-eastern South America.

1. ONCOPTERUS DARWINI, Steindachner.

Rhombus sp., Jenyns, 1842, Zool. Voy. "Beagle", iv, Fish, p. 136.

Oncopterus darwini, Steindachner, 1875, SitzBer. Akad. Wiss. Wien, lxx (1), p. 363, pl. 1; Jordan and Goss, 1880, Rep. U.S. Com. Fish., xiv, (1880), p. 281; Perugia, 1891, Ann. Mus. Stor. nat. Genova, (2) x xxx, p. 629; Berg, 1895, An. Mus. nac. B. Aires, iv, p. 78; Ribeiro, 1915, Arch. Mus. nac. Rio de J., xvii, Heterosomata, p. 16.

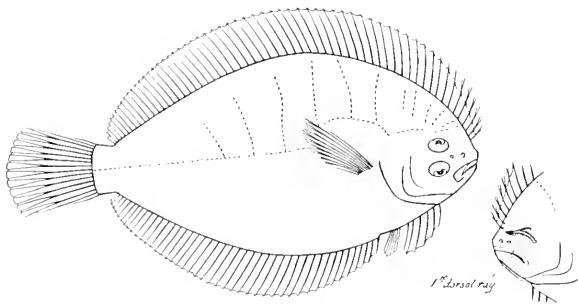


FIG. 362. *Oncopterus darwini*. B.M. (N.H.) 1930.9.4.21. 1/2.

Depth of body about twice in the length, length of head $3\frac{3}{4}$ to nearly 4. Upper profile of head distinctly convex. Snout longer than eye, diameter of which is $4\frac{1}{2}$ to 5 in length of head and about twice interorbital width; anterior margin of eyes level or lower a very little in advance of upper, which is separated from edge of head by a space equal at least to its diameter. Maxillary not reaching anterior edge of eye, length on ocular side $3\frac{1}{2}$ to $3\frac{1}{2}$, on blind side $2\frac{3}{4}$ to $2\frac{3}{4}$ in that of head; lower jaw not projecting, about $2\frac{1}{4}$ in head; lips rather feebly fringed. 9 to 11 gill-rakers on lower part of anterior arch. About 115 scales in lateral line. Dorsal (60) 61-67; first ray with its upper and lower edges fringed; the remainder of the anterior rays deeply forked, free from membrane distally; highest rays $\frac{1}{2}$ to $\frac{2}{3}$ length of head. Anal (42) 43-45. Pectoral of ocular side with 11 to 13 rays (8 to 10 branched), length $1\frac{1}{2}$ to $1\frac{1}{2}$ in that of head. Anterior ray of pelvic of ocular side inserted below eye. Caudal with 16 rays (12 branched), rounded; caudal peduncle more than twice as deep as long. Pale brownish, everywhere covered with small white spots; some larger white spots at upper and lower edges of body.

TYPE.—Vienna Museum.

DISTRIBUTION.—South-east coast of South America, from Rio Grande do Sul to San Mathias Bay.

SPECIMENS EXAMINED:

1 (125 mm.), skin.	Bahia Blanca, Patagonia.	Cambridge Mus. ("Beagle").
2 (188, 215 mm.).	San Mathias Bay, "	Mus. Comp. Zool.
1 (250 mm.).	" "	" "

Attains to a length of 10 or 11 inches.

The function of the curiously modified first ray of the dorsal fin is not known, but it may be sensory. The groove in which it lies penetrates the whole thickness of the head, being bordered internally merely by the skin of the ocular side. According to Steindachner, the ray is fixed to the base of the cavity by a muscular membrane, and only exhibits a moderate degree of mobility. Towards its base the ray broadens out to form two small plates, which clasp the anterior end of the first strongly developed basal bone of the dorsal fin.

Genus 37. PSAMMODISCUS.

Psammodiscus, Gunther, 1862, Cat. Fish., iv, p. 457 [*Psammodiscus ocellatus*, Gunther].

Related to *Oncopterus*. Eyes separated by a low, narrow ridge. Cleft of mouth nearly vertical, the jaws stronger on ocular side; teeth uniserial or in a very narrow band. Gill-rakers rather short, more numerous; lower pharyngeals very narrow, not approximated, each with 2 or 3 rows of small, pointed teeth; branchial septum entire. Dorsal fin commencing in front of nostrils of blind side; first ray not specially modified; most of the rays scaled, posterior rays mostly forked distally. First ray of pelvic fin of blind side opposite fourth of that of ocular side; base of moderate length. Caudal peduncle very short. Lateral line with a distinct supratemporal branch, but with no other accessory branches.

A single species.

1. PSAMMODISCUS OCELLATUS, Günther.

Psammodiscus ocellatus, Gunther, 1862, Cat. Fish., iv, p. 457.

Depth of body $1\frac{3}{4}$ to $1\frac{3}{4}$ in the length, length of head $3\frac{1}{2}$ to $3\frac{3}{4}$. Upper profile of head distinctly convex. Snout shorter than eye, diameter of which is $3\frac{1}{2}$ to 4 in length of head and about 5 times interorbital width; lower eye a little in advance of upper, which is separated from edge of head by a space equal to at least $\frac{1}{2}$ its diameter. Maxillary extending to below anterior edge, or anterior part of eye, length on ocular side $2\frac{1}{2}$ to $2\frac{3}{4}$, on blind side $3\frac{1}{4}$ to $3\frac{3}{4}$ in that of head; lower jaw not projecting, $2\frac{1}{2}$ to $2\frac{1}{2}$ in head; lips not fringed. 15 to 18 gill-rakers on lower part of anterior arch.

68 to 78 scales in lateral line. Dorsal 64-68; anterior rays simple, more or less free from membrane distally; highest rays about $\frac{1}{2}$ length of head. Anal 50-52. Pectoral of ocular side with 11 or 12 rays (about 7 branched), length $1\frac{2}{3}$ to $1\frac{3}{4}$ in that of head. Anterior ray of pelvic of ocular side inserted just behind angle of lower jaw. Caudal with 16 rays (12 branched), rounded. Pale brownish, faintly spotted and marbled with darker; traces of 4 dark brown ocelli, edged with whitish, one immediately below middle of straight portion of lateral line, a similar but less well-defined ocellus above its anterior part, and two smaller ocelli, one above curve of lateral line and another below pectoral; dorsal and anal fins spotted with brown and white.

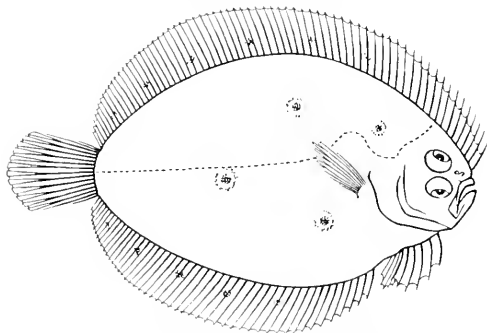


FIG. 393.—*Psammodesmus ocellatus*. B.M. (N.H.) [221]. 1.

TYPE.—British Museum (Nat. Hist.). Reg. No. [221].

DISTRIBUTION.—Not known.

SPECIMENS EXAMINED:

4 (65-90 mm.). Types.¹

Genus 38. AZYGOPUS.

Azygopus, Norman, 1926, Biol. Res. "Endeavour", v, p. 261 [*Azygopus pinnaefasciatus*, Norman].

Body rather elongate, compressed. Eyes on the right side, nearly contiguous, the upper rather close to edge of head; parts of snout and whole of upper surfaces of eye-balls densely scaled; nasal organ of blind side nearer median line of head than that of ocular side; olfactory laminae in moderate number, radiating from a fairly long central rachis. Mouth rather small, subsymmetrical; teeth small, movable, pointed, not enlarged anteriorly, in bands in the jaws; almost entirely confined to blind side, vomer toothless. Gill-rakers short, in moderate number; lower pharyngeals moderately broad, curved, approximated anteriorly, each with 3 or 4 irregular rows of teeth, branchial septum entire. Dorsal fin commencing above nostrils of blind side and just in front of eye; most of the rays simple, not scaled, a low scaled sheath covering basal part of fin on ocular side. Anal similar to dorsal; tip of first interhemal spine not projecting in front of fin. Pectoral fins unequal,

¹ The largest is selected as the holotype.

that of ocular side larger; middle rays branched. Both pelvic fins developed; that of ocular side elongate, with 10 or 11 rays, free from anal, that of blind side with 5 or 6 rays, base very short. Caudal with the middle rays branched; caudal peduncle very short. Scales rather small, adherent, imbricated, ctenoid. Lateral line with a very low curve above pectoral fin; no supratemporal branch. Vent a little on blind side, just in front of anal fin; intestine short.

A single species from southern Australia.

1. *AZYGOPUS PINNIFASCIATUS*, Norman.

Azygopus pinnifasciatus, Norman, 1926, Biol. Res. "Endeavour", v, p. 262, fig. 10; McCulloch 1929, Mem. Aust. Mus., v, p. 280.

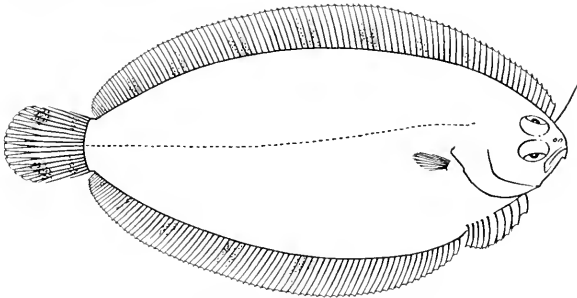


FIG. 304.—*Azygopus pinnifasciatus*. B.M. (N.H.) 1925.7.22.3. $\times \frac{3}{4}$.

Depth of body $2\frac{1}{4}$ to $2\frac{3}{4}$ in the length, length of head $4\frac{1}{4}$ to $4\frac{3}{4}$. Upper profile of head straight or a little convex. Snout shorter than eye, diameter of which is $3\frac{1}{4}$ to 4 in length of head; anterior margins of eyes level or lower a little in advance of upper. Maxillary extending to below anterior part of eye, length 3 to $3\frac{1}{4}$ in that of head; lower jaw not projecting, $2\frac{1}{2}$ to $2\frac{3}{4}$ in head. Bands of teeth in jaws narrowing posteriorly. 11 or 12 gill-rakers on lower part of anterior arch. Scales of ocular side somewhat more strongly denticulated than those of blind side; 88 to 95 in lateral line. Dorsal 104-115; first ray entirely free, longer than those immediately following, its height 2 to $2\frac{1}{2}$ in length of head; remainder of fin rather low. Anal 84-92. Pectoral of ocular side with 10 or 11 rays (6 to 8 branched), length $2\frac{1}{2}$ to 3 in that of head. Anterior ray of pelvic of ocular side inserted below eye, the posterior rays twisted a little on to ocular side of median line, sixth or seventh ray opposite first ray of pelvic of blind side. Caudal with 18 or 19 rays (12 to 14 branched), a little rounded or double truncate; caudal peduncle about 6 times as deep as long. Brownish, with irregular blackish patches; a series of short blackish bars on dorsal and anal fins; some black spots or blotches on caudal.

TYPE.—Australian Museum. No. E. 3600

DISTRIBUTION.—Southern Australia; in deep water.

SPECIMENS EXAMINED:

1 (165 mm.).	Paratype.	S.S.E. from Gnoa Peak, Victoria, 200 fms.	Austr. Mus.
1 (182 ,,).	,,	Great Australian Bight, S.W. from Eucla ($126^{\circ} 45' E.$), 190-320 fms.	,,

Also 8 from southern Australia (Austr. Mus.), including the holotype of the species.

Genus 39. PELOTRETIS.

Pelotretis, Waite, 1911, Trans. Proc. N.Z. Inst., xlii, (1910), Proc. p. 50 (*Pelotretis flavilatus*, Waite), Norman, 1926, Biol. Res. "Endeavour", v, p. 264.

Body ovate, compressed. Eyes on the right side, separated by a low, scaled ridge, the upper touching edge of head, snout not produced; parts of snout scaled, and a patch of small scales on upper surface of each eye-ball; nasal organ of blind side nearly on edge of head, olfactory laminae in moderate number, arranged transversely to or radiating from a long central rachis. Mouth small, subsymmetrical, teeth small, movable, pointed, not enlarged anteriorly, in bands in the jaws of the blind side; vomer toothless. Gill-rakers short, few in number, lower pharyngeals narrow, evenly curved, approximated anteriorly, each with 3 irregular rows of conical teeth; branchial septum entire. Dorsal fin commencing just behind nostrils of blind side and above anterior part of eye; most of the rays forked distally, scaled; a low scaled sheath covering basal part of fin on ocular side. Anal similar to dorsal; tip of first interhaemal spine not projecting in front of fin. Pectoral fins unequal, that of ocular side larger; middle rays branched. Both pelvic fins developed; that of ocular side elongate, with 7 widely spaced rays, united with anal; that of blind side with 5 or 6 rays, base very short. Caudal with the middle rays branched; caudal peduncle short. Scales of moderate size, adherent, imbricated, ctenoid. Lateral line with a very slight curve above the pectoral fin, no supratemporal branch. Vent a little on blind side, just in front of anal fin; intestine rather elongate.

A single species from New Zealand.

1. PELOTRETIS FLAVILATUS, Waite

["LEMON SOLE".]

Pelotretis flavilatus, Waite, 1911, Trans. Proc. N.Z. Inst., xlii, (1910), Proc. p. 50; Waite, 1911, Rec. Canterbury (N.Z.) Mus., i, p. 212, pl. xli; Philipps, 1921, N.Z. J. Sci. Tech., iv, p. 122; Norman, 1926, Biol. Res. "Endeavour", v, p. 265; Philipps, 1927, N.Z. Mar. Dept., Fish. Bull., i, p. 29.

EGGS, LARVAE AND YOUNG.

Thomson and Anderton, 1921, Bull. N.Z. Board Sci. Art, ii, p. 83, figs.

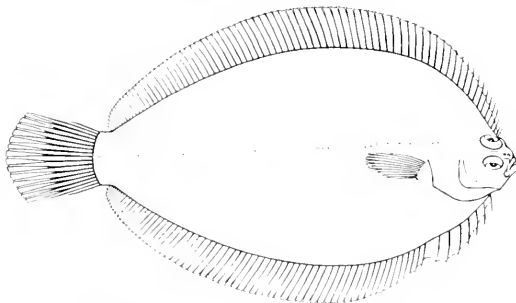


FIG. 305.—*Pelotretis flavilatus*. B.M. (N.H.) 1923.11.5.1. $\times \frac{2}{3}$.

Depth of body $1\frac{3}{4}$ to $2\frac{1}{4}$ in the length, length of head about 5. Upper profile of head distinctly concave. Snout shorter than eye, diameter of which is 4 to $4\frac{1}{2}$ in length of head and $2\frac{3}{4}$ to $3\frac{1}{2}$ times the interorbital width; lower eye a little in advance of upper; a bony protuberance in front of lower eye. Maxillary extending to below anterior edge of eye or not quite as far, length $4\frac{1}{2}$ to nearly 5 in that of head; lower jaw a little projecting, $2\frac{3}{4}$ to 3 in head. Band of teeth in lower jaw a little broader than that in upper. Gill-rakers conical or with 2 or 3 points distally, 7 to 9 on lower part of anterior arch. Scales of ocular side more strongly denticulated than those of blind side; 77 to 85 in lateral line. Dorsal 83-91; highest rays 2 to $2\frac{1}{2}$ in length of head. Anal 70-75. Pectoral of ocular side with 11 to 13 rays (10 or 11 branched), length $1\frac{1}{2}$ to $1\frac{3}{4}$ in that of head. Anterior ray of pelvic of ocular side inserted below eye, sixth or seventh ray opposite first ray of pelvic of blind side. Caudal with 18 rays (14 branched), rounded; caudal peduncle 4 to 6 times as deep as long. Greyish or brownish, sometimes with irregular darker patches.

TYPE.—Canterbury Museum, Christchurch.

DISTRIBUTION.—New Zealand; Chatham Islands.

SPECIMENS EXAMINED:

1 (260 mm.).	Wellington.	Dominion Mus.
1 (330 ,,).	Timaru.	Archey.
1 (225 ,,).	Dunedin.	Otago Mus.

Grows to a length of about 18 inches.

Genus 40. AMMOTRETIS.

Ammotretis, Gunther, 1862, Cat. Fish., iv, p. 458 [*Ammotretis rostratus*, Günther]; Norman, 1926, Biol. Res. "Endeavour", v, p. 266.

Taprisolea, Ramsay, 1883, Int. Fish. Exhib., Cat. Exhib. N.S.W. Court, pp. 17, 44 [N. N.].

Body ovate or rather elongate, compressed. Eyes on the right side, separated by a flattish, scaled space, the upper at some distance from edge of head; eyeballs not scaled; snout produced into a fleshy hook which hangs freely in front of mouth; nasal organ of blind side nearly opposite to that of ocular side; olfactory laminae few or in moderate number, parallel to one another and to the axis of the body, without central rachis. Mouth small, visible on ocular side, the jaws much stronger on blind side, where they are distinctly curved; lower lip of ocular side fringed; teeth small, movable, acutely pointed, not enlarged anteriorly, in bands in the jaws of the blind side; vomer toothless. Gill-rakers tubercular, few in number; lower pharyngeals of moderate width, their inner edges angular, more or less approximated for the greater part of their length; teeth pointed, in several irregular rows, smaller and more numerous posteriorly; branchial septum entire. Dorsal fin commencing at extremity of rostral hook; anterior rays simple, more or less free, their edges more or less bluntly serrated on ocular side; remainder mostly forked distally; most of the rays scaled on both sides; no basal sheath. Anal similar to dorsal; tip of first interhaemal spine not projecting in front of fin. Pectoral fins of equal size or that of ocular side larger; middle rays branched, none of them prolonged. Both pelvic fins developed; that of ocular side elongate, with 7 to 13 rays, more or less united with anal; that of blind side with 3 to 6 rays, base very short. Caudal fin with the middle rays branched; caudal peduncle short. Scales small or of moderate size, adherent, imbricated, ctenoid or cycloid. Lateral line rising slightly or with a very low curve above the pectoral fin; a short supratemporal branch sometimes present. Vent a little on blind side, above first ray of anal fin; intestine of moderate length or rather elongate.

Five species from southern Australia.

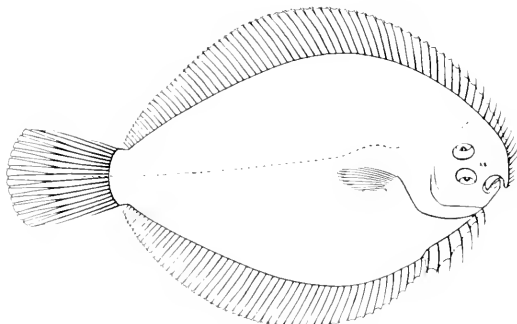
SYNOPSIS OF THE SPECIES

- I Pelvic of ocular side with 7 rays
 A Pectorals subequal, that of blind side pointed; dorsal 75-86 1 *rostratus*.
 B Pectoral of blind side much shorter, rounded, a fleshy tubercle at tip of first ray; dorsal 60 2 *bicipinnus*.
- II Pelvic of ocular side with 10 to 13 rays
 A Depth $1\frac{1}{8}$ to 2 in length; pectoral of blind side with a fleshy tubercle at tip of first ray
 1 Maxillary not reaching anterior edge of eye; 78 scales in lateral line 3 *tudor*.
 2 Maxillary extending to beyond anterior edge of eye; 66 scales in lateral line 4 *macrolepis*.
 B Depth $2\frac{1}{4}$ to $2\frac{1}{2}$ in length; pectoral of blind side normal; 88 to 92 scales in lateral line 5 *elongatus*.

1. AMMOTRETIS ROSTRATUS, Gunther.

LONG-SHOULDED FLOUNDER]

- Ammotretis rostratus*, Gunther, 1862, Cat. Fish., iv, p. 458; Steindachner, 1880, SitzBer. Akad. Wiss. Wien, lxxx (1), p. 171; Klunzinger, 1880, *Icon. cit.*, p. 407; Macleay, 1882, Proc. Linn. Soc. N.S.W., vi, p. 128; Waite, 1890, Mem. Aust. Mus., iv, p. 123; Stead, 1908, Edible Fish. N.S.W., p. 103, pl. lxx; McCulloch, 1914, Biol. Res. "Endeavour", ii, p. 121; Waite, 1921, Rec. S. Aust. Mus., ii, p. 158, fig. 259; McCulloch, 1921, Aust. Zool., ii, p. 36, pl. xiii; Waite, 1923, Fishes S. Austral., p. 182, fig.; Norman, 1929, Biol. Res. "Endeavour", v, p. 267; McCulloch, 1929, Mem. Aust. Mus., v, p. 280; Whitley, 1932, Rec. Aust. Mus., xviii, p. 345.
- Rhombosolea laprina* (part), Gunther, 1862, Cat. Fish., iv, p. 459.
- Ammotretis rostratus* vel *adpersus*, Kner, 1869, Reise "Novara", Zool., i, 5, Fische, p. 286, pl. xiii, fig. 1; Steindachner, 1883, SitzBer. Akad. Wiss. Wien, lxxxviii (1), p. 1195.
- Rhombosolea bairdii*, Castelnau, 1872, Proc. Zool. Soc. Victoria, 1, p. 197; Macleay, 1882, Proc. Linn. Soc. N.S.W., vi, p. 132.
- Solea uncinata*, Klunzinger, 1880, SitzBer. Akad. Wiss. Wien, lxxx (1), p. 408.
- Ammotretis zonatus*, Macleay, 1883, Proc. Linn. Soc. N.S.W., vii, p. 367.
- Ammotretis macleayi*, Ogilby, 1886, Proc. Linn. Soc. N.S.W., x, p. 122.
- Ammotretis adpersus*, Ogilby, 1887, Cat. Fish. N.S. Wales, p. 32.
- Ammotretis ovalis*, Saville-Kent, 1886, Prelim. Rep. Food fish. Qld., p. 10; Saville-Kent, 1893, Great Barrier Reef, p. 370 [N. N.].
- Pellorhamphus bairdii*, Waite, 1900, Rec. Aust. Mus., vi, p. 198, pl. xxxiv.

FIG. 305. *Ammotretis rostratus*. B.M. (N.H.) 1914.8.29.267. 3.

Depth of body $1\frac{2}{3}$ to $1\frac{1}{2}$ in the length, length of head $3\frac{1}{2}$ to 4. Rostral hook extending downwards nearly to level of hinder end of maxillary of ocular side. Lower eye a little in advance of upper, diameter of which is 5 to $5\frac{1}{2}$ in length of head and more than twice the interorbital width. Maxillary not reaching anterior edge of eye, length on ocular side about 5, on blind side 3 to $3\frac{1}{2}$ in that of head; lower jaw $3\frac{1}{2}$ to $3\frac{1}{3}$ in head; a few simple tentacles forming a fringe on lower lip of ocular side. Gill-rakers rather large, 10 to 12 on lower part of anterior arch. Scales ctenoid, those of ocular side more strongly denticulated than those of blind side; 78 to 88 scales in lateral line. Lateral line with a low curve above pectoral fin; a short supratemporal branch, not reaching base of dorsal fin. Dorsal (75) 78-86; highest rays $1\frac{2}{3}$ to twice in length of head. Anal (50) 52-56. Pectoral of ocular side with 10 to 13 rays (9 or 10 branched), length $1\frac{2}{3}$ to twice in that of head; pectoral of blind side of equal length or a little shorter, pointed. Pelvic of ocular side with 7 rays, extending forward nearly to rostral hook, sixth ray opposite first ray of pelvic of blind side, which has 3 or 4 (6) rays. Caudal with 18 or 19 rays (12 or 13 branched), rounded or subtruncate, caudal peduncle $2\frac{1}{2}$ to 3 times as deep as long. Intestine elongate. Coloration varying from blackish to pale brown, with or without small dark dots; pectoral sometimes blackish.

TYPE.—British Museum (Nat. Hist.). Reg. No. 48.3.18.245.

DISTRIBUTION.—New South Wales, northwards to Port Jackson; Victoria; South Australia; southern Western Australia; Tasmania.

SPECIMENS EXAMINED:

1 (140 mm.).	Port Jackson, New South Wales.	Imp. Inst.
1 (158 ").	Pt. Hacking, "	Stead.
1 (240 ").	Melbourne Markets, Victoria.	Austr. Mus.
1 (155 ").	Flinders Island.	Degen.
1 (99 "). Holotype.	Norfolk Bay, Tasmania.	Richardson.
1 (335 "), stuffed.	South Australia.	—
1 (185 "), skin.	Paratypes of <i>Rhombosolca</i> Australia.	—
1 (197 "), ") <i>tapirina</i> .		Australia.

This species attains to a length of about 12 inches.

2. *AMMOTRETIS BREVIPINNIS*, Norman.

Ammotretis brevipinnis, Norman, 1926, Biol. Res. "Endeavour", v, p. 268, fig. 11; McCulloch, 1929, Mem. Aust. Mus., v, p. 281.

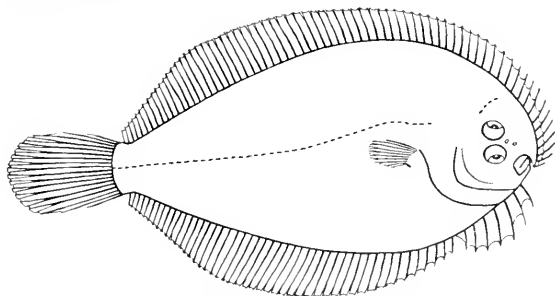


FIG. 307.—*Ammotretis brevipinnis*. B.M. (N.H.) 1925.1.26.1. 11.

Closely related to *A. rostratus*. Depth of body twice in the length, length of head $3\frac{1}{2}$. Diameter of eye 5 in length of head and 5 times interorbital width. Length of maxillary on ocular side $4\frac{1}{2}$, on blind side about $2\frac{3}{4}$ in that of head. Gill-rakers of moderate size, 6 on lower part of anterior arch. Scales of ocular side ctenoid, those of blind side cycloid anteriorly, ctenoid on posterior part of body; 84 scales in lateral line. Dorsal 69. Anal 47. Pectoral of ocular side with 10 rays (7 branched), length about $\frac{1}{2}$ that of head, pectoral of blind side much shorter, rounded, the first ray with a fleshy tubercle at the tip. Caudal peduncle $3\frac{1}{2}$ times as deep as long. Brownish, with traces of small blackish dots.

TYPE.—British Museum (Nat. Hist.). Reg. No. 1925.1.20.1.

DISTRIBUTION.—South Australia.

SPECIMEN EXAMINED:

1 (87 mm.). Holotype.

St. Vincent Gulf.

S. Austr. Mus.

3. AMMOTRETIS TUDORI, McCulloch.

² *Solea lituata*, Richardson, 1849, Trans. Zool. Soc. London, 10, p. 156.

³ *Ammotretis tudori*, McCulloch, 1914, Biol. Res. "Endeavour", II, p. 124, pl. xxvi; Waite, 1921, Rev. S. Austr. Mus., II, p. 159, fig. 201; Waite, 1923, Fishes S. Austral., p. 183, fig.; Norman, 1926, Biol. Res. "Endeavour", V, p. 270; McCulloch, 1929, Mem. Aust. Mus., v, p. 281.

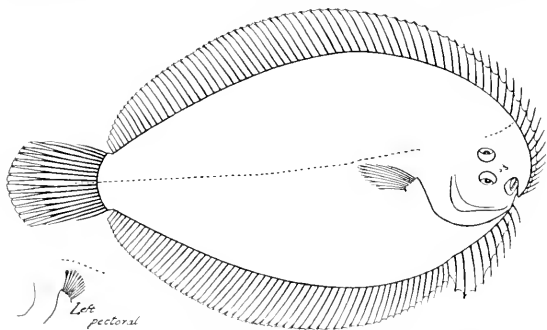


FIG. 308.—*Ammotretis tudori*. B.M. (N.H.) 1925.3.20.1.

Depth of body $1\frac{1}{2}$ in the length, length of head 4. Rostral hook rather broad and flattened, extending downwards to below level of hinder end of maxillary of ocular side. Anterior margins of eyes level, diameter of eye $6\frac{1}{2}$ in length of head, and a little more than twice the interorbital width. Maxillary not reaching anterior edge of eye, length on ocular side $5\frac{1}{2}$, on blind side 3 in that of head, lower jaw $3\frac{2}{3}$ in head, a row of fringed tentacles on lower lip of ocular side. Gill-rakers reduced to 2 or 3 minute tubercles on lower part of anterior arch. Scales of ocular side mostly ctenoid, more strongly denticulated on posterior part of body, those of blind side nearly all cycloid, 78 scales in lateral line. Lateral line rising slightly above pectoral fin; a short supratermporal branch, reaching base of twelfth ray of dorsal fin. Dorsal 77 (82), highest rays about $\frac{1}{2}$ as long as head. Anal 54 (58). Pectoral of ocular side with 10 or 11 rays (7 branched), length twice in that of head, pectoral of blind

side much shorter, rounded, the first ray with a fleshy tubercle at the tip. Pelvic of ocular side with 10 rays, extending forward to meet tip of rostral hook, ninth ray opposite first ray of pelvic of blind side, which has 6 rays. Caudal with 18 rays (12 branched), rounded; caudal peduncle about 3 times as deep as long. Intestine of moderate length. Greyish-brown, with a number of small black spots on head, body and fins.

TYPE.—Australian Museum. No. I. 10350.

DISTRIBUTION.—Victoria; South Australia; Tasmania.

SPECIMEN EXAMINED:

1 (180 mm.).

Spencer Gulf, S. Australia, 20 fms.

Austr. Mus.

4. AMMOTRETIS MACROLEPIS, McCulloch.

Ammotretis macrolepis, McCulloch, 1914, Biol. Res. "Endeavour", ii, p. 125, fig. 9; Norman, 1926, Biol. Res. "Endeavour", v, p. 271; McCulloch, 1929, Mem. Aust. Mus., v, p. 281.

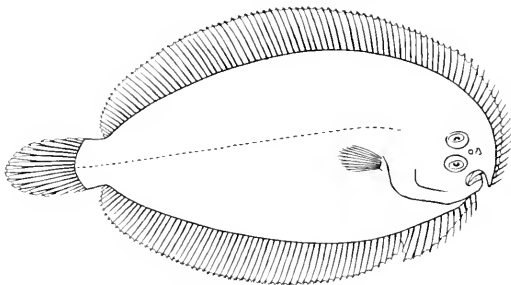


FIG. 309.—*Ammotretis macrolepis*. [After McCulloch.] · 1.

Perhaps not distinct from *A. tudori*. Maxillary extending to beyond anterior edge of eye; a few small tubercles on lower lip of ocular side. Scales all ctenoid, those of ocular side more strongly denticulated than those of blind side; 66 scales in lateral line. Dorsal 90. Anal 59. Pelvic of ocular side with 12 rays, that of blind side with 5 rays. Pinkish, with numerous dark grey ocelli on head and body. Fins dotted with dark grey.

TYPE.—Australian Museum. No. E. 455.

DISTRIBUTION.—Flinders Island, Bass Strait.

The unique holotype is 98 mm. in total length.

5. AMMOTRETIS ELONGATUS, McCulloch.

Ammotretis elongatus, McCulloch, 1914, Biol. Res. "Endeavour", ii, p. 123, pl. xxvii; Waite, 1921, Rec. S. Aust. Mus., ii, p. 159, fig. 260; Waite, 1923, Fishes S. Austral., p. 183, fig.; Norman, 1926, Biol. Res. "Endeavour", v, p. 271; McCulloch, 1929, Mem. Aust. Mus., v, p. 281.

Depth of body $2\frac{1}{2}$ to $2\frac{1}{2}$ in the length, length of head 4 to $4\frac{2}{3}$. Rostral hook not extending downwards as far as level of hinder end of maxillary of ocular side. Lower eye a little in advance of upper, diameter of which is $4\frac{1}{4}$ to 5 in length of head and about 4 times the interorbital width. Maxillary not reaching anterior edge of eye,

length on ocular side $3\frac{1}{2}$ to 4 $\frac{1}{2}$, on blind side $3\frac{1}{2}$ to $3\frac{1}{2}$ in that of head; lower jaw $3\frac{1}{8}$ to $3\frac{1}{4}$ in head; a few simple tentacles forming a fringe on lower lip of ocular side; teeth much smaller than in other species. Gill-rakers rather small, about 10 on lower part of anterior arch. Scales of ocular side ctenoid or cycloid, the denticulations, when present, strong but few in number; scales of blind side nearly all ctenoid, the denticulations feeble; 88 to 92 scales in lateral line. Lateral line with a very low curve above the pectoral fin, no supratermporal branch. Dorsal 74-75; highest rays about $1\frac{1}{4}$ in length of head. Anal 50-51. Pectoral of ocular side with 8 to 10 rays (5 to 8 branched), length $1\frac{1}{4}$ to twice in that of head; pectoral of blind side of equal length, pointed. Pelvic of ocular side with 13 rays, extending forward to meet tip of rostral hook; that of blind side with 3 or 4 rays, the first opposite space between eleventh and twelfth rays of pelvic of ocular side. Caudal with 18 rays (12 branched), rounded, caudal peduncle very short, the last rays of dorsal and anal fins nearly contiguous with bases of outer caudal rays. Pale brownish, with minute black dots scattered over head, body and fins.

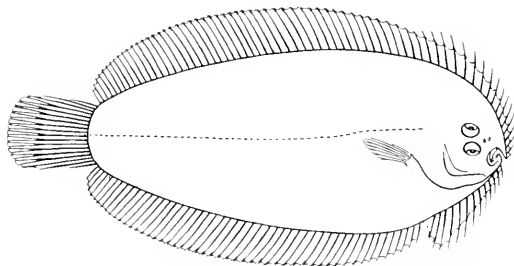


FIG. 310.—*Ammotretis elongatus*. B.M. (N.H.) 1925.1.20.5. ♂.

TYPE.—Australian Museum, No. 112301.

DISTRIBUTION.—South Australia.

SPECIMENS EXAMINED:

1 (125 mm.)

Kangaroo Isl.

S. Austr. Mus.

1 (60 " ")

St. Vincent Gulf.

" "

Genus 41. COLISTIUM

Colistium, Norman, 1926, Biol. Res. "Endeavour", v, p. 272 [*Ammotretis nudipinnis*, Waite].

Close to *Ammotretis*, but olfactory laminae radiating from a short central rachis. Gill-rakers small, rather stout, numerous. Rays of dorsal and anal fins not scaled, a scaled sheath covering basal parts of fins on ocular side.

Two species from New Zealand.

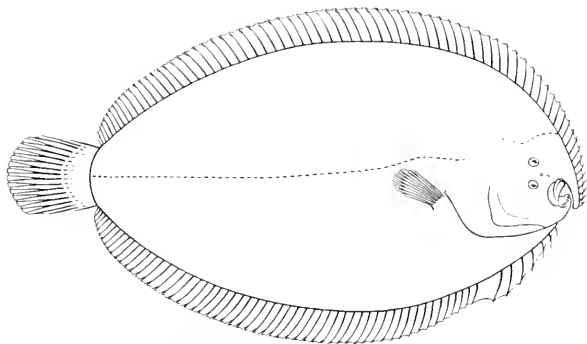
SYNOPSIS OF THE SPECIES

1. Rostral hook long, extending downwards below level of hinder end of maxillary of ocular side; pelvic of ocular side with 7 rays. 1 *nudipinnis*.
11. Rostral hook short, not reaching level of hinder end of maxillary of ocular side; pelvic of ocular side with 10 or 11 rays. 2 *guntheri*.

1. COLISTIUM NUDIPINNIS (Waite).

["TURBOT".]

- Ammotretis rostratus* (non Gunther), Hutton, 1876, Trans. Proc. N.Z. Inst., viii, p. 215.
Ammotretis nudipinnis, Waite, 1911, Trans. Proc. N.Z. Inst., xliii, Proc. p. 50; Waite, 1911, Rec. Canterbury (N.Z.) Mus., 1, p. 209, pl. xxxix; Thomson and Anderson, 1921, Bull. N.Z. Board Sci. Art, ii, p. 82; Phillipps, 1921, N.Z. J. Sci. Tech., iv, p. 122.
Colistium nudipinnis, Norman, 1926, Biol. Res. "Endeavour", v, p. 273; Phillipps, 1927, N.Z. Mar. Dept., Fish. Bull., i, p. 27.

FIG. 311.—*Colistium nudipinnis*. B.M. (N.H.) 1924.1.7.4. 1.

Depth of body nearly twice in the length, length of head $3\frac{3}{4}$. Rostral hook long, extending downwards below level of hinder end of maxillary of ocular side. Anterior margins of eyes level; diameter of eye $11\frac{1}{2}$ in length of head, less than width of inter-orbital space, which is naked in the middle and more or less scaled anteriorly and posteriorly. Maxillary not reaching anterior edge of eye, length on ocular side $4\frac{1}{2}$, on blind side 3 in that of head, lower jaw about $3\frac{1}{2}$ in head; about 12 broad tentacles forming a fringe on lower lip of ocular side. Band of teeth in lower jaw about 3 times as long as broad, that in upper jaw about 7 times. 32 gill-rakers on lower part of anterior arch. Scales of ocular side ctenoid, the denticulations strongly developed; those of blind side cycloid; most of the scales on blind side of head forming membranous processes; 85 scales in lateral line. Lateral line with a slight curve above the pectoral fin; a short supratermporal branch, reaching base of twelfth ray of dorsal fin. Dorsal 80 (85); highest rays $2\frac{1}{2}$ in length of head, well developed membranous folds, with their free edges directed posteriorly, on blind side of all rays, the folds on anterior rays short, and with projecting processes. Anal 58 (60); similar to dorsal. Pectoral of ocular side with (11) 12 rays (6 branched), length $2\frac{1}{2}$ in that of head; pectoral of blind side a little shorter. Pelvic of ocular side with 7 rays, the first inserted below middle of jaws of blind side, the last in advance of first ray of pelvic of blind side, which has 4 rays. Caudal with 18 rays (12 branched), rounded; caudal

peduncle much deeper than long. Greyish, with traces of some irregular darker blotches; an indistinct dark spot edged with paler below and a little behind pectoral fin. Body and fins on blind side irregularly blotched and spotted with grey.

TYPE.—Canterbury Museum, Christchurch.

DISTRIBUTION.—New Zealand.

SPECIMEN EXAMINED:

1 (490 mm.)

Fiunaru.

Canterbury Mus.

2. COLISTHUM GUNTHERI (Hutton).

"BRILL" }

Ammotretis guntheri, Hutton, 1873, Trans. Proc. N.Z. Inst., v, p. 297, pl. xi, fig. 82a; Waite, 1911.

Rev. Canterbury (N.Z.) Mus., 1, p. 211, pl. xl; Philipps, 1921, N.Z. J. Sci. Tech., iv, p. 122.

Colisthium guntheri, Norman, 1926, Biol. Res. "Endeavour", v, p. 274; Philipps, 1927, N.Z. Mar. Dept., Fish. Bull., 1, p. 28.

EGGS, LARVA AND YOUNG.

Thomson and Auderton, 1921, Bull. N.Z. Board Sci. Art, 0, p. 82, figs.

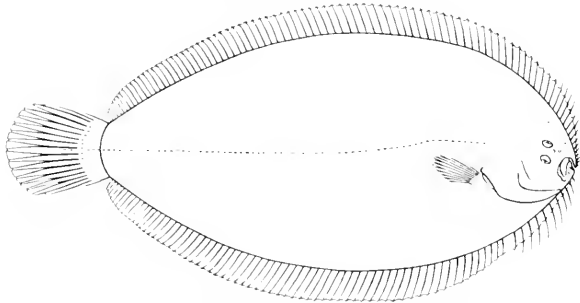


FIG. 212.—*Colisthium guntheri*. B.M. (N.H.) 1923. 11.5.5. 4.

Depth of body $1\frac{1}{2}$ to $2\frac{1}{2}$ in the length, length of head $5\frac{1}{4}$ to $5\frac{1}{2}$. Rostral hook short, not extending downwards to level of hinder end of maxillary of ocular side. Lower eye a little in advance of upper, diameter of which is $8\frac{1}{2}$ to $9\frac{1}{2}$ in length of head and about twice width of interorbital space, which is almost entirely scaled. Maxillary not reaching anterior edge of eye, length on ocular side $4\frac{1}{2}$, on blind side 4 in length of head; lower jaw $3\frac{1}{2}$ in head; 10 to 13 broad tentacles forming a fringe on lower lip of ocular side. Band of teeth in lower jaw $2\frac{1}{2}$ times as long as broad, that in upper jaw about 4 times. 38 to 41 gill-rakers on lower part of anterior arch. Scales of ocular side ctenoid, the denticulations strongly developed, those of blind side cycloid; some of the scales on blind side of head forming membranous processes, 84 to 86 scales in lateral line. Lateral line with a slight curve above pectoral fin, supratemporal branch feebly developed or absent. Dorsal 90-92, highest rays $2\frac{1}{2}$ in length of head; membranous folds on blind side of rays well developed, those of anterior rays short, and with projecting processes with irregular or crenulated edges. Anal 66-69, similar to dorsal. Pectoral of ocular side with (11) 12 rays (10 branched),

length $1\frac{3}{8}$ to $1\frac{1}{4}$ in that of head; pectoral of blind side shorter. Pelvic of ocular side with 10 or 11 rays, the first inserted below anterior part of jaws of blind side, the last opposite to first ray of pelvic of blind side, which has 4 or 5 rays. Caudal with 18 to 20 rays (12 to 14 branched), rounded; caudal peduncle much deeper than long. Greyish, with numerous blackish spots, which are arranged in irregular groups or form broken longitudinal stripes; distal parts of dorsal and anal fins blackish, with a narrow pale margin.

TYPE.—Not traced.¹

DISTRIBUTION.—New Zealand.

SPECIMENS EXAMINED:

1 (335 mm.).	Wellington.	Dominion Mus.
1 (390 ").	Timaru.	Archey.

Genus 42. PELTORHAMPHUS.

Peltorhamphus, Günther, 1862, Cat. Fish., iv, p. 460 [*Peltorhamphus nova-zeelandia*, Günther]; Norman, 1926, Biol. Res. " Endeavour ", v, p. 275.

Related to *Ammotretis* and *Colistium*. Rostral hook somewhat flattened, connected with the head by a membranous flap, which almost or quite conceals the mouth on the ocular side; nasal organs nearly symmetrical in position; olfactory laminae few, parallel to one another and to the axis of the body, without central rachis. Lower lip of ocular side not fringed. Teeth slender, pointed, in 3 or 4 series on blind side of each jaw. Gill-rakers small, conical, in moderate number; lower pharyngeals rather narrow, their inner edges scarcely angular, approximated anteriorly, each with several series of pointed teeth. Anterior rays of dorsal fin partly free from membrane, but not serrated, remainder forked distally; none of the rays scaled; a low scaled sheath covering basal part of fin on ocular side. Anal similar to dorsal. Pectoral fin of ocular side with second upper ray prolonged and filamentous. Pelvic fin of ocular side with 6 rays, that of blind side with 4 or 5 rays. Caudal peduncle very short. Scales of ocular side ctenoid, those of blind side ctenoid or cycloid. Lateral line with a very low curve above the pectoral fin; a more or less distinct supratemporal branch. Vertebræ 36 (9 + 27). Intestine elongate.

A single species from New Zealand.

1 PELTORHAMPHUS NOVA-ZEELANDIÆ, Günther.

[" SOLE "]

Peltorhamphus nova-zeelandia, Günther, 1862, Cat. Fish., iv, p. 461; Hutton, 1872, Cat. Fish. N. Zealand, p. 52; Hector, 1872, *tom. cit.*, p. 117, pl. ix; Waite, 1911, Rec. Canterbury (N.Z.) Mus., i, p. 213, pl. xli; Philipps, 1921, N.Z. J. Sci. Tech., iv, p. 122; Philipps and Hodgkinson, 1922, N.Z. J. Sci. Tech., v, p. 96; Norman, 1926, Biol. Res. " Endeavour ", v, p. 276; Philipps, 1927, N.Z. Mar. Dept., Fish. Bull., i, p. 29.

EGGS, LARVÆ AND YOUNG.

Anderton, 1907, Trans. N.Z. Inst., xxxix, p. 481, pl. xix, figs. d, f; Thomson and Anderton, 1921, Bull. N.Z. Board Sci. Art., ii, p. 88, figs.

Depth of body 2 to $2\frac{1}{2}$ in the length, length of head $3\frac{1}{2}$ to $4\frac{1}{2}$. Rostral hook extending downwards well beyond level of hinder end of maxillary of ocular side.

¹ The Director of the Dominion Museum, Wellington, kindly informs me that the type of this species is not now in the Museum. He adds that it is believed to have been " thrown out about thirty years ago when extensive rearrangements were made in the Museum, following a change in the Directorship ".

Anterior margins of eyes level; diameter of eye 5 to 8 in length of head and equal to or greater than width of interorbital space, which is flat and scaled. Length of maxillary on blind side $3\frac{1}{2}$ to $3\frac{3}{4}$ in that of head. Teeth of outer series in both jaws a little enlarged. 8 to 15 gill-rakers on lower part of anterior arch. Scales nearly all cycloid on blind side in adults, ctenoid on both sides of body in young; 75 to 85 scales in lateral line. Lateral line opening by a series of large pores on blind side of head. Dorsal 04-104; highest rays $2\frac{1}{2}$ to $2\frac{3}{4}$ in length of head; membranous folds on blind side of rays moderately developed. Anal 60-70. Pectoral of ocular side with 10 or 11 rays (5 to 7 branched), length of filamentous ray $\frac{1}{2}$ to $\frac{2}{3}$ depth of body; pectoral of blind side smaller, none of the rays prolonged. Anterior ray of pelvic of ocular side inserted below anterior part of jaws of blind side and immediately behind rostral hook; last ray in advance of first of pelvic of blind side. Caudal with 10 to 18 rays (10 to 12 branched), rounded. Young brownish, often marbled with darker brown and dotted with black; two black blotches often present on lateral line, some of the rays of the dorsal and anal fins blackish; these markings tending to disappear in adults, which are usually uniformly dark or pale brownish or greyish.

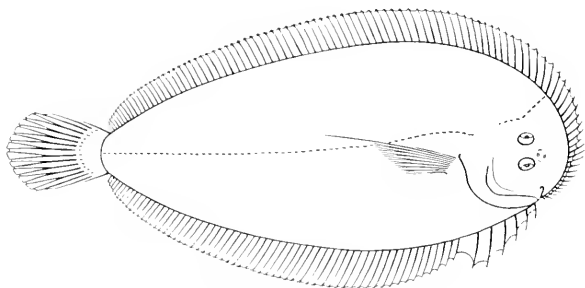


FIG. 317.—*Pellorhamphus novae zelandiae*. B.M. (N.H.) 1923. II. 5. 1. ♂.

TYPE.—British Museum (Nat. Hist.). Reg. No. 48.3.18.—

DISTRIBUTION.—New Zealand, Norfolk Island, Chatham Islands.

SPECIMENS EXAMINED:

1135, 175 mm.)	Wellington Harbor.	Colonial Mus.
1135b (mm.)	"	"
11479, " 1, skeleton	"	"
11290, " 1	Wellington	Dominion Mus.
11291, " 1	S. side of Cook Strait	Hector
11292, " 1	Dunedin	Otago Mus.
11293, " 1	New Zealand	Richardson
11294, " 1	"	"
11295, " 1	"	Stokes
11442, " 1	"	"Field"
11443, " 1	Norfolk Isl.	Richardson

This species attains to a length of 15 to 18 inches.

Genus 43. RHOMBOSOLEA.

Rhombosolea, Gunther, 1862, Cat. Fish., iv, p. 458 [*Rhombosolea monopus*, Gunther].

Bowenia, Haast, 1873, Trans. Proc. N.Z. Inst., v, p. 277 [*Bowenia novæ-zelandiæ*, Haast].

Ipsetta, Kyle, 1900, Proc. Zool. Soc. London, p. 986 [*Ipsetta thompsoni*, Kyle].

Body ovate or rhomboidal, compressed. Eyes normally on the right side, separated by a low, naked ridge, the lower a little in advance of the upper, which is well separated from edge of head; snout and eyeballs not scaled; snout normal or produced into a short, fleshy process projecting freely above the mouth; nasal organ of blind side nearer edge of head than that of ocular side; olfactory laminae few or in moderate number, parallel to one another and to the axis of the body, without central rachis. Mouth of moderate size, the jaws stronger on the blind side, where they are curved; the upper jaw notched to receive symphysis of lower jaw; teeth small, pointed, not enlarged anteriorly, in bands in the jaws of the blind side; vomer toothless. Gill-rakers rather long, slender, in moderate number; lower pharyngeals of moderate width or rather broad, their inner edges usually more or less angular, approximated anteriorly, each with 3 or more series of teeth; branchial septum entire. Dorsal fin commencing near extremity of snout and well in front of nostrils of blind side; most of the rays forked distally, none scaled; no basal sheath. Anal similar to dorsal; up of first interhæmal spine not projecting in front of fin. Pectoral fins unequal, that of ocular side larger; middle rays branched. Only the pelvic fin of the ocular side normally developed,¹ elongate, with 6 well-spaced rays, united with the anal. Caudal with the middle rays branched; caudal peduncle moderate or rather short. Scales small or of moderate size, firm, rather irregularly arranged, more or less embedded and scarcely imbricated on head and anterior part of body; nearly all cycloid. Lateral line rising slightly or with a very low curve above the pectoral fin; a short supratemporal branch. Vertebrae 31 (10 + 21). Vent a little on blind side, between anal and pelvic fins; intestine elongate, forming a series of irregular loops and coils.

Four species from southern Australia and New Zealand.

SYNOPSIS OF THE SPECIES.

- I. 16 to 19 gill-rakers on lower part of anterior arch; body more or less coloured on blind side 1 *retziaria*.
- II 7 to 14 gill-rakers on lower part of anterior arch; blind side of body normally colourless.
- A. Shape of body rhomboidal; dorsal and anal fins elevated; highest dorsal rays $1\frac{3}{4}$ to $2\frac{1}{2}$ in head 2 *plebeia*.
- B. Shape of body ovate; dorsal and anal fins not much elevated; highest dorsal rays 2 to $2\frac{1}{2}$ in head.
1. Snout normal; eye $6\frac{1}{4}$ to $7\frac{3}{4}$ in head 3 *leporina*.
2. Snout produced into a fleshy process; eye $4\frac{1}{2}$ to 6 in head 4 *tapirina*.

1. RHOMBOSOLEA RETIARIA, Hutton.

[BLACK FLOUNDER; PATIKI.]

Rhombosolea tapirina (non Gunther), Hutton, 1873, Trans. Proc. N.Z. Inst., v, p. 268, pl. xii, fig. 83b.

Rhombosolea retziaria, Hutton, 1873, Ann. Mag. Nat. Hist., (4) xii, p. 401; Hutton, 1874, Trans.

Proc. N.Z. Inst., vi, p. 107; Waite, 1911, Rec. Canterbury (N.Z.) Mus., i, p. 207, pl. xxxviii;

Phillipps, 1921, N.Z. J. Sci. Tech., iv, p. 122; Thomson and Anderson, 1921, Bull. N.Z. Board

Sci. Art., ii, p. 87; Phillipps, 1925, N.Z. J. Sci. Tech., vii, p. 368, fig.; Norman, 1926, Biol.

Res. "Endeavour", v, p. 281; Phillipps, 1927, N.Z. Mar. Dept., Fish. Bull., i, p. 29.

¹ The development of the pelvic fin of the blind side, with base either as long as or shorter than that of ocular side, in reversed or ambicolorate examples of *Rhombosolea* has been discussed at some length elsewhere (Norman, 1926, pp. 278-281). See also pp. 26, 29 of the present work.

Depth of body about twice in the length, length of head $3\frac{1}{2}$ to $3\frac{3}{4}$. Upper profile of head straight or a little convex. Snout not produced, longer than eye, diameter of which is $7\frac{1}{2}$ to $8\frac{1}{2}$ in length of head and equal to or greater than interorbital width. Maxillary scarcely extending to below anterior edge of eye, length on ocular side about $4\frac{1}{2}$, on blind side $3\frac{2}{3}$ to $3\frac{2}{3}$ in that of head; lower jaw about $3\frac{1}{2}$ in head. 16 to 19 gill-rakers on lower part of anterior arch; lower pharyngeals $3\frac{1}{2}$ times as long as broad, triangular, approximated for anterior $\frac{2}{3}$ of their length, each with several irregular rows of teeth. Scales mostly cycloid on both sides of body, a few on head and anterior part of body on ocular side with feeble denticulations; 63 to 75 scales in lateral line. Blind side of head largely naked, with a series of large muciferous cavities. Lateral line rising slightly above pectoral fin. Dorsal (60) 65-67; anterior rays deeply split distally and partly free, remainder forked; highest rays 2 to $2\frac{1}{2}$ in length of head. Anal 43-45 (48). Pectoral of ocular side with 10 or 11 rays (9 or

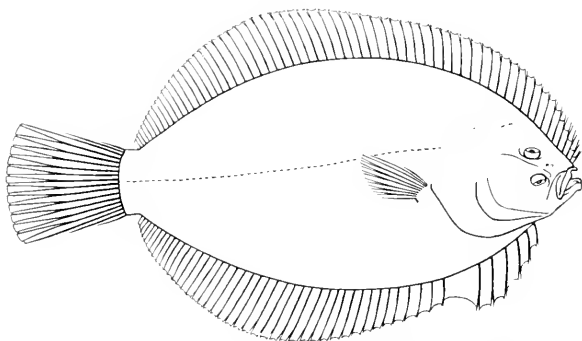


FIG. 314.—*Rhombosolen retziaria*. B.M. (N.H.) 86.11.48.76. . . .

10 branched), length $1\frac{1}{2}$ to twice in that of head. Anterior ray of pelvic of ocular side inserted below middle or posterior part of lower eye. Caudal with 18 rays (12 branched), a little rounded or double-truncate; caudal peduncle $3\frac{1}{2}$ to $3\frac{1}{2}$ times as deep as long. Blackish or brownish, marbled or spotted with darker, head, body and fins often with numerous whitish (red in life) spots, the largest of which are smaller than the eyes; blind side suffused with greyish or dusky brown.

TYPE.—Not traced¹

DISTRIBUTION.—New Zealand, entering fresh water.

SPECIMENS EXAMINED:

11268 mm.	Napier.	Dominion Mus.
11269 "	Dunedin	Otago Mus.
11270 "	" Harbour.	"
11270 "	"	"

This species attains to a length of 15 to 18 inches. Specimens from North and South Island present certain differences, mainly in coloration, but I am unable to say whether these are constant.

¹ See footnote on p. 427.

2. RHOMBOSOLEA PLEBEIA (Richardson).

[SAND FLOUNDER; NEW ZEALAND FLOUNDER; TINPLATE.]

Rhombus plebeius, Richardson [ex Solander MS.], 1843, 12 Rept. Brit. Assoc., (Manch. 1842), p. 27; Richardson, 1843, in Dieffenbach, Travels N. Zealand, ii, p. 222.

Rhombosolea monopus, Günther, 1862, Cat. Fish., iv, p. 459; Hutton, 1872, Cat. Fish. N. Zealand, p. 51; Hector, 1872, *tom. cit.*, p. 117, pl. ix; Steindachner, 1880, SitzBer. Akad. Wiss. Wien, lxxx (1), p. 170; Klunzinger, 1880, *tom. cit.*, p. 407; Macleay, 1882, Proc. Linn. Soc. N.S.W., vi, p. 129.

? *Bowenia nova-zeelandica*, Haast, 1873, Trans. Proc. N.Z. Inst., v, p. 277, pl. xvi.

Rhombosolea plebeia, Gill, 1893, Mem. Nat. Acad. Sci. Washington, vi, p. 121; Waite, 1911, Rec. Canterbury (N.Z.) Mus., i, p. 203, pl. xxxv; Phillipps, 1921, N.Z. J. Sci. Tech., iv, p. 122; Waite, 1921, Rec. S. Aust. Mus., ii, p. 157, fig. 257; Norman, 1926, Biol. Res. "Endeavour", v, p. 282.

Apletta thompsoni, Kyle, 1900, Proc. Zool. Soc. London, p. 986, figs.

EGGS, LARVÆ AND YOUNG.

Anderton, 1907, Trans. N.Z. Inst., xxxix, p. 480, pl. xviii, figs. f, g, xix, figs. a, b; Thomson and Anderton, 1921, Bull. N.Z. Board Sci. Art, ii, p. 84, figs.

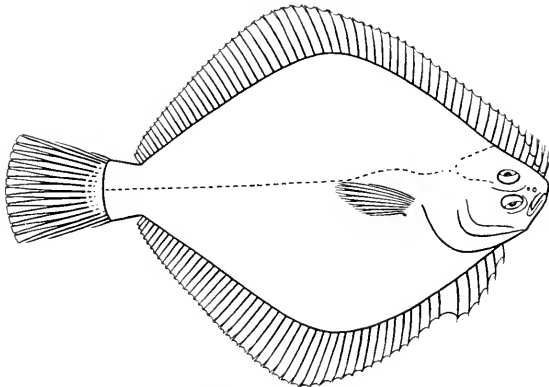


FIG. 315.—*Rhombosolea plebeia*. B.M. (N.H.) 1905.11.30.40. $\times \frac{1}{2}$.

Depth of body $1\frac{1}{2}$ to $1\frac{1}{4}$ in the length, length of head $3\frac{1}{3}$ to 4. Shape of body distinctly rhomboidal; upper profile of head straight or a little concave. Snout not produced, as long as or a little longer than eye, diameter of which is 4 to $6\frac{1}{2}$ in length of head and $2\frac{1}{2}$ to $3\frac{1}{4}$ times interorbital width. Maxillary extending to below anterior edge of eye or not quite as far, length on ocular side $3\frac{2}{3}$ to 4, on blind side $3\frac{1}{4}$ to $3\frac{1}{2}$ in that of head; lower jaw $2\frac{3}{4}$ to $3\frac{1}{4}$ in head. 10 to 14 gill-rakers on lower part of anterior arch; lower pharyngeals nearly 5 times as long as broad, their inner edges scarcely angular, approximated for anterior $\frac{1}{2}$ of their length; teeth cylindrical, the tips

rounded or with narrow, blunt terminal cusps, arranged in series along each edge, with a few teeth between these rows. Scales cycloid on both sides of body; 85 to 98 in lateral line. Blind side of head nearly entirely scaled. Lateral line with a very low curve above the pectoral fin. Dorsal 55-95; first ray deeply split and almost entirely free, next 2 or 3 rays decreasingly so, remainder mostly forked or branched distally, highest rays $1\frac{1}{2}$ to $2\frac{1}{8}$ in length of head. Anal 38-47. Pectoral of ocular side with 11 to 13 rays (6 or 10 branched), length $1\frac{1}{2}$ to $1\frac{3}{4}$ in that of head. Anterior ray of pelvic of ocular side inserted behind level of posterior edge of lower eye. Caudal with 18 rays (12 branched), a little rounded; caudal peduncle $1\frac{2}{3}$ to $1\frac{1}{2}$ times as deep as long. Brownish or greyish, young sometimes with small white spots, distal part of pectoral fin darker, blind side whitish.

TYPE: British Museum (Nat. Hist.). Reg. No. 42.10.12.2.

DISTRIBUTION: Australia (?)¹; New Zealand; Auckland Islands.

SPECIMENS EXAMINED:

1 (200 mm)	Type of	Australia (?)	Richardson.
	<i>R. monopus</i> .		
1 (110 "	"	Bay of Islands.	Smith
1 (260 "	Holotype (?)	New Zealand.	Owen.
1 (210 "	"	"	Hutton.
5 (160-265 mm)	"	Wellington Harbour.	Colonial Mus.
1 (250 mm)	skeleton.	"	"
1 (125 "	"	Wellington.	Donnan Mus.
1 (62 "	"	South side of Cook Strait	Hector.
1 (1430 "	"	Timaru.	Art. Rev.
1 (380 "	"	Dunedin Harbour.	Otago Mus.

Bowena nova-zealandia, originally described from 3 specimens from Lake Ellesmere, which now appear to have been lost, may be this species or *R. leporina*. These were ambicolorate examples, and differ from typical specimens of *Rhombosolea* in having two pelvic fins of equal size.

Apsetta thompsoni, the type of which also seems to have disappeared, is almost certainly a reversed example of this species. The two pelvic fins are equally developed.²

3 RHOMBOSOLEA LEPORINA, Gunther.

YELLOW BILLY :

Rhombosolea leporina, Gunther, 1862, Cat. Fish., iv, p. 460; Kner, 1869, Reise "Novara", Zool. i, 5, Fische, p. 287; Hutton, 1873, Trans. Proc. N.Z. Inst., v, p. 268, pl. xi, fig. 834; Norman, 1926, Biol. Res. "Endeavour", v, p. 283; Philipps, 1927, N.Z. Mar. Dept., Fish. Bull., i, p. 28.

Rhombosolea flesoules, Hutton, 1876, Trans. Proc. N.Z. Inst., viii, p. 215.

Rhombosolea millari, Waite, 1911, Res. Canterbury (N.Z.) Mus., i, p. 205, pl. xxxvii; Philipps, 1921, N.Z. J. Sci. Tech., iv, p. 122; Thomson and Anderson, 1921, Bull. N.Z. Board Sci. Art., ii, p. 87.

Depth of body 2 to $2\frac{1}{2}$ in the length, length of head $3\frac{1}{2}$ to 4. Shape of body ovate; upper profile of head straight or a little convex. Snout not produced, longer than eye, diameter of which is $6\frac{1}{4}$ to $7\frac{3}{4}$ in length of head and $1\frac{1}{2}$ times to twice the inter-orbital width. Maxillary extending to below anterior edge of eye or not quite as far, length on ocular side $3\frac{1}{2}$ to 4, on blind side $3\frac{1}{4}$ to $3\frac{1}{2}$ in that of head, lower jaw

¹ Records of this species from Victoria and from Tasmania are probably incorrect. The specimen believed to be from Australia in the British Museum collection, presented by Sir J. Richardson, has a somewhat more slender and less rhomboidal body than the remainder, but is otherwise identical. It is doubtful whether this species really occurs in Australian waters.

² For a more detailed account of *Bowena* and *Apsetta* see Norman (1926, "Biol. Res. "Endeavour", v, p. 278), see also pp. 26, 29 of the present work.

3 to $3\frac{1}{2}$ in head. 10 to 14 gill-rakers on lower part of anterior arch. lower pharyngeals about 3 times as long as broad, triangular, their inner edges approximated for the entire length; teeth arranged in a series along each edge, with a few teeth between these rows, those of posterior edge small and pointed, remainder larger, with blunt and sometimes flattened tips. Scales cycloid on both sides of body; 75 to 86 in lateral line. Blind side of head nearly entirely scaled. Lateral line with a very low curve above the pectoral fin. Dorsal 60-69; anterior rays split distally and partly free, remainder mostly forked at their tips; highest rays 2 to $2\frac{1}{2}$ in length of head. Anal 41-47. Pectoral of ocular side with 11 or 12 rays (9 or 10 branched), length $1\frac{2}{3}$ to twice in that of head. Anterior ray of pelvic of ocular side inserted below or a little behind level of lower eye. Caudal with 18 rays (12 branched), rounded; caudal peduncle $1\frac{1}{4}$ to $1\frac{2}{3}$ times as long. Brownish or greyish, with or without irregular darker markings; dorsal, anal and caudal fins often speckled with dark brown; distal part of pectoral darker; blind side whitish.

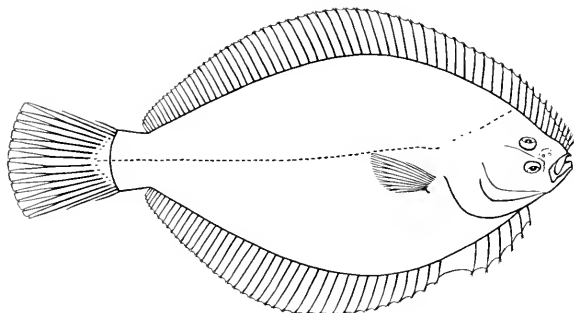


FIG. 316.—*Rhombosolea leporina*. B.M. (N.H.) 86.11.18.75. $\times \frac{1}{4}$.

TYPE.—British Museum (Nat. Hist.). Reg. No. 48.3.18.195.

DISTRIBUTION.—Australia (?); New Zealand.

SPECIMENS EXAMINED :

2 (220, 235 mm.).	Types. ¹	Australia (?). ²	Richardson.
1 (340 mm.).		Auckland.	Nicholson.
3 (215-330 mm.).		Wellington Harbour.	Colonial Mus.
1 (315 mm.).		Wellington.	Dominion Mus.
1 (235 ..).		Dunedin.	Otago Mus.

Archey (1924, N.Z. J. Sci. Tech., vi, p. 342) has described an ambicolorate example of this species.

Attains to a length of about 18 inches.

¹ The smaller specimen is selected as the holotype.

² It is doubtful whether this species occurs in Australia, and the locality of the type-specimens is probably incorrect.

4 RHOMBOSOLEA TAPIRINA, Gunther

[MELBOURNE FLOUNDER; SOUTHERN FLOUNDER; GREENBACK FLOUNDER.]

- Rhombosolea tapirina* (part), Gunther, 1862, Cat. Fish., iv, p. 459; Macleay, 1882, Proc. Linn. Soc. N.S.W., vi, p. 139.
Rhombosolea flesodes, Gunther, 1863, Ann. Mag. Nat. Hist., (3) xi, p. 117; Waite, 1906, Rec. Aust. Mus., vi, p. 197, pl. xxxv; Stead, 1908, Edible Fish. N.S.W., p. 104; McCulloch, 1921, Aust. Zool., ii, p. 39, pl. xiii; Waite, 1923, Fishes S. Austral., p. 181.
Pleuronectes rubroria, Castelnau, 1872, Proc. Zool. Soc. Victoria, i, p. 108.
Rhombosolea tapirina, Hutton, 1873, Ann. Mag. Nat. Hist., (4) xii, p. 401; Hutton, 1874, Trans. Proc. N.Z. Inst., vi, p. 106, pl. xix, fig. 83c; Hutton, 1876, Trans. Proc. N.Z. Inst., viii, p. 215; Boulenger, 1902, Rep. Coll. Nat. Hist. "Southern Cross", v, p. 188; Waite, 1909, Subantarctic Isl. N.Z., xxv, Vertebr., p. 599; Waite, 1911, Rec. Canterbury (N.Z.) Mus., i, p. 294, pl. xxxvi; Philipps, 1921, N.Z. J. Sci. Tech., iv, p. 122; Thomson and Anderton, 1924, Bull. N.Z. Board Sci. Art., ii, p. 87; Norman, 1929, Biol. Res. "Endeavour", v, p. 284; Philipps, 1927, N.Z. Mar. Dept., Fish. Bull., i, p. 21; McCulloch, 1929, Mem. Aust. Mus., v, p. 282; Whitlevy, 1929, Pap. Roy. Soc. Tasini, (1928), p. 66.
Rhombosolea victoriae, Macleay, 1882, Proc. Linn. Soc. N.S.W., vi, p. 132; Waite, 1921, Rec. S. Aust. Mus., ii, p. 158.
Rhombosolea monopus, Woodward, 1902, W. Austral. Year book, (1900-1), p. 272.
Rhombosolea monopus, Stead, 1909, Fish. Austral., p. 181.

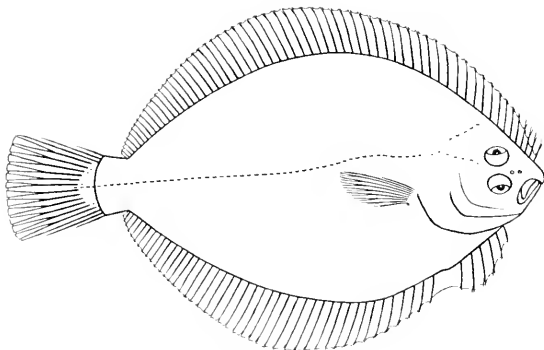


FIG. 317.—*Rhombosolea tapirina*. B.M. (N.H.) 1901.11.8.95. $\times \frac{1}{2}$.

Depth of body $1\frac{3}{5}$ to $2\frac{1}{8}$ in the length, length of head $3\frac{1}{4}$ to $3\frac{3}{5}$. Shape of body more or less ovate, upper profile of head straight or a little convex. Snout longer than eye, produced into a fleshy process which projects freely in front of the mouth¹, diameter of eye $1\frac{1}{2}$ to 6 in length of head and 4 to 5 times the interorbital width. Maxillary scarcely extending to below anterior edge of eye, length on ocular side 4 to $4\frac{1}{2}$, on blind side $3\frac{1}{2}$ to $3\frac{1}{2}$ in that of head, lower jaw 3 to $3\frac{3}{5}$ in head, 7 to 12 gill-rakers on lower part of anterior arch, lower pharyngeals about 4 times as long as broad, their inner edges angular, approximated for anterior $\frac{2}{3}$ of their length; teeth

¹ This process is not developed in young examples.

mostly cylindrical, each with a narrow, bluntly pointed, terminal cusp, arranged in a series along each edge, with a number of teeth between these cusps. Scales cycloid on both sides of body; 72 to 83 in lateral line. Blind side of head nearly entirely scaled. Lateral line with a very low curve above the pectoral fin. Dorsal 56-69; first two rays split at their tips and partly free, remainder mostly forked or branched distally; highest rays 2 to 2½ in length of head. Anal 40-50. Pectoral of ocular side with 10 to 13 rays (9 to 12 branched), length 1½ to 1⅞ in that of head. Anterior ray of pelvic of ocular side inserted below middle of posterior part of lower eye. Caudal with 18 or 19 rays (12 to 15 branched), subtruncate, rounded, or double-truncate; caudal peduncle about twice as deep as long. Brownish or greyish, with or without large darker blotches; distal part of pectoral darker; blind side whitish.

TYPE.—British Museum (Nat. Hist.). Reg. No. 48.3.18.47.

DISTRIBUTION.—Southern New South Wales, Victoria, South Australia; Western Australia (?); Tasmania; New Zealand, Auckland Islands; Campbell Island.

SPECIMENS EXAMINED:

1 (201 mm.).	Murray R., Australia.	Gerrard.
1 (133 ,,).	Queenscliff, Victoria.	Anstr. Mus.
1 (200 ,,).	Adelaide, S. Australia.	Gerrard.
1 (350 ,,).	Coorong, ,,	S. Austr. Mus.
1 (335 ,,), skin. Type of <i>R. fessoides</i> .	South Australia.	Gerrard.
1 (183 ,,).	Flinders Isd.	Degen.
1 (330 ,,).	,,	,,
1 (90 ,,).	Tasmania.	Allport.
3 (75-88 mm.).	,,	,,
4 (73-87 ,,).	Paratypes. Norfolk Bay, Tasmania.	Richardson.
5 (85-120 ,,).	Holotype and paratypes. ¹ Auckland Is.	,,
1 (230 mm.).	Campbell Isd.	"Southern Cross."

ABNORMALITIES.

1 (290 mm.). ²	Reversed, with second pelvic fin.	Dunedin.	Otago Mus.
1 (205 ,,). ³	Ambicolorate, with two equal pelvic fins.	Coorong, S. Australia.	S. Austr. Mus.

The shape of the body and the proportions of the depth and length exhibit considerable variation in this species. It attains to a length of about 15 inches.

SPECIES INQUIRENDÆ.

The following names have been given to Flatfishes, but the species are either indeterminate, or the diagnoses appear in works which are not accessible to me:—

- Bothus diagrammus*, Rafinesque, 1814, 'Précis Som.', p. 16.
Bothus punctatus, Rafinesque, 1814, *tom. cit.*, p. 17.
Pleuronectes minutus, Nardo (ex Chierighi MS), 1847, 'Sin. mod. spec. Lag. Veneto', p. 121.
Pleuronectes nericans, Schneider, 1801, in Bloch, 'Svst. Ichth.', p. 158.
Pleuronectes rhombus, Schneider, 1801, *tom. cit.*, p. 145.
Pleuronectes striatopinnatus, Tilesius, 1805, Voigt's 'Mag. Naturk.', ix (5), p. 443 [N. N.].
Rhombus fitzingeri, Heckel, 1847, 'Ber. Mitth. Fr. Nat. Wien', iii, p. 194 [N. N.].
Rhombus magnus, Minding, 1832, 'Lehrb. Naturg. Fische', p. 99, *teste* C. W. Richmond.
Rhombus ramosus, Michahelles, 1831, 'Isis' (Oken), p. 199.

¹ The largest is selected as the holotype.

² See Norman (1926, 'Biol. Res. "Endeavour"', v, pp. 278, 280, for descriptions of these specimens.

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