

11.—*Natural History Notes from H.M. Indian Marine Survey Steamer 'Investigator,' Commander R. F. Hoskyn, R.N., commanding.*—Series II., No. 1. *On the Results of Deep-sea Dredging during the Season 1890-91.* By J. WOOD-MASON, Superintendent of the Indian Museum, and Professor of Comparative Anatomy in the Medical College of Bengal, and A. ALCOCK, M.B., Surgeon I.M.S., Surgeon-Naturalist to the Survey.

[Plates VII. & VIII.]

ON the 18th October, 1890, the 'Investigator' left Bombay for the Andaman Islands, and on the 9th December following she crossed from the Andaman Islands to the Madras coast, reaching Bimlipatam on the 26th December. During these passages fifteen hauls of the trawl were taken in depths ranging from 95 to 1997 fathoms, and numerous deep-sea soundings were made.

Between Bombay and Colombo, in the Laccadive Sea, numerous soundings were taken and four very successful trawlings were carried out. In this sea the bottom appears to be mainly green mud, with a small percentage of Foraminifera shells: in the immediate neighbourhood of the Laccadive Islands there is, of course, a great deal of fine coral detritus. The feature of these hauls were the starfishes, which will be duly noticed in the sequel.

Between Colombo and the Andamans three successful hauls of the trawl besides many soundings were taken. The deep open part of the Bay of Bengal here worked over shows a bottom of *Globigerina*-ooze with numerous water-worn fragments of pumice; but as one proceeds north-eastwards stiff blue mud is met with. The two deep hauls on this course gave a fine lot of starfishes and Holothurians. The third haul (Station 112), in 561 fathoms, must be particularly noticed. The trawl-bag came up crammed with mud of a low temperature, in which the specimens were imbedded. It may be surmised that compression under a great weight of cold mud kept up an approximation to normal bathybial conditions of temperature and pressure, in order to account for the fact that many of the crustaceans taken were found to be alive. Among these three species of Macrurous Decapods—*Aristans*, sp. n., *Heterocarpus Alphonssi*, Sp. Bate, and *Willemoesia forceps*, A. M.-Edw.—were discovered to be luminous. In the case of *Heterocarpus Alphonssi* clouds of a pale blue highly luminous substance, which not only illuminated the

observer's hands and surrounding objects in the vessel in which the creature was confined, but also finally communicated a luminosity to the water itself, were poured out apparently from below the bases of the antennae. The *Aristæus* was less, and less persistently luminous in the same region. The *Willemoesia* was luminous at two circumscribed points somewhere near the orifices of the genital glands.

In the Andaman Sea four good hauls were made. The bottom to the north appears to be in general blue mud; to the south there is a good deal of green mud. From experience in this and previous seasons the moderate depths of the Andaman Sea in its southern half appear to swarm with life. Station 114 (922 fathoms) in the Andaman Sea must have a special word of notice. The trawl-bag here again came on board choked with cold mud, out of which a gigantic specimen of *Colossendeis gigas*, Hoek, was washed alive. The ventral surface of the body and the ventral surfaces of all the legs except the ovigerous pair shone with a brilliant blue-green metallic lustre, which died away quickly from the body and part of the legs, but remained very persistently along the fifth and sixth segments of all but the first pair of legs.

Crossing the Bay of Bengal from the Andamans to Madras and on the continuation of the passage northwards to Bimlipatam four successful hauls were carried out; and between the parallels of 11° and 12° N. a continuous line of soundings was taken across the Bay. This section of the Bay shows a flat plain rising very abruptly to land on either side, the bottom being impure *Globigerina*-ooze (except, of course, near the land), with large water-worn fragments of pumice. The features of the deep hauls on this line were the magnificent starfishes and Holothurians.

Considering now the results of our trawling from the bathymetric point of view, without any reference to locality, we find that in the Indian seas the depths most favourable to animal life are the moderate depths at 100 to 400 fathoms. At this limit everywhere we find life to be varied and abundant, the fishes and Crustaceans especially being taken in swarms and in great variety.

The following is the list of the 'Investigator' deep-sea dredging stations during the season 1890-91:—

Station No.	Position.	Depth in Fathoms.	Nature of Bottom.	Temperature Fahr.	
				Surface.	Bottom.
106	Laccadive Sea, lat. $9^{\circ} 53' 34''$ N., long. $75^{\circ} 16\frac{1}{2}'$ E.	1091	Green mud, about 3 per cent. Foraminifera.	83.5	37.5
107	Laccadive Sea, lat. $8^{\circ} 23' N.$, long. $75^{\circ} 47' E.$	733	Green mud.	79.5	41.9
108	Laccadive Sea, lat. $7^{\circ} 04' N.$, long. $76^{\circ} 34' 15'' E.$	1043	Green mud, with Foraminifera.	80	38
109	Gulf of Manaar, lat. $7^{\circ} 41' N.$, long. $78^{\circ} 21' E.$	733	Green mud.	81	42
110	Bay of Bengal, lat. $9^{\circ} 34' N.$, long. $85^{\circ} 43' 15'' E.$	1997	<i>Globigerina</i> -ooze, with pieces of pumice.	81.3	35
111	Bay of Bengal, lat. $12^{\circ} 50' N.$, long. $90^{\circ} 52' E.$	1644	<i>Globigerina</i> -ooze.	81	35.4
112	Bay of Bengal, lat. $13^{\circ} 47' 30'' N.$, long. $92^{\circ} 36' E.$	561	Grey mud.	75.4	44.9
113	Andaman Sea, lat. $12^{\circ} 59' N.$, long. $93^{\circ} 23' 10'' E.$	683	Blue mud.	76.5	42.9
114	Andaman Sea, lat. $13^{\circ} 21' N.$, long. $93^{\circ} 27' E.$	922	Blue mud.	80.3	41.2
115	Andaman Sea, lat. $11^{\circ} 31' 40'' N.$, long. $92^{\circ} 46' 40'' E.$	188-220	Green mud.	83	56
116	Andaman Sea, lat. $11^{\circ} 25' 5'' N.$, long. $92^{\circ} 47' 6'' E.$	405	Green mud.	82	47
117	Bay of Bengal, lat. $11^{\circ} 58' N.$, long. $88^{\circ} 52' 17'' E.$	1748	<i>Globigerina</i> -ooze, with pieces of pumice.	75.5	35.3
118	Bay of Bengal, lat. $12^{\circ} 20' N.$, long. $85^{\circ} 8' E.$	1803	<i>Globigerina</i> -ooze, with pieces of pumice.	78.6	35
119	Bay of Bengal, off mouth of Kistna River.	95	Brown mud.	80	66.5
120	Bay of Bengal, lat. $15^{\circ} 56' 50'' N.$, long. $81^{\circ} 30\frac{1}{2}' E.$	240-276	Brown mud.	79.1	52

Subgrade B. *CÆLOMATA*.Phylum **VERTEBRATA**.Class **PISCES**.

By A. ALCOCK.

The deep-sea fishes collected during the season number fifty species, of which twenty are new to science, while eight more have not before been recorded from India.

Among genera not typically bathybial hitherto unrecorded from Indian seas it is interesting to find *Callorhynchus*?, *Dibranchus*, *Peristethus*, *Physiculus*, *Ateleopus*, and *Neoscopelus*.

Among bathybial genera we have to record for the first time *Argyropelecus*, *Alepocephalus*, and *Nettastoma*.

The forms, five in number, which do not fall into any hitherto described genera are sufficiently important to require a separate notice.

1. *Malthopsis* is a Pediculate from the Andaman Sea very similar in general appearance and morphology to *Maltha* from the American side of the Atlantic, but differing from it in possessing only two pairs of gills.

2. *Halicmetus* is a still more remarkable Pediculate from the Andaman Sea. It is closely allied to *Dibranchus* and *Malthopsis*, but both dorsal fins are entirely wanting and the anal fin is rudimentary.

3. Another most remarkable type is *Lamproprogrammus*, an Ophidiid very closely approximate to the Brotuline type, but separated off from it in having no ventral fins, and differing from all other Ophidiids in the structure of the lateral line, which resembles in appearance that of the Halosauridæ. That is to say, the scales of the lateral line are much enlarged, and each one is excavated for the reception of a glandular substance, which is probably luminous in function.

4. *Bathyclupea* is another extremely interesting form, which I have placed among the Physostomi and in the family Clupeidæ, though it differs from all the Physostomes in having the ventral fins, which are rudimentary, subjugular in position, and is unlike other Clupeoids in possessing few pyloric appendages and in having the upper jaw but indistinctly tripartite. I have carefully dissected this form, and have little doubt about its affinities, though I am not certain whether it should be placed apart in a new subfamily of the

Clupeidæ, or even in a new family next to the Clupeidæ. Admitting its present position, it is the first Clupeoid yet discovered in the depths.

5. *Dysommopsis* is a new Murænid closely allied to *Dysomma*, with which singular form it may be included in a new alliance. It differs most conspicuously from *Dysomma* in wanting pectoral fins.

Upon the new species of known genera a few general remarks may be made. Two species of *Dibranchus*—one from the Andaman Sea, the other from the Bay of Bengal—represent here a type hitherto known only from the African side of the Atlantic.

Callorhynchus, *Physiculus*, *Ateleopus*, and with them *Neoscopelus* and *Dibranchus*, may perhaps be looked upon as additional links in the chain which appears to connect the local bathybial fauna of the Bay of Bengal with the fauna on the one hand of the west Atlantic and on the other hand of the Japan seas.

In *Sebastes hexanema*, *Lioscorpius longiceps*, *Peristethus Murrayi*, and *Scopelus engraulis* we have further instances of the existence at moderate depths in the Indian seas of types discovered by the 'Challenger' at similar depths in the seas of the East-Indo-Australian Archipelago, such as our previous experience would lead us to anticipate.

A new species of *Harpodon* deserves a word of remark. It appears to be very near to *Harpodon microchir* from Japan, but differs from it and equally from *Harpodon nehereus* in its more complete squamation, the whole body and the greater part of the head being covered with thin rather deciduous scales.

Lastly, the discovery that the small Brotuline Ophidiid, *Saccogaster maculata*, the male of which is furnished with a bilobed external genital organ, is viviparous, though not particularly appertaining to bathybiology, is interesting enough to call for notice, for it confirms the opinions which have been formed of the function of similar appendages in the males of other Brotuline Ophidiids—e. g. *Dinematichthys iluocæteoides*, Blkr., and *Bythites fuscus*, Reinhardt.

The following is the list of the deep-sea fishes obtained during the season:—

Order CHONDROPTERYGII.

Suborder PLAGIOSTOMATA.

Family Scylliidae.

SCYLLIUM, M. & H.

1. *Scyllium hispidum*, sp. n.

Head broad and depressed. Snout flat and semicircular in outline, the length of its preoral portion is less than half its breadth, not much more than half the distance between the angles of the mouth and twice the interval between the non-confluent nasal valves, each of which bears a small cirrus. Eyes large, with the small spiracles situated behind and below them. A labial fold exists only at each angle of the crescentic mouth. Acutely tricuspid or quincuspid teeth in broadish bands in both jaws. The walls of the buccal cavity and the surface of the tongue are covered with small papillæ.

The entire skin, including that which covers the fins, is closely felted with spines, which are acutely tricuspid, with the middle cusp the longest—exactly resembling, but on a slightly smaller scale, the teeth.

The first dorsal fin, which begins just in advance of the vertical through the posterior limit of the base of the ventrals, is higher than the second, but about equal to it in extent of base. The anal, which terminates exactly opposite to the posterior limit of the second dorsal and very near to the origin of the caudal, is twice the length of either dorsal in extent of base. The pectorals are wide and are much longer and broader than the ventrals, which have a very oblique posterior margin.

Colour in life:—Uniform dull stone-grey.

The young male specimen, 9.5 inches long.

From Station 115, 188 to 220 fathoms.

Suborder HOLOCEPHALA?

2. *Callorhynchus*?, sp.

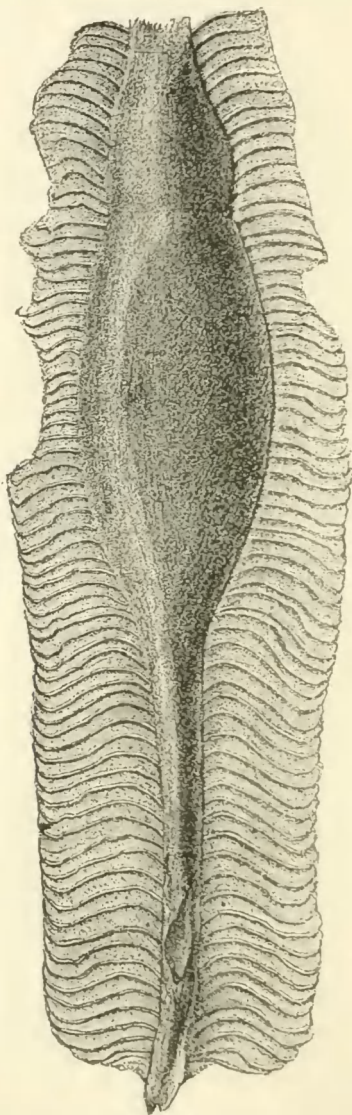
At Station 112, in a depth of 561 fathoms, an empty egg-capsule was dredged which we suppose to be that of either *Chimæra* or *Callorhynchus*, most probably the latter.

It is quite fresh, but has one end broken off. It is of a bottle-green colour and a parchment-like consistence, and measures as it is $5\frac{3}{4}$ inches in length.

It consists of an anterior ovate portion furnished anteriorly

with a bunch of very fine crimped silky hairs, and of a posterior tapering styliform portion, and the whole is surrounded by a broad radially striated or plicated fringe.

Fig. 1.



It is hardly to be supposed that this egg-capsule has drifted from any great distance.

Order ACANTHOPTERYGII.

Family Scorpenidæ.

SEBASTES, Gthr.

3. *Sebastes hexanema*, Gthr.

Sebastes hexanema, Günther, 'Challenger' Shore-fishes, p. 40, pl. xvii. fig. B; and 'Challenger' Deep-sea Fishes, p. 18.

Two specimens of this species, which was originally described from the Arafura Sea, 140 fathoms, were taken by the 'Investigator' at Station 115, 188 to 220 fathoms.

LIOSCORPIUS, Gthr.

4. *Lioscorpius longiceps*, Gthr.

Lioscorpius longiceps, Gthr., 'Challenger' Shore-fishes, p. 40, pl. xvii. fig. C.

This also is a hemibathybial species from the Arafura Sea, where it was taken along with the preceding species by the 'Challenger.'

One specimen was taken at Station 115, 188 to 220 fathoms. It has four large pyloric cæca.

Family Berycidæ.

MELAMPHAËS, Gthr.

5. *Melamphaës*, sp.

Some small specimens mutilated beyond identification were taken at Station 111, in 1644 fathoms, and Station 118, in 1803 fathoms.

POLYMIXIA, Lowe.

6. *Polymixia nobilis*, Lowe.

Two specimens of this well-known deep-sea Berycoid were taken at Station 115, 188 to 220 fathoms.

Family Carangidæ.

BATHYSERIOLA, Alcock.

7. *Bathyseriola cyanea*, Alcock.

Bathyseriola cyanea, Alcock, Ann. & Mag. Nat. Hist. ser. 6, vol. vi. (1890), p. 202.

A single specimen was taken at Station 120, in 240 to 276 fathoms.

Family Pediculati.

HALIEUTEA, C. & V.

8. *Halieutaea nigra*, sp. n.

D. 5. A. 4. C. 9. P. 13. V. 1/5.

Cephalic disk circular, convex anteriorly. Rostral tentacle trilobed. Interorbital space concave; supraorbital margin with long aculeate spines.

Cleft of mouth horizontal, its width being considerably less than half the diameter of the disk; jaws with villiform teeth. Gills $2\frac{1}{2}$. The dorsal surface of the disk and tail bears scattered spines with stellate bases, bifid, trifid, or multifid along the edge of the disk and side of the tail, but elsewhere acicular; the abdominal surface is covered with minute granules only. A few small papillæ along the under surface of the lower jaw; but no other cutaneous appendages. Fins in form and disposition as in *H. stellata*; the length of the pectorals is nearly twice that of the ventrals and about equal to that of the caudal, which is one fourth of the total.

Intestine wide; no pyloric cæca; no air-bladder.

Colour in life:—Uniform blue-black, with jet-black vermicular lines.

One specimen 2·7 inches long, from Station 115, 188 to 220 fathoms.

It is possible, though hardly probable, that this may be an immature form of *Halieutaea coccinea*, mihi. The difference in colour appears not to be an objection, because in a species of *Peristethus* to be described the young are dusky violet in colour, while a large specimen is bright red.

DIBRANCHIUS, Peters.

9. *Dibranchius nasutus*, sp. n. (Pl. VII. fig. 1.)

B. 5? D. 6. A. 4. C. 9. P. 12-13. V. 1/5.

Head and anterior part of body forming a large flat semi-circular disk as broad as long; tail cylindrical. The broadly expanded snout-bones project far beyond the deep semicircular cavity which lies beneath them, and this lodges a fleshy tentacle, which ends in a pair of spherical lobes surmounted by a median bifid filament. A pair of almost confluent nostrils on each side of the subrostral cavity. Eyes small. Mouth-cleft horizontal, its width is about one third the greatest breadth of the cephalic disk; tongue large, blotched

with dusky pigment; villiform teeth in the jaws only. Gill-cleft a small foramen situated superiorly in the axilla; two gills; no pseudobranchiæ.

Dorsal surface of the cephalic disk and entire surface of the tail covered with stout spines, which are marked with numerous trenchant radiating costæ; those on the tail and in three series along the margin of the disk are widely bifid, those elsewhere are acicular. Under surface of the cephalic disk without spines, but with distant granular tubercles. Fins in form and disposition as in *Dibranchus atlanticus*; the pectorals and caudal are coequal in length, being contained $4\frac{1}{2}$ times in the total, and are slightly longer than the ventrals.

A wide coiled intestine; no pyloric cæca; no air-bladder.

Colours in life:—Blue-black, edge of disk and anterior part of abdomen jet-black.

One specimen 3·2 inches long, from Station 115, 188 to 220 fathoms.

10. *Dibranchus micropus*, sp. n.

(Pl. VII. figs. 2, 2 a, 2 b.)

D. 5. A. 4. C. 9. P. 15. V. 5?

Head and anterior part of body depressed, forming a disk which is nearly as broad as long and is truncated in front; there are strong, sharp, simple and bifid spines along its margin, and at the subopercular angle a large trifid one.

The broad front, which is so abruptly truncated as to leave no appearance of a snout, is widely but not deeply excavated below for the lodgment of a large fleshy supra-oral tentacle; this is trilobed, the lateral lobes being smoothly hemispherical and the middle (superior) lobe being foliaceous, with a fringed margin. On each side of the subrostral cavity are the large exsert subtubular nostrils. Eyes small.

Mouth-cleft horizontal; its width is contained about $2\frac{1}{3}$ times in that of the disk; jaws with a row or very narrow band of minute teeth. Gill-cleft a small foramen situated superiorly in the axilla and barely wider than the nostril; two gills only.

Entire surface of body closely covered with fine, short, bristle-like spines, which have stellate bases and either simple or bifid points.

Fins in form and position as in *Dibranchus atlanticus*; the pectorals are large, being as long as the caudal, which in the specimens under examination is nearly as long as the rest of the tail; the ventrals are minute.

No pyloric appendages; no air-bladder.

Colour in life uniform blue-black.

Two specimens, the larger of which is 2·6 inches long, from Station 120, 240 to 276 fathoms.

MALTHOPSIS, gen. nov.

As *Malthe*, but with only two gills on each side.

11. *Malthopsis luteus*, sp. n. (Pl. VIII. figs. 2, 2 a.)

B. 5. D. 5. A. 4. C. 9. P. 11. V. 1/5.

Head and anterior part of body much depressed, forming a triangular wedge, the base of which is surmounted by a stout, fluted and crenulated, projecting, spinous prolongation of the snout, somewhat as in *Malthe*.

Beneath this nasal prolongation is a deep narrow vault, flanked on each side by a pair of large, almost confluent nostrils, and containing a short, fleshy, clavate tentacle.

Eyes large, lateral, nearly circular; their diameter is about one seventh of the total length, caudal not included; they are strongly convergent and anteriorly are barely half a diameter apart; the anterior limit of the orbit is in the same vertical line with the anterior limit of the mouth.

The mouth-cleft, which is horizontal, is about two thirds of an eye-diameter in width. Teeth villiform, in bands in the jaws and in broad patches on the vomer and anterior ends of the palatines.

Gill-cleft a small foramen, in width about one fifth of an eye-diameter, situated superiorly in the axilla; two gills; no pseudobranchiæ. Suboperculum prolonged and ending in a stout trifid or multifid spine.

Body covered with hard granular adherent plates, each with a large radially-striated conical tubercle in its centre. On the dorsal surface of the cephalic disk they are of moderate size, in contact along the middle line, but distant and slightly sunken laterally; on the ventral surface of the cephalic disk they are small, distant, and sunken; on the rest of the trunk and tail they are large and in close contact throughout.

The form and disposition of the fins is as in *Malthe*; the ventrals are very long, nearly equal to the pectorals, which are equal to the caudal, which is two ninths of the total.

A large siphonal stomach is found, and a wide coiled intestine, opening widely in the middle line between the axillæ. No pyloric cæca; no air-bladder.

Colours in life:—Pinkish yellow; some specimens with a few irregular rings of dark chocolate on the dorsum of the cephalic disk.

There are five abdominal and thirteen caudal vertebræ, the neural spines of the former being coalescent into a trenchant ridge as in *Malthe* and *Halieutæa*.

Ten specimens were taken at Station 115, in 188 to 220 fathoms. They vary in length from 1·4 to 2·9 inches; and in the younger specimens the subopercular spine is relatively much larger and the pectoral fins are of greater relative length—being contained $3\frac{1}{2}$ times in the total length, caudal included.

HALICMETUS, gen. nov.

Head and anterior part of body very broad and depressed. Front with a transverse bony bridge and a subrostral cavity lodging a fleshy tentacle. Cleft of mouth horizontal. Villiform teeth in jaws and palatines. Gill-openings small foramina situated superiorly in the axillæ; two gills; no pseudo-branchiæ. Head and body with close-set graniform asperities and large granular tubercles. No dorsal fin whatever. Anal fin very short. Pyloric appendages and air-bladder absent.

12. *Halicmetus ruber*, sp. n. (Pl. VIII. figs. 1, 1a, 1b.)

B. 5? D. 0. A. 3. C. 9. P. 11. V. 1/5.

Head and anterior part of trunk depressed, forming a semi-circular disk rather broader than long, with a slight convexity in the cranial region. The truncated snout is occupied, as in *Halieutæa*, by a bony rugose orbital bridge, beneath which is a cavity lodging a fleshy tentacle which ends in three lobes, the middle (superior) lobe being crested by a small bifid filament. The eyes are small and convergent.

The nostrils are minute papillæ situated on each side of the rostral tentacle, within the subrostral cavity.

Mouth horizontal, with the lower jaw slightly projecting; its cleft is a little wider than the eye. Villiform teeth in bands in the jaws and on the palatines.

Gill-cleft a small foramen, less than half an eye-diameter in width, situated superiorly in the axilla; two gills; no pseudobranchiæ. The suboperculum ends in a stout multifid spine.

Surface of the body uniformly invested with minute close-set graniform spines, which also cover the eyes up to the

corneal margin. The edge of the cephalic disk bears in addition large finely granular multifid spines in three longitudinal series, and the tail is clad with large granular conical tubercles—of which there are five longitudinal series on each side—in close contact.

Fins in form and position as in *Halicutæa*, *Malthe*, &c., but the soft dorsal, as well as the spinous, is entirely wanting, and the anal is almost rudimentary. The pectorals, which are about a third longer than the ventrals and a little longer than the caudal, are nearly one fifth the total length.

Stomach large, siphonal, much constricted at the pylorus. Intestine coiled and very wide. No pyloric cæca. No air-bladder.

Colour in life uniform light pink.

Two specimens, measuring 2·75 inches in length, from Station 115, 188 to 220 fathoms.

Family Cataphracti.

13. PERISTETHUS, Kaup.

Peristethus Murrayi, Gthr.

Peristethus Murrayi, Günther, 'Challenger' Shore-fishes, p. 52, pl. xxxii. fig. A.

A single adult specimen from Station 115, 188 to 220 fathoms, and two young ones. The young ones in life were of a uniform dusky violet colour, the colour of the adult being red. The young also differ from the adult in having three small upstanding points, disposed in a triangle, on the forehead.

Order ANACANTHINI.

Family Gadidæ.

PHYSICULUS, Kaup.

14. *Physiculus roseus*, sp. n.

B. 7. D. 7/57. A. 55. V. 7.

Head and trunk broad; tail compressed, higher than the trunk anteriorly. Length of the head very nearly one fourth of the total, including the caudal; its breadth, which exceeds its height, is a good deal more than half its length. Greatest height of the body, just behind the origin of the dorsal fin, about one sixth of the total.

Snout depressed, broader than long, obtusely rounded; its

length, which is equal to the major diameter of the eye and slightly exceeds the width of the flat interorbital space, is one fourth that of the head. Nostrils superior, situated immediately in front of the orbit.

Mouth wide, oblique, with the upper jaw overlapping the lower; the maxilla reaches beyond the vertical through the middle of the orbit. Teeth villiform, in broadish bands in the jaws only.

Barbel stout, about as long as the eye.

Gill-openings very wide.

Body and head covered with a thick mucilaginous skin, which is invested everywhere with small deciduous scales, of which there appear to be six rows between the first dorsal fin and the lateral line. The dorsal and anal fins, which are invested with a fold of thick scaleless skin, extend to within an eye-length of the caudal. The first dorsal, which is separated from the second only by a notch, begins in the vertical through the base of the pectoral; its first ray is prolonged and nearly equals the postrostral portion of the head in length. The ventrals arise on flattened bases; their outer ray is prolonged beyond the origin of the anal. The pointed pectorals arise on oblique bases; their length is not quite equal to that of the prolonged ventral ray.

The vent is situated well in advance of the origin of the anal fin, and there is a small postanal papilla. A large air-bladder exists.

Colours in life uniform rose-red.

One specimen, 7 inches long, from Station 115, 188 to 220 fathoms.

BREGMACEROS, Thompson.

15. *Bregmaceros*, sp.

Numerous young specimens were obtained at Station 119, in 95 fathoms.

Family Ophidiidæ.

MONOMITOPUS, Alcock.

16. *Monomitopus nigripinnis*, Alcock.

Sirembo nigripinnis, Alcock, Ann. & Mag. Nat. Hist., Nov. 1889, p. 384.
Monomitopus nigripinnis, id. *ibid.* Oct. 1890, p. 297.

One well-preserved specimen, $6\frac{1}{4}$ inches long, from Station 112, 561 fathoms.

NEOBYTHITES, Goode & Bean.

17. *Neobythites macrops*, Gthr.

Neobythites macrops, Günther, 'Challenger' Deep-sea Fishes, p. 102, pl. xx. fig. A.

Neobythites macrops, Alcock, Ann. & Mag. Nat. Hist., Nov. 1889, p. 385.

Twenty specimens, varying in length from 4 to $8\frac{1}{2}$ inches, were taken at Station 115, 188 to 220 fathoms.

18. *Neobythites pterotus*, Alcock.

Neobythites pterotus, Alcock, Ann. & Mag. Nat. Hist. Sept. 1890, p. 210, and Oct. 1890, p. 297.

A very fine male specimen, 1 foot long, from Station 117, 1748 fathoms. It differs from the large female captured last year in the Laccadive Sea in having the pectoral fin-rays very much more prolonged—reaching to the tenth anal ray—and spatulate at the ends. In the female the pectoral fin-rays reach only to the first anal ray.

SACCOGASTER, Alcock.

19. *Saccogaster maculata*, Alcock. (Pl. VII. fig. 3.)

Saccogaster maculatus, Alcock, Ann. & Mag. Nat. Hist., Nov. 1889, p. 389.

An adult male specimen, just over $3\frac{1}{2}$ inches long, from Station 120, 240 to 276 fathoms. The male has a large bilobed postanal papilla, and into the sulcus between the lobes the seminal duct opens. The female, it now appears from a reexamination of the type described in 1889, has the distended ovaries full of developing embryos, so that we now know *Saccogaster maculata* to be a viviparous fish; and we may conclude that the postanal papilla is an intromittent organ of copulation.

PARADICROLENE, Alcock.

20. *Paradicrolene nigricaudis*, sp. n.

B. S. D. circ. 90. A. circ. 75. C. 8?

P. 19-20/6-7. V. 2.

Head conoid; its length about $4\frac{1}{2}$ in the total, with the caudal; its height $\frac{2}{3}$, its breadth $\frac{1}{2}$ its length; all its bones strong.

Body and tail compressed ; the height of the former is nearly one fifth the total, with the caudal. Operculum with a sharp spine above, preoperculum with three flat spines radiating from its angle.

Snout broad and rounded, not overhanging the jaw ; its length, which is equal to the major diameter of the eye or to the width of the convex interorbital space, is contained about $4\frac{1}{2}$ times in that of the head. The anterior nostril is a small foramen near the tip of the snout, the posterior is a moderate-sized elliptical opening in front of the angle of the eye.

Cleft of mouth wide, oblique ; the dilated scaly extremity of the maxilla reaches half an eye-length behind the vertical through the posterior border of the orbit ; the lower jaw is included within the upper in repose, and has a large pore on either side of the symphysis. Villiform teeth in bands in the jaws, palatines, and vomer.

Gill-opening wide ; pharyngo-branchial membrane partially pigmented ; eleven long gill-rakers on the outer side of the first branchial arch, besides small ones above and below ; pseudobranchiæ reduced to two small pinnules.

Body and entire head, including even part of the branchiostegal membranes, covered with small adherent scales, of which there are four rows between the base of the dorsal fin and the lateral line, which is a distinct poriferous groove ending in the posterior fourth of the tail.

Dorsal and anal fins invested in a thick fold of integument, which is scaly in its basal half. The caudal, which is nearly half the length of the head, is adherent to the other vertical fins at its base only. Pectorals very broad, with fleshy scaly bases, pointed, slightly longer than the postrostral portion of the head ; the lowermost six or seven rays are incompletely detached from the rest of the fin and from each other at their bases, and are produced each into a long free filament, of which the longest (uppermost) in large specimens is twice the length of the fin. Ventrals separated by a considerable interval ; each consists of two separate stout filaments, the outer of which is the longer and exceeds in length the post-orbital portion of the head.

Parietal peritoneum black ; stomach siphonal ; intestine long and coiled in several wide loops ; no pyloric cæca ; an air-bladder.

Colours in life :—Chocolate, posterior third of tail, including the vertical fins in that space, black ; caudal fin and pectoral filaments milk-white.

Five specimens, the largest nearly 8 inches long, from Station 115, 188 to 220 fathoms.

21. *Paradicrolene multifilis*, Alcock.

Paradicrolene multifilis, Alcock, Ann. & Mag. Nat. Hist., Nov. 1889, p. 387.

Several small specimens, slightly differing in unimportant characters—*e. g.* in the colour of the body, which is much darker—from the type, were taken at Station 120, 240 to 276 fathoms.

DERMATORUS, Alcock.

22. *Dermatorus melanocephalus*, sp. n.

This species is very closely allied to *Dermatorus trichiurus* from the Laccadive Sea (Ann. & Mag. Nat. Hist., Oct. 1890, p. 298), from which it differs in the following points:—

All the spines of the head-bones are weak and flexible; the opercular spine is broad, flat, and weak; the preopercular border is double, but smooth and unarmed; the humeral spine is almost obsolete; the length of the snout is one third that of the head, twice the major diameter of the eye, and greater than the width of the interorbital space; the maxilla is not quite two thirds of the head in length; there are only fifteen elongated gill-rakers on the outer side of the first branchial arch; there are no pseudobranchiæ whatever.

Colours in the fresh state transparent grey; head and belly black.

The intestine is long and much coiled, and there are a few rudimentary pyloric cæca in a ring round the pylorus.

Length nearly 8 inches.

One specimen from Station 111, 1644 fathoms, and one from Station 117, 1748 fathoms, both being mature females.

LAMPROGRAMMUS, gen. nov.

Head large, body compressed, both entirely covered with thin, smooth, deciduous scales of moderate size. Head-bones with prominent crests and wide muciparous cavities, unarmed except for a weak opercular spine. Snout not overhanging the jaws. Eye of moderate size. Mouth large; teeth in villiform bands in the jaws, palatines, and vomer. No barbel or hyoid filaments. Gill-opening wide; gill-membranes separate; four gills, eight branchiostegals, no pseudobranchiæ. *Lateral line very conspicuous, with much enlarged scales, each of which bears a glandular (luminous) organ.* Vertical fins confluent; pectoral fins entire; no ventral fins.

23. *Lamprogrammus niger*, sp. n.

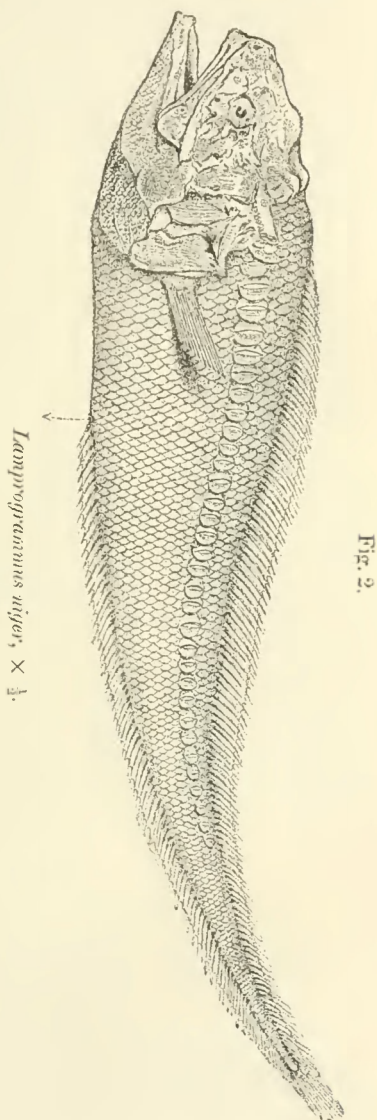
B. 8. D. circ. 110. A. circ. 90. C. 10? P. 17. V. 0.

Tissues fragile. Head large, body compressed, tail compressed and tapering. The head, the length of which is about one fifth of the total, or slightly over half the length of the entire head and trunk in the adult, or a little more than the greatest body-height, has the bones weak and furnished with prominent flexible crests, the intervals between which form wide and capacious muciparous cavities; its only armature is a flat inconspicuous spine on the upper part of the operculum.

The snout, which is broad and rounded, does not overhang the jaws; its length is slightly less than the width of the convex interocular space and $2\frac{1}{2}$ times the diameter of the circular eye, which last is about one ninth the length of the head.

Mouth cavernous, with oblique cleft and jaws nearly conterminous in front; the maxilla, which is much dilated posteriorly, is half the length of the head. Villiform teeth in broad bands in the premaxillæ and in very narrow bands in the mandibles, palatines, and V-shaped head of the vomer.

Gill-openings very wide, the gill-membranes not at-



tached to the isthmus; four gills with narrow laminae and scabrous clavate gill-rakers, which, to the number of about ten, are a little elongated on the outer side of the first arch; no pseudobranchiæ.

Body and head, including the glosso-hyal region and the branchiostegal membranes, covered with deciduous membranous cycloid scales of moderate size.

The scales of the very conspicuous lateral line are adherent and greatly enlarged; they lie beneath a continuous sheath of black skin, which is loopholed over a long narrow groove with raised margins situated along the vertical diameter of each scale. These grooves are filled with an opaque white substance, which probably has a luminous function. The lateral line, in fact, is exactly similar to that of several species of *Halosaurus*.

The dorsal fin, which begins just in advance of the gill-opening, and the anal, which begins almost a head-length behind the same level in the adult, are confluent with the pointed caudal. The narrow, pointed pectorals are as long as the rostrorbital portion of the head. There are no ventral fins whatever.

The stomach is siphonal, with a bulbous pyloric end; the intestine, which is very long, is looped and coiled, the loops being held by a stout mesentery; there are six small cæca in a semicircle round the pylorus; no air-bladder can be detected.

Colours in the fresh state uniform jet-black.

Two females, 15.5 and 11.75 inches long respectively, from Station 112, 561 fathoms; a third specimen from Station 116, 405 fathoms.

This extraordinary form seems almost entitled to rank by itself in a separate subfamily of the Ophidiidæ. In general appearance and in most of its structural details it has the closest resemblance to the typical *Brotulina*; but it differs from them all in its remarkable *Halosaurus*-like lateral line and in the entire absence of ventral fins.

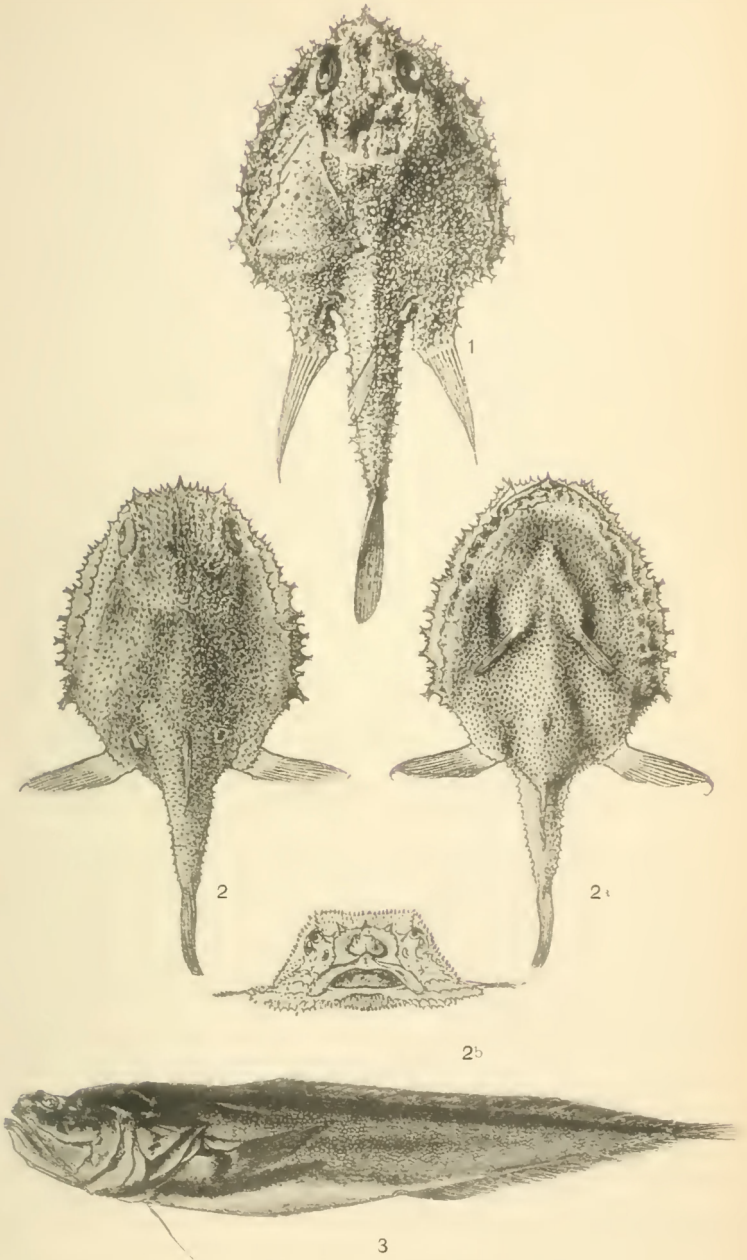
[To be continued.]

III.—Notes concerning the Anatomy of certain Rotifers.

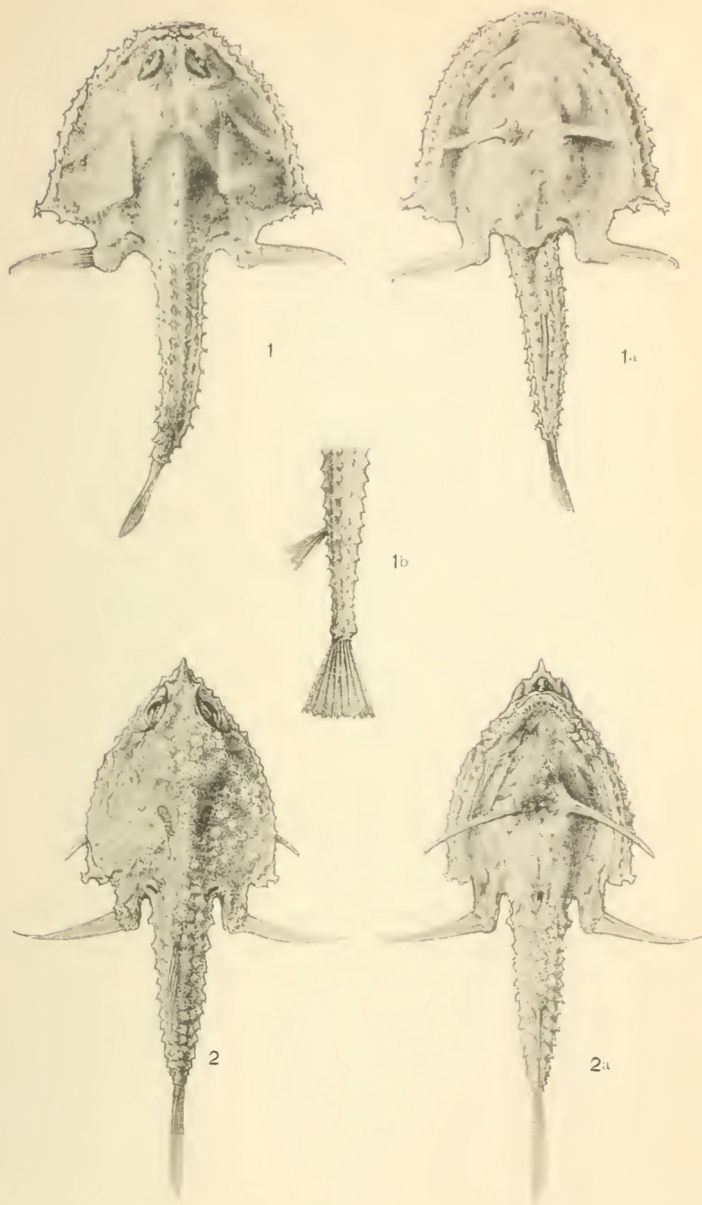
By RUPERT VALLENTIN.

[Plates IV. & V.]

It was originally my intention to prepare for publication a series of papers concerning the anatomy of some of our larger species of common Rotifers whose structure I had been able



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