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Fishes

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THE
VOYAGE OF H.M.S. CHALLENGER.

ZOOLOGY.

27

REPORT on the PELAGIC FISHES collected by H.M.S. Challenger during the
Years 1873-76. By Dr. ALBERT GÜNTHER, M.A., M.D., Ph.D., F.R.S.,
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INTRODUCTION.

THE Third Report on the Fishes collected during the voyage of H.M.S. Challenger comprises an account of the specimens which were obtained in the open ocean by means of the surface-net or otherwise. It is devoted, therefore, chiefly to *Pelagic* Fishes.

The specimens were as numerous as those of either the shore or deep-sea series, but by far the greater majority were of small or even minute size. Many of them would have been lost but for the care taken at the time of their capture, by separating them in tubes or mounting them there and then for microscopic examination. There were comparatively few which, during or after capture, had so much suffered as to be unfit for examination or description; but I am compelled to omit in this Report mention of a considerable number of specimens which were obtained at such an early stage of their development, and which exhibit such small progress towards specialisation, that I am unable to arrive at any conclusion as to the family or even order of fishes to which they belong. On the other hand, I have admitted all such young forms, which, even if their origin be uncertain at present, may be readily recognised by future observers.

The pelagic fish-fauna consists, first, of the truly pelagic fishes, that is, fishes which inhabit the surface of the ocean, approaching the shore only accidentally or while in pursuit of their prey; the majority are bred in the open sea and pass through the various

stages of growth without coming into the vicinity of land. These truly pelagic fishes are represented in the Challenger collection by numerous genera: (species of) *Carcharias*,¹ *Xiphias* and *Histiophorus*, *Coryphæna*, *Lirus*, *Cubiceps*, *Psenes*, *Nomeus*, *Platystethus*, *Thynnus*, *Lepidothynnus*, *Echeneis*, *Seriolichthys*, *Antennarius*, *Centriscus*, *Scombrosox*, *Exocoetus*, *Scopelus* (sp.), *Diplophos*, *Astronesthes*, *Halaphya*, (*Leptocephalus*).

The number of these surface fishes is considerably increased by others which for the greater part of their life inhabit the depth of the ocean, from 100 fathoms downwards. The causes which make these fishes ascend to the surface are not known; but as some of them have been observed to make their appearance at the surface periodically, we may surmise that this change of habitat is in connexion with their propagation. Indeed, most of them are found at the surface only during the early stages of their growth, and it would seem that their ova and fry require for development and growth the higher temperature and the light of the surface water. These fishes connect the surface pelagic fauna with the deep-sea fauna, and are represented in the Challenger collection by the following genera:—*Scorpæna* (*dactyloptera*, young), *Nealotus* (young), *Lepidopus* (adult and young), *Thyrsites* (young), *Schedophilus* (young), *Centrolophus* (young), *Trachypterus* (young), *Lophotes* (young), *Onus* sp. (young), *Bregmaceros* (adult and young), undetermined genera of Pleuronectidæ, *Scopelus* sp. (adult and young), *Prymnothonus*.

The pelagic fauna receives likewise a very considerable contingent from the littoral fauna. A great number of young and undeveloped fishes, which are the offspring of species rarely found in the adult state at any distance from land, occur at the surface in the open sea. Their presence under conditions so widely different from those under which they live when mature, can be explained by the fact that spawn or fry floating on the surface may be driven by currents to great distances from the place where the spawn was originally deposited; this must frequently happen, especially on oceanic banks which are covered by a small depth of water, and which, therefore, are suitable localities for littoral species. The wide distribution of the same littoral species over large oceanic areas, like that of the Tropical Indo-Pacific, finds thus an easy explanation. The Challenger obtained many immature specimens of such littoral forms in the open sea, as *Pimelepterus*, *Holocentrum*, *Lichia*, *Platystethus huttonii*, *Trigla*, *Brosmius* (?), *Onus* sp. *Fierasfer*, *Solea* (?), *Synaptura* (?), *Hemirhamphus*, *Belone*, *Balistes*, *Tetrodon*.²

Finally, fully developed specimens of littoral species may also stray or be accidentally driven into the open sea. But these fishes must be considered to be occasional stragglers

¹ Very little is known about the propagation of the pelagic species of *Carcharias*; all seem to be viviparous, bringing forth their young in the open sea, like other viviparous Plagiostomes, or on oceanic banks.

² Whether *Branchiostoma* should be included in this list is uncertain at present.

and strangers to the pelagic fauna. The Challenger collection contains several instances of such irregular occurrences, viz., *Hemerocoetes*, *Gobius*, *Fundulus*, *Muræna*.

Thus, the pelagic fauna comprises a very varied assemblage of forms : not only fishes excelling above all others in the power of swimming with regard to rapidity as well as endurance of motion, but also species in which the power of locomotion is almost reduced to the faculty of floating on the surface, without resistance, at the mercy of wind and current, or of retaining their hold on other floating substances, like sea weed, logs of wood, &c. It comprises fishes which can raise themselves out of the water in short flights, and others which are provided with a special apparatus to attach themselves to a rapid swimmer, thus partaking of all the advantages derived from his power of locomotion. Many accompany ships, large fishes, Medusæ, any floating object, partly as commensals, partly for protection. All are carnivorous. They seem to descend during very stormy weather to a depth to which the violence of the surface agitation does not reach. And certainly all nocturnal forms pass the day at some depth, coming to the surface during the night only; they are provided with luminous organs like many bathybial forms, and, indeed, form a transition to the deep-sea fauna.

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DESCRIPTION OF SPECIES.

I. SHARKS.

Of pelagic Sharks, that is, of species which were found at a considerable distance from land, and are known to have a wide geographical range, only a few specimens were preserved. They belong to three well-known species of the genus *Carcharias*.

Carcharias glaucus, L.

A specimen, 10 feet long, was caught on March 2, 1876, in the South Atlantic, and another, 8 feet long, on April 5, 1875, off Japan. The Blue Shark is known to inhabit the seas of the temperate and tropical zones generally, but I believe that this is the first recorded instance of its occurrence in Japanese waters.

Carcharias lamia, Risso.

One specimen, 7 feet long, was caught near the Kermadec Group. This also seems to be the first recorded instance of the occurrence of this Shark in the Indo-Pacific.

Carcharias obscurus, Les.

A specimen, 47 inches long, was caught off the coast of Sierra Leone on April 9, 1876. A second specimen, obtained near the island of Ascension, was included in the Report on the Shore Fishes (Zool. Chall. Exp., pt. iv. p. 5).

II. ACANTHOPTERYGIANS.

Pimelepterus waigiensis, Quoy and Gaimard.

Two specimens of 20 and 22 mm. in length were taken from driftwood, north of Papua, February 21, 1875, and resemble more mature ones in every respect, so that no change with advancing age seems to take place in this genus. The teeth are still hidden below the mucous membrane.

Pimelepterus fuscus, Lacép.

A single very young specimen, 27 mm. long, was captured south of the Cape of Good Hope, in lat. 35° 4' S., long. 18° 37' E., near the surface; it has entirely the aspect of the mature fish, but the teeth are not yet developed. This species was previously known to occur at the Cape of Good Hope.

Scorpæna dactyloptera, de la Roche.

Two specimens, 5 and 9 mm. long, were obtained on April 26, 1876, off St. Vincent, Cape Verde Islands. As regards general shape, these young fishes do not differ from the adult, but the spines on the occiput and præoperculum are comparatively much larger and finely denticulated. The pectoral fin also is considerably longer, extending in the smaller specimen almost to the root of the caudal fin. Also the spines of this specimen are longer than in the other.

Holocentrum sp.

A specimen, 6 mm. long, obtained in April 1875, between the Admiralty Islands and Japan, represents the stage figured by Lütken, Vid. Selsk. Skr., xii. 1880, tab. 2, fig. 6. Like the specimen figured there, it possesses the enormously elongate nuchal and præopercular spines, but the rostral process is shorter.

Xiphias gladius, L.

A specimen, 1½ inches long, obtained at the surface between Tenerife and St. Thomas, West Indies, is not in a good condition, and represents the stage figured by Lütken, Vid. Selsk. Skr., xii. 1880, tab. 2, fig. 10.

Histiophorus sp.

A specimen, 9 mm. long, caught in the surface-net between the Admiralty Islands and Japan, in April 1875, agrees in all particulars with the one which I figured and described in Journ. Mus. Godeffroy, vol. i., 1873, p. 98.

Nealotus tripes, Johns.

The specimen, which was captured at Station 40, in lat. 34° 51' N., long. 68° 30' W., and which is only 33 mm. long, has been fully referred to in the Report on the Deep-

Sea Fishes (Zool. Chall. Exp., pt. lvii. p. 35). I have there stated the reasons which lead me to believe that it was captured near the surface, and not at the depth of 2675 fathoms to which the dredge descended on that occasion.

Lepidopus tenuis, Gthr.

Lepidopus tenuis, Günth., Zool. Chall. Exp., pt. lvii. p. 37, pl. vii. fig. B.

On the passage from the Sandwich Islands to Tahiti, at Station 271, in lat. $0^{\circ} 33' S.$, long. $151^{\circ} 34' W.$, a young Trichiurid, 95 mm. long, was obtained. The trawl had been at a depth of 2425 fathoms, but it is probable that this small and delicate fish was swimming near to the surface when it got entangled by the trawl. Although there cannot be any doubt as to this specimen being a young *Lepidopus*, it is too much injured to enable us to say whether it should be referred to *Lepidopus tenuis* or *Lepidopus elongatus*, if, indeed, these fishes are specifically distinct. Neither is the place of its capture a guide for its specific determination, *Lepidopus tenuis* having been found in the Japanese Sea, and *Lepidopus elongatus* off New Zealand and in the North-Western Atlantic.

Thyrsites prometheus, C. V. (Pl. I. figs. C, D).

Of the two small fishes here described and figured, the smaller, which is 5 mm. long, was obtained on June 17, 1875, south of Yeddo, and the larger, of double the size, five weeks later, namely on July 23, 1875, north of the Sandwich Islands.

The specimens are not in a good condition, having been placed at the time of their capture on a microscopic glass-slide; the sides of the head have been much crushed, so as to render the outlines of its constituent parts indistinct, more especially the opercular and scapular portions, which, therefore, could not be delineated in the figures.

The specimens are evidently not far removed from the embryonic condition; and Lütken's excellent account¹ of the developmental stages of *Nealotus* and *Gempylus* cannot leave us long in doubt as to the family of fishes to which our specimens should be referred, especially not, if, as I am still inclined to think, the caudalless and caudate Trichiuridæ be retained in the same family. The embryonic stage of the individuals is apparent from the pointed diphyccercal termination of the vertebral column which is surrounded by a circular membrane out of which the caudal fin is developed; in both specimens the caudal rays are visible as extremely fine striæ. In the larger specimen (fig. C) a series of seven or eight hæmal apophyses has been developed in this portion of

¹ K. dansk. Vidensk. Selsk. Skriv., xii., 1880, p. 448 et seq.

the spinal column; they are scarcely indicated in the smaller one (fig. D). An upper and lower membranous fold, bordering the upper and lower sides of the tail, represents the soft dorsal and anal. In both specimens the greater portion of the fold is striated, the rays being thus faintly indicated. In the larger specimen this fold is separated from the caudal fin and spinous dorsal by a distinct notch.

The spinous dorsal is extremely high, more so in the larger specimen than in the smaller one. It is composed of twenty simple spines, of which the six anterior are armed with numerous barbs; the barbs of the foremost spine point upwards and those of the following downwards. In the young specimen only the first spine shows the denticulation, and there are two very distinct black pigment-spots on the membrane connecting the anterior spines, which are missing in the larger example.

Only in the larger example a trace of pectorals is to be seen; the ventral consists of a strong barbed spine, very long in the older example, shorter in the younger, in which, besides, three soft rays may be distinctly seen.

Spines and excrescences of the bones of the head can be seen especially in the larger example, but they are too indistinct to be exactly described, with the exception of a few short ones at the extremity of the snout and two slender spines on the præopercular margin.

Seriolichthys bipinnulatus, Q. G., young (Pl. I. figs. E, F).

The specimens, which I consider to be the young of this fish, were obtained in considerable numbers from driftwood, north of New Guinea, on February 21, 1875. They measure from $\frac{1}{2}$ to 1 inch in length, and are in a perfect state of preservation.

The changes which this genus undergoes with age are somewhat less considerable than in the allied *Seriola*. As usual in young fishes the body is shorter and deeper than in those approaching the mature age, and in those of half an inch in length it is still shorter than in those of double the size. Also the head and the eye are comparatively larger. The fins are perfectly developed, showing the normal number of rays, viz., D. 5-6 | 27. A. 19. However, as in the young of other genera, in which the adult form possesses detached finlets, so here these rays are not yet differentiated from the remainder of the fin; and I may remark on this occasion that in the specimens of *Seriolichthys* which have attained to a length of 4 inches, these finlets are sometimes still connected by a delicate membrane to the preceding ray.

In the smallest examples the angle of the præoperculum is armed with two prominent spines, the remaining margin being simply denticulated. This armature has entirely disappeared in specimens of 1 inch in length.

Scales begin to be visible in the larger specimens. The coloration is uniform, without any of those blackish bands or markings by which young *Seriolæ* are distinguished.

(?) *Lichia glauca*, L., young (Pl. I. fig. G).

The fish believed to be the young of this species was obtained with the surface-net on April 13, 1876, off the west coast of Africa, in lat. $10^{\circ} 55' N.$, long. $17^{\circ} 46' W.$, and is only 10 mm. long.

The accompanying figure will give a sufficient idea of the general form of its body, which is scaleless and of a silvery colour. The spinous dorsal only is marked with a very conspicuous deep black blotch. The præoperculum is armed with a long spine at the angle, and with several smaller ones besides, which are much more conspicuous on the lower limb than on the posterior. Formula of the fins: D. $\frac{6}{26}$. A. $\frac{3}{22}$. The fin-spines are strong; those of the dorsal as high as, and continuous with, the rays; the third and fourth of these spines are the longest. Caudal slightly emarginate.

It was not without some hesitation that I ventured to refer this single young specimen to *Lichia glauca*, without being able to prove the correctness of this view by intermediate stages. However, I know of no other fish of this part of the Atlantic except *Trachynotus gorensis* (= *Trachynotus myrias*) with which it might be associated; the general form of the head and body, and especially the numbers of the fin-rays, point rather to *Lichia glauca* than to *Trachynotus*, whilst the fins, in the form of which our young fish so conspicuously differs from that of matured fish, are just those organs which we should expect to be modified with age.¹

Coryphæna, Artedi.

The young stages of *Coryphæna* have been known for some time (see, for instance, *Fische der Südsee*, p. 146), but we owe to Dr. Lütken² our acquaintance with the means of discriminating between the young of *Coryphæna hippurus* and *Coryphæna equisetis* (*loc. cit.*, p. 489). Yet, even with the help of the excellent figures which he has given of the young of both species (*loc. cit.*, pl. iii. figs. 9–13) the specific determination is often very difficult and uncertain, especially of individuals less than $1\frac{1}{2}$ inches long. Of the three specimens collected by the Challenger I refer two to *Coryphæna hippurus*, viz., one of $1\frac{1}{4}$ inches obtained in the North Atlantic on April 28, 1876, and one $\frac{3}{4}$ inch long from the vicinity of the Low Archipelago, September 16, 1875; and the third to *Coryphæna equisetis*; it is 1 inch long, and was taken in the North Atlantic on April 29, 1876.

¹ The recent discovery off the island of Skye of a specimen of *Lichia radiata* is additional evidence of the pelagic habits of the fishes of this genus.

² Dr Lütken (*loc. cit.*, p. 483) draws on this occasion attention to the fact that the undue creation of nominal species of this genus is the work of Valenciennes, and not of Cuvier, to whom I had attributed it in *Catal. Fish.*, vol. ii. p. 405. This is perfectly true, and I regret so far the oversight on my part, which I might have avoided by a more careful examination of the index of vol. ix. of the *Hist. nat. des Poissons*. However, the fact of Cuvier's tendency of multiplying species, especially towards the end of his life, is, nevertheless, undeniable; witness his treatment of the genera *Elacate*, *Trachynotus*, &c. I fully agree with Dr. Lütken's conclusion that there are in existence probably two species of Dolphins only.

Lirus, Lowe.

Leirus, Lowe, Trans. Phil. Soc. Cambridge, vi., 1836, p. 199.

„ Jordan and Gilbert, Synopsis, 1882, p. 452.

Palinurus, De Kay, N. York Faun. Fish., 1842, p. 118.

Hyperoglyphe, Günth., Fish., i., 1859, p. 337.

„ Lütken, K. dansk. Vidensk. Selsk. Skriv., xii., 1880, pp. 521, 602.

Pammelas, Günth., Fish., ii., 1860, p. 485.

Palinurichthys, Gill, Proc. Acad. Nat. Sci. Philad., 1861, p. 20.

On the British Museum coming into possession of a specimen of the Rudder-fish, *Pammelas perciformis*, I was enabled to recognise the generic identity of that species with the Australian *Hyperoglyphe porosa*. In the meantime Messrs. Jordan and Gilbert pointed out the true relationship of the Rudder-fish, viz., that it was closely allied to *Centrolophus bennettii* from Madeira, for which Lowe had already proposed the generic name of *Leirus*. *Hyperoglyphe* forms merely the extreme link of a chain of modifications of the form and structure of the dorsal fin as observed, in its most generalised form, in *Centrolophus pompilus* or *Schedophilus medusophagus*. In these fishes the dorsal fin is composed of extremely numerous, homogeneous soft rays, of which the anterior only are unarticulated, though flexible.

In other species of the same genera these unarticulated rays become stiffer and more or less spinous, and as they become stronger and more differentiated, the number of soft rays decreases. In *Lirus perciformis* the spinous and soft portions are completely differentiated, although they still form one continuous fin. In *Lirus porosus* (as I now call the Australian species) a separation into two fins is indicated, but not fully accomplished. But all these fishes form one natural group, the members of which possess the complicated pharyngeal dentary apparatus. *Hyperoglyphe*, therefore, should be eliminated from the Perch-like fishes, and placed as a synonym of *Lirus* immediately after *Schedophilus*. Its teeth are minute, in a single series, and not villiform or in a band.

Lirus, like *Schedophilus* and *Centrophilus*, is a truly pelagic form. These fishes follow floating objects or slowly moving animals (Medusæ),¹ either for the purpose of obtaining protection, or for the sake of food, as many small animals, like Crustaceans, are attracted to the same objects. Some, at least, of the species live at considerable depths, as we may gather from the testimony of fishermen, and safely conclude from the softness of their skeletons; and, probably, the young of all live at or near the surface.

¹ The large Medusæ on our coast (*Pilema octopus*) are almost always accompanied by young fishes. On the south coast I found them to be Horse-mackarel, one large Medusa offering a temporary home to more than fifty of these young fishes, which were from 2 to 3 inches long. Only once I found another species of fish among them, viz, a young Whiting.

Lirus porosus, Richards (Pl. II. fig. F).

Diagramma porosa, Richards, Ereb. and Terr. Fish., p. 26, figs. 5, 6.
Hyperoglyphe porosa, Günth., *loc. cit.*

Since the first discovery of this species during the voyage of the "Erebus" and "Terror," no other specimen seems to have fallen into the hands of a naturalist. During the present voyage seven young examples, 25 to 30 mm. long, were obtained from a patch of floating sea-weed near the Kermadec Islands, Station 170. The hind margin of the præoperculum is finely and evenly serrated, the angle and lower margin of the bone being armed with coarser and longer teeth. Pale olive; fins blackish, with the exception of the caudal fin which is whitish.

Lirus paucidens, n. sp. (Pl. II. fig. E).

D. $\frac{7}{3}$. A. $\frac{3}{9}$.

This species, of which I have only three very young specimens, is closely allied to *Lirus porosus*, but the armature of the præoperculum is very different; some of the characters here mentioned may apply to the young stage only.

The height of the body is contained $2\frac{1}{3}$ times in the total length (without caudal), the length of the head $2\frac{1}{2}$ times. Eye about one-third of the length of the head, the maxillary not extending to below the middle of the eye. The entire margin of the præoperculum armed with distant and comparatively strong dentations. The soft dorsal and anal fins rather high, higher than the spinous dorsal, which is continuous with the soft; pectoral fins extending beyond, ventrals to, the anal. Dark-brown, pectoral and caudal fins white.

Three specimens, the largest of which is 35 mm. long, were obtained in the surface-net on the passage from New Guinea to Japan.

Cubiceps gracilis, Lowe (Pl. II. figs. A, B, C).

A single specimen, 3 inches long, was obtained in the surface-net on the passage between Tenerife and St. Thomas, West Indies. It proves that this species does not undergo great changes during growth, and that the fish described and figured by Lütken (*op. cit.*) under the name of *Psenes maculatus* is not the young of the present species.

Adult *Cubiceps* must be extremely rare; no other specimen has occurred, beside the one obtained by Sir A. Smith, so that the question of the specific distinctness of *Cubiceps capensis* and *Cubiceps gracilis* is still a matter of uncertainty.

Young specimens of *Cubiceps gracilis* are comparatively much more common. The British Museum has received, since the publication of the Catalogue, two examples, 7 and 8½ inches long, obtained at Madeira by Mr. J. T. Johnson; six of from 1¼ to 2½ inches in length, purchased by a friend of the writer at Messina; and, finally, two of 2 and 2½ inches in length, taken by the late Commander W. E. Cookson, near the Azores with Medusæ.

All these specimens resemble much the adult state, so that there could not have been any difficulty in recognising the species. None of the specimens show the slightest trace of spots. The younger ones are comparatively shorter in the body, have a more elevated dorsal fin, and shorter pectorals. We figure, of the natural size, a specimen from Madeira (fig. A'), one from the Azores (fig. B), and the youngest from Messina (fig. C).

Psenes cyanophrys, C. V.

Psenes cyanophrys, Cuv. Val., ix. p. 260, pl. cclxv.; Lütken, K. dansk. Vidensk. Selsk. Skriv., 1880, p. 517.

„ *javanicus*, Cuv. Val., ix. p. 264; Günth., Fish., ii. p. 494.

„ *leucurus*, Cuv. Val., ix. p. 265; Jenyns, Zool. Beagle, Fish, p. 73; Günth., Fish., vol. ii. p. 495.¹

? „ *auratus*, Cuv. Val., ix. p. 264.

Cubiceps multiradiatus, Günth., Proc. Zool. Soc. Lond., 1871, p. 661, pl. lxi.

An examination of a long series of examples shows that the various terms mentioned above refer to one species only, which is truly pelagic and distributed over the Tropical Atlantic, as well as the Indian Ocean. Very young specimens have invariably a white caudal fin. The number of the anal rays ranges from twenty-five to thirty.

The following specimens were collected:—

- a. 10 lines long. Between Tenerife and St. Thomas.
- b. 10 lines long. From Gulf-weed, south of Bermuda; April 1873.
- c. 3 inches long. South of New Guinea; tow-net; August 29, 1874.
- d-e. 1-2 inches long. South of Philippines; surface-net; February 8, 1875.
- f-h. 1-2 inches long. Between Philippines and Papua; surface-net; February 10, 1875.
- i-z. $\frac{2}{3}$ -2½ inches long. North of Papua; from driftwood; February 21, 1875.
 - a. 10 lines long. North of Papua; tow-net; March 3, 1875.
 - β. 1½ inches long. North of Papua; tow-net; March 13, 1875.
 - γ. 2 inches long. Between Papua and Japan; surface-net; 1875.

¹ Lütken (*loc. cit.*) distinguishes a *Psenes leucurus* from *Psenes cyanophrys*.

Psenes arafurensis, n. sp. (Pl. II. fig. G).

D. 7 | 20. A. $\frac{3}{2}$. L. lat. 47.

The height of the body is contained once and two-thirds in the total length without caudal; the length of the head twice and two-thirds. Snout truncated, short, much shorter than the eye, the diameter of which is two-fifths of the length of the head, and less than the width of the interorbital space. Lower margin of the præoperculum crescent-shaped. Check entirely scaly. Anterior dorsal rather higher than the second. Pectoral broad, as long as the head without snout and as the ventrals, which extend beyond the origin of the anal fin. Silvery; tail with some obscure cross-bands which extend over, and are more distinct on, the anal fin. Ventrals black in their basal and terminal thirds.

One specimen, $1\frac{1}{2}$ inches long, was obtained in the Arafura Sea, with the surface-net September 23, 1874.

This specimen is evidently the young of a species attaining to a larger size.

Nomeus gronovii, Gm.

This is a common pelagic fish between the Tropics, young specimens being found in almost all surface gatherings. The four specimens brought home by the Challenger were obtained accompanying Physalias, in the vicinity of the Low Archipelago, on September 16, 1875. They are from $\frac{1}{2}$ to $1\frac{1}{2}$ inches long.

Platystethus huttonii, Gthr. (Pl. II. figs. H, I).

Platystethus huttonii, Günth., Ann. and Mag. Nat. Hist., 1876, vol. xvii. p. 395.

D. 13-15 | 36. A. $\frac{3}{2}$. L. lat. 90.

Body much compressed, its height being one-third, the length of the head one-fourth, of the total (without caudal). Eye of moderate size, two-ninths of the length of the head, situated a little before the middle of the head, not far below the upper profile. Præorbital at least as wide as the eye. Mouth oblique, with the lower jaw very prominent, very narrow, the maxillary not extending to the front margin of the eye. Dorsal spines feeble, of moderate length; the soft dorsal and anal low. Anal spines short, but stronger than those of the dorsal fin. Pectoral broad, rounded, half the length of the head. Ventrals small. Caudal deeply forked. Silvery; back above the lateral line greenish; the spinous dorsal black.

This species was described from two specimens, $6\frac{1}{2}$ inches long, sent by Professor Hutton, from Dunedin, New Zealand. It is admitted here in the series of pelagic

fishes, because it has helped me to clear up the nature of certain young fishes, of which I have known since the year 1860, without knowing to what genus they should be referred. That these young fishes are pelagic is amply proved by the three specimens in the British Museum, all of which were caught in the open sea.

1. The largest specimen is 26 mm. long, and was obtained in the tow-net on the passage from Australia to the Cape of Good Hope, by J. B. Godfrey, Esq., who however omitted to note the exact locality where it was captured. This is the specimen which I mentioned in the year 1860 in the Catalogue of Fishes, vol. ii. p. 415, as possibly representing the young stage of *Mene maculata*.

2. A small specimen, 18 mm. long, was obtained by the Challenger Expedition in July 1874, on the passage from Sydney to Wellington.

3. Finally, for the third specimen, which is only 15 mm. long, we are indebted to Mr. Wykeman Perry, who collected so many valuable specimens, whilst serving on board H.M.S. "Pearl," under the late Commodore Goodenough. This specimen was obtained in lat. 34° S., long. 12° E., in August 1873, that is, in the neighbourhood of the Cape of Good Hope.

The general form of these fishes may be best seen from the accompanying figure. They are characterised by their extremely compressed body, the chest and the abdomen forming a prominent sharp edge. The body is covered by a thick layer of silvery pigment, the largest specimen besides showing distinct cycloid scales; the lateral line runs parallel to the profile of the back, which is much less curved than the lower outline of the body. The back is occupied by a long dorsal fin, the anterior portion of which is spinous. The anal fin is also long, preceded by three spines; the ventral fins small, rudimentary, inserted at a considerable distance behind the root of the pectoral and likewise at a similar distance from the vent.

The head is of moderate size without any armature; eye of moderate size, the mouth small and obliquely turned upwards.

Although I have no doubt that these specimens are the young of *Platystethus*, I consider it quite possible that the three specimens belong to as many distinct species on account of the difference in the numbers of the fin rays. On the other hand we have to take into consideration, that owing to the very young age of these specimens, the posterior fin rays may still be undeveloped. In the largest of these young specimens, which is figured, the dorsal fin is composed of eighteen¹ spines and twenty-nine soft rays. The anal is armed with three spines of which the third is very short, as is also the case in the two other specimens; of soft rays I count eleven. I found it impossible to ascertain the number of dorsal spines in the two smaller specimens, without lacerating them in a manner which would have impaired their utility in the future, but the soft rays were

¹ A comparison with the specimens more recently acquired has shown me that a number of the rays in the dorsal and anal fins, which I formerly in the largest specimen considered to be soft, are in reality spinous.

found to be twenty-eight in the middle-sized specimens, whilst seventeen only could be counted in the smallest. A similar diversity obtains in the number of anal rays which is respectively fourteen and nine.

Lepidothynnus, n. gen.

For the knowledge of this fish I am indebted to Professor Hutton of Canterbury College, Christchurch. The specimen, $5\frac{1}{2}$ feet long, was driven on shore in Lyttelton Harbour on April 17, 1887. It had the appearance of a Tunny, but was covered with scales. Of these Professor Hutton fortunately preserved some, and he also made a sketch of the fish which is reproduced on Pl. VI. fig. A. The specimen is preserved in Christchurch Museum as a skeleton, of which Professor Hutton kindly sent a photograph to me (Pl. VI. fig. A'). These materials, as well as some notes taken by my correspondent from the fresh fish, offer sufficient evidence that this form represents an undescribed genus of Scombroid fishes showing distinct affinities to *Gastrochisma*. It may be characterised thus:—

Body oblong, compressed, covered all over with large cycloid scales. Head with the upper profile arched, parabolic, compressed above into a ridge. Cleft of the mouth of moderate width, horizontal, armed with teeth of moderate size; teeth on the palatines, none on the vomer. Eye lateral, rather small. None of the opercles serrated. The anterior dorsal fin is continuous, formed by numerous slender spines. The soft dorsal and anal consists of an anterior lobe, followed by seven or eight finlets. Pectoral and ventral fins rather short. Caudal bilobed; tail with two keels at the base of the caudal. Pyloric appendages dendritic.

Lepidothynnus huttonii, n. sp. (Pl. VI. figs. A, A').

B. 7. D. 17 | $\frac{2}{3}$ | VII. A. $\frac{2}{3}$ | VIII. L. lat. 78–80. L. transv. 6 | 13 (below 2nd dorsal).

The body is broadest in front of the pectoral fin, the depth of this portion being about two-sevenths of the total length (without caudal). The head is nearly as deep as long, compressed into a crest, the small eye occupying a position in the middle of the depth of the head, but nearer to the end of the mouth than to the hind margin of the operculum. The cleft of the mouth is subhorizontal, extending backwards to below the middle of the eye. Gill-covers broad and firm as in Tunnies.

The body is covered with large cycloid scales (fig. *a.*), somewhat broader than long, $1\frac{1}{2}$ inches broad. The lateral line follows the line of the back, after having made a curved ascent above the pectoral fin.

The spinous dorsal commences above the gill-opening, is low and long, and formed by seventeen slender spines. It is rather widely separated from the soft dorsal, whose anterior connected rays form a short falcate lobe; seven detached finlets follow. The anal corresponds in position and form to the soft dorsal. These vertical fins can be completely concealed in fissures on the back and abdomen.

Pectoral fin short and powerful as in a short-finned Tunny; ventral short, its root opposite to that of the pectoral fin.

Colour uniform steel-grey, lighter below; caudal fin and inside of the pectoral darker.

Professor Hutton has taken the following measurements:—

Total length,	65½ inches.
Length of head,	16½ "
Height of the body,	16 "
Thickness at the pectorals,	10 "
Breadth between eyes,	6 "
Diameter of the eye,	1 "
Length of pectoral,	11 "
Longest dorsal spine,	3 "
Height of soft dorsal,	5¼ "
Height of anal,	3¾ "

The skeleton resembles much that of a *Thynnus*. However, the vertebræ are of a less firm texture, somewhat porous, less deeply sculptured and lacking the high median lateral ridge which is so conspicuous on the centrum of the vertebra of a Tunny. The number of vertebræ is twenty-two or twenty-three in the abdominal, and twenty-one in the caudal division. None of the posterior caudal vertebræ are raised into the elevated lateral ridge of the Tunnies. The arrangement and form of the neural, hæmal, inter-neural, and interhæmal spines are as in *Thynnus*, but all are more slender, as are also the ribs and floating ribs. "Foramina inferiora"¹ seem to be present in the zygapophysis of the sixth to thirteenth caudal vertebræ. The hæmapophyses of the middle and posterior abdominal vertebræ coalesce to form a wide hæmal canal, but whilst in *Thynnus* the ribs are suspended from the extremities of the greatly prolonged hæmapophyses of these vertebræ, they are, in this genus, attached to the base of the apophyses. The neural spines of the seven posterior abdominal vertebræ do not bear interneurals.

The skull differs considerably in having a high crest developed along the whole length of its upper surface, but in other respects shows the closest agreement with that of the Tunny.

¹ See Lütken, *Vidensk. Selsk. Skriv.*, xii., 1880, p. 473.

Thynnus thunnina (C. V.), young (Pl. II. fig. D).

Dr. Lütken¹ has figured two very young Scombroid fishes which he considers to be the young of *Oreynus germo*. A similar specimen 17 mm. long was obtained in the surface-net on the passage from the Admiralty Islands to Japan; it is, however, sufficiently different to prove its specific distinctness from the specimens figured by Dr. Lütken. All three specimens have a more or less extended black patch on the spinous dorsal, a feature which is commonly preserved in adult specimens of the genus *Cybium*, but which is much more rare in mature examples of *Thynnus*. I have seen it in the type specimen of *Thynnus affinis* of Cantor, from Penang, which is in fact specifically identical with *Thynnus thunnina*. Although I provisionally identify our young example with this latter species, I consider it quite possible that all these young specimens may belong to *Cybium*. Perhaps the young of two genera so closely allied as *Thynnus* and *Cybium* are not readily distinguishable.

Our young specimen is uniformly silvery, with the exception of the black patch which covers the first part of the first dorsal fin. Its body and tail are covered with minute scales which become visible when the surface of the specimen is allowed to dry. The head is large, at least one-third as long as the entire fish, the caudal fin included. Eye large, about two-sevenths of the length of the head; jaws armed with the strong teeth which are characteristic of the genus. Angle of the præoperculum armed with two stronger spines which are followed by smaller ones along the lower margin. The anterior part of the spinous dorsal fin is lower than in the fishes figured by Lütken, the posterior portion very low and continuous with the soft dorsal fin; there are altogether seventeen spines of which one would belong to the soft portion. All the rays of the soft dorsal fin, nineteen in number, are connected by membrane, but the seven or eight last are already sufficiently differentiated to show that they would have been modified into finlets. The anal fin is very similar to the second dorsal, consisting of twenty-three rays, of which the two or three anterior would have been converted into spines; the other anterior rays are very closely set, whilst the eight last are further apart and evidently finlets. The pectoral and ventral fins do not show any peculiarity. Caudal fin excised, the middle rays being quite free and not covered with scaleless skin as in the adult *Thynnus*. The trunk of the tail is very thin and depressed, provided on each side with the characteristic pair of keels, which prevents me from referring this specimen to the genus *Cybium*.

¹ *Vidensk. Selsk. Skriv.*, xii., 1880, pl. iii. figs. 1, 2.

Echeneis remora, L.

The following specimens were collected :—

- a-c.* 3–5 inches long. Atlantic, from a Shark ; April 9, 1876.
- d.* 6 inches long. Sandwich Islands, from a Shark ; August 21, 1875.
- e-k.* 3–6½ inches long. North Pacific, from Sharks ; August 27, 1875.
- l.* 5 inches long. Atlantic, from Shark.

Echeneis naucrates, L.

Two specimens from St. Thomas, West Indies, and Kandavu.

Echeneis albescens, Schleg.

A specimen, 1¾ inches long, obtained north of New Guinea (Station 219), agrees entirely with an adult, with this exception that the caudal fin is comparatively longer and rounded, this fin having a vertical hind margin in the adult.¹

Hemerocoetes acanthorhynchus (Forst.).

This fish is a littoral form, although it may occasionally be met far from land. Thus, on the passage from Sydney to Wellington, a young specimen, 2½ inches long, was found swimming close to the surface. The date of capture or the distance from the nearest land was not noted.

Antennarius marmoratus, Gthr.

Of this truly pelagic genus only the following specimens were brought home :—

- a.* 1 inch long. Between Tenerife and St. Thomas, West Indies.
- b-o.* ⅔–1½ inches long. Gulf-weed, south of Bermuda.

Trigla macrodactylus, n. sp. (Pl. III. fig. G).

A specimen, 16 mm. long, obtained off the coast of Sierra Leone on the surface, on April 11, 1876, shows some well-marked peculiarities. The snout is short, the forehead deeply concave, the body transparent, without pigmentation, except on the margin of the pectoral fin. The formula of the fins is—D. 9 | 15. A. 13. P. 11 | 3, which precludes this fish from being referred to any of the known species of the genus. The fin-rays are rather long, and the third of the pectoral fin is prolonged into a filament nearly as long

¹ See *Ann. and Mag. Nat. Hist.*, ser. 3, vol. v. p. 397, 1860.

as the fin. Whether this is a peculiarity of the young stage, or whether it is persistent throughout life, cannot be ascertained at present.

Messrs. Goode and Bean described (Bull. Mus. Comp. Zoöl., x. 1883, p. 210) a species of *Prionotus* which also possesses prolonged pectoral rays, but in that species it is the ninth ray which is most prolonged, and the succeeding rays are graduated, decreasing in regular proportion.

Gobius sp.

A young specimen, $1\frac{1}{4}$ inches long, which I am unable to determine specifically, was obtained by the trawl in the Arafura Sea, on September 12, 1874, from a log of wood to which it had attached itself. The capture of this Goby is worth recording, as one of the instances by which we become acquainted with the means of dispersal of the species of this genus.

Centriscus scolopax, L.

This species, as well as the closely allied *Centriscus gracilis* of Lowe, are truly pelagic fishes. The latter has been known to occur in the Mediterranean and various parts of the North and South Atlantic, in the Japanese and Chinese Seas, and in the South Sea.¹ As to *Centriscus scolopax*, I have ascertained its occurrence on the coasts of Tasmania as far back as the year 1876,² and two of the three specimens obtained by the Challenger Expedition on the passage from Sydney to Wellington evidently belong to the same species.

All three specimens are young (from 6 to 13 lines long), and their dorsal spine is conspicuously shorter and weaker than in adult *Centriscus scolopax*, but longer and more distinctly denticulated than in *Centriscus gracilis*. They approach much more nearly to the typical form of the former species in the shape of their body, as may be seen from the following measurements:—

	Specimen from North Atlantic.	Specimen from South Pacific.
Total length,	23 mm.	17 mm.
Distance between operculum and root of caudal fin, .	10 „	$7\frac{1}{2}$ „
Greatest depth of the body,	5 „	$3\frac{3}{4}$ „
Length of dorsal spine,	$3\frac{3}{4}$ „	$2\frac{3}{4}$ „

Lophotes cepedianus, Giorna, young (Pl. II. figs. K, K').

The discovery of the young of so scarce a fish as *Lophotes* must excite some surprise, but there is no other genus to which the little fish could be referred with

¹ Fische d. Südlsee, p. 222.

² Ann. and Mag. Nat. Hist., ser. 4, vol. xviii. p. 395, 1876; referred to by Lütken, loc. cit., p. 585.

greater propriety than *Lophotes*. The specimen is only 11 mm. long and much distorted; it was obtained in April 1875 on the passage from the Admiralty Islands to Japan. It resembles much the adult form in the shape of its head and in the structure of its fins; the characteristic long and powerful dorsal ray is present though unfortunately broken off, only its basal portion being preserved. The chief difference from the adult is the proportion of the length of the body to that of the head, the body being much less elongate and the head only about two-sevenths of the total length. Differences of minor importance seem to be the position of the anterior dorsal ray, the root of which is somewhat behind the foremost part of the upper profile, and also the absence of the ventral fin, which may have been accidentally destroyed.

The embryonic condition of our specimen is clearly shown in the termination of the tail, which is heterocercal, a condition of which the last trace is indicated in the adult by the lateral line ending at the base of the upper, and not of the middle, caudal rays. In the dorsal fringe, as also in the other vertical fins, the rays are visible as minute and densely packed fibres.

The dorsal fringe surrounds the end of the notochord and is continuous with the portion (*c*) which, with growth, would be differentiated as the caudal fin, and in which the fibres are stronger and longer. The anal fringe (*a*) is separated from the caudal by the integument; a fringe (*pa*) similar to the anal exists in front of the vent (*v*), and runs for a short distance along the median line of the abdomen.

The fish is of a silvery colour, with pigment spots on the head, and others serially arranged along the terminal portion of the notochord.

Fig. K' represents the posterior end of the body much enlarged.

III. ANACANTHS.

Onus reinhardtii, Collett (Pl. III. fig. F.).

Adult specimens of this species were obtained by the "Knight Errant" in the Færøe Channel at a depth of 540 to 640 fathoms in 1880.¹ Two years later three young specimens, referable to the same species, were caught at the surface by the "Triton" (August 9, 1882). They have the compressed body of the *Couchia*-stage of this genus, and are silvery, with a green back. Their fin-formula I make out to be—D. 52. A. 45. P. 20. V. 8. The greatest depth of their body is one-seventh of the total length, the length of the head a little less than one-fourth. The eye is one-fourth of the length of the head and equal to the length of the snout, this portion of the head being more pointed and more projecting beyond the lower jaw than in the young of the

¹ See Report on Deep-Sea Fishes, Zool. Chall. Exp., pt. lvii. p. 98.

other British species. The maxillary extends backwards to below the middle of the eye, and the skin of the upper as well as of the lower jaw is perforated by a series of conspicuous pores. The mandibular barbel is quite as long as the eye, and a small cirrus represents the nasal barbel on each side. The foremost dorsal spine is prolonged, about half as long as the head. Vertical fins low, caudal with straight posterior margin. Ventral fin very narrow, longer than the pectoral, about as long as the head without the snout.

Vent equidistant from the snout and the last anal ray. Scales not formed, visible as flat granulations of the skin on the hinder part of the tail.

? *Raniceps trifurcus*, Walb., young (Pl. III. fig. E).

The little fish, described and figured here, has been in my possession for several years, without my being able to obtain other specimens of more advanced age, by the aid of which its true relations could have been ascertained beyond doubt. It is 25 mm. long, and was obtained in the North Atlantic at the surface, in lat. $52^{\circ} 33' N.$, long. $26^{\circ} 44' W.$ In referring it provisionally to *Raniceps*, a less amount of change has to be assumed to take place, than if it were associated with genera like *Phycis*, *Brosme*, &c. The fin-formula agrees fairly well with *Raniceps*, and it is possible that the rudimentary first dorsal fin of this genus is absent altogether in the young.

D. 69. A. 50. P. 24. V. 8. In the general form of the body this little fish resembles a *Couchia*; it is silvery, dark greenish on the back. Beside the very small mandibular barbel no other barbel can be distinguished. The length of the ventral fin is a conspicuous feature of this young fish, the middle rays being nearly as long as the head, and having the distal half of a black colour.

The depth of the body is one-fifth of the total length, the length of the head one-fourth. Eye large, longer than the short and obtuse snout, one-third of the length of the head. Cleft of the mouth oblique, with the maxillary reaching to below the middle of the eye.

The dorsal and anal fins are very low, the former commencing midway between the root of the ventral fin and the vent, and being preceded by a deep longitudinal groove, which runs along the middle of the back towards the head; no rudiments of an anterior dorsal fin can be discerned in it. Caudal fin as in *Couchia*, with a straight posterior margin. Pectoral fin with a broad base and the upper rays longest, reaching nearly as far back as the ventral. Ventral inserted on the side of the abdomen, a little in front of the root of the pectoral fin, and extending to the vent. Vent nearer to the root of the caudal than to the end of the snout.

Bregmaceros (Pl. III. figs. A-D).

The progress of our knowledge of this genus has been somewhat chequered. It was first described by William Thompson in Charlesworth (*Ann. and Mag. Nat. Hist.*, 1840, vol. iv. p. 184) from materials given to him by Cantor, viz., a young specimen 3 inches long, and a drawing which, with some serious imperfections, was reproduced as a woodcut to illustrate Thompson's description. The species was named *Bregmaceros maccelellandii*, and the genus recognised as a member of the family of Gadoids.

Ignorant of the existence of this paper, Sir J. Richardson redescribed and figured the same fish in the *Voy. Sulphur*, *Ichthyol.* (1843), p. 94, pl. xlvi. figs. 4-7, as *Calloptilum mirum*; and, although a much better figure was given by him, his description leaves as much to be desired as that by Thompson, owing to the small size of his examples, of which the largest was only 2·7 inches long, and is still preserved in the British Museum. He differed from Thompson in referring the genus to the Blennioid fishes.

Before comparing the descriptions given by these two zoologists, I must mention that Richardson himself in 1856 recognised the generic identity of the two fishes (*Encycl. Brit.*, ed. 8, vol. xii. p. 309), although he considered the species figured by him to be distinct from that described by Thompson. He also added to the generic diagnosis two apparently important characters, viz., *the absence of cæca and of an air-bladder*.

In 1862 I characterised the genus in the *Catalogue of Fishes* (vol. iv. p. 368) chiefly after Richardson, having no other material beside that used by my predecessor, and that considerably deteriorated. I differed from him, however, in adopting Thompson's views as regards the natural affinities of the genus, in giving different numbers of the fin-rays and scales, and, finally, in considering his *Calloptilum mirum* to be the same species as *Bregmaceros maccelellandii*. My reasons for taking this latter view were, and are, the following:—

The different statements made by the authors as regards the number of dorsal and anal rays are to be accounted for by the uncertainty of the number of short and rudimentary rays in the middle of those fins. In some specimens it is impossible, and in all very difficult, to ascertain their number; nor is there such a marked break in the formation of the fin, that one could say exactly with which ray the anterior division ends and with which the posterior begins.¹ The difficulties are, of course, the greater, the smaller the specimens; thus, Richardson gave in the small specimen, which he figured, thirteen as the number of rays composing the posterior dorsal, whilst I count fifteen or sixteen in the same specimen, and up to twenty in others. Similar

¹ In my diagnosis I have, therefore, expressed this uncertainty by the mathematical symbol x , which by some subsequent writers has been copied as the roman figure X.

difficulties present themselves as regards the number of scales, which in young specimens are extremely thin and deciduous, and were mostly lost in the examples examined by Thompson, Richardson, and myself. The discrepancies in the statement as to the course of the lateral line, and the presence or absence of vomerine teeth, are likewise to be accounted for by the indifferent condition of the examples examined; and, finally, the black colour of the fins is a character which is absent in young specimens, but becomes more conspicuous with age.

Fully adult examples were first obtained by Lieut.-Col. S. R. Tickell, who in 1865 described them in *Journ. Asiat. Soc. Bengal*, p. 32, accompanying the description with a figure which, but for the scaling, would be a very good representation of the fish. The author was not sufficiently acquainted with the literature, and therefore described the fish as new, naming it *Asthenurus atripinnis*; however, the synonymy was rectified immediately afterwards by myself in the *Zool. Record*, 1866, p. 197. Tickell discovered the existence of vomerine teeth, and of an air-bladder; and although he denies the presence of a "lateral line," he expressly mentions and figures a "mesial groove with a ridge along each side," which groove is, in fact, the lateral line.

Singularly, the same specimens, which had been deposited by Tickell in the Calcutta Museum, were described again as new by Mr. F. Day (*Proc. Zool. Soc. Lond.*, 1869, p. 522), as "*Bregmaceros atripinnis*, n. sp." The presence of vomerine teeth and a lateral line are denied in the diagnosis given by the author. Two pyloric appendages were found in this fish by the same author.¹

A second and very distinct form was discovered in New Zealand and described by Mr. Hutton in 1873,² under the name of *Calloptilum punctatum*. He states (correctly as I now think) that this fish should be placed into a distinct genus, but his description, as well as figure, were by no means satisfactory. Having received a half-grown specimen of this fish in 1876, I corrected Hutton's description in several points, expressing it as my opinion that "it should not be generically separated from *Bregmaceros macclellandii*," an opinion which, with perfect and adult specimens before me, I am obliged to abandon.

Lastly, the relation of these fishes is treated of by Mr. F. Day again in 1877.³ He treats of *Bregmaceros macclellandii* and *Bregmaceros atripinnis* as two distinct species, refers erroneously *Calloptilum punctatum* as a synonym of the latter, and misrepresents me as having identified the New Zealand fish with *Bregmaceros macclellandii*.⁴

Quite recently a fish apparently allied to these Indo-Pacific forms has been described by Messrs. Brown Goode and Bean,⁵ from the Mid Atlantic, under the name of

¹ *Proc. Zool. Soc. Lond.*, 1873, p. 112.

² *Trans. and Proc. New Zealand Inst.*, vol. v. p. 267, pl. xi., 1873.

³ *Fishes of India*.

⁴ I must also demur to this author crediting me with the grammatically erroneous term of "*Bregmaceros punctatum*." *Bregmaceros*, formed like *Rhinoceros*, is of the masculine gender.

⁵ *Bull. Mus. Comp. Zool.*, vol. xii. p. 165, 1886.

Bregmaceros atlanticus. Six specimens, the largest nearly 50 mm. long, were obtained by the "Blake," at depths varying from 90 to 305 fathoms. This occurrence, taken together with the facts that the Challenger obtained a young specimen in the open sea in the Pacific, that *Bregmaceros maclellandii* has a black-coloured pharynx, and that *Bregmaceros maclellandii* and *Bregmaceros punctatus* possess deeply sculptured cranial bones with wide muciferous cavities, proves that these fishes inhabit the open sea, and descend to considerable depths, although they seem not rarely to be met with close to the shore.

I have mentioned above that I agree now with Mr. Hutton in regarding the New Zealand form as the type of a distinct genus; Mr. Hutton adopted the second generic name given to *Bregmaceros maclellandii*, *Calloptilum*, for the genus which he established for the New Zealand fish, but according to a generally accepted rule of nomenclature, this course is not admissible, and a new name has to be given to the latter. It is not possible at present to determine to which of the two genera the young specimens obtained by the Challenger and "Blake" should be referred. The dorsal and anal fins are but little differentiated in the young of all these species, and the structure and changes of their ventral fins are very imperfectly known.

I proceed first to give the distinctive characteristics of the two genera:—

Bregmaceros, Thomps. = *Calloptilum*, Rich. = *Asthenurus*, Tick.

Body fusiform, compressed posteriorly, covered with cycloid scales of moderate size. Two dorsal fins, the anterior reduced to a single long ray on the occiput; the second and the anal more or less depressed in the middle, in adult specimens the middle rays becoming more or less obsolete, so that the fin appears to be divided into two. Ventral fins well developed, composed of five rays, the three outer of which are dilated and much elongated. Minute teeth in the jaws and on the vomer. Air-bladder large. Pyloric appendages few in number (two). Gill openings very wide, the gill membranes being united below the throat, and not attached to the isthmus. Pseudobranchiæ none. Branchiostegals seven.

Auchenoceros, Gthr. = *Calloptilum*, Hutt. nec Rich.

Head and body compressed, elongate, covered with small, exceedingly delicate and deciduous scales. Two dorsal fins, the anterior reduced to a single long ray on the neck, above the pectoral; the second more or less depressed in the middle; one anal. Ventral fins rudimentary, each composed of two slender elongate rays. Minute teeth in the jaws, none on the vomer. Air-bladder small. Pyloric appendages in moderate number (eight). Gill openings very wide, the gill membranes not being attached to the isthmus. Pseudobranchiæ none.

I note the following details for specific descriptions :—

Bregmaceros maclellandii, Thompson (Pl. III. figs. A, B).

Bregmaceros maclellandii, Thompson.

Calloptilum mirum, Richards.

Bregmaceros maclellandii (syn. *Calloptilum mirum*), Gthr.

Athenurus atripinnis, Tickell.

Bregmaceros atripinnis, n. sp., Day.

Bregmaceros atripinnis (excl. synonym.), and *Bregmaceros maclellandii*, Day.

D. 1 | 16-19 + x + 15-21. A. 22-30 + x + 20-22. V. 5-6. L. lat. 64-70.
L. transv. 14-16.

In an adult specimen from the Indian Ocean (Pl. III. fig. A) $4\frac{1}{2}$ inches long, the greatest depth of the body is below the origin of the soft dorsal fin, and contained five and a half times in the total length, without caudal. The head is small, short and broad, its length being contained six and a half times in the total length. The eye is rather large, two-sevenths of the length of the head, and equal to the width of the interorbital space; its upper half is covered with a transparent membrane. Snout short, shorter than the eye, obtuse, rounded, the lower jaw being received within the upper. Mouth of moderate size, the maxillary not extending to the hind margin of the orbit. Teeth in the jaws very minute, and those on the head of the vomer scarcely perceptible. The isthmus is broad and muscular, forming a broad support to the powerful ventral rays. The distance of the vent from the root of the ventral fins exceeds considerably the length of the head. The anterior dorsal ray is inserted above the præoperculum, and considerably longer than the head; it can be received in a groove on the back. The second dorsal fin commences opposite to the vent; its anterior portion is triangular in shape, with the longest rays about as high as the body underneath; a space about as long as the base of the preceding portion follows, and is occupied by a variable number of short and rudimentary rays. These rays gradually increase in length again, and form the posterior portion of the dorsal fin, which, however, is scarcely half as high as the anterior portion, and terminates at a short distance from the caudal. The anal fin commences and terminates almost opposite to the dorsal, resembling this latter in form and structure, but with a greater number of rays composing the developed portions. The caudal fin is short, with the hind margin slightly excised.

The pectoral fin is inserted rather high up the sides, and strongly asymmetrical; it is many-rayed, the rays being inserted on a long and broad base.

The ventral fins (a) exhibit a very extraordinary structure, and seem to be as much organs of touch as of locomotion. Each fin is composed of five or six rays, of which the three outer ones are enlarged, much prolonged, bearing a dilatation along each edge (a' , enlarged), and terminating in fine points. The two outermost rays are quite free, the

others being connected by membrane. The two or three innermost rays are quite short and much branched.

The ventral fins can be laid backwards in a groove running along the middle of the abdomen, and along each side of the anal fin backwards to its middle.

The whole fish is silvery, minutely dotted with brown, but these dots are visible in adult fish only after the scales have been removed. The vertical fins, the pectorals and the short ventral rays are black, which colour is only gradually assumed as the fish grows older. In very young specimens all the fins are pellucid. The pharynx is black.

A specimen obtained by the Challenger near Amboina, $12\frac{1}{2}$ lines or 27 mm. long, agrees in all points with the adult, especially in the structure and form of the fins; only the head is comparatively longer. But in a specimen of 7 lines or 15 mm., of which unfortunately only a drawing could be preserved, the sections of the dorsal and anal fins are not yet differentiated; these fins being subcontinuous with the caudal (see Pl. III. fig. B). In this drawing no pectoral fin is shown.

Auchenoceros punctatus, Hutton (Pl. III. fig. C).

Calloptilum punctatum, Hutton.

Bregmaceros punctatus, Gthr.

D. 1 | 18-22 + x + 32. A. 57-60. V. 2.

In a specimen $4\frac{1}{4}$ inches long the greatest depth of the body is below the origin of the soft dorsal fin, and contained five times and three-fourths in the total length without caudal; the head is compressed and nearly one-fifth of the total length. Eye of moderate size, as long as the snout, a little less than two-sevenths of the length of the head or than the width of the interorbital space. Snout as long as the eye, with the cleft of the mouth oblique, the lower jaw slightly projecting beyond the upper; mouth rather wide, the maxillary not extending to the hind margin of the orbit; teeth in the jaws villiform, vomer and palatine bones toothless. The isthmus is very narrow. The distance of the vent from the root of the ventral fins is not more than the length of the head without snout.

The anterior dorsal ray is inserted above the root of the pectoral and about as long as the head; there is no groove on the back for its reception. The second dorsal fin commences behind the vent; its anterior portion is lower than the body underneath; a space longer than the base of this portion follows, and is occupied by a variable number of very rudimentary rays. These rays gradually increase in length again, and form the posterior portion of the dorsal fin, which, however, is not half as high as the anterior portion, and terminates at a short distance from the caudal. The anal fin commences immediately behind the vent, that is, in advance of the dorsal, and terminates opposite to the last dorsal ray; its middle rays are but slightly shortened; the caudal fin is rounded,

of moderate length, embracing a considerable part of the tail, the rudimentary rays advancing far forward on the upper and lower sides of the tail.

The pectoral fin is inserted in the middle of the side, asymmetrical, many-rayed, as long as the head. The ventral fins (*c*) are inserted at some distance from each other; their base is very small, and each is composed of two very slender rays, the longer of which reaches beyond the vent.

The scales are lost but to judge from the folds of the skin they must have been extremely thin and very small.

The entire fish is uniformly silvery.

A young specimen (Pl. III. fig. D), 19 mm. long, obtained on the 15th of September 1873, indicates the presence of another species in the Pacific, but as the specific characters in this genus evidently change with age, I hesitate to introduce it with a distinct specific name. It seems to have a smaller eye than the other species; the ventral fins are two-rayed but much stronger than in *Auchenoceros punctatus*; the anterior dorsal ray is placed opposite to the operculum; the long dorsal and anal fins commence opposite to each other; they are not divided into separate portions and continuous with the caudal fin; but this is probably only a sign of young age.

Fierasfer acus, Brünn., young (Pl. IV. fig. F).

In the year 1860, Kaup¹ described a small fish in the British Museum as the type of a new genus, *Porobronchus*. T. Gill² alludes to it in these words:—"As to *Porobronchus*, Kaup, it is, perhaps, related to *Fierasfer*; but the character of the first elongated dorsal ray requires to be known before a decision can be arrived at;" whilst I³ stated it to be the young of *Fierasfer acus*. It is 2½ inches long and not in a good state of preservation. A very similar fish, probably of the same species, was examined by Gasco⁴ who published almost simultaneously with my observation a description and figure of it, considering it to be the type of a new genus, *Vexillifer*. His specimen was 20 mm. long and re-examined by Costa⁵ who adopted Gasco's nomenclature. However, some years later, Emery⁶ confirmed my view as to the nature of this fish, from an examination of very young examples which are undoubtedly *Fierasfer acus*.

The most conspicuous characteristic of these young *Fierasfer* is the presence of an extremely long anterior dorsal ray which bears a variable number of small skinny lobes. As the fish grows, this ray is lost or shortened by absorption. The specimens observed by the Italian naturalists showed this ray more or less completely developed, whilst in Kaup's specimen the greater part of the ray and every trace of the lobes had dis-

¹ *Ann. and Mag. Nat. Hist.*, 1860, ser. 3, vol. vi. p. 272, pl. iii. fig. D.

² *Ann. and Mag. Nat. Hist.*, 1865, ser. 3, vol. xv. p. 48.

³ *Bull. Assoc. Natur. e Med. Napoli*, 1870, April, p. 59, c. tab.

⁴ *Ann. Mus. Zool. Napoli*, vi, 1871, p. 88, tav. 2, fig. 1.

⁵ *Atti Soc. Ital. Sci. Nat.*, xxi. 1878, p. 37, figs. 1-3; and *Atti R. Accad. d. Lincei*, 1879-80, vol. vii. tav. 1, a.

⁶ *Catal. Fish.*, vol. viii. p. 145, 1870.

appeared. In the specimen which I describe here, it is reduced to a short rudiment. Evidently it is of use only whilst the young fish leads a free and pelagic life, and disappears when the *Fierasfer* assumes the habits of a commensal.

There cannot be much doubt as to our specimen representing a more advanced stage of the young of *Fierasfer acus*, the resemblance of its head and of the proportions of its body to young *Fierasfer acus* from the Mediterranean being very great. However, it should be remembered that that species has hitherto not been found so far northwards as the British Channel, whilst another species of the genus, *Fierasfer dentatus*, is known, though from two specimens only, to occur on the Irish coast.¹ We possess two representations of the young of this species, a very rude one by Putnam,² and an excellent one by Emery,³ both of which agree in showing that the young of *Fierasfer dentatus* is a much more slender form than that of *Fierasfer acus*. The latter species therefore has to be added to the British fauna.

The specimen is 104 mm. long, the head measuring $5\frac{1}{2}$ mm., and the distance of the snout from the beginning of the anal fin 11 mm. Head and tail are much compressed, the latter terminating in an extremely fine filament into which the vertebral elements do not enter. The eye is of moderate size, rather shorter than the snout, which is obtuse, with the jaws equal in front. The maxillary extends beyond the centre of the eye and the few teeth which can be observed are minute. The abdomen projects much, the vent being behind and not in front of the projection. The dorsal fin commences very little in advance of the anal; of the long ray which is so remarkable a feature in very young specimens, only a short rudiment remains. The fin behind the ray is at first only a low ridge which becomes higher towards the middle of the length of the tail, and decreases in height again behind. In its entire course it is conspicuously lower than the anal fin, which, about the middle of its length, is nearly as high as the body above.

The specimen was obtained on August 9, 1882, in the Farøe Channel, close to the surface, during the cruise of H.M.S. "Triton."

Of the two figures on Plate IV. the upper represents the specimen of the natural size, the lower the anterior part of the body enlarged.

PLEURONECTIDÆ.

Eight young specimens were obtained in the Mid Atlantic swimming at the surface at night, on August 16, 1873, and on April 18, 1876. They are 1 inch long, perfectly symmetrical, and agree entirely with the "pelagic Plagusia" of the same size described and figured by Steenstrup. They do not throw further light on their origin, which is still obscure.

On April 11, 1876, when sailing off the coast of Sierra Leone in lat. $7^{\circ} 33' N.$, and

¹ Collett has described another specimen from Norway, *Christian. Vidensk. Forhandl.*, 1882, No. 19, c. tab.

² *Proc. Boston Soc. Nat. Hist.*, 1874, vol. xvi. p. 347 (*Encheliophis tenuis*).

³ *Atti R. Accad. d. Lincei*, 1879-80, vol. vii. tav. 1, a.

long. 15° 16' W., small Pleuronectidæ were obtained in the towing-net, the relation of which to adult forms is at present likewise perfectly obscure.

They (Pl. I. fig. B) have a length of 6 and 7 mm. The notochord is distinct in its whole course, with its diphyccercal termination. The eyes are symmetrical; no pigment is to be seen on any part of the body except in three spots placed in a triangle opposite to the end of the notochord. The fin-rays are perfectly developed, no part of the embryonic fin-membrane remaining. The dorsal and anal portion pass uninterruptedly into the rayed fringe surrounding the termination of the tail. Very peculiar is an exceedingly long filamentous ray placed in front of the dorsal fin somewhat in advance of the eye. Neither pectoral nor ventral fins can be distinguished, but this may be owing to the condition of the specimens, which were mounted for microscopical examination immediately after their capture. Also the configuration of the bones of the side of the head is indistinct, but the mouth appears to have been of moderate width, and is armed with a few tooth-like apophyses.

Another larval Pleuronectoid, figured on Pl. IV. fig. E, is possibly the young of a *Solea*. It is only 5½ mm. long, and was obtained at the surface, off the mouth of the Plate River on February 26, 1876. It was stained and mounted for the microscope, scarcely more than the outlines being visible; the posterior outlines of the head are very indistinct. The specimen is not far advanced beyond the embryonic condition, and its abdomen protrudes as a rounded sac. The tail tapers and is diphyccercal; eyes and the small mouth symmetrical. Snout very short, with a parabolic outline; eye small, nearer to the angle of the mouth than to the upper profile. Fin-rays are developed and differentiated only anteriorly on the back, the remainder of the fin showing a finely striated appearance throughout its length, in its continuation round the end of the tail to the vent. The two first fin-rays stand above the eye, are much elongate, nearly 3 mm. long, and are followed by about eight developed rays. Pectoral and ventral fins apparently absent.

In a young Pleuronectoid (Pl. IV. fig. D), 13½ mm. long, obtained in the surface-net on the passage from the Admiralty Islands to Japan, March 1875, the fins and rays are much more developed. The body is whitish, semitransparent, like that of a *Leptocephalus*, the eyes and mouth are symmetrical. The anterior profile of the snout is parabolic; the small eye is close to the anterior profile, above the angle of the narrow mouth. Abdomen pendent and protruding. Pectoral well developed, on both sides, with broad base; a rayed fold of the integument, attached to the abdominal sac, represents the ventral fin. The vertical fins are continuous, but the caudal projects as a distinct portion and is composed of twelve rays. Dorsal rays about one hundred, anal seventy-four.

This large number of fin-rays would seem to indicate that this fish is the young of some species of *Synaptura*.

IV. PHYSOSTOMI.

Scopelus, Gthr.

In the Report on the Deep-sea Fishes (p. 195) I have already shortly described the habits of these fishes. They are truly pelagic, but rarely or accidentally coming into the vicinity of land. They are exceedingly common in all seas of the Tropical and Sub-tropical zones, becoming scarcer in higher latitudes, a few species reaching the Arctic and Antarctic circles. Some of the species have a very wide range, and the limits of distribution of others are determined by latitude rather than longitude.

Of the numerous specimens obtained by the Challenger only a few were adult, the majority under 18 lines long, the smallest measuring from 5 to 7 mm. These younger specimens were generally destitute of scales and semipellucid; neither had they the phosphorescent organs developed. In two of the larger individuals, about 1 inch long, the scaly covering was perfect, but of the phosphorescent organs only a few on the side of the head and one at the root of the ventral fin were developed. I was unable to decide whether this paucity of phosphorescent organs indicates specific distinctness or is characteristic of stages of growth.

The specific determination of the majority of these small *Scopeli* is not only a matter of considerable difficulty, but generally of great uncertainty. It would be impossible to avoid mistakes which of necessity would lead to erroneous notions as to the occurrence of a species at a certain season in some area of the ocean. The following species, however, could be made out with a sufficient degree of exactness:—

1. *Scopelus caninianus* (Mus. Brit., an Cuv. Val?). This species is not confined to the Mediterranean and Atlantic, where a specimen 3 inches long was obtained off the Cape Verde Islands on April 28, 1876, but is also tolerably common in the Pacific. Specimens from 20 to 36 lines long were caught at night in the tow-net in the neighbourhood of New Guinea, on November 5, 1874, and February 26, 1875, and also on the passage to the Admiralty Islands.

2. *Scopelus coccoi* (Cocco). Of this small but most common and most widely distributed species some eighty specimens were collected; south of Cape Verde Islands (April 28, 1876), on the passage to the West Indies, in the South Atlantic (March 7, 1876), in the South Pacific (October 20 and November 5, 1875), in Mid Pacific (August 25, 1875), near the Admiralty Islands, and on the passage to Japan. The size of the specimens ranged from $\frac{1}{2}$ to $2\frac{1}{4}$ inches.

3. *Scopelus nigro-ocellatus* (Gthr.). The type, the only specimen previously known,

was caught in the South Atlantic. Two specimens, $1\frac{1}{2}$ inches long, were obtained during the passage of the Challenger from the Admiralty Islands to Japan (April 1875).

The other species of this genus obtained during the voyage were described in the deep-sea series, as there was no reason to doubt their occurrence beyond the 100 fathom line.

Finally, during the cruise of the "Triton" in the Færøe Channel in 1882 a small number of young *Scopeli* were obtained, partly with the surface-net at night, partly with the tow-net, which with a line of 350 and 600 fathoms was worked at various depths. The dates of capture were on August 9, 20, 21, and 30. Their length varies from 9 to $16\frac{1}{2}$ mm., the largest being perfectly developed, and having their specific characters sufficiently distinct. Unfortunately the scales are either entirely, or for the greater part, lost.

I am unable to refer these specimens to a described species of the genus. They differ especially from the other species described from northern seas (*Scopelus glacialis*, *Scopelus krøyeri*), either by the number of the fin-rays, or by a conspicuously smaller eye; they come nearest to *Scopelus glacialis*, and also to a species known from New Zealand (*Scopelus hectoris*), but differ from the latter in the relative position of the dorsal and ventral fins. There is, therefore, sufficient ground for introducing this new addition into the British fauna¹ under a distinct name.

Scopelus scoticus, n. sp.

D. 10-11. A. 16. C. 8 | 20 | 8.

Total length $16\frac{1}{2}$ mm. The height of the body ($3\frac{1}{3}$ mm.) is two-ninths of the total length (without caudal, 2 mm.), the length of the head ($2\frac{2}{3}$ mm.) one-fourth; the least depth of the tail is much less than one-half of that of the body. Diameter of the eye rather longer than the snout, but less than one-third of the length of the head and considerably less than the postorbital portion of the head. Snout with the upper profile rather straight, curved in front only, and with the lower jaw slightly projecting beyond the upper. Maxillary reaching to the angle of the præoperculum, and terminating in an elongate triangular dilatation. Posterior margin of the præoperculum vertical. Scales of the lateral line apparently not larger than the others; phosphorescent organs in the same number and arrangement as in the allied species. Origin of the dorsal fin nearer to the root of the caudal than to the end of the snout, behind the base of the ventrals. Pectoral rather short.

In a specimen 14 mm. long the scales are developed, also nearly all the phosphor-

¹ The cruise of the same vessel yielded another addition to the bathybial fauna of the British seas. A specimen of *Stomias ferox* (Reinhardt), 37 mm. long, was obtained in the dredge on August 9, 1882, at a depth of either 327 or 430 fathoms.

escent organs are present, some with a silvery centre, surrounded by a pigmentary ring, others without the silvery centre.

A specimen, $11\frac{1}{2}$ mm. long, is semitransparent, whitish, without scales; of the phosphorescent organs only the one on the side of the head, covered by the præopercular limb, is visible as a black round pigment spot.

Specimens, 9 mm. long, are without any trace of phosphorescent organs; but the fins and fin-rays are perfectly differentiated.

This species seems to lack the phosphorescent organs on the back of the caudal peduncle.

Diplophos.

Diplophos, Günth., Journ. Mus. Godeffroy, ii. 1873, p. 101.

Body much elongated, band-shaped (covered with large thin deciduous scales?). A double series of phosphorescent organs runs along the lower side of the body and tail. Head compressed, with pointed snout and projecting lower jaw. Mouth very wide but slightly oblique; jaws armed with small pointed teeth rather unequal in size; eye of moderate size; paired fins well developed; dorsal fin in advance of the anal, behind the ventral; adipose fin none; anal very long.

Diplophos tænia (Pl. IV. fig. C).

Diplophos tænia, Günth., *loc. cit.*, p. 104.

D. 8. A. ca. 43. V. 8.

The length of the head is one-sixth of the total length, the greatest depth of the body only one-sixteenth. Snout more than twice as long as the eye, pointed, with the lower jaw longest. The maxillary reaches backwards far behind the eye. Dorsal fin short, its first ray somewhat nearer to the end of the snout than to the root of the caudal; anal fin commencing below the last dorsal ray, and ending at a short distance from the caudal. Paired fins short; pectoral inserted near to the lower profile; ventrals reaching nearly to the origin of the dorsal. The phosphorescent organs are rounded black bodies, without silvery centre; they are very numerous and arranged in two parallel series along each side of the lower profile. Those of the upper series are smaller than those of the lower, are quite round and do not extend so far towards the head and the caudal, as the lower. The lower are larger and transversely oblong. A pair of still larger luminous organs occupies a position in front of the base of the lower caudal rays. Brownish.¹

The largest of three specimens is only $1\frac{1}{2}$ inches long; they were obtained at night by the tow-net in lat. 30° S., long. 24° W.; and in lat. 22° N., long. 30° W.

¹ After fifteen years' immersion in spirit the colour of these specimens is faded into dull white.

Diplophos pacificus, n. sp. (Pl. IV. fig. B).

D. 12. A. 53. P. 9. V. 7.

The length of the head is one-fifth of the total length, the greatest depth one-tenth. Snout thrice as long as the eye, and the maxillary extending far behind the eye, nearly to the præopercular angle; eye one-seventh or one-eighth of the length of the head. Cheek covered by the enlarged suborbital bones. Dorsal fin higher than the body, its origin nearer to the end of the snout than to the root of the caudal fin; its last rays are opposite to those of the anal. Anal extending to within a short distance of the caudal fin, its anterior rays are longest, but shorter than those of the dorsal; ventral fin rather long, reaching to the origin of the dorsal fin, more than twice as remote from the pectoral as from the dorsal. A singular spine-like projection opposite to the last anal ray may be an accidentally detached portion of the root of the caudal fin, or represent a rudimentary adipose fin.

The phosphorescent organs are arranged as in *Diplophos tania*, but are more developed, having a silvery centre with a black ring, not only those of the main series but also the smaller ones of the secondary series. Another series of small organs runs along the middle of the side of the body and seems to be a specialized lateral line. Other luminous organs, but very indistinct, can be seen on the hyoid bone.

Brownish, with silvery lustre.

A single young specimen of this interesting fish was obtained on September 2, 1875, in Mid-Pacific (lat. 5° 54' N., long. 147° 2' W.), in the tow-net which had been attached to the dredge. Although the dredge descended to a great depth, there is no doubt that the specimen was obtained close to the surface; it is 37 mm. long, that is, nearly of the same length as the typical specimen of the Atlantic species. It had been mounted as a microscopic preparation in glycerine, and has suffered considerably from this mode of preservation. Although nearly of the same size as the types of the Atlantic species, it is more advanced in development, as is evident from a comparison of the luminous organs.

Fundulus nigrofasciatus, Lesueur.

A specimen, 1¼ inches long, was obtained on the passage from Tenerife to St. Thomas, West Indies, in the tow-net, in company with other pelagic surface fishes.

The capture in mid-ocean of a species inhabiting the fresh and brackish waters of the Atlantic States of North America is of great interest. It illustrates the way in which reputed fresh-water species are spread to distant coasts by crossing wide expanses of ocean. The wide and irregular distribution of Cyprinodonts generally is probably to be thus accounted for.

Ovum of a Scombresocid (Pl. V. fig. E).

The surface-net enclosed in the Atlantic on February 29, 1876, a single ovum, 2.5 mm. in diameter, which by the development on its surface of long filaments proves to be that of a member of the family of Scombresocidæ. The embryo is considerably advanced in development, its outlines being clearly visible. The ovum differs from that of *Belone* and *Scombresox* in having shorter and fewer filaments; also the filaments have no swelling at the base. It may be that of an *Exocoetus*, the ovum of which I believe is still unknown.

The ovum, which was mounted in glycerine for the microscope immediately after capture, gives the impression of a regular arrangement of the filaments in four concentric circles on each hemisphere, and with a single filament at each pole.

Hemirhamphus sp., young.

One specimen only can be referred with certainty to this genus, but it is not sufficiently advanced in growth to determine the species. It is $1\frac{1}{8}$ inches long, and was captured on the passage from Tenerife to St. Thomas in the West Indies. The lower jaw projects $\frac{3}{16}$ of an inch beyond the upper, the latter being short and broad as in the mature fish; no teeth whatever can be distinguished in this specimen.

Scombresox, young.

The fry and young of this genus belong to the most common forms of pelagic life, and numerous specimens up to $1\frac{2}{3}$ inches in length were captured by the tow-net. Those from the Atlantic I have referred to *Scombresox saurus*, and those from the Pacific to *Scombresox forsteri*, without being able to discover in these immature specimens the slight differences by which those closely allied species are distinguished. Of the dates of capture of the Atlantic specimens were noted March 7, April 28, and May 7 (1876); the Pacific specimens are from 1 to $1\frac{2}{3}$ inches long, and were captured on various occasions in the month of July, 1875.

Belone sp., young.

Among the numerous pelagic young Scombresocidæ collected by the Challenger, or obtained from other sources, there is only one which I can refer without hesitation to *Belone*. It was caught in September about forty miles north of Demerara, and is 21 mm. long. It cannot be determined specifically. The body is subcylindrical in shape with a rather elongate caudal fin. Both jaws are prolonged and toothed, but the length

of the lower, measured from the eye, is $4\frac{1}{2}$ mm., whilst the upper measures 2 mm. only. The basal half of the lower jaw is armed on the sides with strong curved teeth rather distantly placed, the teeth of the upper jaw being smaller, more closely set, nearly uniform in size, and occupying the entire length of the intermaxillaries.

Exocoetus, L.

Of this pelagic genus comparatively few specimens were obtained, the majority being young. The fins do not seem to undergo important changes with growth, with the exception of the caudal fin, which I have found in some specimens, not in all, unusually long. The coloration is not a reliable guide in the determination of young examples, for whilst the colours which ornament the mature fish, especially the fins, in some of the species, are not developed in the young, bands and spots of brown or black colour adorn the young of other species, but disappear with age.

The specimens collected by the Challenger are referred to the following species :—

Exocoetus obtusirostris, Gthr.

Beside a specimen, 8 inches long, which entered the tow-net at night in the North Atlantic on April 28, 1876, and which undoubtedly belongs to this species, five other examples, from 1 to $2\frac{1}{4}$ inches long, were obtained on various occasions in the Tropical Atlantic (August 14, 1873 ; April 28, 1876). These young specimens might be referred with equal right to *Exocoetus evolans*, L.

Exocoetus spilurus, Gthr.

This species is known from young specimens only. Two, 1 to $1\frac{1}{4}$ inches long, were obtained by the Challenger in Gulf-weed, south of Bermuda.

Exocoetus solandri, C. V. (Pl. IV. Fig. A).

Exocoetus solandri, Cuv. Val., xix. p. 129.

In my general account of the Flying Fishes,¹ I have already shown that the fish from Otaheiti, described by Solander and figured by Parkinson, is a different species from the Flying Fish from the Seychelles, with which Valenciennes had identified it, dedicating it to the memory of Solander. Some time ago I found among a number of East African specimens a Flying Fish which closely agrees with Valenciennes' description, showing at the same time that the specimen which I had formerly referred to *Exocoetus solandri*,

¹ Catal. Fish., vol. vi. pp. 280, 285.

and from which I drew up a diagnosis, must belong to another and distinct species. Its pectoral fins and manibulary appendages are, however, too much injured to allow of its characteristics being ascertained. I take now this opportunity of giving a diagnosis of the true *Exocoetus solandri*:—

D. 12. A. 11.

Form of the body very slender, its depth being only one-seventh of the total length (without caudal), the length of the head one-fifth. Snout rather long and pointed, the mandible projecting; eye a little shorter than the snout, and two-sevenths of the length of the head.

The anterior part of each mandible is furnished with a broad, delicate, black skinny flap, bearing on its edge several cirrhi, some longer than others, as long as the eye. The dorsal fin is very high, its longest (middle rays) extending to the middle of the upper caudal lobe; the anal is only half as high, its first ray being opposite to the third or fourth of the dorsal. Pectoral fin reaching to the end of the base of the dorsal; its upper ray simple, two-thirds the length of the third, the second ray forked, the third the longest. Ventral fin inserted midway between the root of the caudal and the eye, and reaching to the caudal. (Scales lost.) Silvery with greenish back; three broad (rose-coloured?) bars cross the abdomen in front of the ventral fins; another bar behind the ventral, and a more indistinct one across the front of the base of the anal fin. The greater part of the dorsal fin, the postero-inferior half of the pectoral, and the ventrals black; an oblique band across the lower caudal lobe and the outer half of the anal fin blackish.

The specimen is $5\frac{2}{3}$ inches long.

Exocoetus naresii, n. sp. (Pl. I. fig. A).

D. 10. A. 8. L. lat. 45.

Allied to *Exocoetus comatus*, but with less dorsal rays and longer fins; a single black, very long and broad, cutaneous appendage, which fringes the lower jaw in its entire circumference, does not quite extend to the root of the ventral fin; it is supported by a mid-rib of a whitish colour. The pectoral fin extends to the last dorsal ray, the ventral to the root of the caudal. The ventral is inserted midway between the head and the root of the caudal. Dorsal fin rather low. The height of the body equals the length of the head without snout, the length of the head being one-fourth of the total (without caudal). Snout shorter than the eye, which is one-third of the length of the head; interorbital space scarcely concave, broad, its width being more than the diameter of the eye. Pectoral blackish, with the exception of the three or four lower

rays; posterior rays of the dorsal and anal fin blackish; ventrals black, with the inner and outer rays white.

One specimen, 7 inches long, came on board ship between the Fiji and New Hebrides Islands, August 16, 1874.

(?) *Exocoetus affinis*, Gthr.

Two specimens, 1 and $1\frac{1}{4}$ inches long, were obtained in Gulf-weed, south of Bermuda. It is impossible to determine whether these young *Exocoetus* should be referred to *Exocoetus lineatus* or the allied *Exocoetus affinis*.

Exocoetus rondeletii, C. V.

Two specimens, $\frac{3}{4}$ and 1 inch long, off the Cape Verde Islands, on April 24 and 29, 1876.

Exocoetus simus, C. V.

Exocoetus simus, Cuv. Val., xix. p. 105.

Not having had a specimen of this species before, I give here a detailed specific description.

D. 12. A. 8. L. lat. 46.

Closely allied to *Exocoetus callopterus* and *Exocoetus brachysoma*.

The height of the body is one-fifth or less than one-fifth of the total length, the length of the head one-fourth or less than one-fourth. The depth of the head is somewhat more than the distance between the extremity of the snout and the hind margin of the præoperculum. Snout obtuse and depressed, its length being three-fifths of the diameter of the eye, which is a little less than one-third of the length of the head, and less than the width of the interorbital space, which is flat. The pectoral fin extends to, or somewhat beyond, the end of the dorsal. Ventral fins midway between the root of the caudal and the gill-opening, not extending to the end of the base of the anal. The dorsal commences far in advance of the anal, its anterior rays being half as long as the head. *The distance between the first dorsal ray and the first rudimentary caudal ray is conspicuously more than the length of the head.* There are thirty-one scales between the occiput and the origin of the dorsal, and eight longitudinal series of scales between the origin of the dorsal and lateral line. Some (the largest) specimens have some round black spots in small or at least not considerable number between the pectoral rays. In other specimens these spots are only indicated, and again in others

entirely absent, the lower rays being whitish. Ventrals nearly uniformly white, or with the outer ray slightly tinged with grey. No black on the dorsal fin.

This is the first species of *Exocoetus* in which I have found the coloration of the pectoral fin varying. There can be no doubt as regards the specific identity of the specimens before me.

Ten specimens, from $10\frac{1}{2}$ to 13 inches long, were obtained at Honolulu. The Sandwich Islands seem to be the only locality at which this species has been found hitherto.

Astronesthes niger, Rich.

This fish was included in the Report on Deep-Sea Fishes, as specimens were recorded from a depth of 2500 fathoms. However, as mentioned there (p. 203), it is one of the most common of pelagic forms in the Atlantic as well as in the Indian Ocean, and, therefore, is caught on almost every voyage during which the tow-net is used. Also, the Challenger obtained a surface specimen near the west coast of Africa on April 28, 1876. The habits of this fish are nocturnal.

Halaphya, n. gen.

I propose this generic name for three specimens, 26 mm. long., and 1.5 mm. deep, which were obtained at the surface, in the open sea, on the passage from Sydney to Wellington. They are evidently the young, and probably a very early stage of growth, of a fish which shows some affinities to *Microstoma*. Costa (Faun. Regn. Napol. Pesc.) figures on pl. xl. fig. 4, a small fish which must have been very similar to *Halaphya*; but neither description nor name seem to have been published by him in explanation of the figure.

There is, however, another fish from the Southern Indo-Pacific, which has to be considered in determining the origin of these young specimens, viz., *Gonorhynchus*. The fishes of this genus are rather scarce, but extend from the Cape of Good Hope to New Zealand, and Japan. The form of the body, the position and shape of the fins, and even the number of fin-rays of *Halaphya* are remarkably like those of *Gonorhynchus*, but the form of the snout is entirely different. We should be obliged to assume that with advancing growth the upper jaw is produced into a long proboscis, at the end of which a barbel is developed. A change like this is not without parallel in the development of fishes, but without knowing any of the intermediate stages we should not be justified in assuming it in this case. Of the development of *Gonorhynchus* nothing whatever is known.

With the materials at present available the genus may be characterised as follows:—

Body elongate, rather compressed, naked, with black (phosphorescent) spots. Cleft of the mouth very small. Eye of moderate size. Dorsal fin short, opposite to the space between ventrals and anal; adipose fin none; anal short; caudal emarginate. Gill-openings wide.

An affinis *Microstomati*?

Halaphya elongata, n. sp. (Pl. VI. fig. C).

The general form of the body and the position of the fins will be seen from the figure. The specimens are perfectly transparent and of the same white colour which the *Leptocephali* assume after immersion in spirits. No scales can be discovered on any part of the body. A series of minute specks of black pigment runs along the intermuscular line of the side of the body, and similar specks occupy the upper and lower margins of the free portion of the tail. These pigment spots remind us of similar organs in the *Leptocephali*, and many young Scopelids. The snout is obtuse, with a narrow transverse anterior mouth. The gill-openings are wide, the gill-membrane being grown to the isthmus anteriorly for a short distance only. Pectorals well developed; ventrals shorter. A very distinct fold of the skin runs from the pectoral along the median line of the abdomen to the vent. Dorsal and anal fins of moderate height, with the rays well developed. D. 12. A. 9. Caudal emarginate behind.

Prymnothonus (Pl. V.).

In the Ichthyology of the Voyage of the "Erebus" and "Terror," Richardson figured a small fish which he named *Prymnothonus hookeri*, and which was known to him from a sketch only, drawn by Dr. Hooker from the fresh specimen. He could not add any further information, the notes made at the time by Dr. Hooker having been mislaid, but he says that the specimen measured $1\frac{1}{4}$ inches in length. It had perished before the collection reached Sir John Richardson's hands. Although I applied again after the return of the Challenger for further information to Sir Joseph Hooker, he was unable to recollect any particulars as regards the capture of the specimen, or the circumstances under which it was obtained.

The Challenger collection contains three specimens which evidently belong to the same kind of larval form, for such *Prymnothonus* proves to be. These specimens are not in a good state of preservation, and as they are unique, only a portion of their structure can be ascertained.

The smallest of the specimens (Pl. V. fig. A), was obtained in the North Pacific, on

July 2, 1875, and is 12 mm. long and 1 mm. broad. It represents evidently a somewhat less advanced stage of the same group of fishes than the following. The snout is much distorted, but the general form and structure of its component parts were probably the same as in the next largest specimen, although rather shorter. The eye is extremely large and of an oval shape, occupying nearly the whole depth of the head. The termination of the tail is diphyercal; the embryonic fin-fringe commences on the back as a transparent rayless membrane in about the middle of the length of the fish, the dorsal rays becoming a little more distinct further behind, all being much more feeble than those of the ventral side. The anal fin becomes distinct behind the middle of the length of the body, is higher than the dorsal, and after having proceeded for a short distance, the rays become abruptly longer, stronger, and more closely set, and are supported by hæmal elements nearly to the end of the chorda. The situation of the vent, and the position of the paired fins, if they be present, cannot be ascertained.

The second specimen (Pl. V. fig. B) is 14 mm. long, and was obtained on May 3, 1876, on the surface of the North Atlantic. It is elongate, band-shaped, with pointed, subconical snout. The mandibular and maxillary bones are long, and the cleft of the mouth extends to below the eye. Teeth, as represented by Richardson in *Prymnothonus*, cannot be detected in this specimen. The eye is large. The vent is clearly distinct at a distance from the head which is nearly equal to the length of the latter. Behind the vent a low embryonic fringe commences, which is continued round the tail, terminating on the back in about the middle of the length of the fish. The fringe is striated or rayed throughout, but the rays are exceedingly fine in the anterior half of the anal portion, become then suddenly longer and stronger, forming a kind of lobe, and are shorter again round the caudal extremity. The termination of the vertebral column is heterocercal, the end of the chorda being bent upwards and continued beyond a group of hæmal elements supporting an assemblage of stronger rays which in the adult fish would be developed into a distinct caudal fin. Of the paired fins the pectorals are clearly developed, but I cannot detect a trace of ventrals. Behind and above the pectorals a larger and two smaller roundish black spots are visible below the transparent integument, which are the liver and other abdominal organs. A similar black spot existed in the specimen of *Prymnothonus hookeri*, and was misunderstood by Richardson, who, having a drawing only for his description, considered it to represent the gill-opening. As far as I am able to judge from the specimen described here, the gill-opening is wide, and at its usual place.

The specimen of which Richardson (*loc. cit.*) has given a figure, reproduced here (Pl. V. fig. C), seems to have been intermediate, as regards development, between that just described and the third discovered by the Challenger. The termination of the tail is homocercal, with a distinctly differentiated caudal fin, which, however, is continuous with the dorsal and anal. The dorsal extends only a short way forward on the tail, but

the anal is continued as an even broad fringe to the vent. A dark shaded portion of this anal fin seems to indicate also, in this specimen, the presence of a permanent anal, the position of which corresponds closely to that of a similar structure in our first and in the following specimen. The vent is placed far forwards, at a distance from the head less than the length of the latter. Abdominal organs visible through the thin integument of the walls of the abdomen. Pectoral present. Eye of moderate size. Snout produced, with wide cleft of the mouth, which was armed with pointed teeth. This specimen was $1\frac{1}{4}$ inches or about 32 mm. long; it was not preserved, nor is it known where it was caught.

The fourth specimen known of *Prymnothonus*, the third of the Challenger collection, is 44 mm. long, and was obtained on February 26, 1874, south-west of Kerguelen Island, in lat. $62^{\circ} 26' S.$, long. $95^{\circ} 44' E.$, in the dredge, which had reached the depth of 1975 fathoms. However, it is more probable that it entered the dredge near the surface, like the other specimens. The head and body are slender (Pl. V. fig. D), the greatest depth of the former being only 2 mm., and that of the middle of the body $1\frac{1}{2}$ mm. The body is compressed, of a whitish colour, no muscular segmentation showing through the integuments. Only the tough wide sheath of the notochord remains, without a trace of ossification. Many of the cranial bones are distinctly ossified. Tail homocercal, with a well-formed bilobed caudal fin; at a distance of 6 mm. in front of the caudal a rayed anal fin commences, which, however, shows rays in the middle only, passing into the remains of the embryonic fin anteriorly and posteriorly; opposite to this anal, in front of the caudal, a dorsal fin is represented by a short strip of the embryonic fin-fringe.

The head is $7\frac{1}{2}$ mm. long, with a prolonged, straight, pointed snout (4 mm.). The cleft of the mouth extends backwards to the eye; jaws armed with widely set, strong, acute teeth, unequal in size. Eye large, projecting. Pectoral fin small, but I have been unable to distinguish ventral fins or the position of the vent. The abdominal cavity seems to have been as long as the head. As in the other specimens, the dorsal and ventral muscles have not yet met in the median line of the side of the abdomen, so that the abdominal organs are covered by the integument only, through which the outlines of the stomach are clearly visible.

I have no doubt that all these specimens represent larval conditions of fishes belonging to *Paralepis* or *Sudis*, or of genera allied to them. That they all are stages of development of the same generic type of fishes is very improbable, but the second and third specimens may well be considered to be the same type, which provisionally may be designated by the name proposed for it by Richardson.

Muræna sp.

A specimen, 3 inches long, obtained at the surface between Tenerife and St. Thomas, West Indies, although very young, has all the characters of an adult fish, and no trace of Leptocephaloid structure. The species cannot be determined.

Leptocephalus, Gron.

Singularly, few specimens only were collected during the expedition; and these do not throw new light upon the question of their origin.

a-f. Obtained in Mid Atlantic on March 4, 1874. They belong to the form which has received the name "*pellucidus*," and other names. The specimens vary much with regard to the relative length of the body.

g. Off the west coast of Africa; lat. 10° 55' N., long. 17° 46' W.; April 13, 1876.

a. Obtained on the west coast of Africa; surface; August 16, 1873; form, "*Leptocephalus morrisii*."

a. Obtained near the Admiralty Islands, March 16, 1875; form, "*Leptocephalus tænia*."

a. North Atlantic; April 13, 1876; form, "*Leptocephalus brevirostris*."

V. PLECTOGNATHS.

Balistes sp.

Three specimens, 5 lines long, from driftwood, north of Papua; February 21, 1875.

Tetrodon sp.

Two specimens, $\frac{1}{3}$ inch long, at the surface, between Tenerife and St. Thomas, West Indies.

VI. LEPTOCARDII.

Branchiostoma, Costa.

The littoral specimens of *Branchiostoma* collected during the voyage, belong to *Branchiostoma belcheri*, Gray, and *Branchiostoma cultellum*, Ptrs., and were obtained, the former at Samboangan, the latter on the north coast of Australia. They are mentioned here, because they were received too late to be introduced into the Report on the Shore Fishes.

Beside these species there is represented a third by a specimen labelled "Deep haul, 1000 fathoms. Pacific, July 26, 1875." On this date the Challenger was in lat. $23^{\circ} 3'$ N., long. $156^{\circ} 6'$ W., a few degrees north of Honolulu. This specimen, therefore, was captured in the open sea, at a great distance from land; but it would seem to be uncertain whether it came from that great depth or from the surface. On the one hand, as living specimens of *Branchiostoma* are always observed to sink to the bottom after some almost convulsive motions to wriggle themselves towards the surface, it is difficult to see how a Lancelet could maintain itself at the surface in the open ocean; on the other hand, the perfect condition of the delicate fin-fringe would suggest that the specimen could not have been hauled up from so great a depth, without showing signs of injury. However this may be, the specimen, although approaching in form, and in the number of myocommas, *Branchiostoma belcheri*, differs from it in the shape of the caudal fin, and especially from this and all the other species by the absence of buccal cirrhi.

Branchiostoma pelagicum, n. sp. (Pl. VI. fig. B).

The specimen is 10 mm. long and 1 mm. deep; it was mounted in glycerine for the microscope at the time of its capture.

The anterior end of the notochord is enveloped in a very strong sheath; the posterior ($\frac{1}{2}$ mm.) is not covered by the myocommas, which leave off abruptly, and extends right to the hind margin of the caudal fin. Eye distinct; nerve-cord with minute pigment-spots arranged intracentrally with regard to the myocommas. Dorsal fin-rays low, but very distinct, about five to each myocomma. The dorsal fin-fringe commences to become distinct about the twenty-seventh myocomma, gradually becoming somewhat higher behind. Its rise is more abrupt where it passes into the caudal fin, which is paddle-shaped and bilaterally symmetrical with regard to the notochord. The lower half of the caudal passes uninterruptedly into the ventral, in which no rays are developed. This fin seems to be continued forward as a very low fringe for some distance beyond the supposed position of the atrial pore. Nearly the whole of this fringe shows a minute vertical striation, especially in its higher portions.

The number of myocommas is sixty-seven, of which fifteen belong to the tail. How many should be attributed to the portion between vent and atrial pore is uncertain on account of the difficulty in ascertaining the position of the latter. I have been unable to make out this pore, and infer its position to be opposite to the thirty-sixth myocomma only from analogy or comparison with other species, and from a slight contraction of the muscular layer at this spot.

Buccal tentacles are absent; this cannot be due to the age of the individual, as they

are clearly developed in specimens of *Branchiostoma belcheri* (?) of only half the size of this specimen.

Gonads not fully developed, extending from the first to the twenty-sixth myocomma, and forming two series in the middle. The atrial cavity extends somewhat behind the supposed position of the atrial pore.

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PLATE I.

PLATE I.

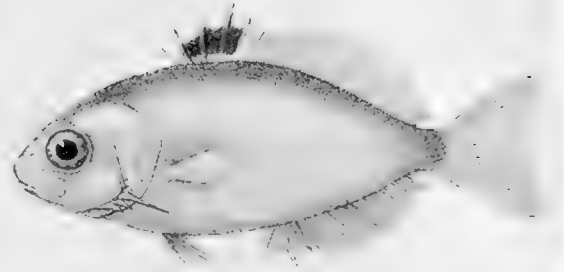
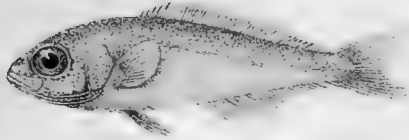
Fig. A. *Exocoetus naresii*, nat. size, off Cape York.

Fig. B. Young of Pleuronectoid, 6 mm. long, off coast of Sierra Leone.

Figs. C, D. *Thyrsites prometheus*, young, 5 and 10 mm. long, the former from south of Yeddo, the latter from north of the Sandwich Islands.

Figs. E, F. *Seriolichthys bipinnulatus*, young, 13 and 25 mm. long, north of New Guinea.

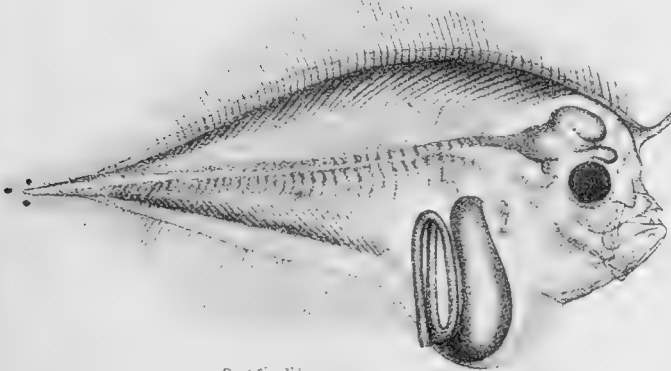
Fig. G. *Lichia glauca*, young, 10 mm. long, off west coast of Africa.



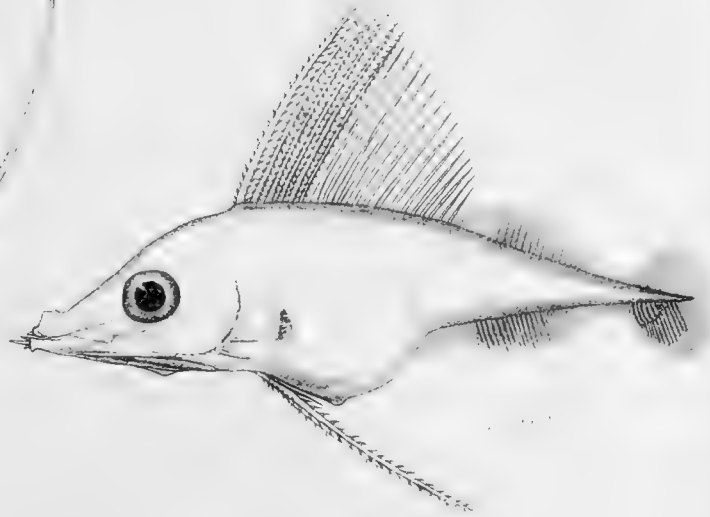
(10 mill.)



F (13 mill.)



B (6 mill.)



A (nat size)

PLATE II.

PLATE II.

Figs. A-C. *Cubiceps gracilis*, nat. size. A. from Madeira, B. from the Azores, C. from Messina.

Fig. D. *Thynnus thunnina*, young, 17 mm. long, West Pacific.

Fig. E. *Lirus paucidens*, 35 mm. long, West Pacific.

Fig. F. *Lirus porosus*, head of a specimen 30 mm. long, off Kermadec Islands.

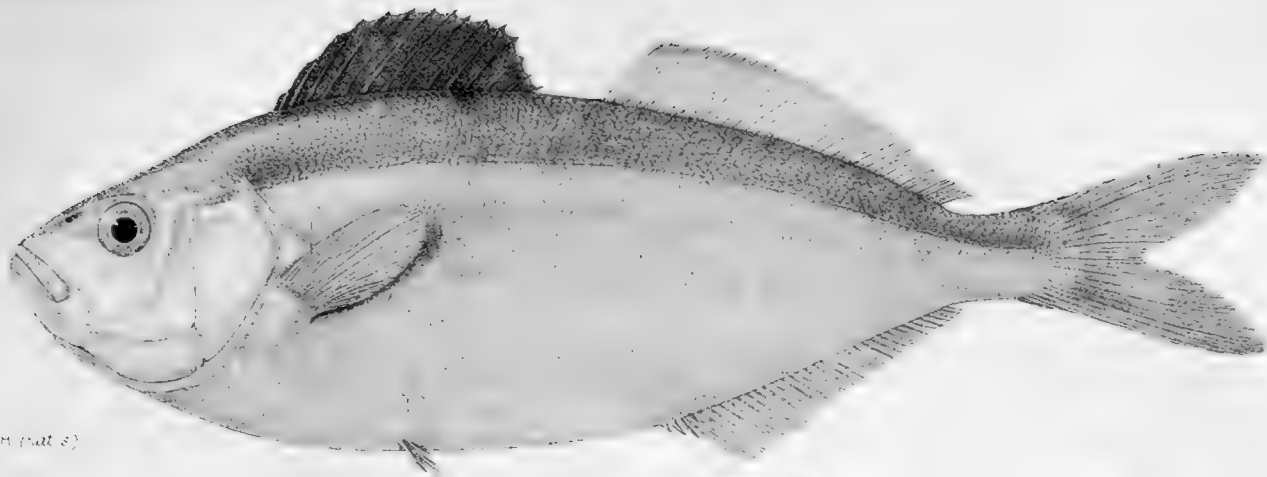
Fig. G. *Psenes arafurensis*, nat. size, from the Arafura Sea.

Fig. H. *Platystethus huttonii*, nat. size, New Zealand.

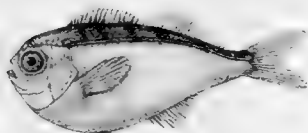
Fig. I. *Platystethus huttonii*, young, 26 mm. long, South Pacific.

Fig. K. *Lophotes cepedianus*, young, 11 mm. long, West Pacific.

Fig. K'. Posterior end of the same, much enlarged. *c.* Caudal fringe; *a.* anal fringe; *pa.* præanal fringe; *v.* vent.



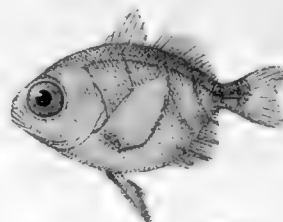
H (nat s)



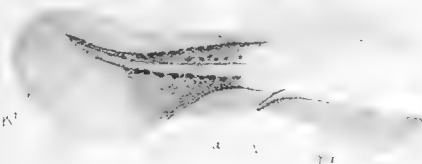
I (60 mill)



K



G (nat)



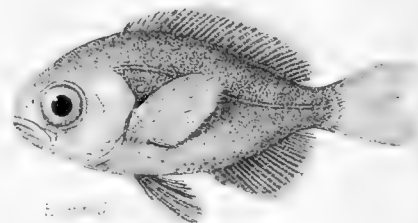
L



D (17 mill)



F (30 mill)



E (nat)

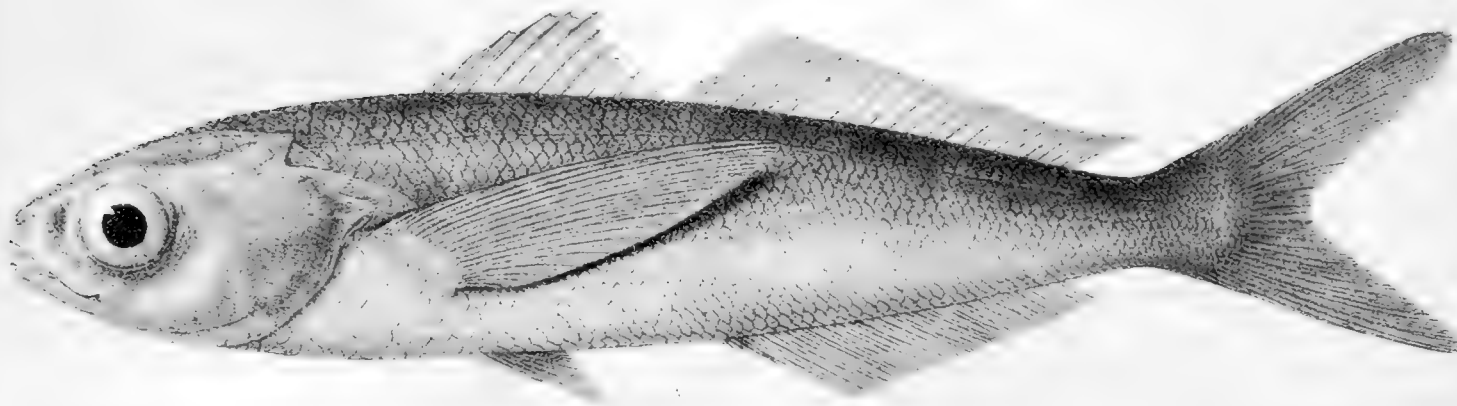
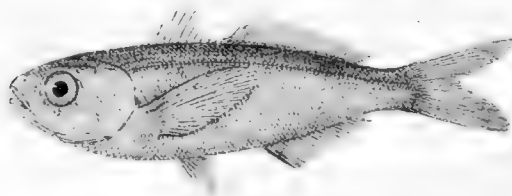


PLATE III.

PLATE III.

Fig. A. *Bregmaceros maclellandii*, adult, nat. size, Indian Ocean. *a*. Lower view of thorax, to show arrangement of ventral rays ; *a'*. portion of long ventral ray, enlarged.

Fig. B. *Bregmaceros maclellandii*, young, 15 mm. long, Indian Archipelago.

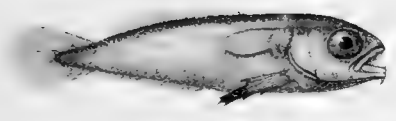
Fig. C. *Auchenoceros punctatus*, adult, nat. size, New Zealand. *c*. Lower view of thorax, to show ventral fins.

Fig. D. *Auchenoceros* sp., young, 19 mm. long, Pacific.

Fig. E. ?*Raniceps trifurcus*, young, 25 mm. long, North Atlantic.

Fig. F. *Onus reinhardtii*, young, 40 mm. long, Færoe Channel.

Fig. G. *Trigla macrodactylus*, young, 16 mm. long, off the coast of Sierra Leone.



E. (25 mill.)

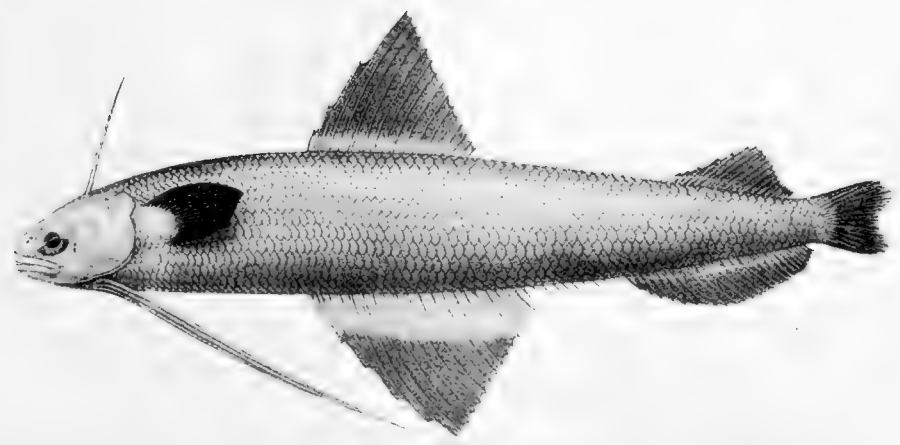
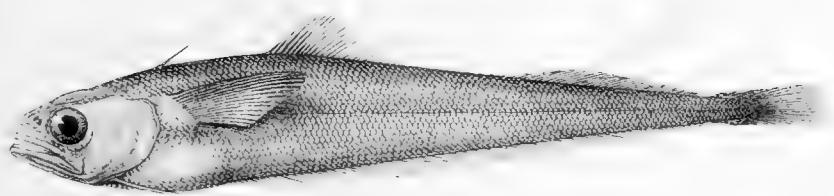
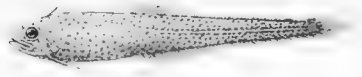
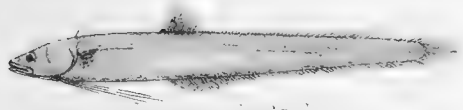
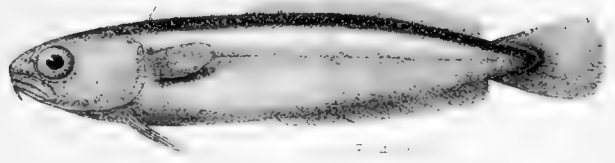


PLATE IV.

PLATE IV.

Fig. A. *Exocoetus solandri*, nat. size, East Africa, with lower view of snout to show barbels.

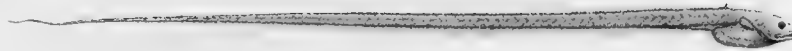
Fig. B. *Diplophos pacificus*, 37 mm. long, Mid Pacific.

Fig. C. *Diplophos tænia*, 38 mm. long, South Atlantic.

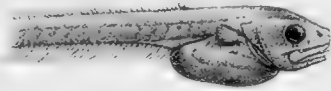
Fig. D. *Synaptura* sp., young, $13\frac{1}{2}$ mm. long, West Pacific.

Fig. E. *Solea* sp., young, $5\frac{1}{2}$ mm. long, off the mouth of the Plate River.

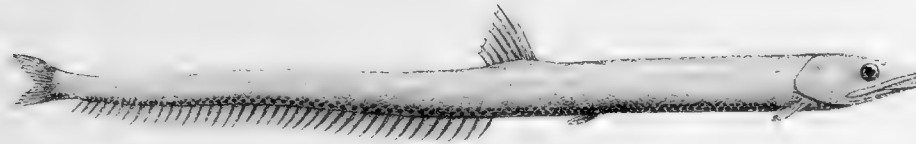
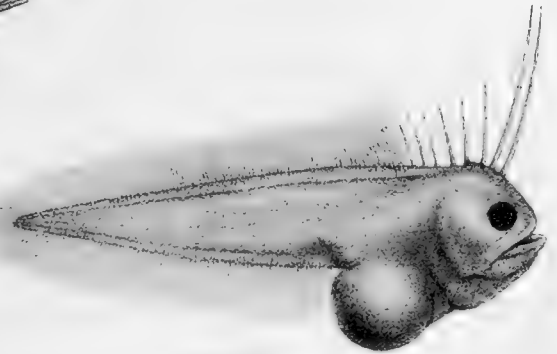
Fig. F. *Fierasfer acus*, young, 104 mm. long, Færoe Channel; with enlarged figure of anterior part of body.



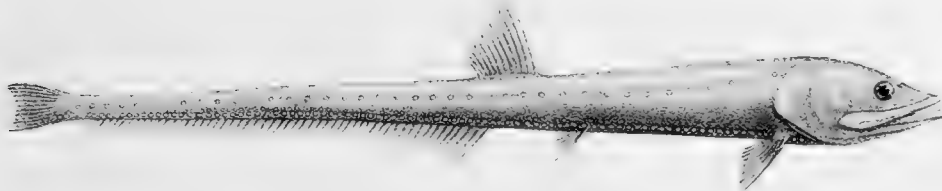
F. (104 mill.)



D. (13 1/2 mill.)



C (38 mill.)



B (37 mill.)



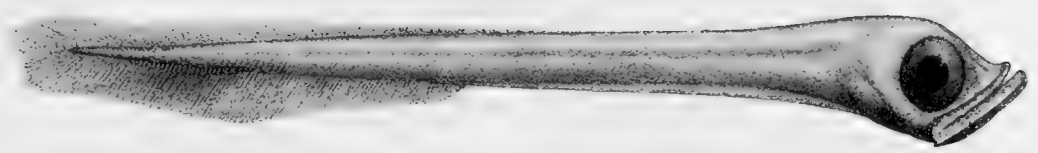
A. EXOCOETUS SOLANDRI B. DIPLOPHYS PACIFICUS C. DIPLOPHOSTENIA D. SYNAPTURA E. SOLEA, young F. HIERASPER ACUS, young

PLATE V.

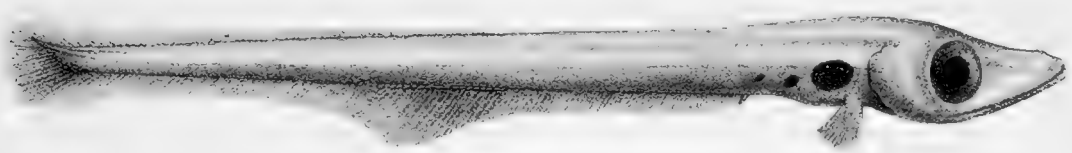
PLATE V.

Figs. A-D. *Prymnothonus*. A. 12 mm. long, North Pacific; B. 14 mm. long, North Atlantic; C. 32 mm. long, reproduced from Voy. Sulph. Ichthyol., place of capture unknown; D. 44 mm. long, with separate view of dentition, Antarctic.

Fig. E. Ovum of a Scombresocid, $2\frac{1}{2}$ mm. in diameter Tropical Atlantic.



A. (12 mill.)



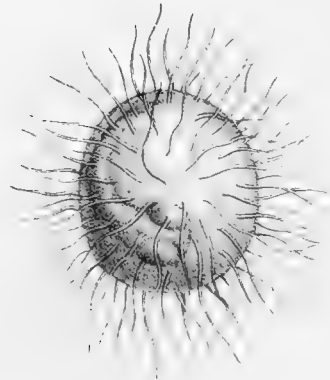
B (14 mill)



C. (32 mill)



44 mill



E (2, 5 mill)

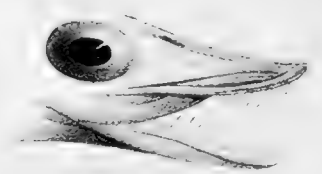


PLATE VI.

PLATE VI.

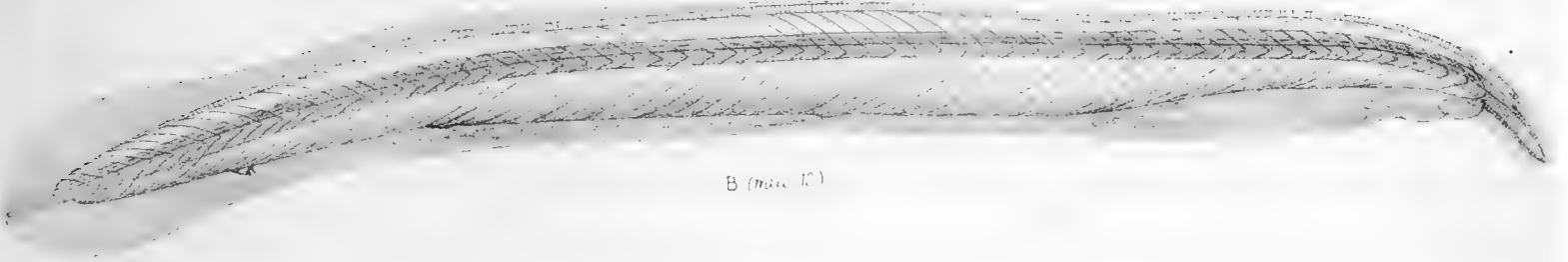
Figs. A, A'. *Lepidothynnus huttonii*, reduced in size, New Zealand. A. from a sketch ;
A'. skeleton, from a photograph ; *a*. scale, nat. size.

Fig. B. *Branchiostoma pelagicum*, 10 mm. long, Mid Pacific.

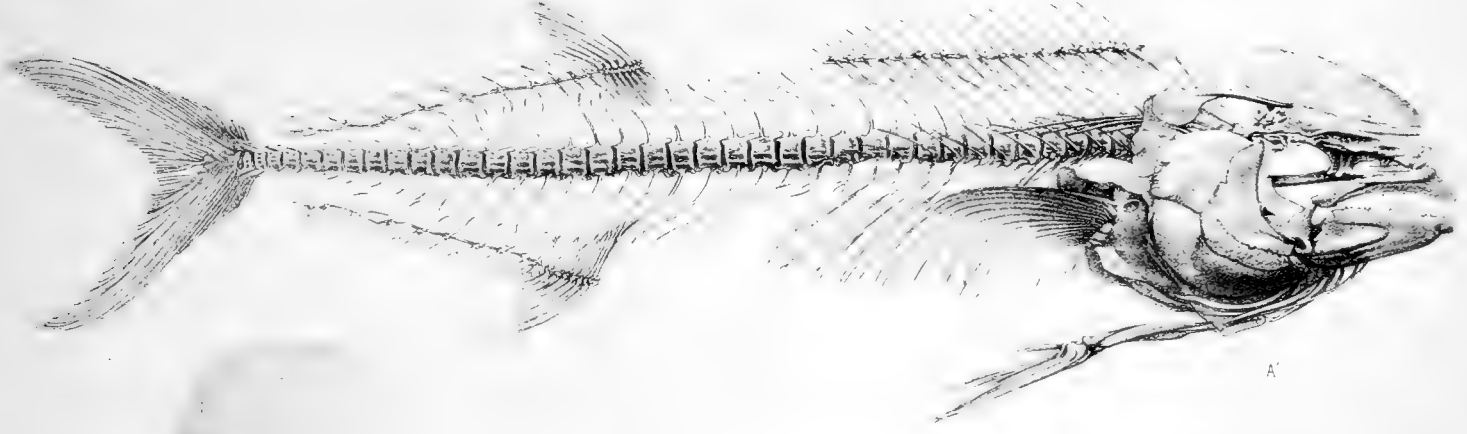
Fig. C. *Halaphya elongata*, 26 mm. long, South Pacific.



C (mill. 26.)



B (mill. 10.)

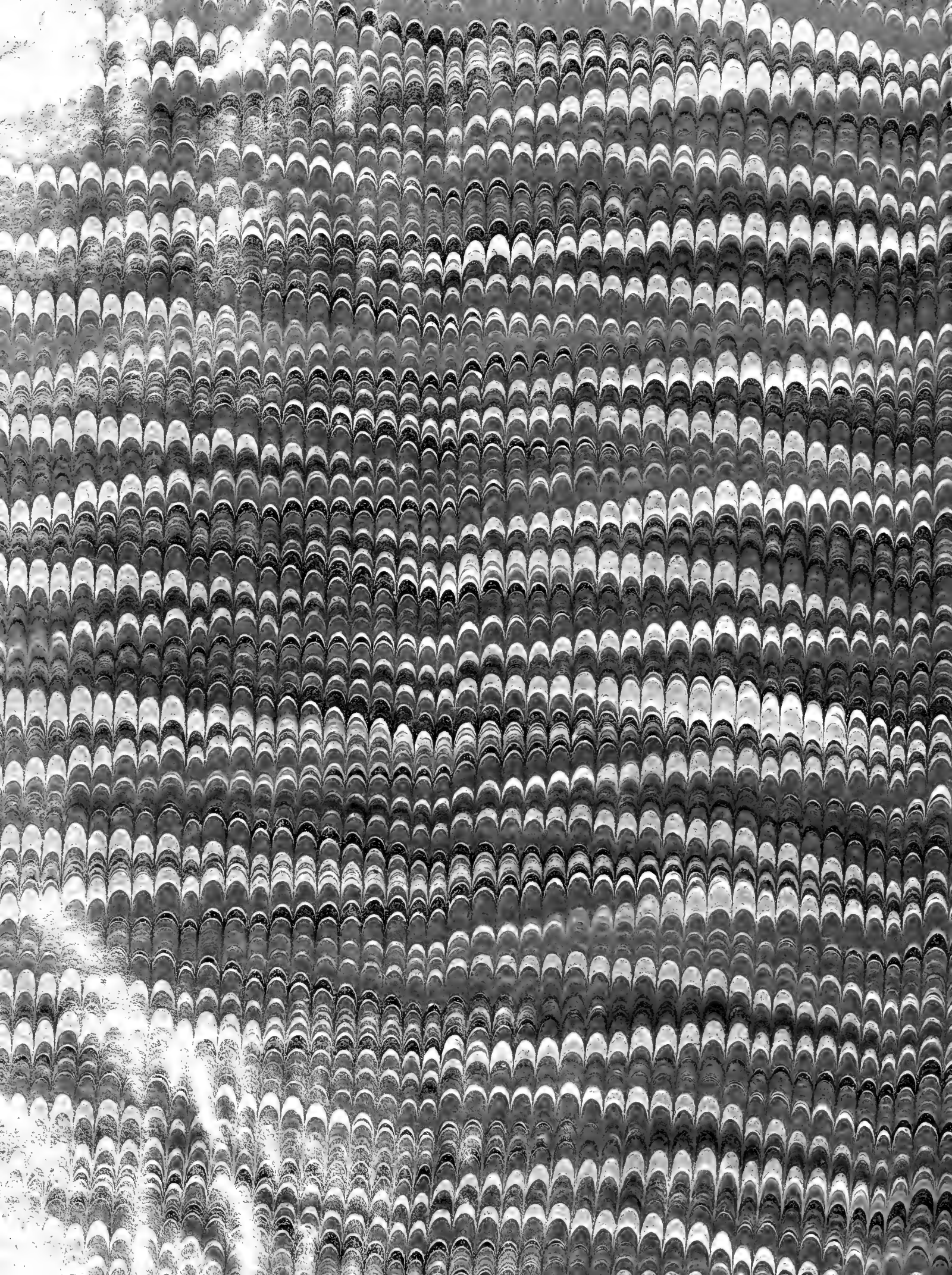


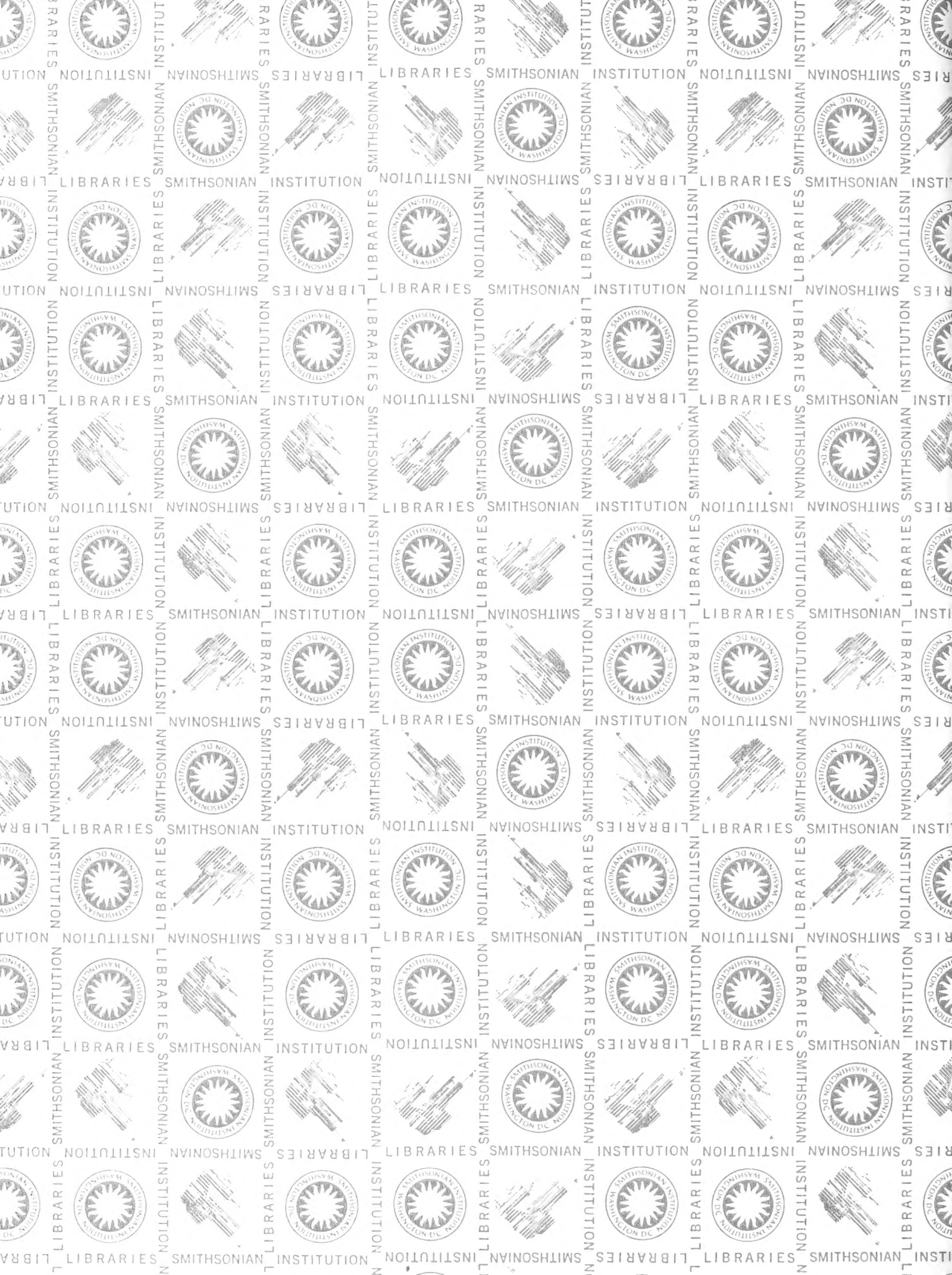
A'

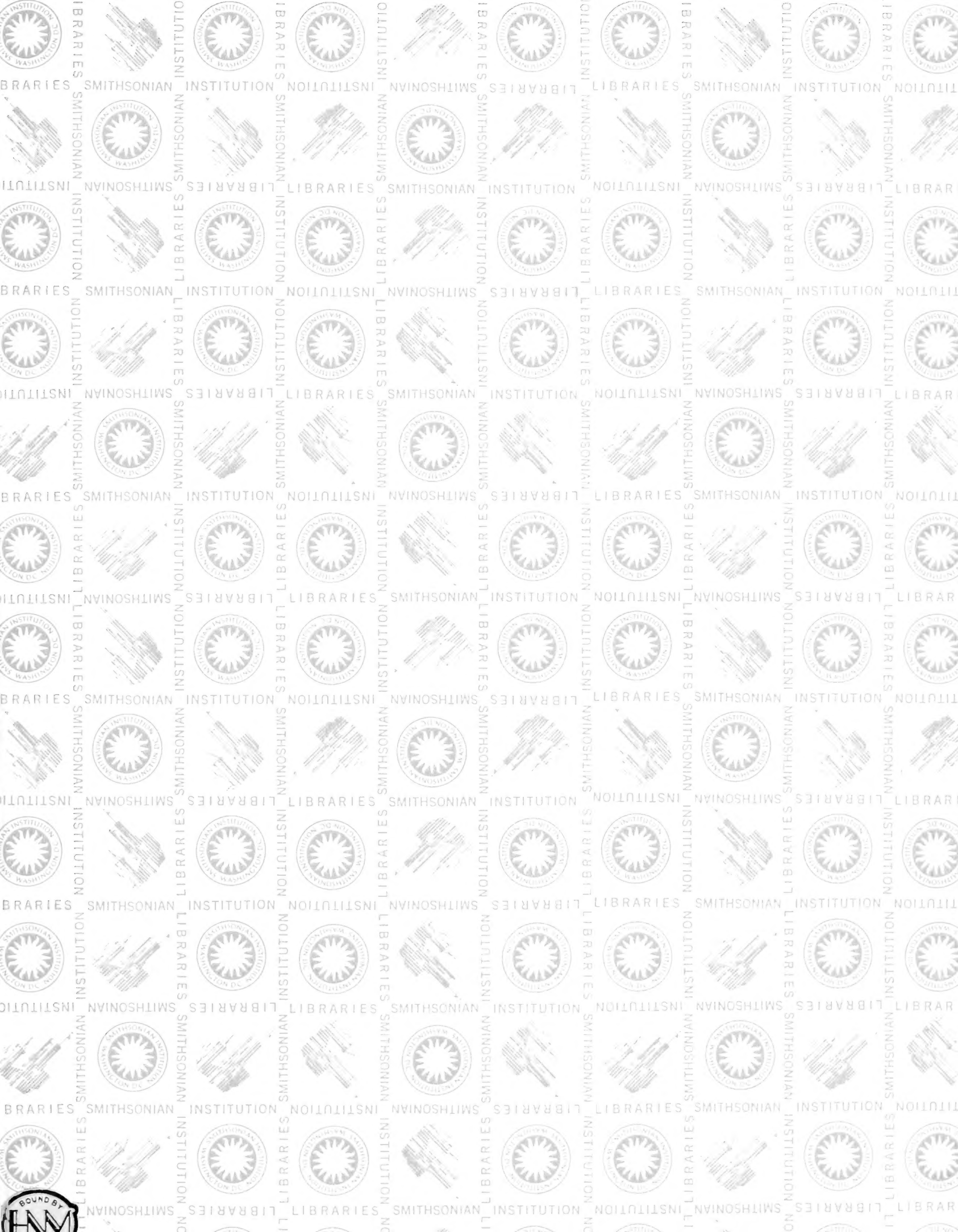


A









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