PELAGIC AMPHIPODS IN THE COLLECTIONS OF THE CENTRAL MARINE FISHERIES RESEARCH INSTITUTE, INDIA: PART I. FAMILY OXYCEPHALIDAE

N. KRISHNA PILLAI

Marine Biological Laboratory, University of Kerala, Trivandrum, India

ABSTRACT

Since Bovallius published his monograph on the Oxycephalidae, this family has not been studied in detail. Fage reviewed the family and added substantially to our knowledge of the synonymy, distribution and biology of the species, but only briefly dealt with the taxonomy. The present collection, made in the Arabian Sea, includes all except two species, considered valid by Fage. Hence this opportunity is availed of to giving full illustrated descriptions of all the species which number fifteen.

THOUGH oxycephalids are very common in the offshore plankton of tropical and subtropical waters they have not been studied in detail since Bovallius (1890) published his monograph. Apart from Stebbing (1888) and Bovallius no other worker seems to have studied them in detail. This is to be regretted since most of the species are highly variable and specific identification is difficult, except for the specialist. However, the recent work of Fage (1960) has added considerably to our knowledge of the biology and distribution of the members of this family.

Though a large number of genera have been referred to this family Fage (1960) recognised only ten as valid. Of these, all, except *Metalycaea* Stephensen (1925), are represented in the present collection. *Metalycaea* has not been recorded from anywhere since its discovery and hence the present collection can be considered as quite representative of the family. Surprisingly all, except two species of *Rhabdosoma* Adams and White, recognised as valid by Fage, are present in this collection. I have, therefore, taken this opportunity to make a detailed study of all the species.

The collection was confined to a restricted part of the Indian Ocean (Figs. 17 and 18) and some of the species are represented by only a small number of individuals. There is hence very little scope for a discussion of the intraspecific variation or distribution of the species. In the present paper the taxonomic part alone is hence attended to. It is earnestly hoped that this would be of some help, especially to non-specialists who may also have to deal with tropical plankton in general. With this end in view detailed illustrations, together with an enumeration of the salient characters of each species, are included.

Family OXYCEPHALIDAE Spence Bate

Spence Bate, 1861; Claus, 1887; Stebbing, 1888; Bovallius, 1890; Stephensen, 1925; Spandl, 1927; Fage, 1960.

Members of this family, except *Metalycaea* and *Simorhynchotus*, are rather elongated, with the cephalon produced into a prominent rostrum. The first antenna is articulated on the ventral side of the rostrum and in the male the basal flagellar segment is swollen and curved, with a close matting of long aesthetasks, the rest of the flagellum consists of three or rarely four small segments, subterminal in position. The second antenna in the male is very much elongated and kept folded like a carpenter's rule underneath the cephalon. The mandibular palp is long and three-segmented.

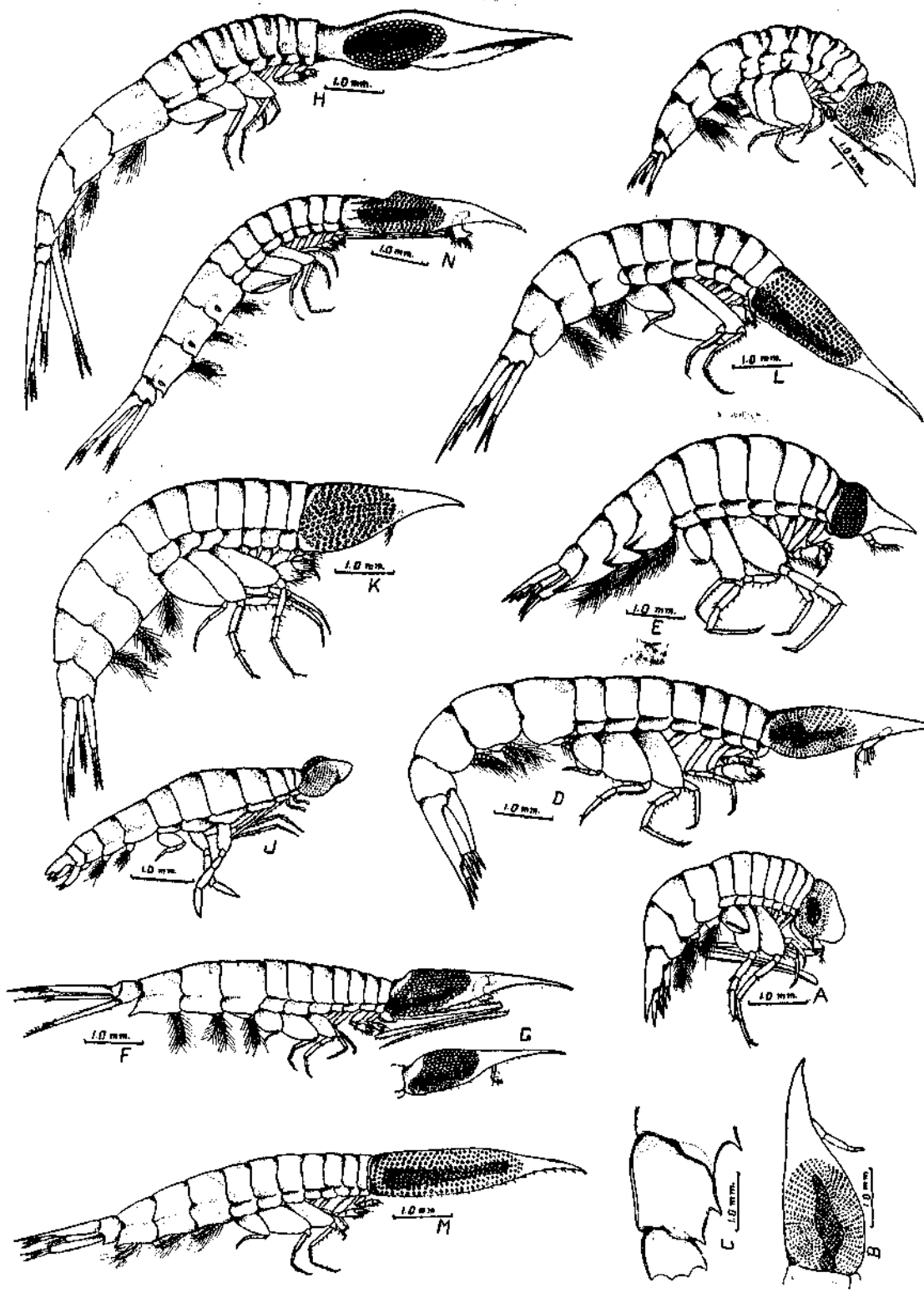

PLATE I

(A) *Simorhynchotus antennarius*, male; (B) *Oxycephalus clausi*, cephalon; (C) *Oxycephalus clausi*, abdomen; (D) *Oxycephalus latirostris*; (E) *Tullbergella cuspidata*; (F) *Leptocotis tenuirostris*, male; (G) *Leptocotis tenuirostris*; female; (H) *Calamorhynchus pellucidus*; (I) *Cranocephalus scleroticus*; (J) *Glossocephalus milne-edwardsi*, small form; (K) *Streetsia porcella*; (L) *Streetsia challengeri*; (M) *Streetsia steenstrupi*; (N) *Streetsia mindanaonis*.

Second segment of peraeopods five to seven is elytra-like. Seventh peraeopod, though reduced in size, has the full complement of segments, except in *Tullbergella* and *Rhabdosoma.*

Based on the absence of maxillae *Simorhynchotus* was transferred from Lycaeidae to Oxycephalidae. It is doubtful whether this character alone is of such crucial importance. *Simorhynchotus* so closely resembles members of the family Lycaeidae and markedly differs from members of the family Oxycephalidae that it would be more appropriate to place it in Lycaeidae. As the consensus of expert opinion is otherwise I do not propose any change in the existing arrangement.

After Bovallius (1890) only Spandl (1927) provided a key for the identification of the oxycephalid genera. Both keys are out of date since some of the genera included in their key ceased to be valid. I, therefore, give a key for the identification of the genera treated here.

1. Inner ramus of second and third uropods coalesced with the peduncle.....2
1. Inner ramus of third uropod coalesced with the peduncle.....4
1. Inner ramus of all the uropods free.....6
2. Rostrum hardly present, peraeopods one and two not cheliform.....*Simorhynchotus*
2. Rostrum prominent, peraeopods one and two cheliform.....3
3. Cephalon produced into a very long rostrum, seventh peraeopod reduced to a flat small segment..... *Rhabdosoma*
3. Cephalon produced into a short rostrum, seventh peraeopod seven-segmented..*Oxycephalus*
4. Seventh peraeopod five-segmented.....*Tullbergella*
4. Seventh peraeopod seven-segmented.....5
5. Cephalon with lateral wings.....*Calamorhynchus*
5. Cephalon without lateral wings.....*Leptocotis*
6. Rostrum short and blunt, peraeopods five and six long and paddle-like....*Glossocephalus*
6. Rostrum long and pointed, peraeopods five and six not paddle-like.....7
7. Hind part of cephalon constricted, coxal plates fused with the peraeon segments..... ..... *Cranocephalus*
7. Hind part of cephalon not constricted, coxal plates not fused with the peraeon segments.... ..... *Streetsia*

Simorhynchotus, Tullbergella, Leptocotis, Calamorhynchus, Glossocephalus and *Cranocephalus* are monotypic. *Rhabdosoma* includes four species, two of which are represented here. *Oxycephalus* includes three species and *Streetsia* four, all are contained in the present collection.

Genus *Simorhynchotus* Stebbing

Simorhynchotus antennarius Claus

(Plate I—A; Figs. 1–2)

Simorhynchotus antennarius Stebbing, 1888, p. 1772, pl. 200; Bovallius, 1890, p. 49; Stephensen, 1925, p. 185, f. 72; Spandl, 1927, p. 211, f. 32; Barnard, 1930, p. 433; 1931, p. 120; 1937, p. 191; Pirlot, 1938, p. 366; Fage, 1960, p. 11, figs. 1–3.

Simorhynchotus lilljeborgi Bovallius, 1890, p. 52, pl. 1, figs. 1–7, t. figs.; Spandl, 1927, p. 212, f. 33.

Simorhynchotus stebbingi Bovallius, 1890, p. 50.

Material.—St. 742, 1 female; St. 749, 2 males; St. 759, 1 male; St. 1044, 2 females; St. 1157, 1 male; St. 1233, 1 female; St. 1256, 1 female; St. 1300, 1 female; St. 1329, 1 female; St. 1337, 2 females; St. 1344, 4 males; St. 1344, 1 male; St. 1344, 2 males; St. 1344, 3 males; St. 1344, 1 male; St. 1351, 1 male; St. 1370, 1 male; St. 1377, 2 males; St. 1385, 1 male, 1 female; St. 1385, 1 female; St. 1393, 1 male; St. 1395, 1 male; St. 1397, 3 males; St. 1411, 6 females, 6 males; St. 1688, 2 females; St. 1703, 1 female; St. 1721, 1 male; St. 1723, 1 female; St. 1732, 1 female; St. 1737, 2 males; St. 1738, 1 male; St. 1739, 1 male; St. 1739, 2 females; St. 1740, 3 females; St. 1749, 1 male; St. 1750, 1 female; St. 1761, 3 females; St. 1773, 2 females; St. 1774, 1 female; St. 1779, 1 male; St. 1805, 3 males; St. 1809, 3 males, 1 female; St. 1811, 1 female; St. 1813, 3 females, 1 male.

Specific characters.—Body is short and subcylindrical. A distinct rostral prolongation is absent. Basal flagellar segment of the first antenna of the male is produced at its distal corners, upper projection is acute. First antenna of female is slender and five-segmented. Second antenna of male as usual in the family.

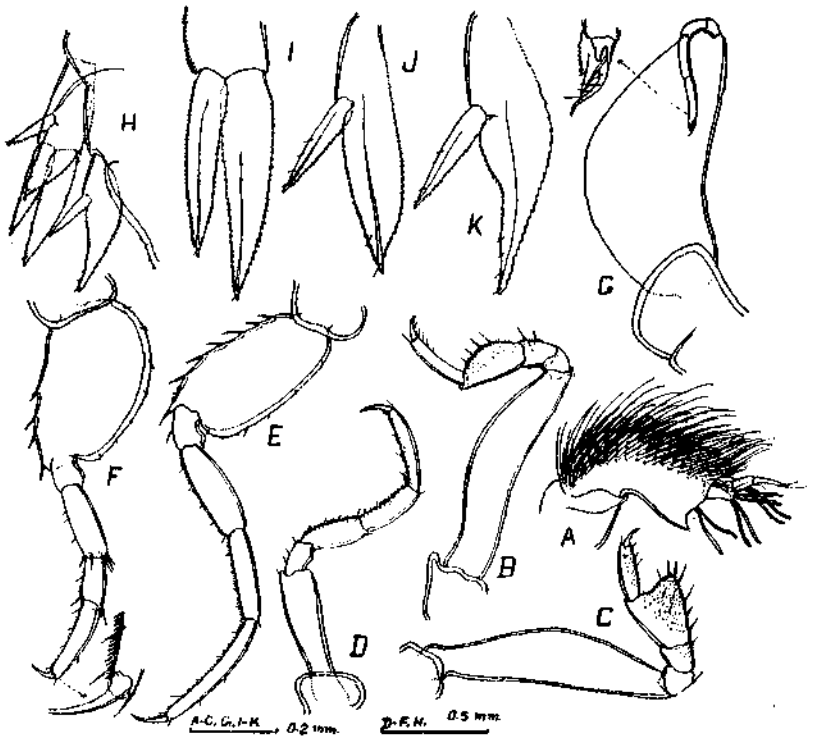

FIG. 1. *Simorhynchotus antennarius* Claus. Male: (A) Antenna 1; (B) peraeopod 1; (C) peraeopod 2; (D) peraeopod 4; (E) peraeopod 5; (F) peraeopod 6; (G) peraeopod 7; (H) uropods and telson; (I–K) uropods 1–3.

Peraeopods one and two are almost similar in both sexes, second peraeopod is longer and stouter than the first, fifth segment of first peraeopod is only slightly expanded but that of the second peraeopod is well produced, with its distal border transverse, thus producing a subchela. Peraeopods three

and four are slender and subsimilar, with the inner border of segments four to six spiny. Second segment of fifth peraeopod is expanded and oblong, with scattered spine-setae along the upper border, inner border of segments four to six is spiny. Second segment of sixth peraeopod is more flattened than that of the fifth and the inner border of segments five and six is spiny. Second segment of seventh peraeopod is very large and leaf-like, sixth segment is distally produced into a conical process against which the seventh segment closes.

In the female peraeopods three to seven are of the same pattern as in the male, but are comparatively very stout and the fifth peraeopod, unlike as in the male, is not spiny.

In the male the telson is slightly longer than the last abdominal segment and is elongate triangular in shape. Peduncle of the first uropod is as long as the outer ramus and its outer border is serrated; inner ramus is longer and stouter than the outer and the borders of both rami are serrated. Peduncle of the second uropod is short and fused with the broad inner ramus, outer ramus is narrow and its outer border is smooth. Peduncle of the third uropod is short, about half the length of the inner ramus, the latter is narrowed at its middle and further on characteristically curved outwards, outer ramus is similar to that of the second uropod but slightly broader.

In the female the uropods are generally like those of the male but the outer border of the peduncle of the first uropod is not serrated. The rami of the uropods are more conspicuously narrowed towards the tip and their borders are not closely serrated as in the male. Telson is much different from that of the male, roughly triangular with rounded apex. In the male the telson suddenly narrows in the middle and tapers to form an acute apex.

Length 6·7 mm.

Remarks.—As Stephensen (1925) has shown this species shows very pronounced sexual dimorphism in the peraeopods, uropods and telson. The description given by Stebbing applies very well to the males in the present collection except with regard to the size of the fifth segment of the first peraeopod and the shape of the inner ramus of the third uropod. Barnard (1930) pointed out that the inner ramus of the third uropod shows all degrees of variation between the figures of Stebbing (1888) and of Spandl (1927).

Distribution.—This widely distributed species has been previously recorded from the Mediterranean, Indian Ocean, Atlantic Ocean and the Pacific Ocean. In the present locality it is the most widely distributed species.

Genus *Oxycephalus* Milne Edwards

Bovallius, 1890; Stephensen, 1925; Spandl, 1927; Fage, 1960.

Fage (1960) recognised only three species in this genus. They can be distinguished by the following key.

1. Lateral borders of the first three abdominal segments with a sharp spine.....*clausi*

1. Lateral borders of the first three abdominal segments without a spine.....2

2. Lateral borders of first three abdominal segments with the distal half sinuous, cutting edge of chela of peraeopods one and two feebly toothed.....*piscator*

2. Lateral borders of first three abdominal segments evenly rounded, cutting edge of chela of peraeopods one and two with conspicuous comb of spines.....*latirostris*

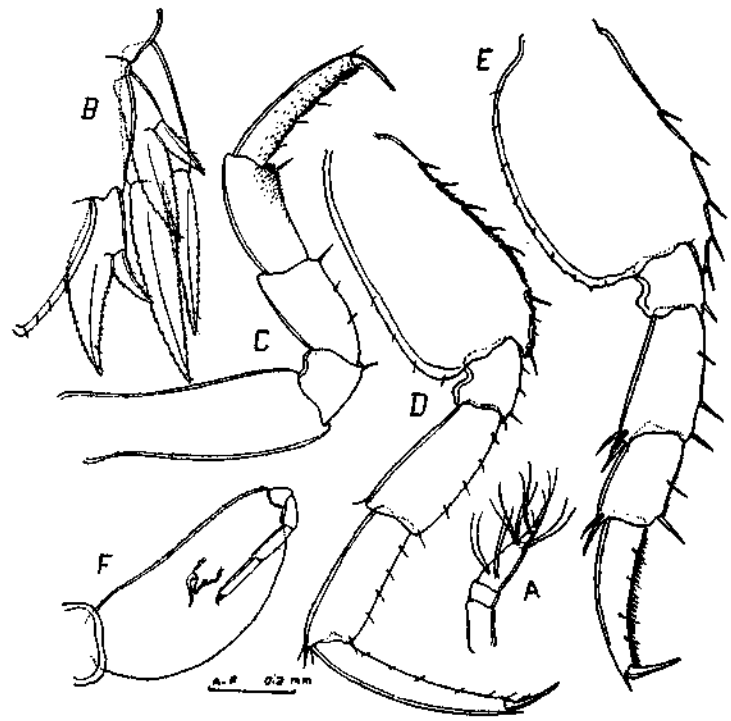

FIG. 2. *Simorhynchotus antennarius* Claus. Female: (A) Antenna 1; (B) uropods and telson; (C) peraeopod 4; (D) peraeopod 5; (E) peraeopod 6; (F) peraeopod 7.

Oxycephalus clausi Bovallius

(Plate I, B & C; Fig. 3)

Oxycephalus clausi Bovallius, 1890, p. 60, pl. 1, figs. 19–24, pl. 2, fig. 1, t.-figs.; Stephensen, 1925, p. 188; Spandl, 1927, p. 180; Barnard, 1930, p. 433; 1932, p. 130; 1937, p. 192; Pirlot, 1938, p. 192; Shoemaker, 1945, p. 251; Fage, 1960, p. 20, figs. 11–14.

Material.—St. 976, 1 female; St. 1164, 1 female; St. 1245, 1 female; St. 1278, 6 females, 1 male; St. 1278, 4 males, 9 females; St. 1278, 1 male, 9 females; St. 1278, 10 females, 6 males; St. 1292, 1 female; St. 1300, 1 male; St. 1351, 1 male; St. 1385, 3 males; St. 1385, 1 female; St. 1397, 1 male; St. 1415, 1 male; St. 1417, 1 female; St. 1719, 1 female; St. 1737, 1 male; St. 1737, 1 male; St. 1738, 1 male; St. 1739, 1 female; St. 1748, 1 female; St. 1749, 1 female; St. 1749, 1 male; St. 1749, 1 female; St. 1750, 2 males; St. 1750, 1 male, 1 female; St. 1750, 2 males; St. 1763, 1 male; St. 1788, 1 female; St. 1802, 1 female; St. 1807, 1 male.

Specific characters.—Cephalon is rather deep with the rostrum nearly half the length of the cephalon. In full grown individuals the peraeon segments are fairly deep. Pleura of the first three abdominal segments have a median lateral and a postero-lateral conical spine with the intervening border deeply concave. Telson is nearly as long as the last abdominal segment and the distal two-thirds of its lateral borders is serrated.

Peraeopod one is fairly stout, its fifth segment has a prominent outer distal tooth-like projection, inner distal part is produced into a conical process with irregularly serrated border, clearly over-reaching the tip of the sixth segment, inner border of the sixth segment is nearly straight and finely

serrated, inner surface of both fifth and sixth segments carries a large number of setae. Fifth segment of the second peraeopod has an outer distal tooth as in the first peraeopod, its inner distal process is a stout thumb with the cutting edge armed with about ten blunt teeth, sixth segment is slightly shorter than the prolongation of the fifth segment and its cutting edge is finely crenulate. Second segment of fifth peraeopod is oblong and its upper border is serrated, segments four to six carry well-spaced spines. Second segment of sixth peraeopod is nearly rounded and the distal half of its inner border is serrate, inner border of segments four to seven is armed with a closely packed row of strong short teeth mixed with long spines. Second segment of seventh peraeopod conspicuously narrows distalwards, the succeeding segments are unarmed.

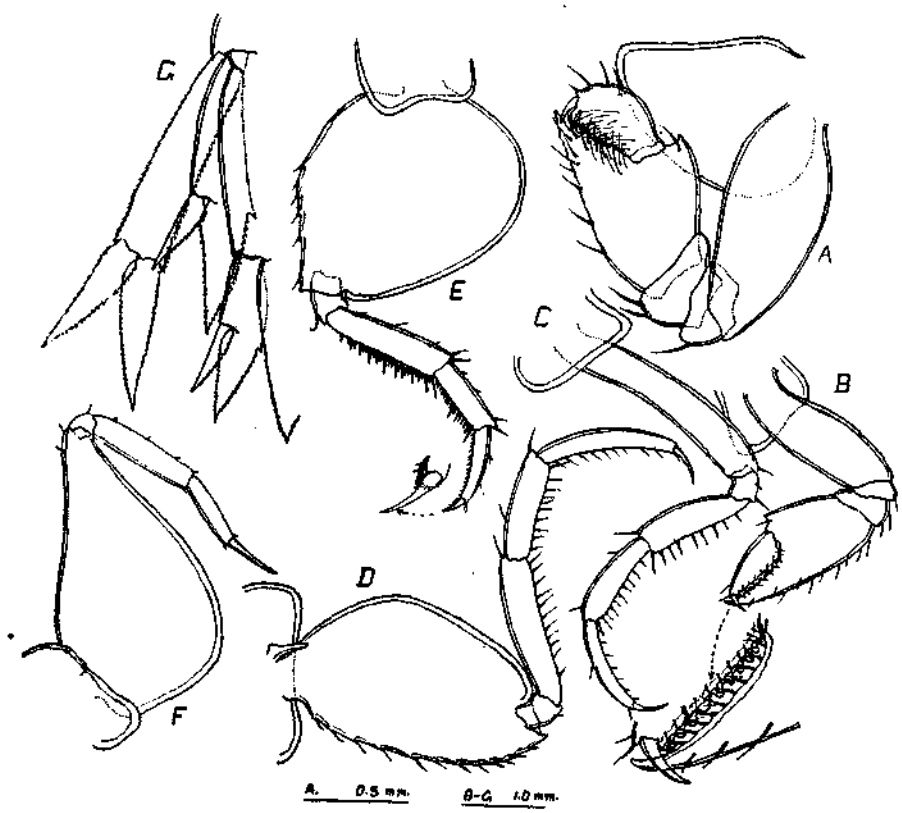

FIG. 3. *Oxycephalus clausi* Bovallius. (A) Peraeopod 1; (B) peraeopod 2; (C) peraeopod 4; (D) peraeopod 5; (E) peraeopod 6; (F) peraeopod 7; (G) uropods and telson.

Peduncle of the first uropod overreaches the base of the third uropod, its borders are serrated, rami are subsimilar and the inner ramus is slightly longer than the outer, both borders of the rami are serrated. Peduncle of the second and third uropods is fused with the inner ramus and the place of fusion is indicated by a strong tooth on the inner border, outer ramus of both uropods is considerably smaller than the inner and their outer border is not serrated.

Length 21·4 mm.

Remarks.—O. clausi can be easily distinguished by the apically acute rostrum, the presence of a sharp spine-like process at the middle of the lateral borders of the first three abdominal pleura and the presence of a tooth-like process at the outer distal part of the fifth segment of the first and

second peraeopods. Stebbing has shown the apex of the telson as drawn out and pointed but in the present specimens it is less produced and in this respect resembles the specimens of Bovallius. Both Stebbing and Bovallius have shown the lower border of the second segment of the sixth peraeopod as serrated. In the present specimens they may be serrated or not irrespective of the size of the specimens. As observed by Fage the present collection includes dimorphic forms.

The peraeopods of *O. longipes* Spandl (1927, p. 181) are peculiar in that they are somewhat different from those of all the other species, particularly in the extreme elongation of the end segment of the seventh peraeopod. But the denticulation of the second peraeopod is very much like that of *O. clausi.*

Distribution.—This is a very widely distributed species which has been previously recorded from the North and South Atlantic, Mediterranean, Tropical and South Pacific and the Indian Ocean. In the present locality this is the most abundant member of the genus.

Oxycephalus piscator Milne Edwards

(Fig. 4)

Oxycephalus piscator Milne Edwards, 1840, p. 100; Bovallius, 1890, p. 56, pl. 1, figs. 8–16, t.-figs; Spandl, 1927, p. 180, fig. 13; Barnard, 1930, p. 433; Shoemaker, 1945, p. 246, figs. 42–43; Fage, 1960, p. 14, figs. 5–10.

Material.—St. 1278, 1 male, 1 female; St. 1278, 4 males; St. 1278, 1 male; St. 1278, 1 male; St. 1312, 1 female; St. 1356, 1 male; St. 1356, 1 female; St. 1375, 2 males; St. 1389, 1 female; St. 1722, 1 female; St. 1735, 1 male; St. 1750, 1 female; St. 1763, 1 female.

Specific characters.—The cephalon is only moderately deep and the rostrum proper is comparatively short, in adult specimens the basal part of the cephalon is constricted to form a neck followed by a dorsal hump. The pleura of the first three abdominal segments are postero-laterally produced but there is no lateral spine, posterior half of the lateral border is concave. Telson is roughly triangular but the proximal one-third of its lateral borders is plain and nearly parallel.

Fifth segment of the first peraeopod is produced at its inner distal part but this process does not quite reach the distal border of the sixth segment, its outer distal angle is rounded. Peraeopod two is comparatively weak, its second segment is as long as the rest of the limb, fifth segment has parallel sides and its inner distal border is feebly crenate, outer distal part of the segment is not produced. Inner border of fourth and fifth segments of the fourth peraeopod carries well-spaced spine-setae, that of the sixth segment is spiny. Outer border of second segment of the fifth peraeopod is dentate, that of the sixth segment is feebly spiny. Distal half of outer border of the second segment of the sixth peraeopod is dentate, that of segments four to six is armed with closely packed spines. Second segment of seventh peraeopod narrows towards the tip, the rest of the limb is subequal to the second segment in length.

Peduncle of the first uropod overreaches the base of the third uropod, distal half of both borders is serrate, inner ramus is more than half the length of the peduncle. Inner ramus of second uropod is less than half the length of the peduncle. Inner ramus of the third uropod is as long as the peduncle and slightly overreaches the telson.

Length 15·6 mm.

Remarks.—*O. piscator* closely resembles *O. clausi* but judging from the present collection it can be distinguished by the following characters. The outer distal part of the fifth segment of the first and second peraeopods does not form a tooth-like process; Spandl (1927, p. 180, fig. 13 *a, b*), has shown a tooth and this probably shows that he based his illustrations on a specimen of *O. clausi.*

Neither Shoemaker (1945) nor Fage (1960) has shown this tooth. The cutting edge of the prolongation of the fifth segment of the second peraeopod is only feebly crenulate whereas in *O. clausi* this edge is armed with a row of strong blunt teeth. In this character Spandl's figures are in agreement with mine. The lateral border of the first three abdominal segments has no spine-like process; each segment has a prominent tooth in *O. clausi*. The telson is proximally parallel sided whereas in *O. clausi* the telson steadily narrows towards the tip.

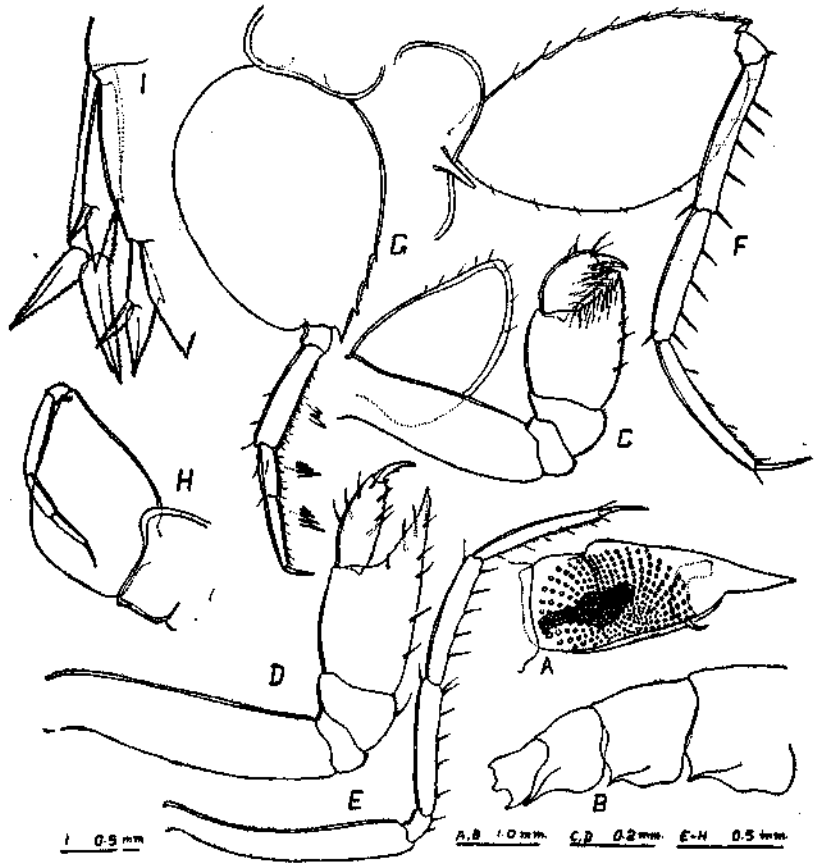

FIG. 4. *Oxycephalus piscator* M. Edwards. (A) Cephalon of male; (B) abdominal segments 1–4; (C) peraeopod 1; (D) peraeopod 2; (E) peraeopod 4; (F) peraeopod 5; (G) peraeopod 6; (H) peraeopod 7; (I) uropods and telson.

The description and figures given by Shoemaker clearly apply to the present specimens except for the shape of the second segment of the seventh peraeopod. In the single specimen Shoemaker had, the second segment strongly narrows towards the tip so that the distal one-third of the segment is no more wider than the third segment. In the present specimens the second segment is considerably less narrowed, even less than in *O. clausi*. Shoemaker's specimen was abnormal or as remarked by him the seventh peraeopod is undergoing reduction in the suborder Hyperiidea and hence cannot have much specific importance.

Distribution.—North, Tropical and South Atlantic, Subtropical and Tropical Pacific, New Zealand, Indian Ocean and the Mediterranean.

Oxycephalus latirostris Claus

(Pl. I—D; Fig. 5)

Oxycephalus latirostris Claus, 1879, p. 71, pl. 24, fig. 1; Bovallius, 1890, p. 66, pl. 2 , figs. 7–12, t.-figs.; Pirlot, 1938, p. 367; Fage, 1960, p. 26.

Oxycephalus pectinatus Bovallius, 1890, p. 64, pl. 2, figs. 4–6, t.-figs.

Oxycephalus notabilis Spandl, 1927, p. 182, figs. 15–16.

Material.—St. 1256, 1 male; St. 1278, 1 male; St. 1278, 2 males; St. 1278, 1 male, 1 female; St. 1278, 3 males, 1 female; St. 1762, 1 female; St. 1808, 1 female.

Specific characters.—Body is slender. Rostral part of the cephalon is short and apically rather blunt. The lateral borders of the first three abdominal segments are rounded, without lateral and postero-lateral processes. Telson is triangular and steadily narrows towards the tip with the proximal one-third of the border smooth.

Peraeopods one and two are very characteristic. Second segment of the first peraeopod is comparatively slender and long, fifth segment steadily broadens distalwards so that together with the sixth segment it forms a stout club, the inner distal prolongation of the fifth segment is stout and as long as the segment itself. The cutting edge of the fifth and sixth segments carries a closely packed

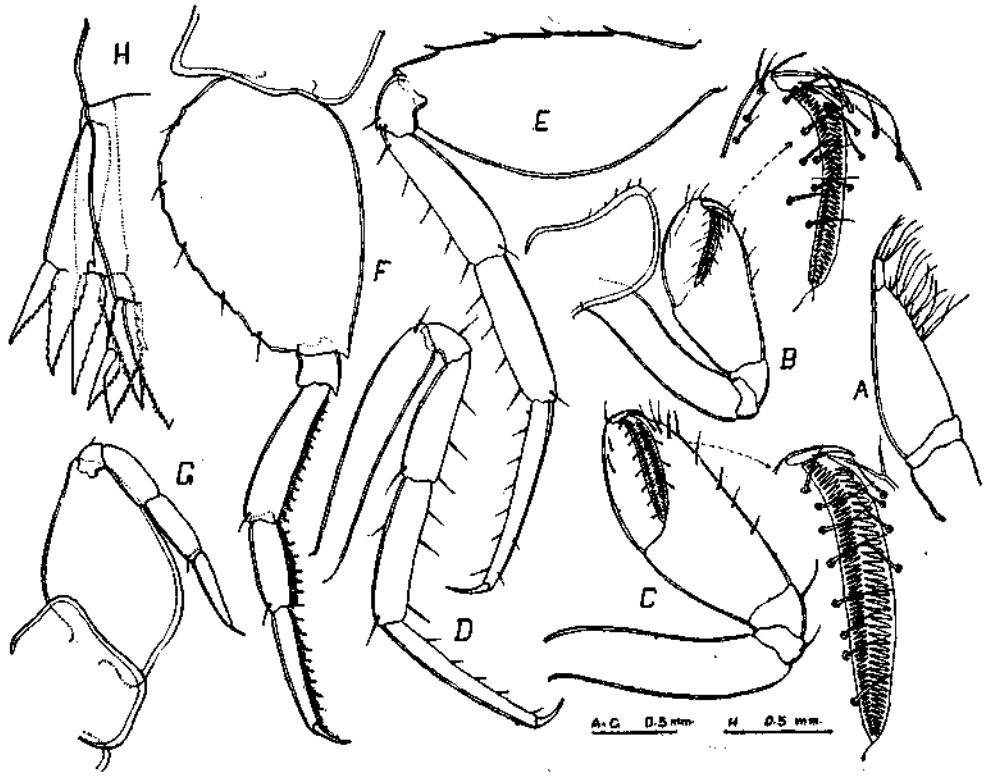

FIG. 5. *Oxycephalus latirostris* Claus. (A) Antenna 1; (B) peraeopod 1; (C) peraeopod 2; (D) peraeopod 4; (E) peraeopod 5; (F) peraeopod 6; (G) peraeopod 7; (H) uropods and telson.

row of sharp spines and several long submarginal setae. Second peraeopod is similar to the first but is longer and stouter, its sixth segment is nearly parallel sided and as long as the prolongation of the fifth segment, the armature of the chela is similar to that of the first peraeopod. Third and fourth peraeopods are similar to those of *O. clausi* and *O. piscator*. Second segment of the fifth peraeopod is somewhat elongated, with non-serrate border. The second segment of the sixth peraeopod is also rather elongated, with irregularly serrated inner border; seventh peraeopod is similar to that of other species, but its second segment is less narrowed distally.

Peduncle of the first uropod slightly overreaches that of the second, distal two-thirds of its inner border is serrated, outer ramus is shorter than the inner and its outer border is not serrated. Peduncle of the second uropod is one and a half times the length of the inner ramus, outer border of the outer ramus is not serrated. Peduncle of the third uropod is almost as long as the inner ramus, outer ramus is broader than that of the second uropod.

Length 13·9 mm.

Remarks.—The long slender body and the shape and armature of the first two peraeopods easily distinguish *O. latirostris* from *O. clausi* and *O. piscator*. In *O. latirostris* the inner border of the peduncle of the first uropod, unlike as in the other two species, is unarmed.

Distribution.—Tropical and Subtropical Pacific, Indo-Malayan and Indian Oceans, Atlantic, Mediterranean and the Red Sea.

Genus *Tullbergella* Bovallius

Tullbergella cuspidata Bovallius

(Pl. I—E; Fig. 6)

Tullbergella cuspidata Bovallius, 1887, p. 38; 1890, p. 69, pl. 2, fig. 13, t.-figs.; Spandl, 1927, p. 191, fig. 22; Fage, 1960, p. 30.

Material.—St. 1799, 2 females.

Specific characters.—Body is somewhat tumid, quite unlike that of other oxycephalids, except *Simorhynchotus*. Cephalon is rather small and produced into a short rostrum, triangular in dorsal view and narrow in lateral view. Telson is as long as the last abdominal segment but completely fused with it and apically drawn out and acute.

First antenna is fairly stout and five-segmented, with long setae, fifth segment is slender and long. Mandible has no palp and the maxilliped is provided with foliaceous palps.

First two peraeopods are subsimilar but the second is much longer than the first, fifth segment of both is flattened and triangular, with several stiff spine-setae, inner distal angle is drawn out into a long slender spine, the inner border of the sixth segment is armed with a row of sharp spines, that of the first peraeopod is comparatively broader and more spiny. Second segment of second peraeopod is as long as the rest of the limb. Third and fourth peraeopods are subsimilar, inner border of segments five and six is armed with small spines arranged in series, seventh segment is long. Second segment of the fifth peraeopod is flattened and oblong, its inner border carries a row of stiff setules and fine spines, fourth and fifth segments are fairly broad with their inner border spiny, sixth segment is equal to the combined lengths of the two previous segments. Sixth peraeopod is very characteristic, its second segment carries only very few setae along the inner border, its distal outer part is drawn out into an outwardly curved process and the distal border is obliquely truncate, fourth and fifth segments are spiny, sixth segment, compared to that of the fifth peraeopod, is short,

Seventh peraeopod is also very characteristic, its second segment is nearly twice as long as broad, with nearly straight inner border and convex outer border, this segment is followed by three small segments.

Peduncle of the first uropod is curved outwards and reaches the base of the third uropod, distal part of its outer border is serrated, rami are subequal in length and width, and as long as the peduncle, their borders are serrated, the teeth being irregularly long and short. The peduncle of the second uropod is only half as long as that of the first, but the rami are nearly as long as those of the first. The third uropod is subequal to the peduncle of the first uropod in length, inner ramus is fused with the peduncle and the outer border of the outer ramus is not spiny.

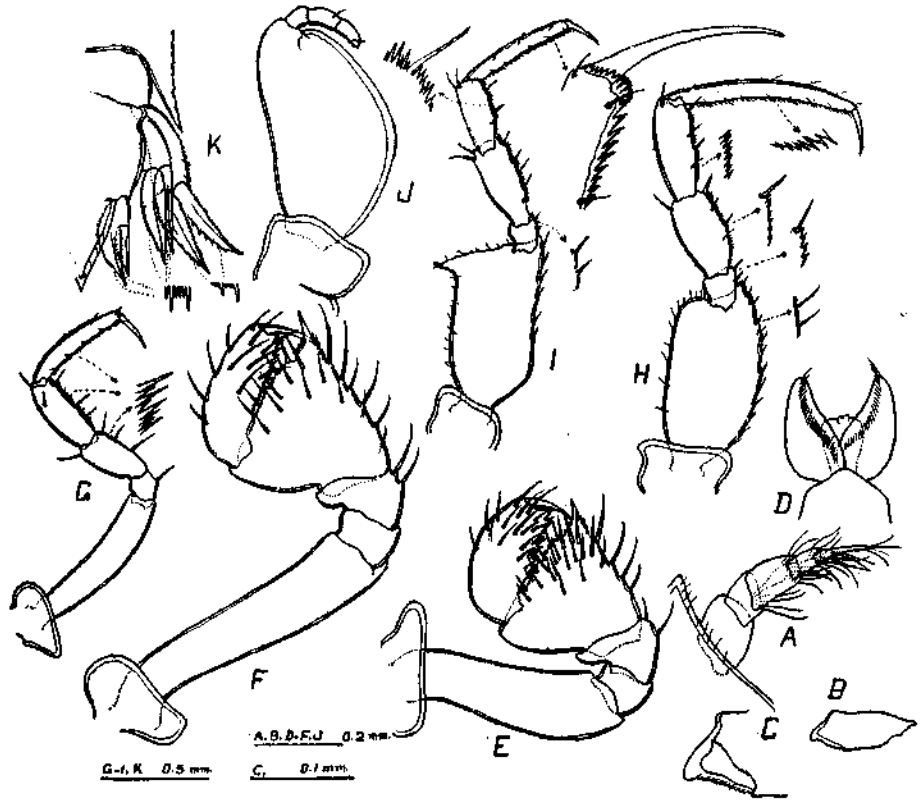

FIG. 6. *Tullbergella cuspidata* Bovallius. (A) Antenna 1; (B) mandible; (C) same, tip enlarged; (D) maxilliped; (E) peraeopod 1; (F) peraeopod 2; (G) peraeopod 4; (H) peraeopod 5; (I) peraeopod 6; (J) peraeopod 7; (K) uropods and telson.

Length 8·0 mm.

Remarks.—Compared to Spandl's figures the telson of the present specimens is apically drawn out and acute and the inner ramus of the third uropod is narrower. Spandl has shown the latter as very broad. It may be pointed out that Bovallius (1890) has also shown the telson apically rather blunt. Compared to the figure given by Bovallius the apex of the rostrum in my specimens is also more blunt. The illustrations of both these authors were those of a male while mine are of a female. This may perhaps account for the differences.

Distribution.—This species has been previously recorded from Malay Archipelago, Batavia, Gulf of Siam, Indian Ocean and Great Barrier Reef. This is one of the rare species.

Genus *Leptocotis* Streets

Leptocotis tenuirostris (Claus)

(Pl. I—F and G; Fig. 7)

Leptocotis tenuirostris Stephensen, 1925, p. 191, fig. 74; Spandl, 1927, p. 206, fig. 30; Barnard, 1930, p. 435; 1931, p. 132; 1937, p. 194; Pirlot, 1938, p. 371; Shoemaker, 1945, p. 253; Fage, 1960, p. 37, figs. 21–24.

Leptocotis spinifera Streets, 1877, p. 137; 1878, p. 283, pl. 2, fig. 4.

Leptocotis ambobus Stebbing, 1888, p. 1594, pl. 205.

Leptocotis lindstroemi Bovallius, 1890, p. 76, pl. 2, figs. 16–18, pl. 3, fig. 1, t.-figs.

Leptocotis similis Spandl, 1927, p. 204, fig. 29.

Material.—St. 1157, 1 male; St. 1245, 1 female; St. 1254, 1 male; St. 1256, 1 male; St. 1278, 1 female; St. 1302, 1 male; St. 1329, 1 male; St. 1337, 6 males, 11 females; St. 1337, 1 male; St. 1340, 4 males; St. 1344, 2 males; St. 1351, 1 female; St. 1373, 2 females, 1 male; St. 1381, 1 male, 3 females; St. 1383, 2 females; St. 1385, 1 male; St. 1385, 2 males; St. 1385, 1 male; St. 1389, 1 male, 1 female; St. 1391, 2 females, 1 male; St. 1393, 1 male, 1 female; St. 1411, 1 female; St. 1413, 1 female; St. 1413, 1 male; St. 1415, 22 males; St. 1415, 1 male; St. 1415, 2 males, 1 female; St. 1415, 3 females; St. 1417, 1 male; St. 1750, 1 male; St. 1808, 1 female.

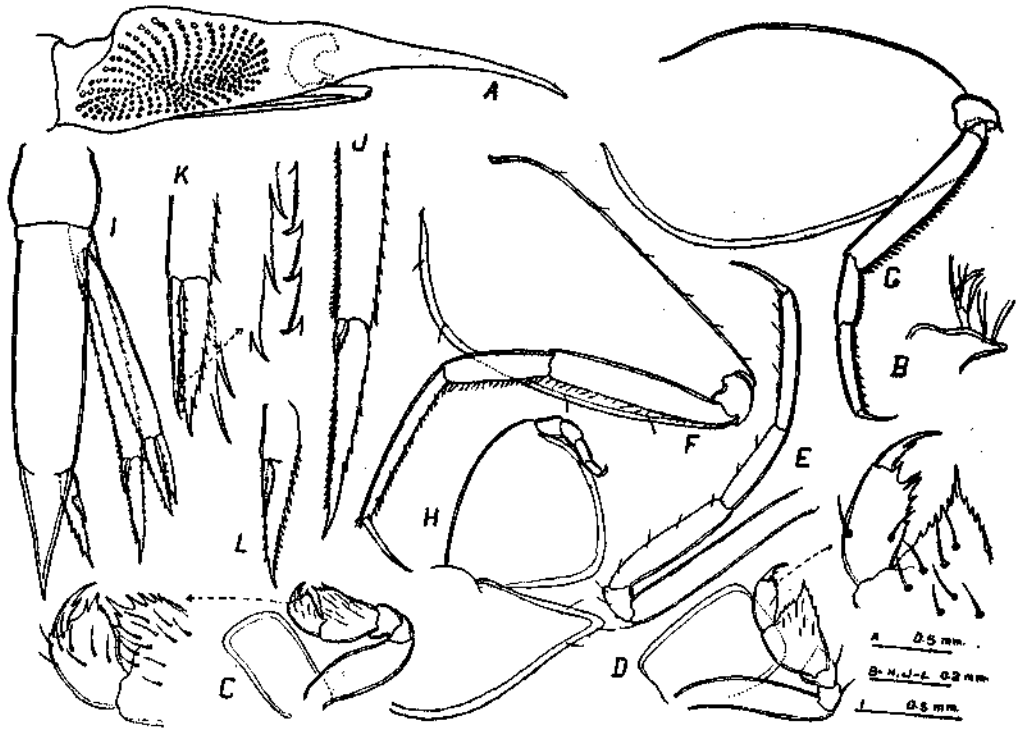

FIG. 7. *Leptocotis tenuirostris* (Claus). (A) Cephalon of male ; (B) antenna 1 ; (C) peraeopod 1; (D) peraeopod 2; (E) peraeopod 4; (F) peraeopod 5; (G) peraeopod 6; (H) peraeopod 7; (I) uropods and telson; (J–L) uropods 1–3.

Specific characters.—Cephalon is comparatively long and produced into a long rostrum which is slightly curved downwards near the tip; the ventral border of the cephalon and the rostrum carries scattered fine hairs but no serrations. In the female the cephalon has an indistinct neck constriction but in the male the neck constriction is made more conspicuous by a sudden elevation of the dorsal side of the cephalon. The first two abdominal segments are postero-laterally rounded but the third is drawn out into sharp spines reaching clearly beyond the middle of the fourth abdominal segment. The fifth abdominal segment is fused with the sixth and this composite segment is about two and a half times as long as the telson and subequal to the peduncle of the first two uropods in length.

Basal flagellar segment of the first antenna of the male is produced at its outer distal angle and the succeeding four-segmented part originates from the middle of the distal border. Second antenna of the male is only sparsely setose.

Fifth and sixth segments of the first peraeopod are internally expanded and their inner border is cut into a large number of strong acute teeth. In the second peraeopod the fifth and sixth segments are similarly armed, but the fifth segment is broader than that of the first peraeopod and the sixth segment is narrower. Third and fourth peraeopods are slender and weakly armed. Segments four to six of peraeopods five and six are internally armed with spines, the spines on the fourth segment of the sixth peraeopod are very strong and bent basalwards, those on the sixth segment are arranged in series of small spines alternating with long ones. The coxal plate of the seventh peraeopod is subequal to the second segment in size and is produced backwards. Though this appendage is reduced in size all the segments are distinct.

The peduncle of the first uropod is longer than that of the second and both margins of the first and the inner margin of the second are serrated. In the first uropod the endopod is very small and the exopod is long and closely serrated on the inner side and sparsely serrated on the outer margin. The endopod of the second uropod is slightly longer than the exopod and armed with widely spaced teeth, each tooth having a frilled border, inner border of the exopod carries large curved spines armed with a row of subsidiary spines. The peduncle of the third uropod is fused with the endopod, exopod is small and less than half the length of the endopod. Telson strongly tapers to the apex. Dorso-median part of the abdomen and the telson is keeled.

Length 10·1 mm.

Remarks.—The consensus of expert opinion is that genus *Leptocotis* is monotypic. The present study has shown that *L. ambobus* Stebbing (1888) was created on the males of *L. tenuirostris*. The present collection is very rich in specimens of both sexes and all the males show the "ambobus" shape of the cephalon. The two sexes show conspicuous difference in the shape and size of the cephalon.

As pointed out by Barnard (1930) the lower margins of the abdominal segments are not serrated and the peduncle of the third uropod is coalesced with the inner ramus.

Distribution.—This is a very widely distributed species which has been previously recorded from North and South Atlantic, Pacific, East Indies and Indian Ocean. In the present locality this is the most abundant oxycephalid. The males always outnumber the females.

Genus *Calamorhynchus* Streets

Calamorhynchus pellucidus Streets

(Pl. I—H; Fig. 8)

Calamorhynchus pellucidus Streets, 1878, p. 285, pl. 2, fig. 5; Bovallius, 1890, p. 73, pl. 2, figs. 14–15, t.-figs.; Spandl, 1927, p. 198, figs. 25–26; Barnard, 1930, p. 434; Pirlot, 1938, p. 371; Shoemaker, 1945, p. 251; Fage, 1960, p. 31, figs. 19–20.

Calamorhynchus rigidus Stebbing, 1888, p. 1600, pl. 206; Bovallius, 1890, p. 74; Stephensen, 1925, p. 189, fig. 73; Spandl, 1927, p. 203, fig. 27.

Material.—St. 1730, 1 female; St. 1749, 1 male.

Specific characters.—The cephalon is about a third of the total length of the animal and is divisible into a short but distinct neck, an oblong cephalon proper occupied by the eyes and a long rostrum expanded into broad wings with feebly serrated border. The cephalon has a prominent dorso-median longitudinal keel. Each peraeon segment has an indistinct transverse furrow. The postero-lateral angles of the first three abdominal pleura are produced and apically acute. Telson is about two-thirds the length of the previous segment and is apically drawn out and acute.

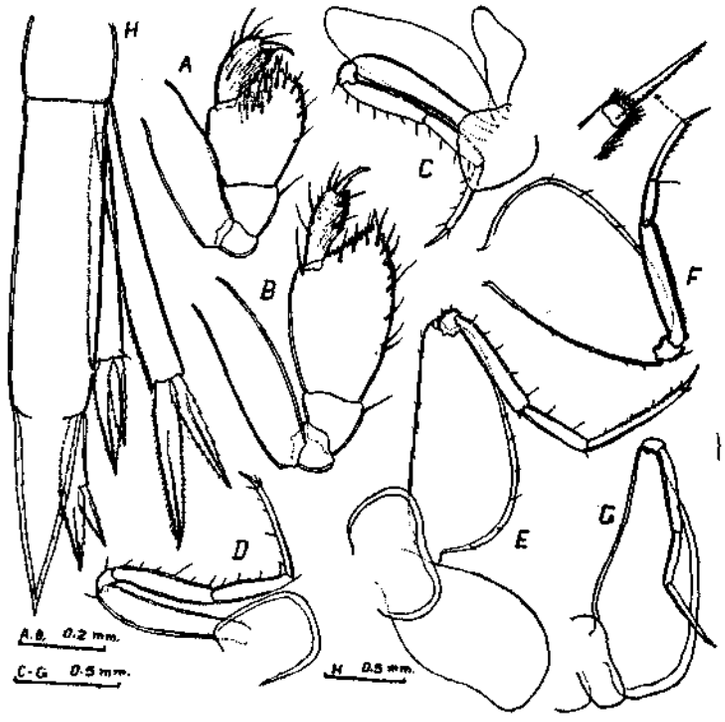

FIG. 8. *Calamorhyncuhs pellucidus* Streets. (A) peraeopod 1; (B) peraeopod 2; (C) peraeopod 3; (D) peraeopod 4; (E) peraeopod 5; (F) peraeopod 6; (G) peraeopod 7; (H) uropods and telson.

First peraeopod has a highly swollen fifth segment armed with a row of teeth at the broadly produced inner distal part, inner border of the sixth segment is also toothed. Fifth segment of the second peraeopod is swollen and its inner distal corner is produced, distal border is armed with a row of small blunt teeth, inner border of the sixth segment has the same armature. Peraeopods three and four are subsimilar, slender and weakly armed. Second segment of fifth peraeopod has a nearly straight and feebly serrated upper border and a convex lower border, the segment slightly narrows towards the tip, the sixth segment has its inner border spiny. Second segment of the sixth peraeopod is shorter but broader than that of the fifth peraeopod, segments four to six have their inner border strongly spiny. Second segment of the seventh peraeopod is nearly as long as the rest of the limb and conspicuously narrows towards its distal end so that the distal border is only slightly broader than the third segment.

Peduncle of the first uropod clearly overreaches that of the second and stops a little short of the base of the third uropod, its inner margin is strongly serrate, inner ramus is larger than the outer,

with closely serrate border, outer ramus has sparsely serrate border. Inner margin of the peduncle of the second uropod is very indistinctly serrate, rami are weakly serrate. Peduncle of the third uropod is completely fused with the inner ramus and is as long as the latter, outer ramus is comparatively small.

Length 10·1 mm.

Remarks.—Except in very minor characters the present specimens are exactly like those described by Stebbing. The margin of the rostrum is serrated and each peraeon segment has a faint transverse groove. I could not find the close spinulation of the third and fourth peraeopods illustrated by Stebbing, instead, there are long spine-setae. In Stebbing's figures the spines arming the cutting edge of the chela of the second peraeopod are pointed. They are actually blunt as illustrated by Fage (1960). In the fifth peraeopod the dorsal border of the second segment is sparsely serrated and not smooth as shown by Stebbing and the fourth and fifth segments possess only a few spine-setae and are not closely spiny as shown by Stebbing. Similarly, the sixth peraeopod is much more strongly armed than shown by Stebbing.

Distribution.—North and South Atlantic, North Pacific, East Indies, Indian Ocean and the Mediterraenan.

Genus *Cranocephalus* Bovallius

Cranocephalus scleroticus (Streets)

(Pl. I—I; Fig. 9)

Oxycephalus scleroticus Streets, 1878, p. 281, pl. 2, fig. 3.

Oxycephalus typhoides Claus, 1879, p. 195; 1887, p. 72, pl. 24, figs. 11–14.

Cranocephalus goesi Bovallius, 1890, p. 95, pl. 4, figs. 7–9, t.-figs.

Stebbingella sclerotica Bovallius, 1890, p. 98, pl. 4, figs. 13–16.

Stebbingella typhoides Bovallius, 1890, p. 100, pl. 4, figs. 10–12, t.-figs.; Stephensen, 1925, p. 199, fig. 76; Spandl, 1927, p. 193, fig. 23.

Stebbingella theeli Bovallius, 1890, p. 101, pl. 5, figs. 1–4, t.-figs.

Cranocephalus scleroticus Shoemaker, 1945, p. 251, fig. 44; Fage, 1960, p. 72, figs. 44–53.

Material.—St. 1393, 1 female; St. 1723, 1 male.

Specific characters.—The proximal dorsal side of the cephalon is abruptly raised so that a deep neck constriction is evident. Each peraeon segment has a transverse furrow slightly behind its anterior border. Coxal plates, except the first, are fused with the peraeon segments, but a deep posterior incision demarcates them, the fifth coxal plate has a conspicuous median spine directed backwards. Inferior border of the first three abdominal segments is nearly straight. The telson is linguiform and only very slightly narrows towards the broadly rounded apex.

Lower distal corner of the basal segment of the flagellum of the first antenna of the male is bluntly produced. Peraeopods one and two are subequal in size and shape but the second segment of the second peraeopod is longer than that of the first and the anterior border of the fifth segment of the first peraeopod is more prominently serrated. Peraeopods three and four are long and slender and subsimilar, second segment is as long as the fourth and fifth segments combined. Peraeopods

five to seven have broad flattened second segment which is somewhat irregular in shape, that of the sixth peraeopod is the longest, the anterior border of the second segment of peraeopods five and six is feebly serrated, segments three to six of the fifth peraeopod carry scattered setae while those of the sixth are serrated as in other oxycephalids. Seventh peraeopod, though comparatively small, has all the segments.

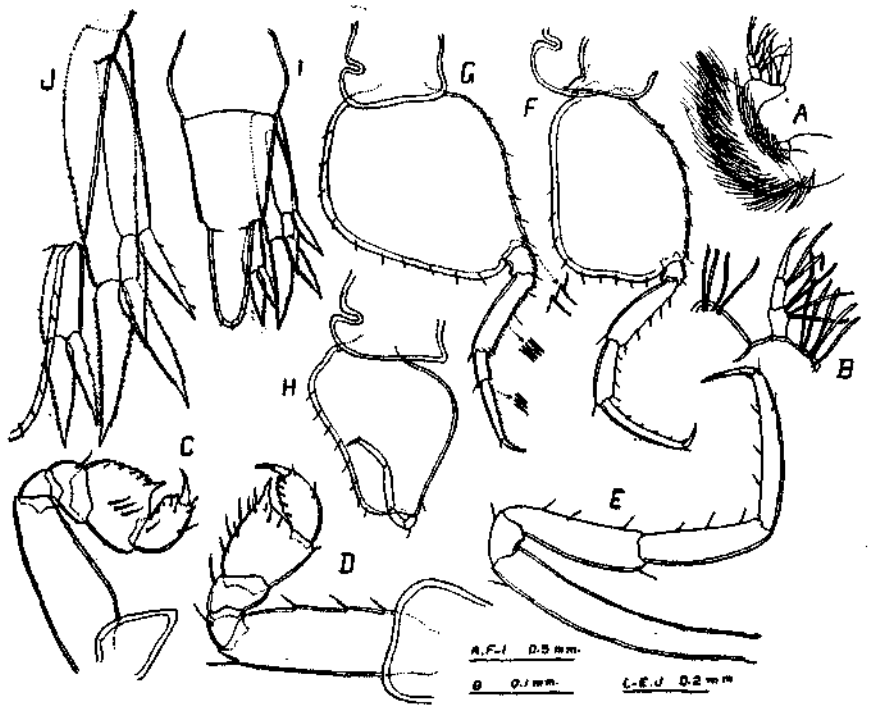

FIG. 9. *Cranocephalus scleroticus* Bovallius. (A) Antenna 1; (B) same, tip enlarged; (C) peraeopod 1; (D) peraeopod 2; (E) peraeopod 4; (F) peraeopod 5; (G) peraeopod 6; (H) peraeopod 7; (I) uropods and telson; (J) same, enlarged.

Peduncle of the first uropod is stout and reaches beyond the base of the telson, distal two-thirds of its inner border and distal half of its outer border are serrated, rami are strongly serrated on both borders, inner ramus is longer than the outer and slightly overreaches the telson. Borders of the inner ramus and inner border of the outer ramus of the second uropod are prominently serrated, outer border of the outer ramus is smooth. Peduncle of the third uropod is as long as the inner ramus, distal half of its inner border is serrated, outer border of the outer ramus is sparsely toothed.

Length 11·3 mm.

Remarks.—Fage (1960) described the growth changes and sex difference this species exhibits. When compared with the illustrations published by Shoemaker (1945) the inner distal prolongation of the fifth segment of peraeopods one and two in the present specimens is more prominent. The specimen described above is an young male very well agreeing with the figures given by Fage (1960, p. 73, fig. 45 B and p. 77, fig. 51).

Distribution.—North Pacific, Mediterranean, Tropical Atlantic, Indian Ocean, North Atlantic and South Atlantic.

Genus *Glossocephalus* Bovallius

Glossocephalus milne-edwardsi Bovallius

(Pl. I—J; Fig. 10)

Glossocephalus milne-edwardsi Bovallius, 1887, p. 35; 1890, p. 106, pl. 5, fig. 5, t.-figs; Chevreux and Fage, 1925, p. 432, fig. 421; Spandl, 1927, p. 196, fig. 24; Pirlot, 1938, p. 371; Shoemaker, 1945, p. 253, fig. 45; Fage, 1960, p. 83, fig. 56.

Glossocephalus spiniger Bovallius, 1887, p. 35; 1890, p. 108, pl. 5, figs. 6–9; t.-figs.

Elsia indica Giles, 1888, p. 250, pl. 6, figs. 2–4.

Glossocephalus adriaticus Steuer, 1911, p. 682, pl. 3.

Material.—St. 1688, 1 female, 1 male; St. 1710, 1 male; St. 1711, 1 female; St. 1737, 1 male; St. 1766, 1 female.

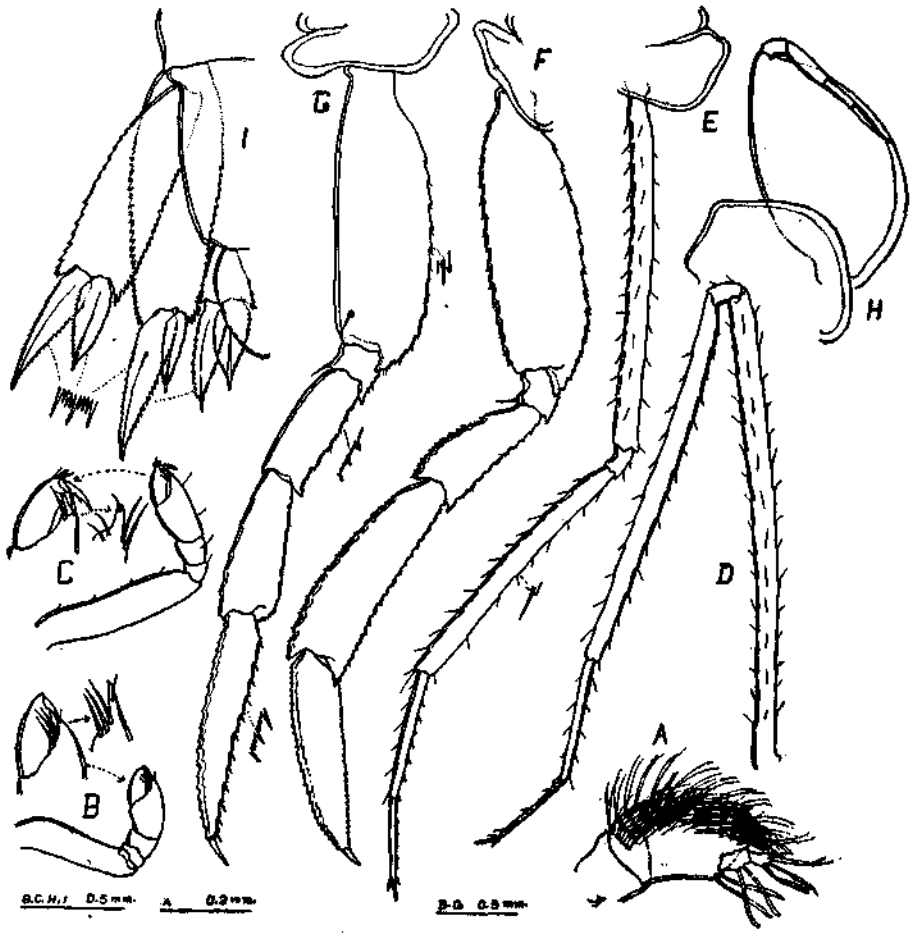

FIG. 10. *Glossocephalus milne-edwardsi* Bovallius. (A) Antenna 1; (B) peraeopod 1; (C)) peraeopod 2; (D) peraeopod 3; (E) peraeopod 4; (F) peraeopod 5; (G) peraeopod 6; (H) peraeopod 7; (I) uropods and telson.

Specific characters.—The cephalon is comparatively small and hardly forms a rostrum, its anterior end is blunt. First two peraeon segments are short but the others are long so that unlike as in other oxycephalids the peraeopods are well spaced. Abdominal segments are fairly deep and have neither lateral nor postero-lateral spine-like prolongations.

First antenna has a four-segmented flagellum, first flagellar segment is broad and fringed with olfactory setae. Second antenna is folded as usual and armed with well-spaced setules. Peraeopods one and two are similar in structure but the second is slightly longer, the process of the fifth segment is spooned and armed with three to four strong spines. Peraeopods three and four are subsimilar, third is slightly longer than the fourth, segments are armed along the borders with stiff setules, seventh segment is very small. Fifth peraeopod is flattened and oar-like, both borders of the segments are serrated and each serration is secondarily armed with microscopic spinules, sixth segment is only slightly shorter than the fifth, seventh segment is very small. Sixth peraeopod is almost similar to the fifth, but its sixth segment is more slender than that of the fifth peraeopod and much longer than the fifth segment. The seventh peraeopod remotely resembles that of other oxycephalids and is formed of a large flat segment followed by four slender segments.

The peduncle of uropods one and two has strongly serrate border, outer ramus is longer than the inner, inner ramus of first uropod is narrow and that of the third is broad. Telson is slightly longer than broad and distally rounded, distal half of its lateral borders is serrated.

Length 12·7 mm.

Remarks.—Shoemaker (1945) illustrated this species but did not attempt a description. The present specimens differ as follows: The first flagellar segment of the first antenna of the male is distally produced. Shoemaker has neither described nor figured the armature of the distal segments of legs five and six. He pointed out the difference in the shape of the cephalon and attributed this to the difference in the size of the specimens. In the present specimens, which include very small ones, the cephalon has evenly curved dorsal side which is not abruptly raised as shown by Shoemaker. The cephalon is apically blunt and not sharply angular as illustrated by Shoemaker.

The small specimens, of both sexes, in the present collection appear to be dimorphic forms. They are seemingly mature, but only a third of the length of the normal ones. In general shape these fully agree with the figure of *G. spinifer* given by Bovallius (1890, pl. 5, fig. 6).

Distribution.—North and South Atlantic, South Pacific, Indian Ocean, Mediterranean and Red Sea.

Genus *Streetsia* Stebbing

Stebbing, 1888; Bovallius, 1890; Stephensen, 1925; Spandl, 1927; Fage, 1960.

A large number of species have been referred to this genus but Fage recognised only four of them as valid. All the four are represented in the present collection by small numbers. The following key serves to distinguish them.

1. Body stout.....*porcella*
1. Body slender.....2
2. Cephalon with a distinct neck constriction, abdominal segments one to three with a pair of sense-organs.....*mindanaonis*
2. Cephalon without a neck constriction, abdominal segments without sense organs.....3
3. Postero-lateral angles of third abdominal segment blunt.....*challengeri*
3. Postero-lateral angles of third abdominal segment pointed.....*steenstrupi*

Streetsia porcella (Claus)

(Pl. I—K; Fig. 11)

Oxycephalus porcellus Claus, 1887, p. 71, pl. 24, figs. 7–9; Bovallius, 1887, p. 36; Stebbing, 1888, p. 1587, pl. 203.

reetsia porcellus Bovallius, 1890, p. 83, pl. 4, figs. 4–6.

Streetsia porcella Stephensen, 1925, p. 192; Barnard, 1930, p. 435; 1932, p. 295; 1937, p. 192; Pirlot, 1938, p. 370; Shoemaker, 1945, p. 255; Fage, 1960, p. 63.

Streetsia intermedia Spandl, 1927, p. 188, figs. 20–21.

Material.—St. 941, 1 female; St. 976, 1 female; St. 1029, 1 female; St. 1245, 1 female; St. 1278, 1 female; St. 1278, 1 female; St. 1292, 2 males, 1 female; St. 1389, 1 male; St. 1415, 1 female; St. 1417, 1 male; St. 1720, 1 male, 1 female; St. 1789, 1 female.

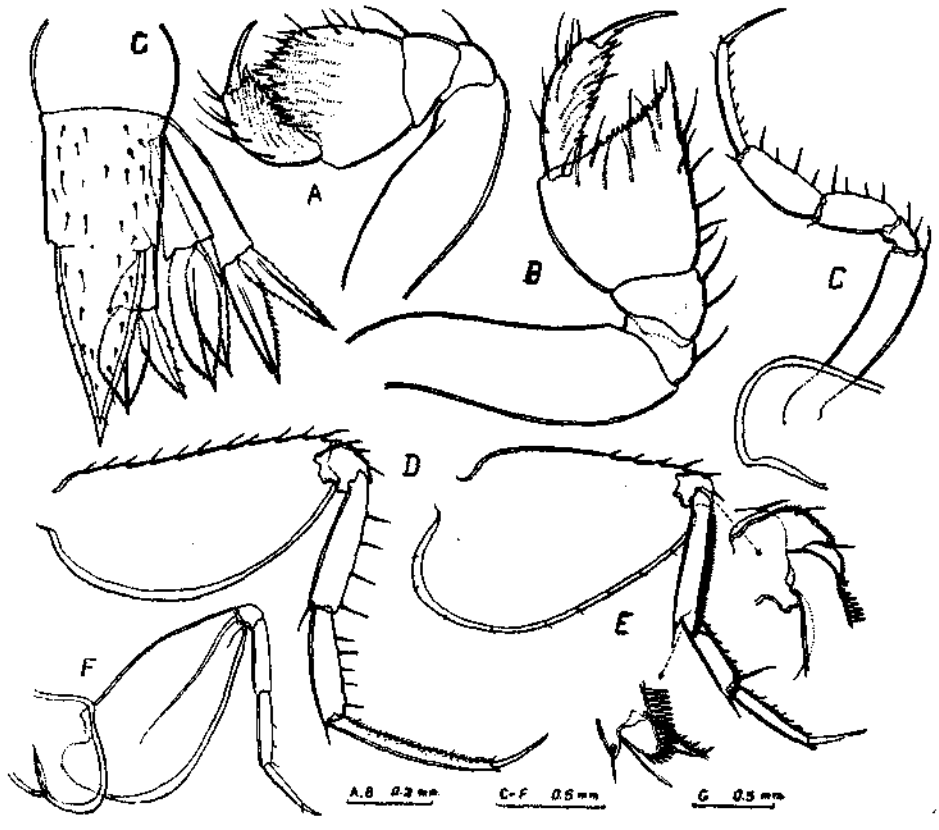

FIG. 11. *Streetsia porcella* (Claus). (A) peraeopod 1; (B) peraeopod 2; (C) peraeopod 4; (D) peraeopod 5; (E) peraeopod 6; (F) peraeopod 7; (G) uropods and telson.

Specific characters.—The body is comparatively stout and strongly built, quite unlike that of other species. The cephalon is comparatively short and produced into a short downwardly curved rostrum which is nearly half the length of the cephalon proper. First three abdominal segments

are rather deep with their postero-lateral prolongations acute. Telson is about one and a half times the length of the last abdominal segment and is apically drawn out and acute.

Peraeopods one and two are rather robust, fifth segment of first peraeopod is produced into a more or less rounded lobe armed with about ten unequal teeth, inner border is finely serrate, inner surface of the segment carries a large number of stiff spine-setae, inner margin of sixth segment is also armed with sharp teeth and its inner surface carries stiff spine-setae. Inner distal angle of fifth segment of second peraeopod is drawn out into a long spine, distal border is irregularly serrate, the serrations successively but very gradually increase in size, sixth segment is armed as in the first peraeopod. Peraeopods three and four are slender and weakly armed. Second segment of the fifth peraeopod has a serrate straight upper border, sixth segment is weakly spiny. Distal half of the upper border of the second segment of the sixth peraeopod is serrated, segments four to six have their inner border strongly spiny, inner distal part of the fourth segment is produced into a large rounded lobe overlapping the base of the fifth segment. Second segment of the seventh peraeopod is as long as the rest of the limb.

Peduncle of the first uropod reaches beyond the base of the peduncle of the third, its rami are comparatively narrow and the inner ramus, which is broader, has its borders more closely serrate, inner border of the peduncle is pectinate. Peduncle of the second uropod slightly overreaches the base of that of the third uropod, rami are longer than the peduncle and rather broad and flattened, with serrate borders, inner border of the peduncle is pectinate. Third uropod has a short peduncle with the distal half of its inner border pectinate, rami are longer than the peduncle and reach the tip of the rami of the first uropod, inner ramus is very much flattened.

Length 9·1 mm.

Remarks.—The neck constriction shown by Stebbing is absent. The dorsal margin of the second segment of the fifth peraeopod and the distal half of that of the sixth peraeopod is serrated but this has not been shown by Stebbing. Likewise the third segment of the sixth peraeopod is produced into a large spiny lobe overlapping the fourth segment which also has not been shown by Stebbing. Second segment of the seventh peraeopod is slightly more elongated than in Stebbing's figure of this appendage.

Distribution.—North and South Atlantic, Mediterranean, Sea of Japan, New Zealand and the Arabian Sea.

Streetsia challengeri Stebbing

(Plate I—L; Fig. 12)

Streetsia challengeri Stebbing, 1888, p. 1591, pl. 204 B; Bovallius, 1890, p. 82; Stephensen, 1925, p. 194, fig. 75; Spandl, 1927, p. 186, figs. 18–19; Barnard, 1930, p. 435; 1932, p. 295; 1937, p. 295; Pirlot, 1938, p. 369; Fage, 1960, p. 51, fig. 37.

Streetsia pronoides Bovallius, 1890, p. 84, pl. 3, figs. 7–12, t.-figs.

Streetsia stebbingi Chevreux, 1900, p. 161, pl. 18, fig. 4.

Streetsia washingtoni Senna, 1903, p. 15, pl. 2.

Streetsia subada, Colosi, 1918, p. 218, pl. 2, figs. 5–8.

Streetsia gaussi Spandl, 1927, p. 184, fig. 17.

Material.—St. 1044, 1 female; St. 1278, 2 females; St. 1278, 1 female; St. 1385, 1 female.

Specific characters.—The cephalon is nearly a third of the total length of the animal and is produced into a long slender rostrum with feebly serrate inferior border. Postero-lateral angles of the

first two abdominal segments are not produced. Telson is nearly as long as the last abdominal segment and is apically drawn out.

Fifth segment of first peraeopod is expanded at its inner distal part but is not produced, its border is armed with a few sharp spines; sixth segment is broad and its cutting edge is straight and feebly serrated. Inner distal angle of the fifth segment of the second peraeopod is produced into a long spine, distal border has two to three spines, sixth segment is rather slender, with two inner distal spines, inner border is finely serrate. Third and fourth peraeopods are subsimilar and armed with slender spine-setae. Second segment of the fifth peraeopod is considerably flattened and elongated, its upper border is nearly straight, and feebly serrated, outer distal angle of the second segment is slightly produced, succeeding segments are armed with short stiff setae along the inner border. Second segment of the sixth peraeopod is shorter but broader than that of the fifth peraeopod, its upper border is distally serrated, its lower distal part is prolonged into a prominent conical process which is very characteristic of this species, outer distal angle of the second segment is produced in a sharp process, segments three to six are armed with closely packed spines. Second segment of seventh peraeopod is rather short and longer than the rest of the limb, seventh segment is represented by a spine.

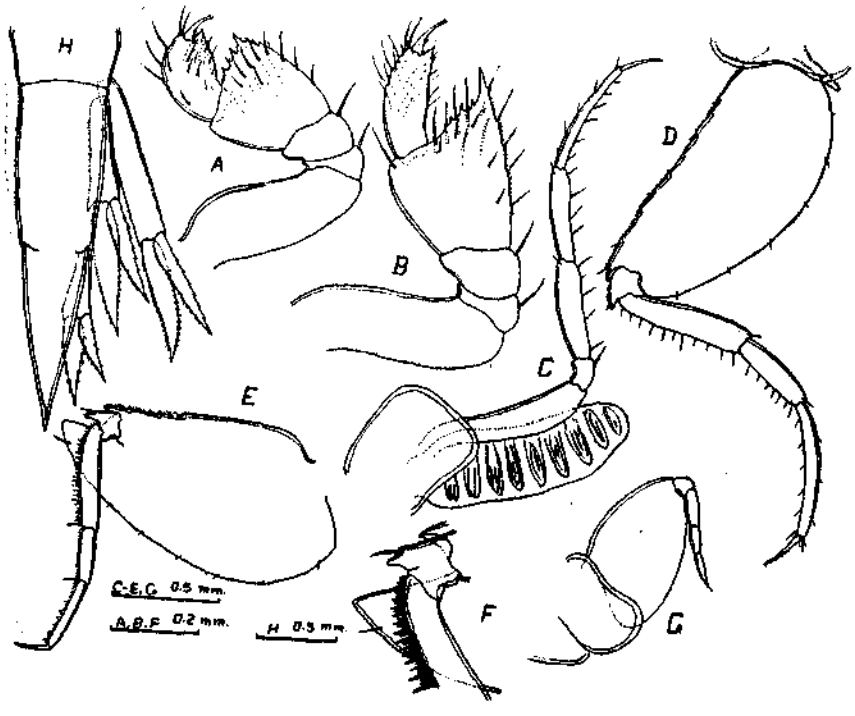

FIG. 12. *Streetsia challengeri* Stebbing. (A) Peraeopod 1; (B) peraeopod 2; (C) peraeopod 3; (D) peraeopod 5; (E) peraeopod 6; (F) same, segments 2 and 3 enlarged; (G) peraeopod 7; (H) uropods and telson.

Peduncle of the first uropod just reaches the base of the third uropod, its inner border is finely spiny, inner ramus is broader and longer than the outer and closely serrate, outer ramus is sparsely serrate. Peduncle of the second uropod is shorter than the inner ramus, latter is longer and broader than the outer. Peduncle of the third uropod is as long as the inner ramus, latter stops far short of the tip of the telson.

Length 10·9 mm.

Remarks.—This species is apparently quite variable. When compared to the detailed description by Stebbing (1888) the following differences emerge. In Stebbing's figure the cephalon is nearly cylindrical with the rostrum subequal to the cephalon proper in length. In the present specimens the cephalon perceptibly narrows distalwards and the rostrum is comparatively short. In this character Spandl's figure agrees with mine. Stebbing has shown the postero-lateral corners of the third abdominal segment slightly produced; they are blunt in mine. In Stebbing's specimen the last abdominal segment is only half as long as the telson but in mine they are nearly equal in length. In the appendages also variations are observed. The most important difference is the absence of the distal prolongation of the second segment of the second peraeopod. This is only a sign of immaturity (Stephensen, 1925). The lower distal prolongation of the second segment of the sixth peraeopod is very characteristic of this species and hence there is very little difficulty in referring the present specimens to *S. challengeri*. *S. challengeri* very closely resembles *S. steenstrupi* (Bovallius).

Distribution.—Hawiian Islands, North and South Atlantic, South Pacific, Indian Ocean. Arabian Sea and the Mediterranean.

Streetsia steenstrupi (Bovallius)

(Pl. I—M; Fig. 13)

Oxycephalus steenstrupi Bovallius, 1887, p. 37.

Oxycephalus longiceps Stebbing, 1888, p. 1591, pl. 204 B.

Streetsia steenstrupi Bovallius, 1890, p. 89, pl. 3, figs. 2–6, t.-figs.; Fage, 1960, p. 42, figs. 25–27.

Material.—St. 1044, 1 female; St. 1278, 1 female.

Specific characters.—Cephalon is elongated and about a third of the total length of the animal, Rostrum is comparatively short with feebly serrate border. Postero-lateral corners of the first three abdominal segments are acute but not produced, except those of the third. Telson is elongated and tapering, almost as long as the last abdominal segment.

First peraeopod is rather stout and of uniform width, fifth segment is cylindrical with feebly serrated inner border, inner distal part is produced into a narrow process, distal border is very indistinctly dentate, sixth segment is rather broad and its inner distal angle is prolonged beneath the seventh segment. Fifth segment of second peraeopod is minutely pectinate along the inner border, inner distal angle is prolonged into a large triangular process almost reaching the tip of the sixth segment, distal border is weakly dentate, sixth segment is comparatively slender, seventh is long. Peraeopods three and four are subsimilar, third is slightly shorter but broader than the fourth. Second segment of fifth peraeopod is expanded, the dorsal side is straight and weakly dentate, outer distal part of the third segment is expanded into a flat lobe with spiny border, overlapping the fourth segment. Second segment of sixth peraeopod is broader than that of the fifth, third segment is greatly expanded, segments four to six are strongly spiny. Seventh peraeopod is of the usual pattern with large leaf-like second segment.

Peduncle of the first uropod just reaches the base of the third uropod, its inner distal border is spiny, inner ramus is more strongly dentate than the outer. Peduncle of the second uropod is as long as the outer ramus, both rami are sparsely dentate. Peduncle of the third uropod is as long as the outer ramus and its inner border is finely pectinate.

Length 10·7 mm.

Remarks.—In the shape of the cephalon of the female there is much difference between the illustrations of Stebbing and Fage; mine are like those of Fage. There is, however, no doubt about

the identity because of the very exact similarity in the shape of the fifth segment of the first peraeopod and of the third segment of the sixth peraeopod.

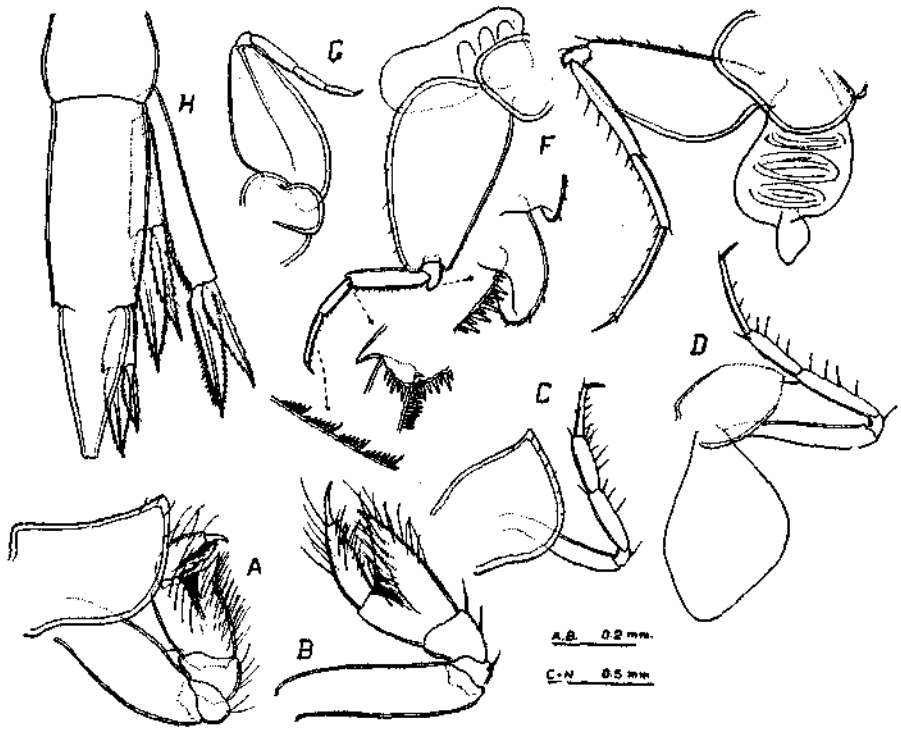

FIG. 13. *Streetsia steenstrupi* (Bovallius). (A) Peraeopod 1; (B) peraeopod 2; (C) peraeopod 3; (D) peraeopod 4; (E) peraeopod 5; (F) peraeopod 6; (G) peraeopod 7; (H) uropods and telson.

Streetsia mindanaonis (Stebbing)

(Pl. I—N; Fig. 14)

Leptocotis mindanaonis Stebbing, 1888, p. 1598, pl. 204 *c*.

Streetsia mindanaonis Bovallius, 1890, p. 93; Fage, 1960, p. 45, figs. 28–32.

Material.—St. 1302, 1 male; St. 1385, 1 male; St. 1393, 1 male; St. 1397, 1 male; St. 1723, 1 male.

Specific characters.—Cephalon is slightly more than one-third the total length of the animal and in the male is divisible into a neck, a cephalon proper housing the eyes and a long curved rostrum. First three abdominal segments have their postero-lateral angles acute but are not produced backwards, each carries a pair of sense organs. Telson is about two-thirds the length of the last abdominal segment and is apically drawn out and acute.

The basal flagellar segment of the first antenna of the male is rounded at the lower distal part and bluntly produced at the upper distal. First peraeopod is shorter but stouter than the second, fifth segment is produced into a conical unarmed process at the inner distal part, inner part of sixth segment is expanded and feebly toothed. The inner distal angle of the fifth segment of the second

peraeopod is considerably produced, with the cutting edge minutely spiny, inner border of the sixth segment is similarly armed. Third and fourth peraeopods are subsimilar and armed with long stiff setae, sixth segment is feebly spiny. Second segment of fifth peraeopod is elongated and flattened, nearly twice as long as broad, its upper border is partly serrate, inner border of sixth segment is spiny. Second segment of sixth peraeopod is comparatively broad and its upper border is serrate, fourth segment is armed with strong spines, interspersed with longer ones, fifth and sixth segments have uniform spines. Second segment of seventh peraeopod is as long as the rest of the limb.

Peduncle of the first uropod stops short of the base of the third uropod, its inner border is strongly serrated, outer border of outer ramus and inner border of inner ramus are closely serrated. Peduncle of second uropod stops slightly short of the base of that of the third, its inner border is feebly serrated, teeth on the inner border of the rami are armed with subsidiary teeth, the outer border of the inner ramus has secondarily armed teeth near the tip but the rest of the border is closely spiny. Peduncle of the third uropod is slightly shorter than the rami, all the uropods stop far short of the tip of the telson.

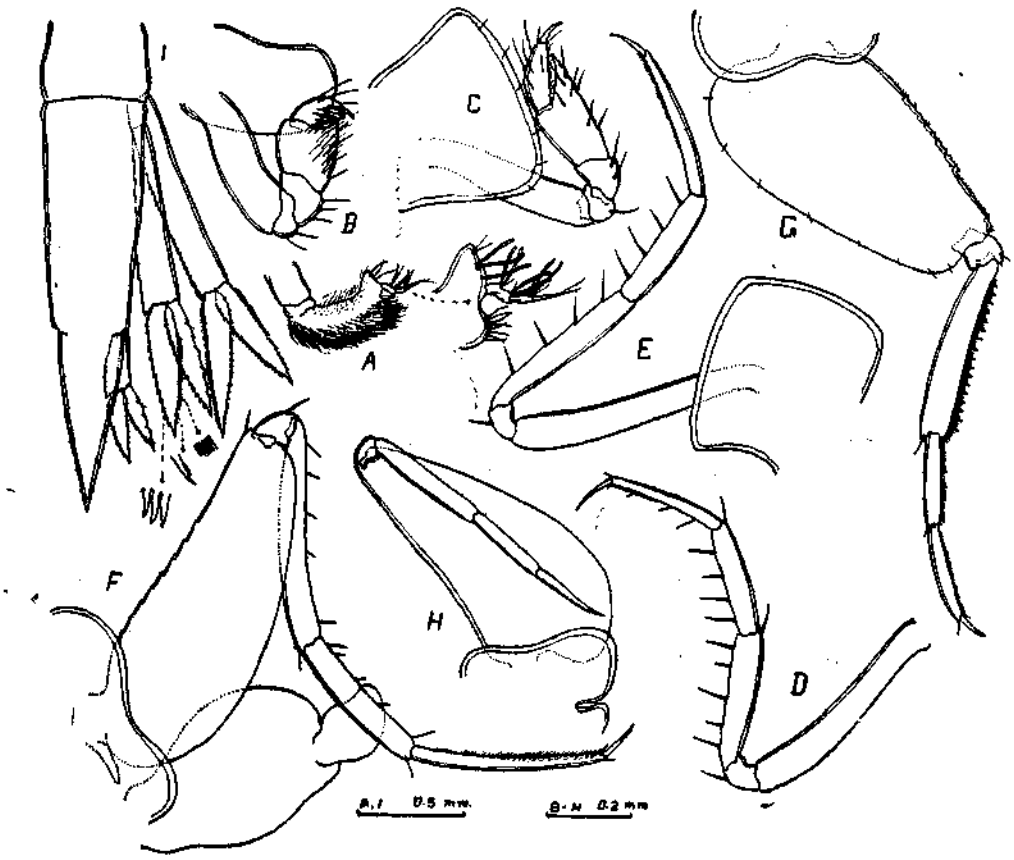

FIG. 14. *Streetsia mindanaonis* (Stebbing). (A) Antenna 1; (B) peraeopod 1; (C) peraeopod 2; (D) peraeopod 3; (E) peraeopod 4; (F) peraeopod 5; (G) peraeopod 6; (H) peraeopod 7; (I) uropods and telson.

Length 10·0 mm.

Remarks.—In previous descriptions of this species by Stebbing (1888) and Fage (1960) adequate attention has not been paid to the finer details like the very specific armature of the rami of the uropods.

S. mindanaonis shows very close resemblance to *Leptocotis tenuirostris* but can be easily distinguished by the comparatively longer neck, the spines on the fourth segment of the sixth peraeopod which are at right angles to the long axis of the segment (at an angle in *Leptocotis*) the nearly transverse hind border of the third abdominal segment (very oblique in *Leptocotis*) and the subsimilar rami of the first uropod (inner ramus is very small in *Leptocotis*).

Distribution.—Recorded from all the oceans.

Genus *Rhabdosoma* Adams and White

Stebbing, 1888; Spandl, 1927; Fage, 1960.

Of the six species Fage recognised in this genus only two are contained in the present collection. They differ thus:

1. Fifth segment of first peraeopod with an accessory process on the inner side, outer ramus of second and third uropods rudimentary.....*armatum*

1. Fifth segment of first peraeopod without accessory process, outer ramus of second and third uropods normally developed.....*whitei*

Rhabdosoma whitei Spence Bate

(Fig. 15)

Rhabdosoma whitei Spence Bate, 1862, p. 345, pl. 54, fig. 7; Spandl, 1927, p. 208, fig. 31; Barnard, 1930, p. 436; Stephensen, 1925, p. 207; Barnard, 1931, p. 132; 1937, p. 193; Pirlot, 1938, p. 373; Shoemaker, 1945, p. 255; Fage, 1960, p. 97, fig. 71.

Xiphocephalus whitei Bovallius, 1890, p. 125, pl. 7, figs. 1–20, t.-figs.

Material.—St. 1254, 1 female; St. 1378, 5 males, 1 female; St. 1278, 1 female; St. 1278, 1 male; St. 1312, 1 female; St. 1329, 1 female; St. 1355, 1 female; St. 1373, 1 male; St. 1383, 2 females; St. 1385, 2 females; St. 1399, 1 male, 1 female; St. 1409, 1 female, 2 males; St. 1411, 1 male; St. 1763, 1 female; St. 1766, 1 male; St. 1799, 1 female; St. 1802, 1 male.

Specific characters.—The fifth segment of the first peraeopod is internally produced into a large conical lobe reaching far beyond the distal border of the sixth segment, sixth segment is likewise strongly produced at the inner distal part and its borders are feebly serrate. In the male the prolongation of the sixth segment is rounded. The prolongation of the fifth segment of the second peraeopod is narrow and as long as the sixth segment, the prolongation of the latter segment is very small and more rounded in the male. Peraeopods three and four are subsimilar but the fourth is longer. Fifth peraeopod is very much elongated with sparsely distributed spinules. Sixth peraeopod is shorter and more slender than the fifth, segments three to six are internally armed with small spines arranged in series, on fifth and sixth segments the members of a series show a tendency to get fused basally. Peraeopods two to six carry large branchial lobes attached to the inner side of the coxal plates and overlapping successively but they do not overlap ventrally. Seventh peraeopod is reduced to an oval lamina, its coxal plate is somewhat crescentic, with the hinder part produced.

Inner ramus of first uropod is subequal to the outer in length and width and is apically curved outwards in a characteristic fashion, its borders are closely toothed, outer ramus has its borders armed with well-spaced spines. Inner ramus of second uropod is fused with the peduncle and is longer and wider than the outer. The rami of the third uropod are similar to those of the second. Telson is an apically acute long process clearly overreaching the third uropod.

Length 65·6 mm.

Remarks.—Reviewing the observations of Schellenberg (1933) and Stephensen (1925), concerning the breeding habits of this species, Fage (1960) observed that between the first pair of branchiae exists an anterior window which permits the entry of water into the marsupium and that the branchiae of the posterior pair are free, through which the expulsion of the young takes place. I have had the opportunity to study only preserved specimens, many of which contain embryos numbering upto 40, arranged compactly in two rows. Every embryo faces obliquely upwards and forwards. By slightly pressing the marsupium one could easily make them come out through the anterior opening of the marsupium. In one large specimen the marsupium contained larvae as well as eggs and unhatched larvae and the eggs were at the hinder part. This probably indicates that the expulsion of the embryos takes place through the anterior opening of the marsupium. But I have no other positive evidence in support of this observation.

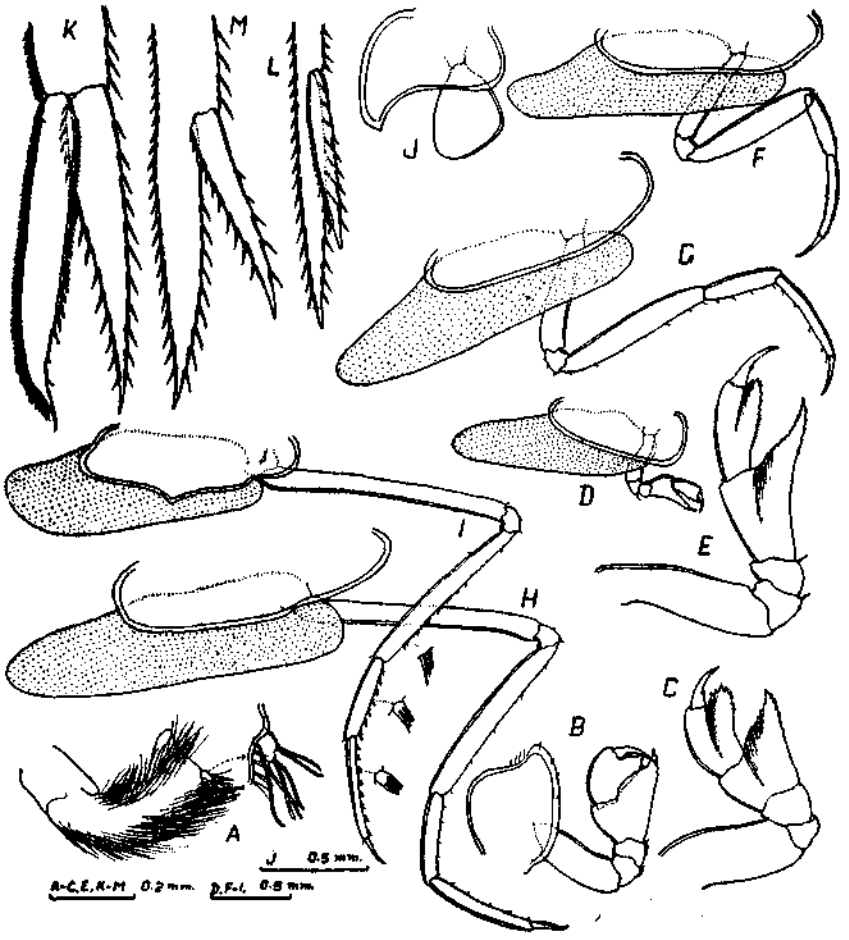

FIG. 15. *Rhabdosoma whitei* Spence Bate. (A) Antenna 1; (B) peraeopod 1, female; (C) same, male; (D) peraeopod 2, female; (E) same, male; (F) peraeopod 3; (G) peraeopod 4; (H) peraeopod 5; (I) peraeopod 6; (J) peraeopod 7; (K–M) uropods 1–3.

Distribution.—Very common in the tropical part of the Atlantic, Indian and Pacific Oceans.

Rhabdosoma armatum Milne Edwards

(Fig. 16)

Rhabdosoma armatum Spandl, 1927, p. 210; Barnard, 1930, p. 436; 1931, p. 132; Pirlot, 1938, p. 374; Fage, 1960, p. 88, figs. 60–67.

Xiphocephalus armatus Bovallius, 1890, p. 119, pl. 6, t.-figs.

Material.—St. 1278, 1 female.

Specific characters.—The first peraeopod is comparatively stout, its fifth segment is produced into a large process reaching the tip of the seventh segment, its inner border is dentate and the outer distal part carries a stout process. Inner distal part of the sixth segment is also produced into a large triangular process. Seventh segment is apically blunt. The prolongation of the fifth segment of the second peraeopod is very long, that of the sixth segment is triangular. Peraeopods three and four are subsimilar, fourth segment is very stout and is the longest. Fifth peraeopod is the longest and its second and fourth segments are swollen, the borders of the second segment are feebly dentate. Second segment of the sixth peraeopod is swollen, following segments are slender and armed along the inner border with sharp spines falling into series. Seventh peraeopod is reduced to a pear-shaped lamina, its coxal plate is roughly rectangular with concave inferior border. Inferior border of the abdominal segments is serrate. Peraeopods two to six carry large branchial plates

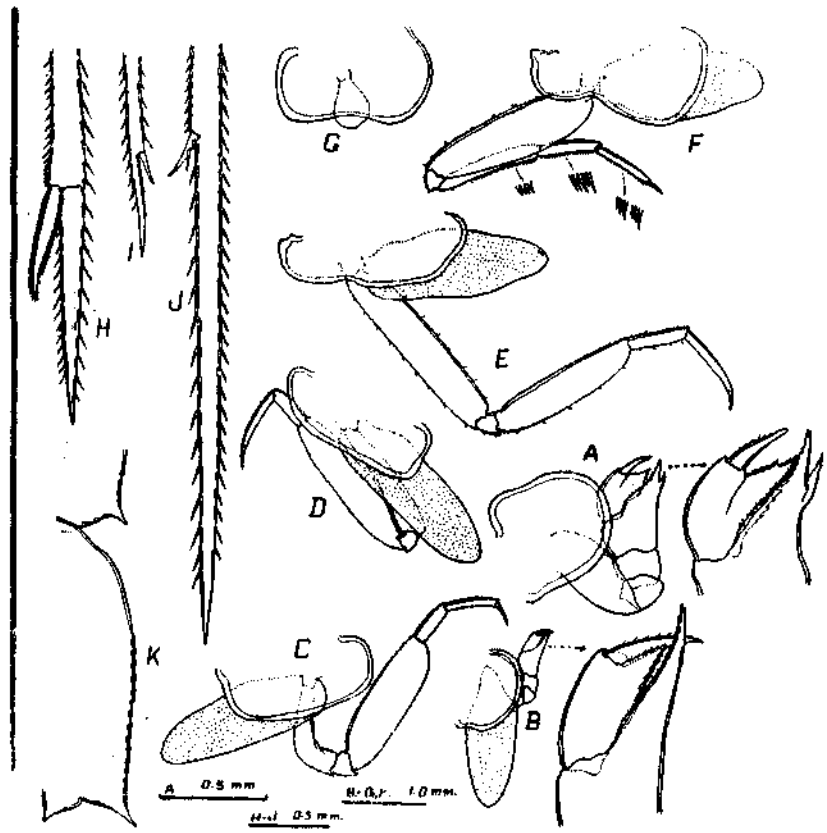

FIG. 16. *Rhabdosoma armatum* Milne Edwards. (A) Peraeopod 1; (B) peraeopod 2; (C) peraeopod 3; (D) peraeopod 4; (E) peraeopod 5; (F) peraeopod 6; (G) peraeopod 7; (H–J) uropods 1–3; (K) lateral border of abdominal segments 2 and 3.

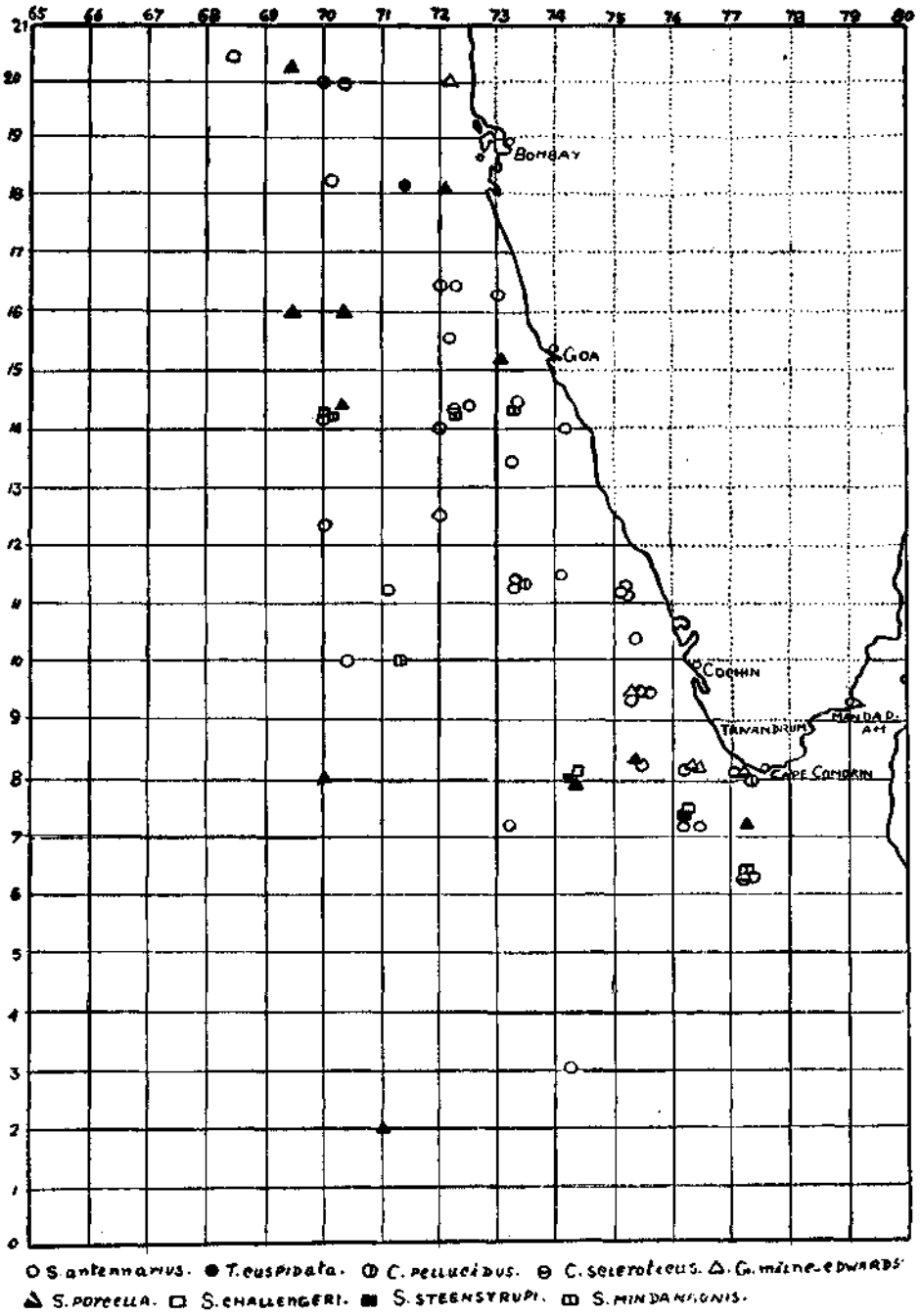

FIG. 17. Showing the distribution of species in the area of collection.

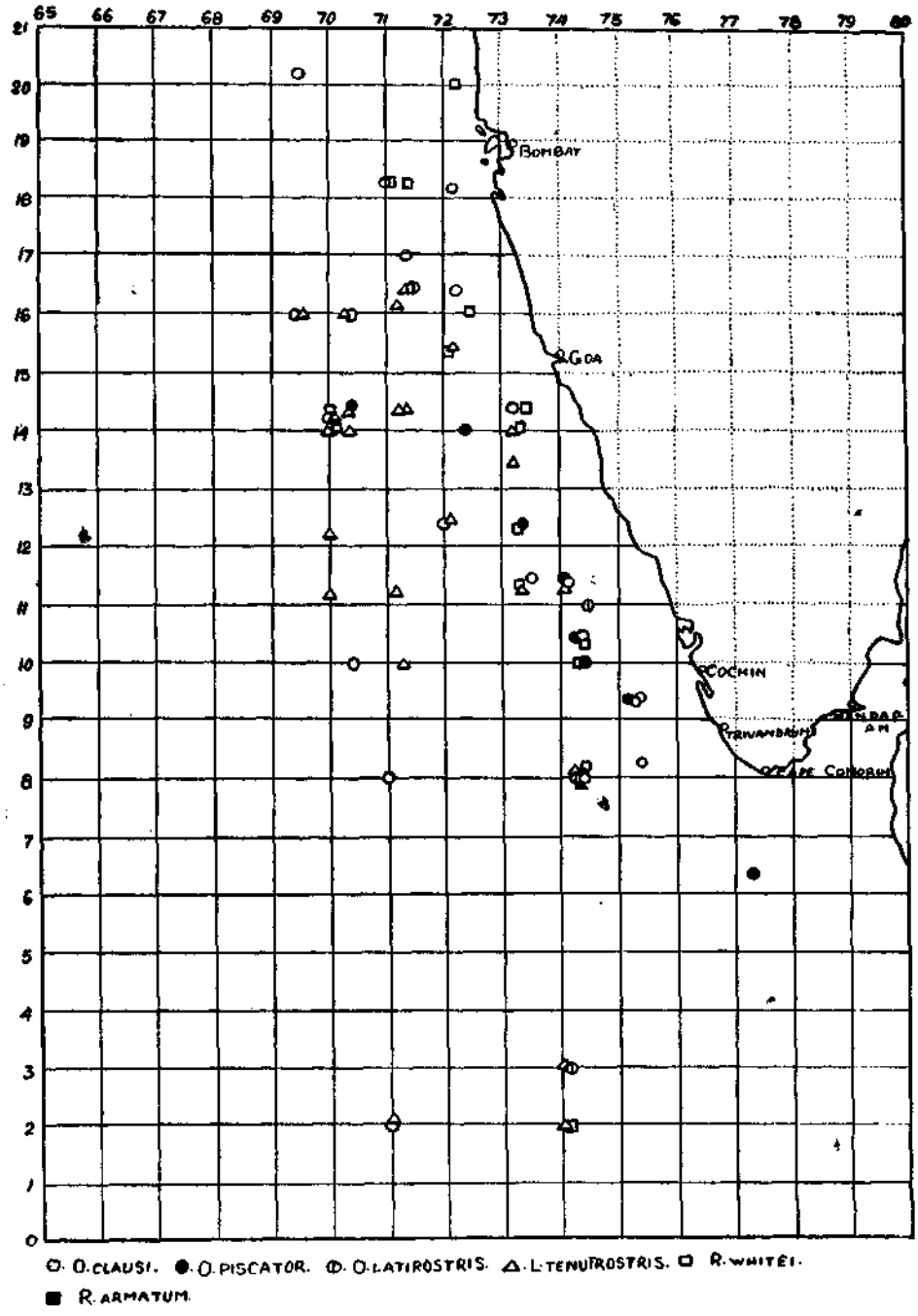

FIG. 18. Showing the distribution of species in the area of collection.

Both rami of the first uropod are free from the peduncle, inner ramus is similar to that of *R. whitei* but the outer ramus is twice as long as the inner. Inner ramus of the second and third peraeopods is fused with the peduncle, outer ramus is very small. The telson is apically acute and overreaches the third uropod.

The surface of the body including that of the telson is prominently spiny.

Length 116·9 mm.

Remarks.—In general aspects *R. armatum* resembles *R. whitei* but can be easily distinguished by the spiny body, the presence of an accessory process on the fifth segment of the first peraeopod, by the swollen fourth segment of peraeopods three, four and five and the shape of the coxal plate of the seventh peraeopod. The rudimentary nature of the outer ramus of the second and third uropods is also very characteristic of *R. armatum*.

Propagation is similar to that of *R. whitei*. The single female in the present collection has its brood pouch filled with 43 embryos.

The length of the present specimen is rather high for a tropical individual. The rostrum was partly broken and when complete the animal would have been 15–20 mm. longer than given above.

Distribution.—Previously recorded from the tropical and subtropical parts of the Atlantic, Indian and Pacific Oceans.

References

Barnard, K. H. 1930. Amphipoda. *British Antarctic 'Terra Nova' Expedition. Natural History Reports*, **8**: 307–454.

——— 1931. Amphipoda. *Great Barrier Reef Expedition. Scientific Reports*, **4**: 111–114.

——— 1932. Amphipoda. *Discovery Reports*, **5**: 1–326.

——— 1937. Amphipoda. *The John Murray Expedition. Scientific Reports*, **4**: 131–201.

Bovallius, C. 1887. Systematical list of the Amphipoda Hyperiidea. *Svenska Vet. Akad. Handl.*, **11**: 1–50.

——— '1890. The Oxycephalids. *Nova Acta Reg. Soc. Scient. Upsala*, 1–141, pls. 1–7.

Chevreux, E. 1900. *Amphipodes provenant des campagnes scientifiques accomplies sur son yacht par Albert, Prince Souverain de Monaco*, **16**: 1–195, pls. 1–18.

—— and L. Fage 1925. Amphipodes. *Faune de France*, **9**: 1–488, figs. 1–438.

Claus, C. 1887. *Die Platysceliden*. Alfred Holder, Wien, 1–77, pls. 1–25.

Colosi, G. 1918. Raccolte Planctoniche fatte dalla R. Nave 'Liguria' 2. Oxicefalidi. *Publ. R. Inst. Studi Suple Florence*, **2** (3): 207–224, pl. 17.

Fage, L. 1960. Oxycephalidae. Amphipodes Pelagiques. *Dana Reports*, No. **52**: 1–145.

Giles, G. M. 1888. Further notes on the Amphipoda of the Indian waters. *J. Asiat. Soc. Beng.*, **57**: 220–254, pls. 6–12.

Milne Edwards, H. 1840. *Histoire Naturelle des Crustacea*. **3**: 432–529.

Pirlot, J. M. 1938. Les Amphipodes Gammarides. *Siboga Exped.*, **33** *d*: 167–235, figs. 61–100.

Schellenberg, A. 1933. Der Brutapparat des pelagischen Amphipoden *Rhabdosoma whitei* Bate. *Zool. Anz.*, **103**. 154.

Senna, A. 1902. Les esplorazione abissali nel Mediterraneo del R. Piroscafo washingtonnei 1881. 1. Nota sugli oxicefalidi. *Bull. Eoc. Ent. Ital.*, **34**: 10–32, pl. 2.

Shoemaker, C. R. 1945. The Amphipoda of the Bermuda Oceanographic Expedition. *Zoologica*, **30**: 185–266.

SPANDL, H. 1927. Die Heperiiden (exkl. Hyperiidea Gammaroidea and Phronimidae). *Deutsche Sudpolar Exped.*, **19**: 145–287, figs. 1–65.

STEBBING, T. R. R. 1888. *Report on the Amphipoda collected by H.M.S. Challenger. Zool.*, **29**: 1–1737, pls. 1–210.

STEPHENSEN, K. 1925. Hyperiidea-Amphipoda. Part 3. *Danish Oceanogr. Exped. to the Mediterranean*, **2**, 150–252.

STREETS, T. 1878. Pelágic Amphipoda. *Proc. Acad. nat. Sci., Philad.*, 276–290, pl. 2.

STEUER, A. 1911. *Adriatische Planktonamphipoden Sitsungsberichte der Kaiserlichen Akademie dei Wissenchaften Maht Naturwill Klasse Wien.*, **120**: 671–688.

APPENDIX

List of Stations where R. V. Varuna *Collected Amphipods*

Serial No.	Station No.	Position		Date	Time (hrs.)	Depth and type of haul (m.)	Depth of station (m.)	Type of gear
		Latitude N	Longitude E					
1	742	11° 24′	75° 11′	1- 2-1962	20·33-20·40	53-0 (V)	58	Not specified
2	745	11° 09′	75° 03′	2- 2-1962	00·30	100-0 (V)	112	,,
3	748	11° 07′	75° 22′	2- 2-1962	04·00-04·15	50-0 (V)	54	,,
4	749	11° 15′	75° 11′	2- 2-1962	05·50-06·05	55-0 (V)	60	,,
5	759	10° 45′	75° 30′	3- 2-1962	02·00-02·16	49-0 (V)	54	,,
6	941	15° 15′	73° 01′	2- 4-1962	18·10-18·30	100-0 (V)	118	,,
7	945	15° 50′	72° 35′	3- 4-1962	05·49-06·25	100-0 (V)	445	,,
8	953	14° 38′	73° 21′	4- 4-1962	19·00-19·20	97-0 (V)	102	,,
9	960	16° 42′	72° 44′	11- 5-1962	23·45-00·15	60-0 (V)	65	,,
10	968	17° 23′	72° 04′	13- 5-1962	01·45-02·15	90-0 (V)	95	,,
11	975	18° 03′	72° 22′	13- 5-1962	21·20-22·00	35-0 (V)	40	,,
12	976	18° 03′	72° 06′	13- 5-1962	23·45-24·00	71-0 (V)	76	,,
13	977	18° 03′	71° 51′	14- 5-1962	02·00-02·20	77-0 (V)	82	,,
14	1029	07° 13′	77° 30′	12- 6-1962	21·30-22·20	100-0 (V)	210	,,
15	1032	07° 18′	76° 41′	13- 6-1962	11·00-13·15	100-0 (V)	1700	,,
16	1044	07° 59′	76° 15′	14- 6-1962	21·45-23·40	100-0 (V)	1390	,,
17	1045	07° 52′	76° 08′	15- 6-1962	01·00-04·00	100-0 (V)	1510	,,
18	1046	08° 24′	75° 49′	15- 6-1962	08·45-11·00	100-0 (V)	1190	,,
19	1055	08° 56′	75° 54′	21- 6-1962	22·00-22·34	100-0 (V)	295	,,
20	1066	09° 54′	75° 55′	23- 6-1962	13·24-13·59	30-0 (V)	35	,,
21	1085	10° 45′	75° 37′	16- 7-1962	02·45-03·40	35-0 (V)	42	,,
22	1118	12° 05′	74° 18′	24- 7-1962	23·10-24·00	10)-0 (V)	555	,,
23	1157	13° 52′	73° 22′	22- 8-1962	12·15-12·45	..	..	,,
24	1161	16° 52′	72° 42′	24- 8-1962	10·54-11·10	65-0 (V)	70	,,
25	1164	16° 45′	72° 11′	24- 8-1962	17·30-18·30	100-0 (V)	860	,,
26	1167	15° 40′	72° 42′	25- 8-1962	09·46-10·35	100-0 (V)	550	,,
27	1233	07° 06′	72° 14′	5-10-1962	11·00-13·20	100 (H)	1750	Mosquito net
28	1241	03° 59′	71° 07′	7-10-1962	03·10-06·00	50 (H)	4040	,,
29	1245	02° 00′	71° 00′	7-10-1962	23·30-02·30	100 (H)	3840	,,
30	1245	02° 00′	71° 00′	7-10-1962	22·30-02·30	50 (H)	3840	,,
31	1254	02° 00′	74° 00′	12-10-1962	15·55-17·55	50 (H)	2280	,,
32	1256	03° 00′	74° 05′	13-10-1962	01·10-03·00	50 (H)	2420	,,
33	1256	03° 00′	74° 05′	13-10-1962	01·10-03·00	100 (H)	2420	,,
34	1256	03° 00′	74° 05′	13-10-1962	01·10-03·00	75 (H)	2420	,,
35	1265	07° 14′	74° 00′	16-10-1962	16·44-16·50	..	2670	,,
36	1272	08° 29′	76° 02′	13-11-1962	23·40-01·05	200-0 (V)	880	Argo net
37	1278	08° 00′	74° 40′	14-11-1962	18·45	50 (H)	2700	Mosquito net
38	1278	08° 00′	74° 40′	14-11-1962	18·45	30 (H)	2700	,,
39	1278	08° 00′	74° 40′	14-11-1962	18·45	200 (H)	2700	,,
40	1278	08° 00′	74° 40′	14-11-1962	18·45	0 (H)	2700	,,
41	1278	08° 00′	74° 40′	14-11-1962	18·45	200-0 (V)	2700	Argo net
42	1285	08° 00′	72° 20′	15-11-1962	23·45-24·00	..	2050	,,
43	1290	08° 00′	70° 40′	16-11-1962	18·00-20·55	0 (H)	3880	Mosquito net
44	1290	08° 00′	70° 40′	16-11-1962	18·00-20·55	50 (H)	3880	,,
45	1292	08° 00′	70° 00′	17-11-1962	01·35-03·52	200-0 (V)	4500	Argo net
46	1294	08° 40′	70° 00′	17-11-1962	08·35-11·30	50 (H)	4530	Mosquito net
47	1298	10° 00′	70° 00′	17-11-1962	23·55	50 (H)	4420	,,
48	1298	10° 00′	70° 00′	17-11-1962	23·55	200-0 (V)	4420	Argo net
49	1300	10° 00′	70° 40′	18-11-1962	08·05-10·10	200-0 (V)	3970	,,
50	1302	10° 00′	71° 22′	18-11-1962	14·55-18·.0	100 (H)	2860	Mosquito net

Serial No.	Station No.	Position		Date	Time (hrs.)	Depth and type of haul (m.)	Depth of station (M)	Type of gear
		Latitude N	Longitude E					
51	1306	10° 00′	72° 40′	19-11-1962	03·30	100 (H)	1780	Mosquito net
52	1310	10° 00′	74° 00′	19-11-1962	17·00	200 (H)	2320	,,
53	1312	10° 00′	74° 40′	20-11-1962	00·55–02·14	200–0 (V)	2380	Argo net
54	1329	11° 22′	73° 46′	28-11-1962	18·35–21·00	200 (H)	2050	Mosquito net
55	1329	11° 22′	73° 46′	28-11-1962	18·35–21·00	50 (H)	2050	,,
56	1329	11° 22′	73° 46′	28-11-1962	18·35–21·00	0 (H)	2050	,,
57	1329	11° 22′	73° 46′	28-11-1962	18·35–21·00	75 (H)	2050	,,
58	1329	11° 22′	73° 46′	28-11-1962	18·35–21·00	200–0 (V)	2050	Argo net
59	1333	11° 22′	72° 25′	29-11-1962	07·40–09·30	200 (H)	1700	Mosquito net
60	1335	11° 22′	71° 45′	29-11-1962	11·05–15·15	200 (H)	1520	,,
61	1337	11° 22′	71° 04′	29-11-1962	20·02–22·45	50 (H)	3260	,,
62	1337	11° 22′	71° 04′	29-11-1962	20·02–22·45	0 (H)	3260	,,
63	1337	11° 22′	71° 04′	29-11-1962	20·02–22·45	200 (H)	3260	,,
64	1340	11° 22′	70° 00′	30-11-1962	07·50–11·10	100 (H)	4300	,,
65	1344	12° 34′	70° 00′	30-11-1962	21·50–00·50	0 (H)	3250	,,
66	1344	12° 34′	70° 00′	30-11-1962	21·50–00·50	200 (H)	3250	,,
67	1344	12° 34′	70° 00′	30-11-1962	21·50–00·50	75 (H)	3250	,,
68	1344	12° 34′	70° 00′	30-11-1962	21·50 00·50	50 (H)	3250	,,
69	1344	12° 34′	70° 00′	30-11-1962	21·50–00·50	200–0 (V)	3250	Argo net
70	1344	12° 34′	70° 00′	30-11-1962	21·50–00·50	30 (H)	3250	Mosquito net
71	1345	12° 53′	70° 00′	1-12-1962	03·00–05·00	200–0 (V)	3580	Argo net
72	1347	12° 47′	70° 47′	1-12-1962	09·55–11·55	200 (H)	2370	Mosquito net
73	1349	12° 53′	71° 20′	1-12-1962	15·55–16·45	200–0 (V)	1650	Argo net
74	1351	12° 53′	72° 00′	1-12-1962	21·15–24·00	50 (H)	1440	Mosquito net
75	1351	12° 53′	72° 00′	1-12-1962	21·15–24·00	75 (H)	1440	,,
76	1351	12° 53′	72° 00′	1-12-1962	21·15–24·00	200 (H)	1440	,,
77	1351	12° 53′	72° 00′	1-12-1962	21·15–24·00	100 (H)	1440	,,
78	1351	12° 53′	72° 00′	1-12-196	21·15–24·00	30 (H)	1440	,,
79	1351	12° 53′	72° 00′	1-12-1962	21·15–24·00	0 (H)	1440	,,
80	1353	12° 53′	72° 40′	2-12-1962	4·15– 6·00	200–0 (V)	1600	Argo net
81	1355	12° 55′	73° 25′	2-12-1962	10·45–12·55	200–0 (V)	1850	,,
82	1356	12° 56′	73° 46′	2-12-1962	15·05–16·00	0 (H)	1700	Mosquito net
83	1356	12° 56′	73° 46′	2-12-1962	15·05–16·00	75 (H)	1700	,,
84	1356	12° 56′	73° 46′	2-12-1962	15·05–16·00	200 (H)	1700	,,
85	1368	13° 56′	74° 26′	13-12-1962	03·35	20–0 (V)	28	Argo net
86	1370	14° 00′	74° 13′	13-12-1962	07·45	30–0 (V)	41	,,
87	1373	14° 00′	73° 20′	13-12-1962	13·48	30 (H)	230	Mosquito net
88	1373	14° 00′	73° 20′	13-12-1962	13·48	100 (H)	230	,,
89	1373	14° 00′	73° 20′	13-12-1962	13·48	50 (H)	230	,,
90	1375	14° 00′	72° 40′	13-12-1962	,,	200–0 (V)	1200	Argo net
91	1377	14° 00′	72° 00′	14-12-1962	01·45	200–0 (V)	1600	,,
92	1377	14° 00′	72° 00′	14-12-1962	01·45	50 (H)	1600	Mosquito net
93	1377	14° 00′	72° 00′	14-12-1962	01·45	200 (H)	1600	,,
94	1377	14° 00′	72° 00′	14-12-1962	01·45	30 (H)	1600	,,
95	1379	14° 00′	71° 20′	14-12-1962	08·40	200–0 (V)	1950	Argo net
96	1381	14° 00′	70° 40′	14-12-1962	15·15	200–0 (V)	3040	,,
97	1381	14° 00′	70° 40′	14-12-1962	15·15	75 (H)	040	Mosquito net
98	1383	14° 00′	70° 00′	14-12-1962	22·20	200–0 (V)	3900	Argo net
99	1385	14° 25′	70° 00′	15-12-1962	03·35	100 (H)	3580	Mosquito net
100	1385	14° 25′	70° 00′	15-12-1962	03·35	75 (H)	3580	,,
101	1385	14° 25′	70° 00′	15-12-1962	03·35	50 (H)	3580	,,
102	1385	14° 25′	70° 00′	15-12-1962	03·35	200–0 (V)	3580	Argo net
103	1385	14° 25′	70° 00′	15-12-1962	03·35	0 (H)	3580	Mosquito net
104	1385	14° 25′	70° 00′	15-12-1962	03·35	200 (H)	3580	,,
105	1385	14° 25′	70° 00′	15-12-1962	03·35	30 (H)	3 80	,,
106	1389	14° 49′	70° 40′	15-12-1962	17·40	75 (H)	3000	,,
107	1389	14° 49′	70° 40′	15-12-1962	17·40	0 H)	3000	,,
108	1389	14° 49′	70° 40″	15-12-1962	17·40	200–0 (V)	3000	Argo net

Serial No.	Station No.	Position		Date	Time (hrs.)	Depth and type of haul (m.)	Depth of station (m.)	Type of gear
		Latitude N	Longitude E					
109	1389	14° 49′	70° 40′	15-12-1962	17·40	50 (H)	3000	Mosquito net
110	1389	14° 49′	70° 40′	15-12-1962	17·40	100 (H)	3000	"
111	1389	14° 49′	70° 40′	15-12-1962	17·40	30 (H)	3000	"
112	1389	14° 49′	70° 40′	15-12-1962	17·40	200 (H)	3000	"
113	1391	14° 49′	71° 20′	16-12-1962	01·12	200-0 (V)	2080	Argo net
114	1393	14° 49′	72° 20′	16-12-1962	08·00	75 (H)	2020	Mosquito net
115	1393	14° 49′	72° 20′	16-12-1962	08·00	200-0 (V)	2020	Argo net
116	1393	14° 49′	72° 20′	16-12-1962	08·00	50 (H)	2020	Mosquito net
117	1393	14° 49′	72° 20′	16-12-1962	08·00	200 (H)	2020	"
118	1395	14° 49′	72° 40′	16-12-1962	15·20	200-0 (V)	770	Argo net
119	1397	14° 49′	73° 20′	16-12-1962	21·10	75-0 (V)	83	"
120	1397	14° 49′	73° 20′	16-12-1962	21·10	50 (H)	83	Mosquito net
121	1397	14° 49′	73° 20′	16-12-1962	21·10	30 (H)	83	"
122	1397	14° 49′	73° 20′	16-12-1962	21·10	75 (H)	83	"
123	1397	14° 49′	73° 20′	16-12-1962	21·10	0 (H)	83	"
124	1399	14° 49′	73° 41′	17-12-1962	00·35	40-0 (V)	48	Argo net
125	1400	14° 49′	74° 00′	17-12-1962	03·05	14-0 (V)	19	"
126	1404	13° 20′	74° 32′	4- 1-1963	20·15-20·30	0 (H)	20	Mosquito net
127	1407	16° 00′	73° 05′	6- 1-1963	19·55-20·10	0 (H)	70	"
128	1407	16° 00′	73° 05′	6- 1-1963	19·55-20·10	65-0 (V)	70	Argo net
129	1409	16° 00′	72° 43′	6- 1-1963	23·05	75 (H)	125	Mosquito net
130	1411	14° 11′	72° 03′	7- 1-1963	05·00-07·30	75 (H)	1720	"
131	1411	14° 11′	72° 03′	7- 1-1963	05·00-07·30	200-0 (V)	1720	Argo net
132	1413	16° 02′	71° 22′	7- 1-1963	12·50-14·55	200-0 (V)	2200	"
133	1413	16° 02′	71° 22′	7- 1-1963	12·50-14·55	100 (H)	2200	Mosquito net
134	1413	16° 02′	71° 22′	7- 1-1963	12·50-14·55	200 (H)	2200	"
135	1413	16° 02′	71° 22′	7- 1-1963	12·50-14·55	75 (H)	2200	"
136	1413	16° 02′	71° 22′	7- 1-1963	12·50-14·55	0 (H)	2200	"
137	1415	16° 00′	70° 40′	7- 1-1963	19·40-22·25	50 (H)	3350	"
138	1415	16° 00′	70° 40′	7- 1-1963	19·40-22·25	75 (H)	3350	"
139	1415	16° 00′	70° 40′	7- 1-1963	19·40-22·25	30 (H)	3350	"
140	1415	16° 00′	70° 40′	7- 1-1963	19·40-22·25	200 (H)	3350	"
141	1415	16° 00′	70° 40′	7- 1-1963	19·40-22·25	0 (H)	3350	"
142	1415	16° 00′	70° 40′	7- 1-1963	19·40-22·25	200-0 (V)	3350	Argo net
143	1417	16° 00′	69° 59′	8- 1-1963	03·05-06·40	200-0 (V)	3600	"
144	1688	8° 11′	77° 01′	10- 4-1963	02·00	50-0 (V)	55	"
145	1691	7° 58′	76° 46′	10- 4-1963	12·50	135-0 (V)	142	"
146	1703	7° 58′	76° 43′	11- 4-1963	20·20	200-0 (V)	330	"
147	1704	8° 00′	76° 38′	11- 4-1963	22·36	200-0 (V)	600	"
148	1710	8° 26′	76° 54′	12- 4-1963	09·25-09·50	30-0 (V)	36	"
149	1711	8° 25′	76° 51′	12- 4-1963	10·40-10·55	38-0 (V)	45	"
150	1719	8° 30′	75° 58′	18- 4-1963	14·35	30-0 (V)	1100	Mosquito net
151	1720	8° 24′	75° 48′	18- 4-1963	17·20-19·20	200-0 (V)	1250	Argo net
152	1721	8° 19′	75° 41′	18- 4-1963	20·40-21·15	30-0 (V)	1460	Mosquito net
153	1721	8° 19′	75° 41′	18- 4-1963	20·40-21·15	200-0 (V)	1460	Argo net
154	1721	8° 19′	75° 41′	18- 4-1963	20·40-21·15	100-0 (V)	1460	Mosquito net
155	1721	8° 19′	75° 41′	18- 4-1963	20·40-21·15	75-0 (V)	1460	"
156	1722	06° 41′	77° 32′	19- 4-1963	14·35-17·00	200-0 (V)	2400	Argo net
157	1723	06° 51′	77° 32′	19- 4-1963	18·08-20·16	200-0 (V)	2280	"
158	1724	07° 02′	77° 32′	19- 4-1963	21·15-23·15	200-0 (V)	1560	Mosquito net
159	1724	07° 02′	77° 32′	19- 4-1963	21·15-23·15	200-0 (V)	1560	Argo net
160	1725	07° 12′	77° 32′	20- 4-1963	00·25-01·30	200-0 (V)	280	"
161	1726	07° 22′	77° 32′	20- 4-1963	02·40-03·25	150-0 (V)	175	"
162	1727	07° 32′	77° 32′	20- 4-1963	04·30-05·15	30-0 (V)	93	Mosquito net
163	1730	08° 00′	77° 32′	20- 4-1963	09·45-10·15	15-0 (V)	24	Argo net
164	1732	08° 08′	76° 36′	20- 4-1963	20·45-21·30	200-0 (V)	220	"
165	1735	09° 41′	75° 03′	21- 4-1963	14·45	200-0 (V)	2400	"
166	1737	09° 46′	75° 25′	21- 4-1963	20·15-21·35	100-0 (V)	1416	Mosquito net

Serial No.	Station number	Position		Date	Time (hrs.)	Depth and type of haul (m.)	Depth of station (m.)	Type of gear
		Latitude N	Longitude E					
167	1737	09° 46′	75° 25′	21-4-1963	20·15-21·35	30-0 (V)	1416	Mosquito net
168	1737	09° 46′	75° 25′	21-4-1963	20·15-21·35	75-0 (V)	1416	,,
169	1737	09° 46′	75° 25′	21-4-1963	20·15-21·35	50-0 (V)	1416	,,
170	1737	09° 46′	75° 25′	21-4-1963	20·15-21·35	200-0 (V)	1416	,,
171	1737	09° 46′	75° 25′	21-4-1963	20·15-21·35	200-0 (V)	1416	Argo net
172	1738	09° 49′	75° 36′	21-4-1963	22·50-23·30	100-0 (V)	160	Mosquito net
173	1738	09° 49′	75° 36′	21-4-1963	22·50-23·30	30-0 (V)	160	,,
174	1739	09° 52′	75° 48′	22-4-1963	00·42-01·10	50-0 (V)	64	Argo net
175	1739	09° 52′	75° 48′	22-4-1963	00·42-01·10	30-0 (V)	64	Mosquito net
176	1740	09° 55′	75° 57′	22-4-1963	02·20-02·50	30-0 (V)	40	,,
177	1746	12° 35′	74° 05′	25-4-1963	11·10-12·45	150 (H)	716	,,
178	1747	12° 32′	73° 56′	25-4-1963	13·55-15·35	200-0 (V)	1300	Argo net
179	1749	11° 40′	73° 59′	26-4-1963	00·45-03·00	200 (H)	1250	Mosquito net
180	1749	11° 40′	73° 59′	26-4-1963	00·45-03·00	50 (H)	1250	,,
181	1749	11° 40′	73° 59′	26-4-1963	00·45-03·00	500-0 (V)	1250	Argo net
182	1749	11° 40′	73° 59′	26-4-1963	00·45-03·00	30 (H)	1250	Mosquito net
183	1749	11° 40′	73° 59′	26-4-1963	00·45-03·00	100 (H)	1250	,,
184	1750	11° 43′	74° 09′	26-4-1963	04·10-06·30	200 (H)	1250	,,
185	1750	11° 43′	74° 09′	26-4-1963	04·10-06·30	50 (H)	1250	,,
186	1750	11° 43′	74° 09′	26-4-1963	04·10-06·30	100 (H)	1250	,,
187	1750	11° 43′	74° 09′	26-4-1963	04·10-06·30	200-0 (V)	1250	Argo net
188	1752	11° 48′	74° 29′	26-4-1963	10·25-11·40	50 (H)	250	Mosquito net
189	1752	11° 48′	74° 29′	26-4-1963	10·25-11·40	75 (H)	250	,,
190	1752	11° 48′	74° 29′	26-4-1963	10.25-11·40	30 (H)	250	,,
191	1752	11° 48′	74° 29′	26-4-1963	10·25-11·40	200-0 (V)	250	Argo net
192	1756	0° 58′	75° 07′	26-4-1963	17·55-18·15	,,	24	,,
193	1761	11° 01′	75° 01′	27-4-1963	05·18-06·55	200-0 (V)	850	Argo net
194	1762	11° 00′	74° 50′	27-4-1963	08·05-09·40	75 (H)	1250	Mosquito net
195	1763	10° 57′	74° 40′	27-4-1963	10·50-12·07	200 (H)	1250	,,
196	1763	10° 57′	74° 40′	27-4-1963	10·50-12·07	200 (H)	1250	Argo net
197	1766	20° 00′	72° 15′	7-5-1963	06·00	25-0 (V)	33	I.O.S. net
198	1773	20° 00′	70° 31′	7-5-1963	20·25-20·50	80-0 (V)	85	,,
199	1775	20° 00′	70° 00′	8-5-1963	00·48-01·22	60-0 (V)	72	,,
200	1779	20° 56′	69° 53′	8-5-1963	17·35-19·50	200-0 (V)	1250	,,
201	1788	20° 20′	69° 59′	9-5-1963	17·45	68-0 (V)	73	,,
202	1789	20° 14′	69° 55′	9-5-1963	19·10-19·30	68-0 (V)	73	,,
203	1794	20° 19′	72° 29′	10-5-1963	14·45-15·15	29-0 (V)	34	,,
204	1796	18° 30′	72° 30′	13-5-1963	05·05-05·30	40-0 (V)	46	,,
205	1799	18° 30′	71° 45′	13-5-1963	11·25-11·55	80-0 (V)	85	,,
206	1801	18° 30′	71° 15′	13-5-1963	15·35-16·00	75-0 (V)	84	,,
207	1802	18° 30′	71° 00′	13-5-1963	17·30-17·45	30-0 (V)	88	Mosquito net
208	1802	18° 30′	71° 00	13-5-1963	17·30-17·45	50-0 (V)	88	,,
209	1802	18° 30′	71° 00′	13-5-1963	17·30-17·45	80-0 (V)	88	I.O.S. net
210	1805	18° 30′	70° 14′	13-5-1963	23·30-01·05	200-0 (V)	1250	,,
211	1806	18° 30′	70° 00′	13-5-1963	02·45	200-0 (V)	1250	,,
212	1807	17° 00′	71° 30′	14-5-1963	18·00-19·10	30-0 (V)	1250	Mosquito net
213	1808	16° 58′	71° 45′	14-5-1963	20·50-22·00	75-0 (V)	1250	,,
214	1808	16° 58′	71° 45′	14-5-1963	20·50-22·00	30-0 (V)	1250	,,
215	1808	16° 58′	71° 45′	14-5-1963	20·50-22·00	200-0 (V)	1250	I.O.S. net
216	1808	16° 58′	71° 45′	14-5-1963	20·50-22·00	50-0 (V)	1250	Mosquito net
217	1809	16° 55′	72° 00′	14-5-1963	24·00-00·35	180-0 (V)	185	I.O.S. net
218	1809	16° 55′	72° 00′	14-5-1963	24·00-00·35	50-0 (V)	185	Mosquito net
219	1811	16° 49′	72° 29′	15-5-1963	04·05-04·30	65-0 (V)	70	I.O.S. net
220	1813	16° 43′	73° 00	15-5-1963	08·05-08·20	35-0 (V)	40	,,

Mosquito net—Net with ½ m. diameter ring, filtering part made of mosquito netting.

Argo net—Net supplied by the U.S. Research Ship Argo. I m. diameter ring, filtering portion made of synthetic fibre.

I.O.S. net—International Indian Ocean Expedition standard net, 113 cm. diameter ring, mesh size, 0·33×0·33,

V—Vertical haul.

H—Horizontal haul.