PLANKTON STUDIES

PRELIMINARY NOTES UPON NEW OR INTERESTING SPECIES

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PART I.

COPEPODA

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PREFACE.

The pages following are intended to contain brief descriptions (sufficient, however, I trust, to lead to their identification) of species new, or debateable, which came under my notice from time to time in the course of examination of the following collections:

1. Plankton examples for three years consecutively taken in the Faroe Channel during the cruises of my yachts the *Walwin* and the *Silver Belle*.

2. During a cruise in 1903 from Valentia (Ireland) to the Faroe banks, along the deep Atlantic trough.

3. A cruise during 1904 from Valentia to the Azores, Madeira, the Straits of Gibraltar, and across the Bay of Biscay to the English Channel—both of these cruises undertaken in the *Silver Belle*.

4. The collections of the *Gauss*.

5. The collections of the *Discovery*.

6. The collection made by Mr. J. Stanley Gardiner in the Indian Ocean.

7. The collection made by Dr. G. H. Fowler in the Faroe Channel.

These notes are, of course, only preliminary, and the fuller description and necessary drawings will subsequently be published in their appropriate places. The immense amount of material accumulated necessitates considerable time for its proper examination. Meanwhile, notes of species, new or interesting, accumulate with rapidity.

In the following pages the abbreviations frequently used—*e.g.*, B 1, B 2, Le 1, Le 2, Li 1, 2, 3, Ri, Re, etc.—will be readily understood by those who are familiar (as all workers in this subject must be) with Giesbrecht's colossal work published in the Naples series of Monographs.

The plates which accompany these pages are autocopyist reproductions of the finished drawings executed by Miss Marion Lees. They are added to elucidate the notes in the text, and, though strictly accurate, are to be regarded as more or less rough reproductions of the originals.

ERRATA.

Page 22, line 6 *et seq.*: *for* 'Re 1 long and narrow with rudimentary Ri,' etc., *read* 'Re 1 long and narrow; Re 3 represented by stylet process. Left foot short, of four segments, the end segment very short, and with short spine at the end.'

Plate VI.: *for* 'brevicaudia' *read* 'brevicaudatus.'

COPEPODA

GENUS MEGACALANUS (*nov.*). (*Wolfenden.*)

Megacalanus. (Wolfenden, *Journ. Mar. Biol. Assoc.*, April, 1905.)

Generic Characters.—Head separate from first segment; last two thoracic segments separate. Abdomen of four segments; five pairs of feet. In general characters resembling Calanus, but the third segment of each exopodite with three external spines and end-saw; first feet with extraordinary hook process on the basal; fifth feet without denticulation on the inner margins of the basal.

Megacalanus Bradyi : (*nov. sp.*). Plate I.

The animal is distinguished by its great size—viz., 10 mm., in the adult female. (Cephalothorax 7·9 mm.; abdomen 2·1 mm. long). The *Cephalothorax* is of six segments, the head separate from the first thoracic segment; the fifth and sixth segments also separate. The greatest breadth of the thorax is 2·35 mm., about one-third the length. The head is slightly produced anteriorly between the antennæ, possessing a strong two-pointed rostrum, and with a perfectly even dorsal curve. The last segment of the thorax is produced into wing-like points, resembling *Cal. hyperboreus.*

The *Abdomen* consists of four segments, the genital segment very little longer than broad (as 17 : 15), Ab 2>Ab 3>Ab 4; the furcal segments about the same length as the anal, and very little longer than broad, each with five tail bristles and a short inner accessory bristle. The next to the innermost bristle of each side is much thicker and longer than the others.

The *Anterior Antennæ* comprise twenty-five segments, and are longer than the whole body by about the last eight segments; all except terminal bristles very short.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
8	13	8	7	9	9	10	8	10	11½	12½	14	16½	16	16½	16½	17	17	17	12½	11½	12½	11	7½	6½

The twelfth and thirteenth segments have a row of fine teeth on the under surface.

The *Posterior Antennæ* have the inner and outer rami of about equal length; first basal with marginal basal hump and one strong bristle, second basal with two bristles, first segment of the endopodite four times as long as broad.

The mandible has the inner ramus a little longer than the outer, the first segment of the endopodite with a lateral swelling. The masticatory plate is half as broad as long, and has

six strong bifid teeth. The first segment of the inner ramus has a strong marginal projection (like that of *Calanus gracilis*). The second basal rather long, with four stout marginal bristles.

The *Maxilla* is of the usual Calanus shape, the exopodite oval and nearly as long as the endopodite, the latter small and much narrower than the second basal, but distinctly three-segmented. There are fourteen bristles on the endopodite and four on the second basal; eleven on the exopodite, nine on the first outer lobe; second outer lobe with one, second inner lobe with four bristles.

The *Anterior Footjaw* is short and compact, the fifth lobe much longer than any of the others, with a long, thin hook; no hooks on lobes four or six, and all the bristles with stiff hairs wide apart like Calanus.

The *Posterior Footjaw*, of the usual Calanus form, has the first basal much longer than the second; the endopodite smaller than the latter—relative proportions 20 : 14 : 11; each basal twice as long as broad. The bristles are of the usual character.

Five pairs of *Swimming Feet*, each with outer and inner rami of three segments, the first basal segments of the second and fourth pairs with a very convexly projecting inner margin. The first pair with respectively one, two, six bristles on the segments of the endopodite, and a remarkable arrangement on the second basal. At the distal margin of the posterior surface of the segment are two strong hooks, the lower one very thick and strong, and projecting downwards, backwards, and outwards (very prominent in profile), and an upper hook process, broad below, tapering to a whip-like extremity directed straight upwards and more than half the length of the endopodite. Each segment of the exopodite with long flagellate external marginal spine. The second feet with second basal with three spines (one external and two central) on the distal margin; endopodite not much more than half the length of the exopodite; the first and second segments of the endopodite ending in points at the distal outer margin (similar in third and fourth pairs); the third segment of the exopodite comparatively large, broad at the base and narrow distally; the segment divided by the external spines into portions respectively 14 (prox.) : 8 : 14½ (distal), the terminal saw not as long as the last part of the segment. The third and fourth pairs rather similar generally, the last segment of the exopodite in the latter with the proximal portion much the largest (19½ prox. : 11 : 13 distal), and the saw rather longer than the distal third of the segment. The endopodite of the second pair with one, two, eight bristles respectively; outer margins of second segment and proximal part of third segment of the exopodites of second to fifth feet thickly haired, saws in all cases broad at base and lanceolate, foliaceous, with ribs very numerous, which at first sight resemble teeth, but the unserrated margin of the folia can be distinguished beyond them. In the fourth foot, at the external distal margin of the second basal, besides the short spine is a delicate short-feathered bristle.

All external marginal spines are small.

The fifth pair resembles the other feet, except that they are short, and the external margin of the last segment of the exopodite has only two marginal spines instead of three. Between the terminal saw of each foot and the outer marginal spine is another small apical spine. The inner margin of the first basal of the fifth foot has neither teeth nor hairs.

Colour of the animal greenish-yellow when fresh, with no pigmentation.

The general resemblance of this copepod to a Calanus is very great, especially in the mouth organs. In the '*Challenger* Report,' Brady describes under the head of *Calanus princeps* a copepod 12 mm. long, but which, from the spinulation of the feet, is certainly not a Calanus, as Giesbrecht has pointed out (abdomen three segments, last but one joint of the Antennæ very small; Maxilla with short unsegmented endopodite, sawed terminal spines of the feet, etc.).

The animal here described might, so far as the feet as figured by Brady are concerned, belong to the same species, but there are in this no such setæ on the Anterior Footjaw as Brady figures; the Maxilla is totally different as regards its bristles, the segmentation of the Anterior Antennæ, and of the abdomen, etc. It is therefore certainly not Brady's *Calanus princeps*, and the presence of three external spines on the Re 3 of the second and fourth feet as clearly removes it from any other species of the genus Calanus.

The ♂ resembles the ♀, but the *Anterior Antennæ* are more closely beset with æsthetasks; the *abdomen* consists of five segments, and the fifth feet differ somewhat. The foot of one side is also somewhat different from that of the opposite side. In one the inner margin of the second exopodite segment bears at its outer distal margin a stumpy process, which ends distally in a spine and stout bristle. The upper and inner and outer margins are also covered with hairs. The third segment, just below its distal extremity, has often an upright spine varying in length in different individuals, but extending a little beyond the end of the joint. The outer margin of the third exopodite joint has only one spine, distal of the middle. The foot of the opposite side has no process on the second exopodite segment. (A difference in the feet of the two sides is also noticed in the closely allied *M. princeps*.) The basals of the fifth feet are without teeth; the first basal is very long comparatively, and the bristles of the endopodite are 0, 1, 6. This copepod was abundant in the *Gauss* collection, and occurred twice in my collection of 1903 from the West of Ireland.

Megacalanus Princeps (Syn. *Cal. princeps*, Brady; '*Chall.* Rep.,' p. 36.) Plate I.

This copepod does not strictly belong to the Northern Fauna, its habitat being mid-Atlantic, and it is in abundance in the *Gauss* collections made in the Atlantic traverse. It is reported to have been once met with, however, in the Atlantic west of Ireland, and as it may perhaps be met with occasionally north of Lat. 60°, it must be noticed. In all the author's collections north of this latitude it has never once occurred. Brady, in the '*Challenger* Report,' very briefly described it as having been taken in two deep-water dredgings, of 1,240 and 1,250 fathoms respectively, and also off Sandy Hook at 1,250 fathoms. It has an extensive area of distribution throughout the deep water of the Atlantic north and south of the equator.

♀ 10·9 to 11 mm. long,* the *Cephalothorax* of five segments, the last two being coalesced. *Head* narrowed in front, the forehead slightly produced and bearing two short spines, with two short hairs below them, the rostral processes long and stiff, ending bluntly, without filaments. The posterior margins of the *thorax* are rounded and but slightly produced. The *Abdomen* of four segments, with the genital twice as long as the following one. *Anterior Antennæ* at least four joints longer than the whole body, and of twenty-five segments, the basal joints small,

* One large example from the Southern Ocean measured 12 mm. long.

from the eighth to the nineteenth gradually increasing in size, the twentieth to the twenty-third shorter, the twenty-fourth only half the length of the twenty-third, and the twenty-fifth not quite twice as long as the twenty-fourth. The *Posterior Antennæ* and mandibles are as in the last species. In the *Maxillæ* the second basal and endopodite are rather pyriform in shape, the endopodite partially segmented, only on the inner margin, the second outer lobe small, and apparently without bristle. The *Anterior Footjaws* with short, weak bristles on the proximal lobes; the fifth and sixth and also the endopodite with very thick and very long, ribbon-shaped bristles, densely feathered on the proximal side. These bristles are very characteristic of the species. The *Posterior Footjaws* have a very thick, spiniform seta densely feathered, and a second thin bristle, both arising from the distal lamellar projection of the first basal, and both as long as the second basal. The bristles of the last joint of the endopodite are long broad, and resemble those of the Anterior Footjaw. The first four pairs of swimming feet have three segmented rami, and in general resemble those of the last species, having three marginal spines on the last joint. The first pair has no trace of the hooks which characterize the last species, and the first and second joints of the exopodite have no marginal setæ externally. The fifth pair has only two external spines on the last exopodite segment, four inner marginal bristles, and an end-saw three-quarters the length of the segment. There are no teeth on the margins of the basals. The saws of the feet have numerous fine, closely-set teeth. (They may be identical with the last species, but, having been preserved in spirit, may have lost the fine membranous protective sheath occurring in fresh specimens of *M. bradyi*.)

The ♂ differs chiefly in the shape of the head (which has not the two small frontal spines of the ♀), the last two segments of the thorax are separate, the abdomen has five segments, the posterior footjaw is weaker, but the terminal bristles are thick and ribbon-shaped, and the fifth feet are otherwise formed. In them the last segment of the exopodite has only one external marginal spine, and a very short apical spine, representing the end-saw; one inner marginal seta, which is modified, being short, thick, and spine-like, curved, and standing more or less at right angles from the segment. There is one inner marginal seta on the second joint, which is without the stumpy process which occurs in the last species. As in the latter species, however, the two feet are not quite symmetrical, the inner marginal seta of the second joint being absent in one foot. The first basal is not so elongated as in the last species, and there are no teeth on the inner margin; the second basal is, however, very convex distally on the internal margin, and has strong bunches of hairs.

The *diagnosis* between these two species may be expressed:

1. First pair of feet with a pair of hooks on each second basal; the bristles of the endopodites of Anterior and Posterior Footjaws of ordinary character = *M. bradyi*.

2. First feet without hooks; bristles of endopodites of footjaws very broad, extremely long, and, distally, densely feathered = *M. princeps*.

Size of ♂ and ♀ 10 to 12 mm.

Both are deep-water species, with a distribution extending from the west of Ireland to far in the Southern Ocean (as far as Lat. 60° S.).

[NOTE.—In Sars' recently published 'Liste préliminaire des Calanoïdés, etc.' (in *Bulletin du Musée Océanographique de Monaco*, No. 26, March 20, 1905), is briefly described a new genus,

Macrocalanus, and species, *M. longicornis*. It is impossible, without further description or figures, to accurately locate this genus, but probably it is identical with *Megacalanus*, the brief description of which, accompanied by figures, was published by me in the *Journ. Brit. Mar. Biol. Assoc.* in April, 1904, thus antedating Sars' description by about a year.]

GENUS GAUSSIA (*nov.*).

Generic Characters.—Resembling *Metridia* in the structure of the feet and *Pleuromamma* in the form of the body, but no trace of pigmented 'ocellus.'

Gaussia Scotti (*nov. sp.*). Plate II.

Pleuromamma princeps. Scott, *Trans. Linn. Soc.*, 1889.

Metridia Scotti. Giesbt., *Zool. Anzeiger*, vol. xx. Giesbt. and Schmeil, "Tierreich," p. 107.

♀ 10 to 10·3 mm. long; whole fore-part of body, legs, and mouth organs deep blue-black; genital segment deep sienna coloured. Cephalothorax twice as long as Abd. Ce with short crest, prolonged into frontal process like *Pleuromamma ziphias*, with short rostrum. Last thoracic segments on each side prolonged into stout spines, slightly curved, and not half the length of the genital segment. Abdomen of only three segments (first and second coalesced to form an unsymmetrical laterally and ventrally swollen segment, 20 long and 17 broad). Second segment very small and not half as long as the anal. On the upper and right side dorsally of the first segment is a strong curved hook. Genital openings and swellings occupy whole lower half of the segment. Anal segment twice as broad as long, with dorso-lateral flaps extending over the furcal segments. Furcal segments as long as broad, with strongly haired margins, two outer and two apical, and two inner marginal seta (innermost thin and short), the two apical three-quarters as long as the whole abdomen. Very large and haired epistomal cushion.

AA = twenty-three, longer than whole body by four and a half joints; on the first and second segments are strong, broad-based spines, not recurved; on the fourth, fifth, and sixth, smaller spines. *Mx*, *P.F.J.* (B 1 : B 2 : Ri = 20 : 18 : 28) and *A.F.J.* like *Pleuromamma*. *Mn*, Ri much longer than Re (B 2 extended on inner side) and with four marginal hairs on B 2.

Second feet, with clusters of small spines on surface of B 1, B 2 very convex, both feet with hooks on Ri 1 (outer much longest). *Third feet* without deep curve of margin of Re 1, saw of Re 3 of normal shape, not bent like *Pleuromamma*. *Fourth feet*, end-saw short. *Fifth feet*, each of four segments, last two about same size; no bristles on one, two, or three, but three end bristles on fourth; innermost very long, middle only half its length, outermost very short; margins of all joints without hairs.

♂ a little smaller than the female, *Ce* separate from *Th* 1. Last thoracic segment on each side ending in stumpy prolongations, but without the spines of the female. Clasping Antenna on the right side, with three joints beyond the elbow; joints before the elbow broadened out a little; joint immediately distal to the elbow with two spine processes on the upper margin, one

distal, not more than one-third the length of the joint, one proximal. At end (distal) of the segment a short, blunt, rounded spiny projection, just reaching beyond the end of the segment; joint preceding elbow without spines or teeth, proximal joint to this with short spine reaching a little beyond end of segment. Mouth with strong upper and lower lip, as in ♀; crest of head a little weaker than in ♀, and mouth organs like those of ♀, but weaker. Abdomen with five segments, anal very broad and longer than the rather square-shaped furcal segments.

Fifth feet peculiar, best understood from the figure.

There is an entire absence of pigment 'ocellus,' as in *Pleuromamma*. The body has a great resemblance to *Pleuromamma*, especially in the asymmetrical female abdomen, but is quite unlike any *Metridia*. The fifth feet of the ♂ differ from either genus. It seems to partake of the characters of both genera, and to belong properly to neither.

Many specimens occur in the *Gauss* collection gathered in the North Atlantic. I have little doubt that it is identical with the description of *Pleuromamma princeps* by Scott,* of which one male only formed the subject of the description. Scott does not speak of the pigment ocellus, nor does he mention any pigmentation of the animal. In all the *Gauss* specimens this is very striking. Giesbrecht (*Zool. Anzeiger*, xx., p. 253) referred the species to *Metridia*, changing the name to *Met. Scotti*, as *M. princeps* was already appropriated, and remarking that the structure of the feet relegated it to the genus *Metridia*. Scott was probably more accurate in referring it to *Pleuromamma*. With the exception of this single specimen of Scott's, the animal has, I believe, as yet remained undescribed again. The striking form of the female and the difficulty of referring it to either genus induce me to suggest that it is preferable to create for its reception another and distinct genus, for which I suggest the name 'Gaussia.'

GENUS GAIDIUS. (*Giesbrecht.*)

Gaidius Intermedius (*nov. sp.*). Plate III.

♀ 4·5 to 4·8 mm. *Head* rounded, with short one-pointed rostrum. First cephalic segment larger than the remaining three segments. Head only partially divided from the first segment by a dorsal line. Last segment rounded, and with very short lateral and thin spines, curved and bent in a ventral direction. *Abdomen*, one-third as long as the cephalothorax. Genital segment ventrally protuberant, and nearly as long as the next two segments. *Furcal segments* equal in length to the anal. *Anterior Antennæ* of twenty-three joints not quite reaching the end of the genital segment. *Posterior Antennæ* with Re greater than Ri by one-third, and a tubercular projection on the Re 1. *Anterior Footjaw* with hook on the fourth lobe larger and stouter than that of the fifth. *Maxilla* with Re longer than Ri. *Posterior Footjaw*, B 1 : B 2 : Ri = 11 : 3 : 4½, the three bristles of B 2 short; B 1 with extraordinary lamellar hump, of transparent colour on the outer margin.

First feet, Ri = 1, Re = 3, but no Se on Re 1.

* *Trans. Linn. Soc. of London.*

Second feet, Ri = 2, Re = 3.

Third and fourth feet, Ri and Re = 3 segments, the fourth feet with special tubal bristles, as in other *Gaidius*.

The characters of the Posterior Footjaw and Posterior Antennæ resemble *Gaetanus* more than *Gaidius*; the absence of any spine on the head and its evenly rounded contour alone prevent its inclusion in the former genus. It is not very common, but occurred at two of the *Gauss* stations near the ice (March 10, 1903, and March 27, 1903).

GENUS GAETANUS. (*Giesbrecht.*)

Gaetanus Antarctica (*nov. sp.*). Plate III.

8 mm. long. Body thick, with rather gibbous dorsal swelling of the first segment, which, consisting of the coalesced head and first thoracic segment, is more than twice the length of the next three segments. The last segment is produced laterally into short, stout, curved spines, directed dorsally. The *head* is in front rather square, and the dorsal cephalic spine very short, thick basally, and directed forwards. The *Abdomen* is short and thick, not, altogether, a quarter the length of the cephalothorax. The *Anterior Antennæ* are not more than 7 mm. long—*i.e.*, not as long as the whole animal; they consist of twenty-three segments, of which the eighteenth, nineteenth, and twenty-first are much longer than the twentieth. They are sparingly setiferous.

Ri of the *Posterior Antennæ* more than half as long as Re.

Posterior Footjaw with lamella on the outer margin of B 1.

Maxilla, Li 2 and 3, each with four bristles; B 2 with five; Ri small and two-jointed. Re small, and less than half the length of B 2.

First feet, Re of three segments, quite distinct, and with three marginal spines. Ri of one segment.

Second feet, Ri distinctly two-jointed.

Third and fourth, Ri and Re of three joints each. B 2 with tubal bristles.

Much larger than *G. caudani* or *G. miles*; is nearly related to the former. It occurred at the *Gauss* station, March 27, 1903, vert. 2,000 m.—*i.e.*, at the edge of the ice.

Gaetanus Longispinus (*nov.*). Plate III.

Head with very strong dorsal spine, broad based, and curved, but directed quite backwards. Space between this and the rostrum almost straight, with a clear chitin line representing a rudimentary crest. Just above the rostrum a small chitinous tubercle; rostrum very short but strong. *Anterior Antennæ* not reaching the end of the abdomen. Last segment of the thorax with spines arising at the frontal margin of the segment, strong and long (as long as the genital segment), a little curved, the tips directed backwards. In the dorsal aspect they appear to be very wide apart. Posterior Footjaws with small lamella on

basal. First feet, Re with three segments and three Se. Second feet, Ri of two segments. B 1 of fourth feet with the characteristic tubal bristles.

This quite differs from *Gaetanus miles* (Giesb.), and *Gaetanus caudani*, and does not appear to be identical with any of the four new species described by Sars (*loc. cit.*), one of which—viz., *G. inermis*, 'sans aucune trace d'une corne pariétale'—does not appear to be a *Gaetanus* at all.

Size.— ♀ (Cephalothorax, 3·72; Abdomen, 1·02 mm.), 4·74 mm.

Occurred in my Atlantic collection of 1904 at Lat. 44° 5′ N., and Long. 20° 34′ W.

GENUS LUCICUTIA. (*Giesbrecht.*)

Lucicutia Grandis. (*L. grandis*, Gbt., *Bull. Mus. Harv.*, v., 25; Gbt. and Schmeil, 'Das Tierreich,' p. 111; Wolfenden, *Journ. Mar. Biol. Assoc.*, April, 1904.) Plate II.

♀ 7 mm. long, or a little over. Cephalothorax of five segments; *head* separate from first thoracic segment; the last thoracic segment rounded on each side; the dorsum of the front segments rather gibbous. Genital segment very prominent, and with large ventral swelling. *Furcal segments* six times as long as broad. Proportionate length of abdominal segments, 6 : 4 : 3 : 4 : (and furca) 12. The latter about six times as long as broad.

Anterior Antennæ of twenty-five joints, with very many very long æsthetasks.

Posterior Antennæ with endopodite longer than the exopodite.

Mandibles with endopodite longer than the exopodite, the second basal and endopodite extended.

Maxillæ: first outer lobe with five bristles, exopodite large and oval; masticatory plate with strong teeth; B 2 with three bristles.

Swimming feet: all pairs with three-jointed exopodites and endopodites; the second basal of the first pair with a tubal process; the fifth pair with curved Heterochæta-like bristle on the inner side of the second segment of the exopodite.

Many examples appeared in the *Gauss* collection even down to the southernmost stations. The females are, I believe, identical with the examples I captured in the Atlantic, off the West Coast of Ireland, in 1904, and described by me in the *Journ. Mar. Biol. Assoc.*, April, 1904. The ♂'s agree with Giesbrecht's *L. grandis* ♂ described by him in *Bull. Mus. Harv.*, v., 25. The female was hitherto unknown. (See note appended, Lucicutia.)

GENUS HETERORHABDUS. (*Giesbrecht.*)

Heterorhabdus Grandis. (Wolfenden, *Journ. Mar. Biol. Assoc.*, April, 1905.) Plate IV.

♀ 7 mm. long (CT over twice as long as Abd.). Last thoracic segment ending in rounded produced margins anteriorly. Genital segment as long as the next three, and rather protuberant ventrally; fine pectinations on Abd. 1 and 2.

Anterior Antennæ about four joints longer than the whole body; twenty-fourth two and a half times as long as the twenty-fifth.

Posterior Antennæ with Ri longer than Re.

Mandibles with Ri longer than Re; no thickened teeth, all equidistant.

Anterior Footjaws with fifth lobe a little longer than the fourth. The three bristles of lobe 4 are long and thin, with wide-apart hairs; only the distal bristle of lobe 5 is a hook with comb hairs on the inner margin. It is shorter than its two fellows (with wide-apart marginal bristles), and the proximal thin and sparingly feathered bristle is the shortest and finest of the four. Of the three bristles of lobe 6 the anterior one is a delicate hook with comb bristles on the inner margin. The bristles of Ri are long and thick, two of them as long as the hook of the sixth lobe.

Posterior Footjaws without spine on B 1.

Maxilla rather Calanoid in form; Le 1 with five long and two short proximal bristles; Li 1 broad, with eight delicate hooks and four bristles; Li 2 small, with one bristle; Li 3 with three bristles; B 2 short and broad, with four marginal bristles; Ri large and unsegmented, with nine bristles; Re large, oval, with six long thick and five very thin apical bristles, the two proximal very long.

Third foot has the Re 3 wider than in the second and fourth pairs; the end-saw only one-third the length and curved at the tip.

Fifth feet comparatively short; Re 3 not as long as the two proximal joints, with two outer marginal spines, four Si, and a short end-saw with unserrated edge; Re 1 and 2 without Si; at the outer distal margin of Re 2 are two strong upright curved teeth, the outer one the largest.

Ri with segments not very unequal; Ri 2 a little the longest; the outer distal margins of Ri 1 and 2 prolonged into short spines, the Si of these segments short, and not thicker than the other bristles, but quickly tapering to delicate whiplike bristles and densely haired.

Two adult females occurred at 400 and 700 fathoms respectively in the deep Atlantic trough west of Ireland. Both were very transparent, and the chitin covering apparently thin.

♂ a little less than the female. Plate IV.

Anterior Antenna (the geniculating) with a spine on the joint before the elbow, nearly parallel to the segment, not extending to the end, and with four segments beyond the geniculation.

Oral organs like the female.

Fifth feet very peculiar and characteristic.

Right foot: B 2 with upright lamellar process, small, and haired on inner margin; Re 2 very globular proximally, with a very stout, broad-based, short, and rather curved spine, and short tooth below it; Re 3 rather oblong and short, with hump on external distal margin and rather long spine arising from the inner margin.

Ri 2 broad in the middle, the inner margin very convex.

Left foot: B 2 with globose swelling of inner margin, with short marginal hairs; Re 2 with strong spine on the inner margin, and longer thinner spine below it; Re 3 with stout

inner marginal spine, two short apical spines, and continued into a very stout, long spine bent over like a hook.

Ri 2 large, broad, and distally with a bilobed lamellar appendage.

Several examples occurred in a *Gauss* gathering at station, October 9, 1903, both males and females, and are identical with the specimen described before.

Heterorhabdus Grimaldi. (Richard, *Bull. Soc. Zool. France*, vol. xviii., p. 151.)

♀ 9·0 m. long (CT = 6·6; Abd. = 2·4). Ce rounded with papilla; no spine. Genital segment large, and with prominent ventral swelling.

Anterior Antennæ reach beyond the end of the genital segment, last joint very small, last but one three times as long and about ten times as long as broad.

Posterior Antennæ with Ri much longer and thicker than Re.

Mandibles with outer tooth thickened, alike in both.

Anterior Footjaws resemble those of the ♂; the strong, broad hooks of the fifth and sixth lobes similar.

Posterior Footjaws without spine on B 1.

Maxillæ as in the ♂, only Li 1 has nine weak hooks.

Third and fourth feet alike.

Fifth feet very squat; Re short, with broad segments; Ri short, and the bristles of Re 1 and 2 short, not thicker than the others, but stiff and haired in the distal half. End-saw of Re 3 short, only one-third as long as Re 3.

This, the largest *Heterorhabdus* known, is distinguished from all other members of the group to which it belongs (*grandis*, *major*, *longicornis*, *brevicornis*, *vipera*) by its size and the peculiar character of the long hooks of the Anterior Footjaws. It would closely agree with the *H. Grimaldi* of Richard, except that the fifth feet appear to differ somewhat.

The ♂ resembles the ♀ generally, and is 9·0 mm. long. Plate IV.

The *Anterior Footjaws* have the proximal lobes small; the fourth with three thin bristles, and a fourth thin but rather longer; the fifth elongated, with one very thick strong curved hook with about six strong teeth wide apart, and one thin bristle; the sixth lobe short, with a hook similar to the foregoing lobe, but weaker; the Ri with four bristles of unequal length, the longest only three-quarters the length of the hooks.

The *Maxillæ* with very large and oval-shaped Re, with five very long and thin bristles; Ri with six, B 2 with one, Li 1 with four or five weak hooks, Li 2 with one; no Li 3.

Third and fourth feet similar.

Fifth feet: Ri 2 not elongated, and about same length as Ri 3; Ri 2 and 3 very broad in proportion to length, with respectively two and six similar bristles.

B 2 on *right* side with prominent upright enlargement, with stiff hairs over most of the margin; Re 2 with prominent ovoid enlargement of the inner margin, with distal tuft of hairs; Re 3 only a little longer than Re 2, curved, ending in a rounded point with short stiff bristle not half the length of the joint.

On *left* side: B 2 with rounded inner margin, thickly beset with hairs; Re 2 and 3 about equal, curved; Re 3 with rounded end and stiff short prolongation resembling a spine.

The ♂ of this very large species has hitherto remained unknown, and the species itself has been regarded as rather doubtful, but there is no doubt that it is a good species.

It occurred at the *Gauss* station, October 8, 1903, 3,000 metres, and several others.

Heterorhabdus Major. (Dahl, *Verh. d. Zool. Gesellsch.*, p. 79.) Plate IV.

Only briefly mentioned in Giesbrecht and Schmeil's 'Tierreich': 'Sonst verwandt mit *H. longicornis* aber L über 5 mm.,' and noted by Dahl (*Verh. d. Zool. Gesellsch.*, p. 94, 1894) as having 'Posterior Footjaw with weak bristles, long tap lobe on Anterior Footjaw, teeth of Mandible little different in thickness; Re of third pair like second and fourth. Anterior Antennæ very long, and over 5 mm.'

A ♂ occurring at *Discovery* station, November 6, 1902, was 4·8 mm. long; *Anterior Antennæ* very long; Mandible teeth alike, and not thickened; *Anterior Footjaws* with the fifth lobe elongated; thick hook without combs; one thick hook on the fourth lobe, smaller than that of the fifth lobe; the bristles of Ri very long. *Posterior Footjaws* without spine; *Maxilla* of Heterorhabdus type.

Third feet like the fourth.

Fifth feet peculiar: right foot with long upright process on B 2, haired marginally; Re 2 broad, with marginal projection; Re 3 with stout based apical spine; right Ri with very narrow Ri 2; Ri 3 comparatively broad; Ri 2 with thick marginal bristle.

Left foot: B 2 with haired marginal projection; R 3 with long, stout, apical spine, three-quarters the length of the Re, and short distal inner marginal spine; Ri 2 broad, with rather thick marginal bristle.

I suggest that this may be the ♂ of Dahl's species. It naturally falls into the group to which it and *longicornis* belong, and is certainly not the latter.

Heterorhabdus Brevicornis. (Dahl, *Verh. d. Zool. Gesells.*, p. 59.)

This species is little more than mentioned by Dahl, and described as like *H. vipera*, only the series of spines on the B 2 of the Maxillipedes are finer, thicker, and longer; the last but one joint of the Anterior Antennæ is not double (in place of three times) as long as broad (Giesbt. and Schmeil, 'Tierreich,' p. 116).

♀ 2·55 mm. long. CT nearly four times as long as Abd., and very broad (more than half as broad as long); head with frontal papilla; furcal segments short, but asymmetrical. *Anterior Antennæ* not as long as the CT, the last joint but one about four times as long as broad. *Posterior Antennæ* with two very thick bristles on the inner margin of the B 2. *Mandibles* thickened outer teeth. *Maxilla* of Heterorhabdus type, Ri extended with three bristles, B 2 small, and with two bristles, Re small with five bristles, Le 1 with five bristles, Li 2 with two,

Li 1 very large. *Anterior Footjaws* with the fourth lobe with two long bristles and short proximal bristle; fifth lobe very long, with long curved comb bristle; sixth lobe with a thinner comb bristle; bristles of Ri long.

Posterior Footjaws without spine bristle.

Third feet broader than the fourth.

Fifth feet with very thick slightly curved inner marginal bristle on Re 2.

Ri 2 not lengthened, and all bristles of Ri similar.

I assume this to be the same animal as meant by Dahl under the above name. (*Gauss* station, November 12, 1903, 3,000 metres.)

Heterorhabdus Brevicaudatus (*nov. sp.*). Plate IV.

♀ 3·15 mm. long. Head with papilla, but no spine. Cephalothorax a little over twice as long as Abd. Genital segment very protuberant.

Anterior Antennæ as long as the body. *Posterior Antennæ* with Ri three times as long as Re and much wider.

Mandibles with Ri longer than Re, basal longer than wide, masticatory plates with outer teeth, not thickened, and about equidistant.

Anterior Footjaws with hook on the fifth lobe (not toothcombed, but with short bristles on the convex outer side); sixth lobe with similar but weaker hook; one simple bristle on this lobe, and two very thin bristles on the fifth lobe. Bristles of Ri very long.

Posterior Footjaws without spine on B 1.

Maxillæ like those of *H. grandis*. Li 1 large, with nine hooks and three bristles; Li 2 large, with two bristles; Li 3 with one bristle; B 2 has two, Ri has four, and the Re is very large and oval (bristles defective). Le 1 with straight margin and four bristles.

The third foot is not broadened, but resembles the fourth.

The fifth have broad Re; Re 1 without Si, Re 2 with thin curved inner distal bristle about as long as the Re 3.

Ri with outer distal margins of first and second segments strongly produced into spines, the Si of all three segments alike.

In the structure of the mouth organs (Post. Ant., Mandibles, Footjaws, Maxillæ), this animal resembles the type, *H. grandis*.

It was captured in June, 1903, in the Atlantic, south-west of Valencia, at 375 fathoms.

Heterorhabdus Profundus. (Dahl, *Verh. d. Zool. Gesellsch.*, p. 80.) Plate IV.

This species again has only been briefly described by Dahl, and Giesbrecht and Schmeil (*loc. cit.*): 'Verwandt mit *H. norvegicus*: aber: die distale Borste am Engl. des rechten Exp. des 5 B des ♂ sagt weit über das Gliedende hinaus: das proximale Stück des Endgl. des linken Exp. ist verdickt und trägt aus Innenrande eine Borste, die bis zur Mitte des Gl. reicht.—L.'

♂ 3·2 mm. long; Abd. 1·2·3, with margins of segments pectinated. Head with small papilla. *Anterior Antennæ* with five joints beyond the elbow, reaching a little beyond the

furca. *Posterior Antennæ*, Ri longer than Re. *Mandibles* with strongly thickened outer teeth. *Anterior Footjaw* with one comb hook on lobe 6, one on lobe 5 with a file bristle very nearly as long, on the fourth lobe two file bristles and one bristle half the length; bristles of Ri at least half as long as the last comb bristle. *Posterior Footjaws* with curved spine bristle on B 1 as long as the rest of the organ. Fifth feet of *norvegicus* type, but differing.

Right Re with long, narrow, upright, curved and marginally-haired process on B 2; Re 2 with projection haired at tip, and second projection below it, with two very short teeth on the distal margin, leaving a triangular space between these two projections; Re 3 rather long, outer distal end rounded, with short spine, and internal to it a rather long bristle reaching a long way beyond the end of the segment.

Left foot B 2 convex and haired marginally, Re 1 and 2 with strong triangular outer marginal spines; Re 3 broadened below, gradually tapering to a long curved spine, an inner marginal bristle arising in the middle of the broadened part and half the length of the terminal bristle; the outer distal margin of Re 3 with short strong spine.

Ri 2 of both sides very long.

Occurred at *Gauss* station, March 23, 1903, 400 metres.

The diagnosis between this species and *H. abyssalis* and *norvegicus* is not easy.

Heterorhabdus Austrinus ♂ (*nov.*). (*H. austrinus*, Gbt., '*Belgica*' *Report*). Plate IV.

The ♀ of this species has been described and figured by Giesbrecht.

The ♂ is 4·0 mm. long, head rounded, with frontal papilla.

Anterior Antennæ (geniculating left) with four joints beyond the elbow, the first two very long, the last but one three times as long as the end joint.

Mandibles with thickened outer teeth.

Anterior Footjaws with very long tap lobe, two distal comb hooks, long but rather weak; the fourth lobe with a shorter hook bristle and two others, the proximal of which is only about half the length of the comb; bristles of Ri about three-quarters as long as the last comb.

Fifth feet quite peculiar. Right B 2 strongly projecting and rounded, with fine marginal hairs proximally, Re 2 with protuberance of peculiar shape.

Re 3 short and wide, with short end spine not as long as the segment. Left foot with basal wide but without process; Re 3 with short terminal spines on inner margin and short, very thick curved process arising about the middle of the segment, armed on the lower surface with short broad teeth. Ri of both sides with broad but not very unequal segments, the marginal bristles similar.

Heterorhabdus Atlanticus (*nov. sp.*).

♂ 3·7 mm. long (CT 2·4, Abd. 1·3). Ce with frontal papilla. *Anterior Antennæ* only reaching a little beyond the end of the genital segment. Clasping antenna with four joints

distinct beyond the elbow, respectively long 50 : 48 : 22 : 10, the last but one four and a half times as long as broad, the last three as long as broad. Relative length of the last five joints of the normal antenna, 19 : 18 : 20 : 12 : 9, the last but one two and a half times as long as broad. Antennæ clothed with long æsthetasks. *Posterior Antennæ* with Ri much longer than Re. *Mandibles* with Ri longest, teeth not thickened, and equidistant. *Maxilla* of ordinary type, long Re (oval) with six bristles, Ri small with four, B 2 with two, Li 2 with two, Li 3 with one bristle. *Anterior Footjaws* weak, fifth lobe with a curved hook, combed, and two short, thin bristles; sixth lobe with hook without combs, but wide apart, short bristles on both sides. *Posterior Footjaws* thin, without curved spine on B 1.

Third feet like fourth.

Fifth, B 2 of right foot with short distal projection, upper half of margin haired; Re 2 with long process, haired distally, and carrying a short, rather thick bristle; Re 3 short, square, and with very thick long bristle at the distal inner margin. Left foot with B 2 only slightly projecting, and with fine marginal hairs; Re 2 with two long, thin spines; Re 3 continued into a curved hook with a long spine (more than half its length) internal to it. Ri of right side with second joint elongated, and very thick and long inner marginal bristle. Ri of left side with very elongated second joint, but no marginal bristle.

It belongs to the same group as *H. major* and *longicornis*, except for the short fifth lobe of the anterior footjaw. The antennæ and fifth feet are entirely different from *H. longicornis*. It differs from *vipera* in mandibles, third and fourth feet and fifth feet, and also from *brevicornis*, Dahl; from *brevicaudatus* in being larger, and especially in the maxilla, which is distinctly Heterorhabdoid in form, the former being Calanoid. It occurred in the deep water (600 fathoms) of the Atlantic off the West Coast of Ireland (St. E. 15, 1903). It is only provisionally regarded as a new species, which may ultimately prove to be incorrect, but certainly does not appear to quite agree with any known species.

GENUS HALOPTILUS. (*Giesbrecht.*)

Haloptilus Ocellatus (*nov. sp.*). Plate V.

♀ From tip of frontal spine to end of furca 8·75 mm. long (CT 7·5 mm., Abd. 1·25). Furca over three times as long as broad; first cephalothoracic segment longer by one-third than the remaining segments of the anterior body; last two segments of the thorax united. On the second thoracic segment, in the middle of the back, is a rounded pigment spot, a so-called 'ocellus,' giving a very characteristic appearance to the animal, with its transparent body and black 'ocellus.' The frontal spine is extremely long, broad-based, tapering, and curved a little downward distally. The distance from the tip of the spine to the base of the antennæ is equal to the distance between the base of the antennæ to nearly the distal end of the second cephalic segment.

Anterior Antennæ reach about four joints beyond the furca.

Posterior Antennæ with six segments; only a faint indication of division of the most distal segment (which would make seven); the first segment very long, and nearly as long as the distal five joints.

Maxillæ with small and one-jointed Ri carrying five bristles, the outermost of which is much the longest and stoutest.

Anterior and Posterior Footjaws like *H. ornatus*.

All feet with Re and Ri of three segments each; the fifth feet with Re 2 with bristles resembling Re 3.

This copepod is most nearly related to *H. spiniceps* and *H. ornatus*, but is distinguished by great size, the dorsal 'ocellus,' the Ri of the maxilla, the fifth feet, and the length of the anterior antennæ. It occurred with frequency in the *Gauss* collections made in the South Atlantic to the more southerly stations.

GENUS LUBBOCKIA.

Lubbockia Minuta (*nov. sp.*).

One example only occurred in a vertical haul from 500 fathoms off the West Coast of Ireland.

♀ length 1·3 mm. (Cephalothorax 0·6, Abdomen 0·7), the head scarcely at all produced, and rounded. The head only partially divided by dorsal line from the first thoracic segment; last thoracic segment rounded. Abdomen of four segments, of respective lengths of 22 (genital), 15, 17, 8. Furca 11; the latter about five times as long as broad.

Anterior Antennæ distinctly of seven joints of respective lengths—

1	2	3	4	5	6	7
4	4½	3	6	3	2½	2½

and very short. *Posterior Antennæ* with the endopodite one-third longer than the basals, carrying six bristles at the distal margin, of which one (marginal) is as long as the endopodite. On the opposite margin are two bristles, one short proximal, and one comparatively long distal one.

The *Posterior Footjaws* claw-shaped, but without any spines on the claw (as in *L. Squillimana*).

The swimming feet in all pairs (except the fifth) with the endopodites and exopodites distinctly of three segments, the latter much shorter than the endopodites; but in the first and second pairs the last segment bearing three marginal spines as well as the terminal saw, thus differing from *L. Squillimana* and *aculeata*, in which this segment in all feet bears only two marginal spines; the two distal spines rather close together, the proximal the shortest.

The third and fourth feet in this species have only two marginal spines on the last segment of the exopodite; fifth pair of feet very slender and short, the inner distal bristle (the largest) not being much more than half the length of the genital segment, lancet-shaped, but not so broad as in *L. Squillimana*; the outer bristle simple and short.

The animal differs from both *L. Squillimana* and *aculeatus* in its very much smaller size, its seven-jointed antennæ, the spines of the swimming feet,* and the small fifth pair; and also in the segmentation of the abdomen.

GENUS MORMONILLA.

Mormonilla Atlantica (*nov. sp.*).

Size of ♀ 1·2 mm. to 1·3 mm.; the cephalothorax not quite three times as long as the abdomen, the furca the same length as the latter; the Anterior Antennæ a very little longer than the cephalothorax, in all specimens examined, of four segments; these two segments together shorter than the middle segment (as 21 : 27). The long furcal segments are marginally divided by the external bristle into portions of which the distal is five times as long as the proximal.

First, second, and third feet with three-jointed exopodites; the endopodite of the first pair three-jointed, of the second pair two-jointed, of the third and fourth pairs one-jointed. In the fourth pair the exopodites are, however, only two-jointed, resembling *M. minor*, Gbt. The segmentation of the feet differs, however, from that of *M. minor* ♀ as follows:

	Mormonilla minor.			*Mormonilla atlantica.*
First pair,	Re=3, Ri=2	...	...	Re=3, Ri=3.
Second pair,	Re=3, Ri=2	...	...	Re=3, Ri=2.
Third pair,	Re=3, Ri=1	...	...	Re=3, Ri=1.
Fourth pair,	Re=2, Ri=1	...	...	Re=2, Ri=1.

The mouth parts resemble the same organs in *M. minor*, Gbt.

But for the different segmentation of the feet and the distinctly four-segmented Anterior Antennæ there would have been no hesitation in regarding this as identical with Giesbrecht's *M. minor*. The latter examples were taken from the Pacific. The specimens here referred to, of which there were about a dozen, were taken in a vertical haul with the open net from 500 fathoms to the surface at a station (E. 6) off the South-West Coast of Ireland. Having regard to the structural differences of the swimming feet as well as the very different localities of distribution, it is perhaps better to regard this as a new species, rather than a variety of the Pacific form.

* First foot, Re 3 with three spines and four inner bristles; Ri 3=Ri 1+2; not longer than Exop.

Second foot, Re 3 with three spines and five inner bristles; Ri 3<Ri 1+2; Re and Ri nearly equal length; saw as long as whole Re.

Fourth foot, Re 3 with two spines and five inner bristles; Ri 3<Ri 1+2; Ri much>Re; saw as long as whole Re. In *L. Squillimana* and *aculeata* Re with 1, 1, 2 spines in all pairs.

GENUS EUCHIRELLA. (*Giesbrecht.*)

The *Gauss* collections are rich in examples of this genus, several new species occurring. In Sars' latest work, *Bulletin du Musée Océanographique*, March 20, 1905, four new species of *Undeuchaeta* are mentioned, which I think should undoubtedly be referred to the genus *Euchirella*.

In the allied genera *Gaidius*, *Gaetanus*, *Euchirella*, the characters of the modified tubal or spine appendages of the first basals of the fourth feet form a useful and satisfactory generic distinction. *Euchirella* is distinguished by the constant occurrence of such spines in all except one species, and another strong generic character is found in the structure of the *Posterior Antennæ*, in which the *Ri* varies from a rudimentary structure to not more than half to three-quarters the length of the *Re*.

Both types of *Undeuchaeta* hitherto known (*U. major* and *U. minor*) are distinguished generically by the peculiar characteristics of the *abdominal segments* (spines on the genital segment), the total absence of spines on the *fourth feet*, the unequal length of the bristles of the Re of the Maxilla, and the more equal size of the *Re* and *Ri* of the *Posterior Antennæ*; while the characters of the genus *Euchirella* differ in all these respects—no spines on the genital segment, spines on the fourth feet (in all except one species, *E. carinata*), equal size of the bristles of *Re* of the *Maxilla*, and very short *Ri* of the *Posterior Antennæ*. The species enumerated by Sars (*U. dubia*, *U. scopularis*, *U. pustulifera*, *U. obtusa*) answer to these generic characters, and the variable segmentation of the rami of the first and second feet is not of great generic value, since in several genera of this subfamily this is rather inconstant.

Euchirella Hirsuta (*nov.*). Plate VI.

♀ 8·5 to 9 mm. long. Cephalothorax over five times as long as Abd. *Head* moderately narrow in front, rounded, without crest, but with short and strong rostrum. Last two segments of the thorax imperfectly divided, the posterior one prolonged laterally into blunt triangular wings, rounded at the tips. Abd. very short, with large genital segment, as long as the next three, and very broad.

Anterior Antennæ long, reaching nearly to the furca.

Posterior Antennæ with Ri a little more than half as long as Re, the Ri with eight and six bristles. *Maxillæ*, Ri with fifteen, B 2 with five, Re with eleven bristles. *Posterior Footjaws* with lengthened B 2, over seven times as long as broad: B 1 : B 2 : Ri = 19 : 30 : 12.

First feet, Re with three segments; second feet, Ri distinctly two; fourth feet, Bi 1 with prominent cushion, on which are fourteen strong and equal teeth; the second and third segments densely covered with short hairs. The margins of the last thoracic segment and the abdominal segments are very hirsute.

Several examples were met with in the *Gauss* collection from Station 12, November, 3,000 metres, to 13 February, 1903.

Specimens from the Southern Ocean are rather larger (9·8 mm.) than those from the Atlantic.

Euchirella Rostrata, *var. Magnus.*

The ♀, 6·2 to 6·5 mm. long, resembles the *E. rostrata* of the Mediterranean and Faroe Channel in all particulars except its large size, which is constantly nearly twice as great as the Mediterranean samples.

Euchirella Venusta (Gbt.).

♀ 4·8 mm. long; very rounded *head* with strong rostrum, but no dorsal crest; last two segments of the thorax partially divided; lateral margins evenly rounded, with a few rather long marginal hairs. Abdomen more than one-third as long as CT. Genital segment protuberant ventrally and dorso-laterally; swollen on the right side with prominent projection. Anterior Antennæ reaching nearly to the furca; Posterior Antennæ with Ri quite rudimentary, bearing seven very short bristles. First feet, Re only two, with three spines; second feet, Ri = 1; fourth feet with two stout spines on B 1, the proximal rather the largest.

Probably identical with Giesbrecht's Pacific Ocean species.

Euchirella Maxima (*nov.*). Plate VI.

♀ 8·7 mm. long. *Head* with strong frontally-directed triangular crest, and in front with small rostrum. *Anterior Antennæ* reaching beyond the end of the thorax, the last segment of the latter ending in front in small triangular wings with points. Head and first thoracic segment united, last two segments separate, but the hinder one very small. *Abdomen* one-fourth as long as the cephalothorax; genital segment large, and with strong protuberance in the centre ventrally and below, excavated above (short spermatophore attached). *Posterior Antennæ* with Ri very short, only one-fourth the length of Re, and with five and five very short naked bristles, the outer ones twice as long as the inner.

Maxillæ, B 2 with two very short bristles; Ri 1 with one; Ri 2 with three; Re with eleven. *Basals of fourth feet* with one strong, thick-based, short and curved tooth.

This copepod occurred at September 26, 3,000 metres, and September 30, 1,500 metres, *Gauss* stations.

Euchirella Brevis (?). (Sars, *E. brevis; Bull. Mus. Océanog. de Monaco*, No. 26.) Plate VI.

♀ 3·65 mm. (Cephalothorax, 3·1; Abd., ·55). The *head* rounded and broad, without dorsal crest, and with small rostrum. The *Abdomen* extremely short, not much more than one-sixth the length of the cephalothorax; the first (genital) segment very broad, and distally ending in a point dorsally, the second and third crowded together. The *Anterior Antennæ* not reaching the end of the thorax. *Posterior Antennæ* with almost rudimentary Ri

of two segments, and three very short apical bristles. *Mandibles* with broad B 2, with extraordinary thick curved hook on the inner margin. *Maxillæ*, B 2 with two, Ri with four, Re with seven bristles.

Fourth feet, B 1 with seven extremely short but broad-pointed spines.

It occurred at many of the *Gauss* Atlantic stations, and the characters of the mandible are quite distinctive.

But for the difference in the number of spines on the basals of the fourth feet and in the length of the antennæ, I should have little hesitation in regarding this as identical with the species referred to by Sars.

Euchirella Elongata (*nov.*). Plate VI.

♀ 7·7 mm. long (CT, 6·0 mm.; Abd., 1·7 mm.). *Head* evenly rounded, and narrower dorsally than the distal portion of the first segment, produced in front into a short, but strong, one-pointed rostrum; no crest. Head and first segment only partially divided; last two segments separate, the last one prolonged into triangular wings ending in points, the tips curved inwards, the right more so than the left. *Abdomen* with segments pectinated at distal margins; genital segment a little swollen below laterally, but genital orifice on slightly elevated cushion in the upper half of the segment.

Anterior Antennæ not longer than the thorax, and of only twenty-two distinct segments, 1∿2, 8∿9, 24∿25. *Posterior Antennæ* with Re about twice as long as Ri. *Anterior Footjaws* and *Maxillæ* of *Euchirella* type, the latter having B 2 with five, Ri with fifteen, Le 1 with seven long and two short, and Re with eleven equally long bristles. *Posterior Footjaws*, B 1 : B 2 : Ri = 16 : 28 : 8, the B 2 slender, and seven times as long as broad.

First feet, Re = 3, with three spines; second feet, Ri = 1; fourth feet with seven large thin spines on B 1, the inner longer than the outer.

This copepod occurred at *Gauss* station, March 10, 1903.

Euchirella Spinosa (*nov.*). Plate VI.

♀ 6·2 mm. long (CT, 4·7 mm.; Abd., 1·4 mm.). *Head* rounded, with short, strong, one-pointed rostrum; two last thoracic segments united, the last one having laterally short, strong spines directed downwards and about half the length of the genital segment; the abdominal segments fringed distally with pectinations, the genital segment not swollen laterally and only a little ventrally in the upper part. *Anterior Antennæ* not as long as the body, of twenty-three segments, the twentieth smaller than the twenty-first or nineteenth segments. *Posterior Antennæ* with Re twice as long as Ri. *Posterior Footjaws*, B 1 : B 2 : Ri = 12 : 23 : 7. B 2 very attenuated, eight times as long as broad. The mouth organs of *Euchirella* type. First feet, Re 1 and 2 imperfectly segmented with three spines, the first very thin and delicate. Second feet, Ri = 2. Fourth feet, B 1 with a cushion carrying thirteen or fourteen strong spines, the inner ones rather longer than the outer.

The short, strong spines of the last thoracic segment of this species are distinctive. It occurred at *Gauss* station, October 8, 3,000 metres.

Euchirella Atlantica. (*E. curticauda, var. Atlantica*; Wolfenden, *Journ. Mar. Biol. Assoc.*, April 1, 1904.)

In a former paper I described this as a variety of *E. curticauda*, Giesb., and remarked that it might perhaps be considered to be a new species. In my plankton from the station Lat. 42° 01′ N.; Long. 10° 48′ W., in 1904, I have again met with the same copepod. The difference in the spinulation of the fourth feet being constant, I think it must be regarded as a new species. The *head* is armed with a triangular and prominent helmet-shaped crest directed forwards; rostrum is absent, the genital segment very protuberant, the anal segment with dorsal prolongation between the furcal segments; the whole abdomen very short, only one-eighth as long as the cephalothorax; last two thoracic segments only partially separate. *Anterior Antennæ* about as long as the body. *Posterior Antennæ* with Ri almost rudimentary, with three and two very short, weak bristles distally. Re 1 with marginal tubercle. *Maxillæ*, Ri with only three bristles. First feet, Re only two segments, with three Se. Second feet, Ri only one segment. Fourth feet with six short spines on the first basal.

The resemblance to *E. curticauda* is very great, this being, however, a Pacific Ocean species.

Size.— ♀ 4·08 mm. (CT, 3·6; Abd., 0·48 mm.).

GENUS CORNUCALANUS (*nov.*).

This is very nearly related to *Xanthocalanus*, but chiefly differs in the shape of the head and the extraordinary claw-shaped appendages of the Posterior Footjaws. As in all *Xanthocalanidæ*, the last lobe of the Anterior Footjaws carries a strong hook, which is characteristic of the genus mentioned, only in *Cornucalanus* it is of quite exceptional size and strength. The Ri of this organ is furnished with seven brush sensory appendages and one long vermiform appendage, and there is a similar brush appendage on the Posterior Footjaw. The head is quite characteristic, with a strong, though short, dorsal horn. In the lateral view the front is square-shaped, and the appearance of the head is like a *Gaetanus* with small horn. The mouth has a very large epistomal process, strongly haired. Feet segmented as in *Xanthocalanus*, with a pair of very small and almost rudimentary fifth feet. While resembling *Xanthocalanus* in many particulars, the form of the head and the Posterior Footjaws especially are so different as to justify its inclusion in another, though very closely allied, genus.

So far as I understand Sars' description, this does not appear to agree with his genus '*Onchocalanus*' (*Bull. du Musée Océanographique de Monaco*, March 20, 1905), which is characterized by rostral appendages formed of 'bifurcated chitinous lamellæ, Anterior Footjaws

ending in a very strong and acutely curved claw, Posterior Footjaws "grêles et allongés," all feet covered with fine spines.'

In *Cornucalanus* the character of the head with its dorsal horn is quite distinctive. A strong hook on the last lobe of the Anterior Footjaw, simple or elongated Posterior Footjaws, the surfaces of the segments of the feet densely spinose and hirsute, are characteristic of *Xanthocalanus*, of which many examples occur in my collections. Brush sensory processes on the footjaws, especially the Ri of the Anterior Footjaws, are especially characteristic. These are not, however, mentioned by Sars in his description.

Cornucalanus Magnus (*nov.*). Plate VII.

♀ 8 mm. long. CT over three times as long as the Abdomen.

Head with strong, short, dorsal horn, and between that and the rostrum the line almost straight, and head very square. A strong, short, bifurcated rostrum. Prominent epistomal processes.

Ce—Th 1, and Th 5 only partially separated from Th 6. The last thoracic segment produced laterally into triangular wings with blunt rounded margins projecting well over the genital segment.

Abdomen short and of four segments, and very hirsute.

Anterior Antennæ not longer than the cephalothorax, of twenty-four segments.

Maxillæ like *Xanthocalanus*, well shaped Re with ten, B 2 with five, Ri with nine bristles.

Anterior Footjaws, proximal lobes crowded together, posterior margin proximally excavated, with strong prominence in front, last lobe produced into very strong, thick, and long-curved claw, with three bristles (two short, and one as long as the claw) at the end of the lobe (and base of the claw). Ri small, with seven brush sensory processes and one long vermiform appendage.

Posterior Footjaws, B 2 with teeth along proximal part of the inner margin, bristles very small; Ri 2 large and with Ri 3, each carrying a strong, thick, curved claw, with teeth set wide apart. B 1 with a brush sensory appendage.

Feet all with broad segments. First pair Ri 1 with a bunch of spines on the distal outer margin. Second pair Ri 2, each with bunches of strong spines on the surface, the segments of Re very broad (Re 3 is three-quarters as broad as long), end-saw larger than Re 3; strongly toothed, and as in the fourth pair, with a second row of teeth basally.

Fourth pair with bunches of spines on the surfaces of Re 2 and Ri 2, all the segments with many small prickles.

Fifth pair exceedingly small, and not longer than the B 1 of the fourth pair. Each of three segments, not very distinctly divided, with scattered and not dense marginal hairs, and one terminal short spine, into which the last joint is apparently produced.

♂ 5·8 to 6 mm. long. Head without the dorsal spine and roundly oval, broadly triangular, separated from CT 1 by a faint dorsal line; last segment produced into lateral wings like the female. Abdomen of five segments.

Anterior Antennæ of twenty-three joints, the twentieth very small and not half the length of

the nineteenth; basal joints thick and well supplied with bristles and æsthetasks. Oral organs somewhat retrograded and footjaws without claws. First, second, third feet like the female, but fourth pair unsymmetrical: on one side Re with only two segments and no Se distally, and with only five bristles apically and on the inner margin; the opposite foot normal, with three segments in Re. (This is probably abnormal development.) Fifth feet, right comparatively very long; two broad basals; Re 1 long and narrow, with rudimentary Ri, and Re 3 represented by a long stylet process. Left foot shorter, of four segments, the end segment long and narrow, square-ended, with short spine at the end. This was found in a sample containing only females of the former species, and is probably the male of the same.

This species occurred in several of the *Gauss* samples.

Cornucalanus Simplex (*nov.*).

Whether this should be a new species or only a variety of the former is difficult to say, only one example having been met with. From the form of the genital segment it appeared to be adult, and the only essential difference between the two is the entire absence of dorsal cephalic horn and the evenly rounded oval head. Claws on the Anterior and Posterior Footjaws occur precisely as in the former species, and the structure of the feet is similar.

[Note.—In 'Ann. and Mag. N. Hist.,' vol. xii., p. 21 and Table V., is described by I. C. Thompson a copepod which probably belongs to this genus, but is named by Thompson *Scolecithrix chelifer*. The description is very unsatisfactory. The Anterior Footjaw is figured and described as a mandible, and the maxilla as the Anterior Footjaw. From the drawing of the Posterior Footjaw, the two strong terminal claws seem to resemble the same organs in the species above described, but no dorsal cephalic spine is mentioned. The species, however, is probably not a *Scolecithrix*. The specimens appear to have been immature males, according to Thompson of 6·0 mm. length.

Note to Page 8.

The brief description of *Lucicutia grandis* ♀ published by me in April, 1904, was followed by the publication of the description of *L. maxima* by Steuer in *Zool. Anzeiger*, in June, 1904. As he was apparently unaware of my earlier publication, so was I unaware of his article in the *Zool. Anzeiger* until recently. I have in my possession a large number of examples of *Lucicutia*, varying in size from 5 mm. to 7 mm. length—none so large as Steuer's example of 8·7 mm. length—and the discrimination of these species is by no means easy. I am of the opinion that *L. grandis* ♀ described by me (*loc. cit.*), the ♂ of which was originally described by Giesbrecht, and *L. maxima* of Steuer are one and the same animal. There is a second species, which I shall mention further on, which must, I think, be regarded as distinct; but with regard to *L. grandis vel maxima*, it does not seem rational to make any distinction between the specimens (of adult females) between those of 5 mm. and those of 7 mm. length. The variations in important particulars in this genus are considerable, and have already been drawn attention to by Giesbrecht (in the 'Fauna u. Flora, Neapel.,' vol. xix., p. 359). Especially is this the case

with *L. clausi*, in some examples of which Giesbrecht met with teeth on the sides of the head, 'resembling *Pontella*,' while in others the side hooks were replaced by 'Ausbuchtungen,' or these failed altogether. The length and breadth of the body, and the proportions of thorax to abdomen, varied also considerably. Both *L. flavicornis* and *L. clausi* are, however, comparatively small animals, at the most of 2 mm. length, even from the great oceans. These Atlantic examples are three to four times the size, and the specimen described by Brady ('*Challenger* Report,' p. 50) as *Lœckartia flavicornis*, 6·2 mm. long, is no doubt identical with *L. grandis*, formerly described by me, and in all probability with Steuer's *L. maxima*. (Brady's *L. scopularis* is undoubtedly a *Heterorhabdus*.) Occurring throughout the Atlantic Ocean, the examples from the Southern Ocean are usually the largest. The following points refer to animals occurring at different regions:

1. ♀. No trace of side hooks, F = 20, Abd. = 36. Abdominal segments 10 (GS) : 7 : 7 : 10 (anal). Anterior Antennæ extend to end of furca. Size, 6-8 mm. (Southern Ocean.)

2. ♀. No side hooks, F = 13, Abd. = 26. Anterior Antennæ extend to end of furca. Size, 5·1 mm.

3. ♀. No side hooks, F = 12, Abd. = 26. Anterior Antennæ extend a little beyond furca. Size, 6·4 mm.

4. ♀. No side hooks, F = 12, Abd. = 30. Anterior Antennæ extend a little beyond furca. Size, 6·1 mm.

5. ♀. No side hooks. Anterior Antennæ extend a little beyond furca. Size, 5·7 mm.

6. ♂. No side hooks, F = 17, Abd. = 20. Anterior Antennæ extend to end of furca. Size, 6·0 mm.

7. ♂. Very small lateral hooks; none in front. F = 19, Abd. = 25. Anterior Antennæ extend to end of furca. Size, 5·2 mm.

In all females, and in males the nongeniculating antennæ, reach to the end of the furca, or are only a little longer; the furca in the female is not more than half the length of the abdomen, and in the ♂ is not three-quarters of the same; the head is without side hooks (only occurring in one young and undeveloped female, which might be a young example of the next species), though often there are more or less prominent lateral projections. The furca in the ♀ is six to seven times as long as broad; in the ♂ the proportionate length is rather greater.

A typical mid-ocean example is as follows:

♀, 6·0 mm. long; head without side hooks; furca half as long as the abdomen; segments of abdomen proportionally (GS) 8 : 4 : 3 : 11 (anal). Antennæ reaching end of furca; maxilla with three bristles on B 2; Ri of first foot with eight bristles; fifth foot endsaw only half the length of Re 3; Re 1 only about two-thirds the length of Re 3, the Ri short, not reaching to the base of the inner big seta of Re 2.

♂, 6·0 mm. long. Furca : whole abdomen : 18 : 28 (more than half as long). Anterior Antennæ 19-25 segments of geniculating antenna > 14-18. Ri of fifth on each side with three segments and resembling that of *L. flavicornis*, except that the Ri 3 of the right side is broader and has six long bristles, that of the left side only five, and the Ri 3 extends beyond the end

of Re 2. B 2 of this male has an upright marginal protuberance with seven marginal teeth. Head with short side hooks.

The ♂ and ♀ are therefore very similar to *L. flavicornis*, except for size and small difference in the fifth feet of the ♂, which are subject to variation. The same feet in the ♀ appear to differ considerably in being stouter, in the proportions of the joints of the Re, and specially of the stout bristle of the Re 2.

The maxilla of ♀ and ♂ appears to constantly differ from that of *flavicornis* in having only three bristles on B 2. The Li 1 of the Anterior Footjaw in both ♀ and ♂ has five bristles and small spine, while Steuer describes for *L. maxima* only four bristles, and the B 2 of the Posterior Footjaw is constantly four times as long as broad. The differences, therefore, between Steuer's *L. maxima* and the numerous Atlantic specimens under observation is very small, except as to size; but this varies greatly, as also does the absence of an indication of rudimentary side hooks of the head. And while there can be no doubt that the species is distinct from *L. flavicornis*, it is more rational to regard all these Atlantic specimens (*L. grandis*, W., *L. maxima*, S.) as one and the same species. The second example of *Lucicutia*, however, differs so much that it merits specific designation, the characters of the head being widely different from any other species.

L. Bicornuta (*nov.*). Plate II.

♀, 6·75 mm. long. Anterior Antennæ extend about four joints beyond the furca. The furca longer than the abdomen. Lengths: Furca : Abdomen : Thorax = 37 : 30 : 68. Proportionate lengths of abdominal segments: 9 (genital) : 7 : 5 : 8 (anal). The genital and anal segments are therefore different in proportion from the last species. Furcal segments of unequal length.

The Ri of mandible not haired; B 2 of maxilla with three bristles. P.F.J., B 1 : B 2 : Ri = 10 : 11 : 10, the B 2 not four times as long as broad, and with a row of stiff, short bristles on the margin.

All feet with Ri and Re of three segments, with tubal process on B 2 of first pair, in which Ri has seven bristles. In the fifth pair Ri all together only a little longer than Re 1; Re 1 and Re 3 about the same length; the endsaw a little more than half as long as Re 3; Ri with seven bristles, the sabre bristle of Re 2 not much thicker (basally) than the others.

The head is characteristic. Frontally are two strong broad-based triangular spines, one on each side, and laterally two downward and outwardly bent large hooks (see Figure).

♂, 6·7 mm. long (another specimen 6·9 mm. long), with geniculating antenna on the left side, head like the ♀, and feet and oral organs like the ♀. Fifth feet, left side, Ri extends beyond proximal margin of Re 2, indistinctly of three segments; Ri 3 with five bristles; B 2 with an upright process with two teeth. Right side, Ri = only two segments, second very broad and with six bristles. B 2 very convex, and on margin a stumpy tubercular process. In two male specimens examined, the fifth feet exhibited small variations, maintaining the character of the genus for variation. Altogether, three males and one female were met with in a sample from the *Gauss* station, October 9, 1903.

(To be continued.)

First to fourth pair of feet Ri and Re=3; in all Ri very short and Re broad.

Fifth feet: Re 2, with short, thick bristle tapering to a point at the distal inner margin of Re 2; end-saw of Re 3 nearly as long as Re 3. Ri of only one segment not reaching beyond end of Re 1, very short with four marginal bristles. Of the Haloptilus with rounded heads (*chierchiæ*, *longicornis*, *plumosus*, *ornatus*) this animal approaches more nearly to *Ornatus* than the others. It is, however, much larger. The bristles of the Maxilla, length of Antennæ, large size of Posterior Footjaws, characters of the bristles of this and of the Anterior Footjaws, and the fifth feet, distinguish it from any of them.

Occurrence: Station 19, x. 1901, 500 metres. (*Gauss.*)

GENUS XANTHOCALANUS.

Xanthocalanus Simplex (*nov. sp.*) Plate X.

♀ 1·45 mm. long (Cephalothorax 1·08; Abdomen 0·4 mm.). Head rounded, cephalothorax of six distinct joints, head separate from first segment and fifth from sixth, last segment ending laterally in points, and the whole dorsal surface covered with fine prickles. Abdomen of four segments, the anal segment very small and only visible on the ventral surface, the genital very large, the posterior margins of the first and second segments dorsally pectinated; furcal segments longer than the anal, and with four bristles on each side, and a short accessory dorsal bristle.

Anterior Antennæ not as long as the cephalothorax, and of twenty-four segments (the eighth and ninth coalesced), the twenty-fourth separated from the twenty-fifth by an oblique line, the penultimate joint longer than either of the two preceding ones. Æsthetisks absent, except for one long one on the last joint; few and short bristles.

Posterior Antennæ with the exopodite nearly twice as long as the endopodite. Mandibles, the endopodite much longer and also broader than the expodite, the second joint of the former with seven, the third joint of the latter with five, bristles, the second basal longer than broad, and with two marginal bristles; the masticatory plate three times as long as broad, with six (or seven?) pointed thin teeth, the outer one only being large, and with a row of long fine bristles marginally, as long as the teeth.

Anterior Footjaws small, and lobes compressed and of about equal size, the fourth and fifth lobes with plain hook bristles, endopodite very small, and with four long vermiform processes.

Posterior Footjaws rather long and thin, second basal longer than the first, and longer than the endopodite, the second joint of the latter very long (rather longer than the three last joints); very short bristles on the first basal, and none on the second, those of the endopodite very few and thin.

Maxillæ, with first outer lobe very square-shaped and only three bristles; first inner lobe large, with eight hooks; second lobe short, with two bristles very long, one of which is much thicker than the other; third inner lobe attenuated, with three thin bristles; second basal

twice as long as broad, with four bristles; endopodite short, with six bristles and clearly segmented from the basal, exopodite longer than broad, upright, and with only two thin bristles.

First pair of feet with endopodite of only one segment, long and narrow (and with marginal lobe), as long as the first two joints of the exopodite. The latter of three segments, each with external marginal spine. The two basals without inner marginal setæ.

Second feet, endopodite of two segments, exopodite of three segments, comparatively broad, marginal spines long and thin, end-saw very broad, and with toothed margin; last segment with three external marginal spines and four inner marginal setæ.

Third and fourth pairs of feet with three jointed endopodites and exopodites, and inner marginal setæ on first basal, absent in the second pair.

Fifth feet extremely small and readily overlooked, each of a broad basal and two distal segments, the last small, and with two short terminal spines on the left foot, the right foot with the last segment rounded, and one external spine only (probably abnormal).

The segments of the exopodites in second to fourth feet are very broad, those of the endopodites very narrow, and only half the breadth of the exopodites, and in the second pair even less broad in proportion, and the terminal saws are especially broad at the base (and comparatively short). There is an entire absence of spines on the surfaces of the feet segments.

The animal is an adult female, with spermatophore attached to the genital segment. Both anal segment and fifth pair of feet are so small that they are only discovered upon close examination. It possesses characters which make it difficult to assign it to either the genus Scolecithrix or Xanthocalanus, the segmentation of the thorax especially being unlike the former, the absence of brush sensory processes and spinulation of the feet, amongst other peculiarities, being very unlike a Xanthocalanus. The pointed last segment of the thorax of the fifth feet, the proportions of the second to fourth pairs of feet, the Posterior Footjaw, are, amongst other things, peculiar, and it is only provisionally that I venture to include it in the genus Xanthocalanus. It is a deep-water species, and was taken at a depth of 500 fathoms at station E. 6 (South-West Coast of Ireland).

Xanthocalanus Subcristatus (*nov. sp.*). Plate X.

♀ 7·1 mm. CT nearly four times as long as Ab.

Ce~Th 1. Fifth segment united with sixth. Head narrowed in front, with strong dorsal crest, laterally rather triangular, and bifurcated rostrum. Head not unlike a Lophothrix, very prominent and bristled epistome. Last segment of thorax produced over genital segment, and triangular, with short apical points.

Abdomen very short, and very hirsute; genital segment very little swollen ventrally, and one-third longer than next. Anal and Furcal segments very short.

Anterior Antennæ of twenty-four joints (twenty-fourth separate from twenty-fifth), reaching to end of genital segment.

P.A.: Re a little longer than Ri. *Mn*, Ri much longer than Re. B 2 with three bristles. *Mx*, B 2 extended and narrow; Ri with ten bristles; Li 1 long and narrow, with eight long-bristles, only four of which are hooks. Li 2=2, Li 3=4, B 2=4, bristles. Re conical and rather small; Le 1 small, square shaped.

Ant. Footjaw: Basal deeply excavated proximally, convex distally, B 1, B 2, Ri, deeply cleft on outer margin; a strong hook on last lobe, and terminal, appendages, brush, and vermiform.

P.F.J.: B 1, B 2, Ri = 9 : 22 : 12; all bristles comparatively weak; the two distal ones very long and weak, hook-shaped. A thick brush sensory process on B 1.

First feet, Ri = 1, with strong corona of spines. Re = 3 (Re 1 + 2), hirsute on outer margins, the Se long and thin.

Second feet, Ri = 2, Re = 3; the Se dagger-shaped, with serrated edges; no surface spines.

Fourth feet, B 1 and B 2 outer margins with strong stiff bristles; B 2 on outer distal margin a stout spine; inner distal margins of Ri 1 and 2 produced into strong spines; Ri 1 with stiff bristles on outer margin; Ri 2 with similar bristles inner margin. Re with stiff bristles on surfaces and margins of Re 2 and 3, none on Ri or Re 3.

Fifth feet, each of three segments, distal the longest and tapering, ending in two short spines, the smaller one external. First joint with stiff hairs inner margin; second joint the same bristles all along inner margin, and a bunch distally on outer margin; third joint both margins and surface and just below the distal end two short spines on the surface.

Examples were met with at the *Gauss* Stations 10 and 11, which varied considerably in size from 6 to 7 mm., but which were apparently the same species. They also very nearly resemble the species briefly described by me (*Journ. of the Mar. Biol. Assoc.*, April, 1904), and of which I gave figures of the head and fifth feet, under the name *Xanthocalanus cristatus*. The differences between the two appear to be as follows:

Xanthocalanus cristatus.	*Xanthocalanus subcristatus.*
AA, reach the end of the furca.	AA, reach only the genital segment.
PA, Re = Ri.	PA, Re larger than Ri.
Mn, Re = Ri.	Mn, Ri longer than Re.
Mx, B 2 with 2, Ri with 13 bristles.	Mx, B 2 with 4, Ri with 10 bristles.
P.F.J., B 1 : B 2 : Ri = 12 : 16 : 8. Bristles comparatively strong.	P.F.J., B 1 : B 2 : Ri = 9 : 22 : 12. Bristles weak.
Feet very spinulose.	Feet only very little spinulose.

Xanthocalanus Magnus (*nov. sp.*). Plate X.

♀ 8·8 mm. Cephalothorax three times as long as the Abdomen. Head imperfectly separated from the first segment; last two segments with an imperfect line of separation, produced into triangular processes with very short blunt points. Head narrowed in front, and produced frontally, but evenly rounded, without trace of crest, prolonged below into stout bifurcated rostrum, each with delicate filament. Very large and strongly-haired epistomal process. Abdomen stout; genital segment as long as the next three, very swollen ventrally, with lateral flap on each side guarding the genital orifice. Fourth segment and furcal segments very short; the abdominal segments fringed with a row of fine pectinations at posterior extremities, and all segments very hirsute. Tail Se 4 in number.

Anterior Antennæ reach about half the length of the genital segment, of twenty-four joints (8 ♂ 9).

Posterior Antennæ with Ri longer than Re.

Mandibles: Ri and Re about equal.

Maxillæ: Re reaching to end of B 2; Ri large; Le 1 twice as long as broad; bristles of B 2 = 5, Re = 10, Ri 7 + 3, Li 1 = 6 long hooks and 3 thin bristles, Le 1 = 9, Li 2 = 3, Li 3 = 4.

Anterior Footjaws with basal proximally deeply excavated, distally strongly convex; the segments deeply cleft; an extraordinarily strong hook curved and denticulated on the last lobe, at least three times thicker than the slightly thickened bristle of the lobe before it; sensory processes seven brush and one long vermiform, the former not very large.

Posterior Footjaws rather stout; B 1 : B 2 : Ri = 13 : 17 : 10, the Ri therefore more than half as long as the B 2, the latter five times as long as broad. Terminal bristles not strong.

First feet: Ri = 1, Re = 3.

Second feet: Ri = 2, Re = 3. Ri reaching only to distal end of Re 2. Ri 1 and 2 with coronas of long spines; segments of Re covered with prickles. B 2 distally a strong tooth at outer angle. All Se of Re very large and strong, dagger-shaped, with proximal margins finely serrated. The Re 3 is rather more than half as broad as long, and the terminal saw very stout, with strong marginal teeth, and as long as Re 3.

Third and fourth feet: Ri = 3, Re = 3.

In the fourth pair Ri short, only reaching to end of Re 2. Ri 2 with corona of spines; Ri 1 and 2 with outer distal margins prolonged into teeth. No spines on Re, but segments covered with fine prickles. Re 3 about half as broad as long, the end-saw only about three-quarters as long as the segment.

Fifth pair very small, not as long as B 1 + B 2 of the fourth feet; of three segments, 1st > 2nd > 3rd, the last joint about four times as long as broad, but differing in thickness on each side, tapering towards the end with two short end and two lateral spines; the two basal joints with stiff, long, marginal bristles. The spines at the end and sides of the last joint articulate, and are not mere prolongations of the joint.

In another example which is not quite so large (8·65 mm.) the agreement with the above is very close, but with the following differences:

The anterior footjaws have sensory brush processes of much greater size, two of them of extraordinary size; the posterior footjaw has slightly different proportions, B 1 : B 2 : Ri = 22 : 30 : 15, the Ri thus only half as long as the B 2; the fifth feet are different, the end joint being twice as long as the second, conical, tapering, and with two spines at the end, which are not articulated, but continuations of the joint; all joints with long stiff hairs. In addition, the Cephalothorax is over three times as long as the Abdomen; the genital segment one-third longer than the next, but without ventral protuberance.

On the whole, I think, these must be regarded as the same species, the latter only an immature form of the first described species.

Xanthocalanus Calaminus (*nov. sp.*). Plate XI.

♀ 5·5 mm. long. CT four and a half times as long as the Abdomen. Head evenly rounded, without any trace of crest and with a very small bifid rostrum. The last two segments of the thorax separate, the posterior one forming bluntly triangular lateral lappets. Head indistinctly separated from first thoracic segment. Furcal segments just as broad as long, and as long only as the anal segment.

Anterior Antennæ along with tail bristles completely broken.

Posterior Antennæ with rami of equal length; Re 2 and Ri 1 elongated joints, bristles apparently absent on the basals.

Mandibles with rami subequal, masticatory plate elongated, four times as long as broad, and with very small teeth.

Anterior Footjaws short and stout; the fourth lobe with an extremely stout curved hook, very broad basally, and armed its whole length with very large triangular teeth; the fifth lobe with two longer very finely-toothed hooks (both unfortunately broken); the Ri with seven strong brush and two vermiform processes.

Posterior Footjaws comparatively short and stout. B 1 : B 2 : Ri = 16 : 12 : 14; the two basals twice as long as broad; two of the bristles of each of the last four Ri segments very peculiar—rather like quills, each armed with a broad chitin edge delicately serrated on the margin, extending throughout the distal two-thirds. Ri 1 and Ri 2 have each three, Ri 3 and Ri 4 each two, Ri 5 two long ones and two very short bristles (see Fig. 4).

Maxillæ. Le 1 very small, with seven bristles; Re twice as long as broad, with ten bristles; B 2 and Ri rather elongated; Li 1 very elongated, three times as long as broad.

First feet: Ri = 1, Re = 3, with three Se, the two proximal ones very small.

Second feet: Ri = 2, Re = 3; a strong corona of spines on the surface of Ri 2.

Fifth feet very small, each of three segments, about equal in length, the two proximal much thicker than the distal, which is more or less conical-shaped, with short spine at the extremity and two short spines on the external margin; a short spine on the inner margin of the second joint at the distal extremity, and proximal to it three or four marginal small teeth, with a few similar teeth on the inner margin of the first joint.

In some respects this appears to resemble Sars' new species *X. muticus*, in which, however, the Anterior Footjaws are 'munis de deux épines très fortes et unguiforme l'extérieur tout lisse, l'intérieur grossièrement dentelée en dedans. Maxillipèdes postérieurs assez robustes quelques unes des soies sortant de la partie terminale transformées en épines fortes.' The structure of the Posterior Footjaws especially differs, in which in my specimen there are no strong spines, but the bristles are quite peculiar. The fifth feet also appear to differ, in Sars' species of two segments, in mine of three. I hesitate, therefore, to regard the two as identical, and provisionally regard the example briefly described as new. The specimen was taken in the Bay of Biscay in September, 1904, by the *Silver Belle*.

GENUS GAIDIUS.

Gaidius Maximus (*nov. sp.*). Plate XI.

♀ 8 mm. Cephalothorax over four times as long as broad. Ce 2, Th 1, and last two segments of the thorax united, on each side prolonged into short, but stout, and slightly curved and divergent spines. The head is on the dorsum somewhat narrowed and elevated, forming a slight keel; in front prolonged into short, stout, one-pointed rostrum (without filaments), with a chitinous thickening of the forehead above the base of the rostrum. The first segment is dorsally very gibbous. The Abdomen is short, stout, the genital segment very prominent ventrally, and as large as the next two, the anal segment, with dorsal flap produced over the furcal segments, which are a little longer than broad, with four Se, the place of the fifth Se (external), represented by a short spine, and on each side is a comparatively long accessory bristle.

Anterior Antennæ of twenty-four segments, reaching about two joints beyond the end of the furca. The twenty-fourth and twenty-fifth segments separate.

Posterior Antennæ, with Re larger than Ri, of seven joints; B 1 with one; B 2 with two bristles.

Maxillæ, B 2 extended, twice as long as broad, with five bristles; Ri small, with fourteen bristles; Re very small, only half as long as B 2, with eleven bristles; Le 1 with eight bristles.

Anterior Footjaws, the basal narrow proximally, with strong swelling distally.

Posterior Footjaws, B 1 : B 2 : Ri = 17 : 22 : 7. B 2 four times as long as broad; Ri very short; B 1 with very large lamellar process.

First feet, Ri = 1, Re = 3, with 3 Se.

Second feet, Ri = 2, Re = 3; Re 3 two and a half times as long as broad, the end-saw with strong teeth, as long as the Re 3.

Fourth feet, with the peculiar modified tube process on the first basal, as in other species of this genus. They are not half the length of the bristles of the second and third feet (B 1), and much thicker, ending in fine-pointed extremity.

No fifth feet.

This is by far the largest species of *Gaidius* known, and two specimens occurred in the *Gauss* haul at station, November 10, 1901.

GENUS ISOCALANUS (*nov.*).

Head separate from thorax, rostrum a stumpy plate of chitin ending in blunt extremity and without filaments. Anterior Antennæ of twenty-two or twenty-three joints. Rami of Posterior Antennæ and Mandibles about equal. Posterior Footjaws comparatively slender, with basals and endopodite not very unequal. Anterior Footjaws with proximal lobes suppressed; Ri strong and with five or six long stout curved hooks; tooth combed in distal part. First feet with one jointed endopodite, and four Si on Re 3; second feet with five Si on Re 3. A pair of fifth feet, only one ramus each, of three segments, and a long spine-like bristle.

In segmentation of feet and number of Si on Re 3 the antennals resemble *Spinocalanus*, but are quite different from this genus in rostrum, structure of footjaws, and possession of fifth feet. The armature of the Anterior Footjaws is quite exceptional. Both were subtropical species, from 0° to 20° N. and S., and probably deep-water species, the first found in a capture from 1500, the second in one from 3,000 m. (*Gauss*).

Isocalanus Minor (*nov. sp.*). Plate XII.

♀ 2·6 mm. Cephalothorax about three times as long as the Abdomen.

The former three and a half times as long as broad, the latter nearly four as long as broad, and not more than one-third as broad as the Cephalothorax.

Head rounded, with blunt rostrum as in the next species. Cephalothorax of six segments, Ce separate from Th 1, and Th 5 and 6 separate, the last segment with evenly-rounded margin. Abdomen of four segments. Genital segment rather longer than the next two, and scarcely protuberant at all ventrally; anal segment very small; furcal segments short, and rather broader than long, each with four setæ; the next to the outermost on each side very long and thicker than the rest, one-third longer than the whole abdomen.

Anterior Antennæ of twenty-three segments, reaching to the end of Ab 2; basal twelve joints well supplied with æsthetasks, bristles almost conspicuously absent on the antennæ.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
13	12	5	6	6	5	6	11	6½	7	9	16	17	16	15	14	14	16	15	16	19	20	19

Posterior Antennæ, Ri and Re equal in length, Ri very thick; the first segment about one-third as thick as long. Re of six segments.

Mandibles, with rami about equal; masticatory plate weak, and with irregular teeth, the outer one strong, with considerable space between it and the next also strong tooth, three small triangular weak inner teeth; no Si, apparently, but inner edge of the plate with fine hairs.

Anterior Footjaws of peculiar structure. B 1 elongated and thick, but without lobes or bristles; B 2 short, with one lobe carrying three short bristles and one short stout comb bristle; Ri large, and with six very long robust hooks, strongly curved, and in their distal third combed with rows of short stiff bristles and a series of ridges; one short curved comb on external aspect, only one-fourth the length of the long comb bristles, and a much shorter thick bristle at the proximal end.

Maxillæ, Re large, much longer than B 2, and with ten bristles; Le 2 with one bristle; Li 2 and 3 small lobes, with each one bristle; Li 1 without hooks, but only plain bristles.

Posterior Footjaws very slender. B 1 : B 2 : Ri = 5 : 4 : 4. B 1 a little more than three times as long as broad; B 2 four times as long as broad. B 1 without any lobes or bristles, but inner distal end much produced, and with a short curved hook on it. B 2 with only two bristles in the middle, the distal one the strongest, and one short bristle at the distal

extremity. Ri of four joints, the second the largest, each segment respectively with four, four, two, five bristles, the proximal very short, those of the last segment moderately long.

First feet, Ri = 1; second Ri = 2; third and fourth Ri = 3.

Re in all four pairs = 3.

In the first pair Re 3 has four Si, and is without Se on Re 1 or 2.

In the second pair Re 3 has three Se and five Si. Re 1 very small, Re 2 nearly twice as long, Re 3 as long as Re 1 and 2, and the end-saw three-fourths as long as Re 3, and with numerous teeth. The Re 3 is four times as long as broad, the Si of Re 2 is (as in the third and fourth pairs) thicker than the Si of Re 1 or Re 3. The marginal Se are comparatively large and slightly recurved.

The third and fourth pairs of feet were very much broken.

Fifth feet, each of three segments and a long spine-like terminal bristle, the first segment one and a half times as broad as the second and a little longer, the end bristle nearly twice as long as the two basal segments.

Isocalanus Major (*nov. sp.*). Plate XII.

♀ 3·9 mm. CT more than three and a half as long as Ab. CT of four segments, with head partially divided from the first Th segment by dorsal line, not carried to ventral side, last two segments almostly completely fused, and produced laterally with rounded margins. Head evenly rounded, and ending in front in quite peculiar rostrum, a stiff chitinous prolongation, triangular at extremity, and pointed, with two small spines on the top before the terminal piece. This rostral projection is not bifurcated.

Abdomen of four segments. From its appearance, the animal is probably not quite adult, but the genital swelling is commencing to form.

First, second, and third segments nearly equal in size, anal much larger than any of the others. Furcal segments broadest at base, truncated, and about as long as broad in greatest dimensions; one very thick apical bristle on each side, and a very short accessory ventrally-placed bristle.

Anterior Antennæ of twenty-two joints, about as long as the Cephalothorax. The first ten joints crowded the next six, enlarged and thickened from side to side, the last three the largest of all. Very few bristles.

Posterior Antennæ, with rami about equal.

Mandibles, Re a little larger than Ri; masticatory plate short with strong teeth, Si thick, and a bunch of very strong stiff hairs, with three smaller bunches on the surface of the plate. Two inner teeth sharp and thin, two middle thick and short, two outer broad-based, curved, and pointed, with some distance between.

Maxillæ, outer lobes poorly developed. Le 1 with only four, Re large, curved inwards at apex, with only nine bristles; Li 1 with fourteen bristles, hooks thin and long; Li 2 and 3 each comparatively large, with only one bristle each; Ri 1 and B 2 coalesced into a small lobe, with only one apical bristle.

Anterior Footjaws comparatively powerfully built. B 1 and B 2 similarly long, proximal

lobes small, with L 1 = 1, L 2 = 1, L 3 = 3, short bristles; L 4 with five—two short (one a combed hook), and one a long, broad-based, curved comb hook. Ri with five very long, broad-based, comb hooks, curved inwards towards apex, and with armature only on distal third. These hooks resemble those in the last species.

Posterior Footjaws, with B 1 : B 2 : Ri = 6 : 6 : 4. B 1 thicker than B 2, and nearly one-half as thick as long; only one bristle in middle, and three at inner distal end.

B 2, with three short bristles distal of the middle, the most distal one twice as thick as the two others, and densely feathered.

Two bristles at inner distal extremity, one very minute, the other thick.

Ri with three, three, two, five bristles; first three joints distinct, fourth and fifth less distinct. Ri 1 and 2 equal, and a little longer than the similarly equal Ri 3 and 4. Ri 5 very short.

All the bristles of the Posterior Footjaw are extremely short, the largest terminal bristles only as long as the whole Ri.

First feet: Ri = 1, Re = 3.

B 1 and B 2 each with Si. Re 3 longer than Re 1 and 2; no Se on Re 1 or Re 2, but two on Re 3: one in the middle of the outer margin, and one at the end. Saw nearly as long as the whole Re, and armed with fine teeth. Four Si on Re 3. Ri elongated and extending beyond the distal margin of Re 2.

Second, third, and fourth pairs, Ri = 3, Re = 3.

In the *second* pair the whole Ri is only as long as Re 1 and 2, Ri 2 being nearly twice as long as Ri 1, Ri 3 as long as Ri 1 and 2, Ri 1, with outer distal margin ending in spine.

Re 3 as long as Re 1 and 2, Re 2 twice as long as Re 1; end-saw shorter than Re 3, and with strong teeth. Si = 5, Se = 3.

B 1 with Si; B 2 without Si.

Third feet: Re 2, with a long thin Se at outer distal margin.

Re 3, with three small Se, the segment long, as in the fourth pair.

Fourth feet: B 2, with only a small external marginal Se. Re 2 much larger than Re 1, Re 3 longer than Re 1 and 2, and end-saw with strong teeth, and half as long as Re 3. Re 3, with three Se and five Si. Ri 1 smaller than Ri 2, Ri 3 much longer than Ri 1 and 2.

Fifth feet, with three segments, basal much the largest; second and third small, a rather long spine at the end, nearly as long as the two last joints, and a very small spine also at the apex of the last segment.

The two preceding species differ in size and shape of body, in the characters of the rostrum, to a smaller extent in the Posterior Footjaws and Maxillæ, and in the segmentation of the second pair of feet. They, however, agree very much in the peculiar anatomy of the Anterior Footjaws and fifth feet, and in the number of spines and bristles on the exopodites of the feet, and the relative size of the segments. On this ground I group them together, especially as in the latter the anatomy of the abdomen indicates that the animal in not fully adult. It may be desirable eventually to separate these species into other genera. The characters of the Anterior Footjaw are quite peculiar, and unlike any other known genus.

AUTANEPSIUS* (*nov. gen.*).

Body long in proportion to Abdomen, with or without proper rostrum, angles of last Thoracic segment pointed, Abdomen of ♀ 4 segmented. First feet, Ri of 1; second feet, Ri of 2; and in third and fourth feet of three segments. No fifth pair. Anterior Antennæ short, Posterior Antennæ with both rami nearly equal in length, Anterior Footjaws short, Posterior pair extraordinarily long, and the distal bristles with very peculiar armature. Mandibles with Ri very small, Maxillæ with basal very large, outer and inner lobes and Re very small.

This genus has a resemblance to *Augaptilus* only in the fact that the bristles of the Posterior Footjaw are armed with very peculiar sensory processes, not cups as in the first-named genus, but wing-shaped membranous-looking processes, which at first sight and under low magnification recall *Augaptilus*, but under higher magnification are seen to be quite different. The new genus *Pontoptilus*, recently established by Professor G. O. Sars, resembles it in some particulars, but is strikingly different in others—*e.g.*:

Pontoptilus.	*Autanepsius.*
Abdomen of four segments.	Abdomen of four segments.
Re of Posterior Antennæ much longer than Ri.	About equal.
Maxillæ, basal large, other lobes rounded and with short bristles.	Basals large, inner lobes well developed with long bristles.
Feet, five pairs.	Feet only four pairs.
Posterior maxillipedes, with or without "buttons," in size more or less equal to the Anterior pair.	Without "buttons," but with peculiar appendages of large size.

Clearly, the two species mentioned below differ in most important points from *Pontoptilus* (Sars), though related to this and to *Augaptilus*, in the fact of bristles of the maxillipedes being transformed into sensory organs.

Autanepsius Major (*nov. sp.*). Plate XIII.

♀ 8·15 mm. long. (Cephalothorax, 6·6; Abdomen, 1·55 m. long.) Abdomen short, not quarter the length of the thorax. Head oval, rounded, ending in front in a short blunt one-pointed rostrum; broadest part of the CT about the middle; Ce ∼ Th 1, last two segments separate, last segment on each side with short blunt lateral points; head as long as the rest of the Cephalothorax.

Abdomen of four segments, the genital as broad as long, and as long as the rest of the abdomen; furcal segments as broad as long, and a little longer than the anal, broader at the base than at the end. The bristles are much broken; the innermost, however, which is preserved, is twice as long as the abdomen, the one external to it is nearly as thick (length

* αὐταν*έ*ψιος—Greek, a cousin.

unknown), the outer one is very thin and short. In addition to these three apical bristles is a similarly thin and short bristle arising from the middle of the external margin; the inner margins of the furcal segments are haired. The abdominal segments along their posterior margins are strongly pectinated.

Anterior Antennæ: not quite as long as the CT, and of twenty-four segments (8 ∼ 9) very densely bristled, many bristles being very long, especially on the third, seventh, eighth, eleventh, thirteenth, fourteenth, twentieth, twenty-third, and twenty-fourth segments. The eighth joint twice as long as the joints before and after, from the ninth to twentieth all nearly the same length, the twenty-first shorter than the twenty-second; the twenty-fourth only half as long as the twenty-third.

Posterior Antennæ: Re a little longer than Ri; the former of seven segments.

Mandibles: Basal and Re of normal size and shape; Ri very small, only half as broad or long as Re, and with two segments. Ri 1 with one short bristle, Ri 2 with five very short weak bristles. Masticatory plate with five outer powerful teeth; the innermost spine shaped with a strong bunch of hairs at the base.

Maxillæ, B 2 lengthened with short Ri; Re small. Li 2 and 3 well developed lobes. Le 1 small, with nine bristles. Re = 11 : Ri = 15 : B 2 = 5 : Li 3 = 4 : Li 2 = 3 : Li 1 = 10 hook bristles.

Anterior Footjaws comparatively very small, the lobes small and rather compressed; Ri distinctly of three segments, its bristles stout, 'file'-like, two of the three bristles of the fifth lobe of the same character, the lobe itself longer than the proximal four lobes, which are about equal size, with three stout bristles in each lobe, two of them at least twice as long as the third, and densely feathered with widely-apart bristles.

Posterior Footjaws of extraordinary length and size, more than three times as long as the Anterior pair, and one and a half as long as the fourth feet: B 1 : B 2 : Ri = 28 : 30 : 8. Ri is thus very small, of five segments, with ten long slightly curved broad-based and tapering bristles with extraordinary sensory processes upon them in the distal half, as in the next species (*A. Minor*).

First pair of feet: Ri = 1, Re = 3. The two basals without Si, but with haired inner margins. Re 1 without Se or Si; Re 2 with very strong Se and one Si; Re 3 with four Si and one Se.

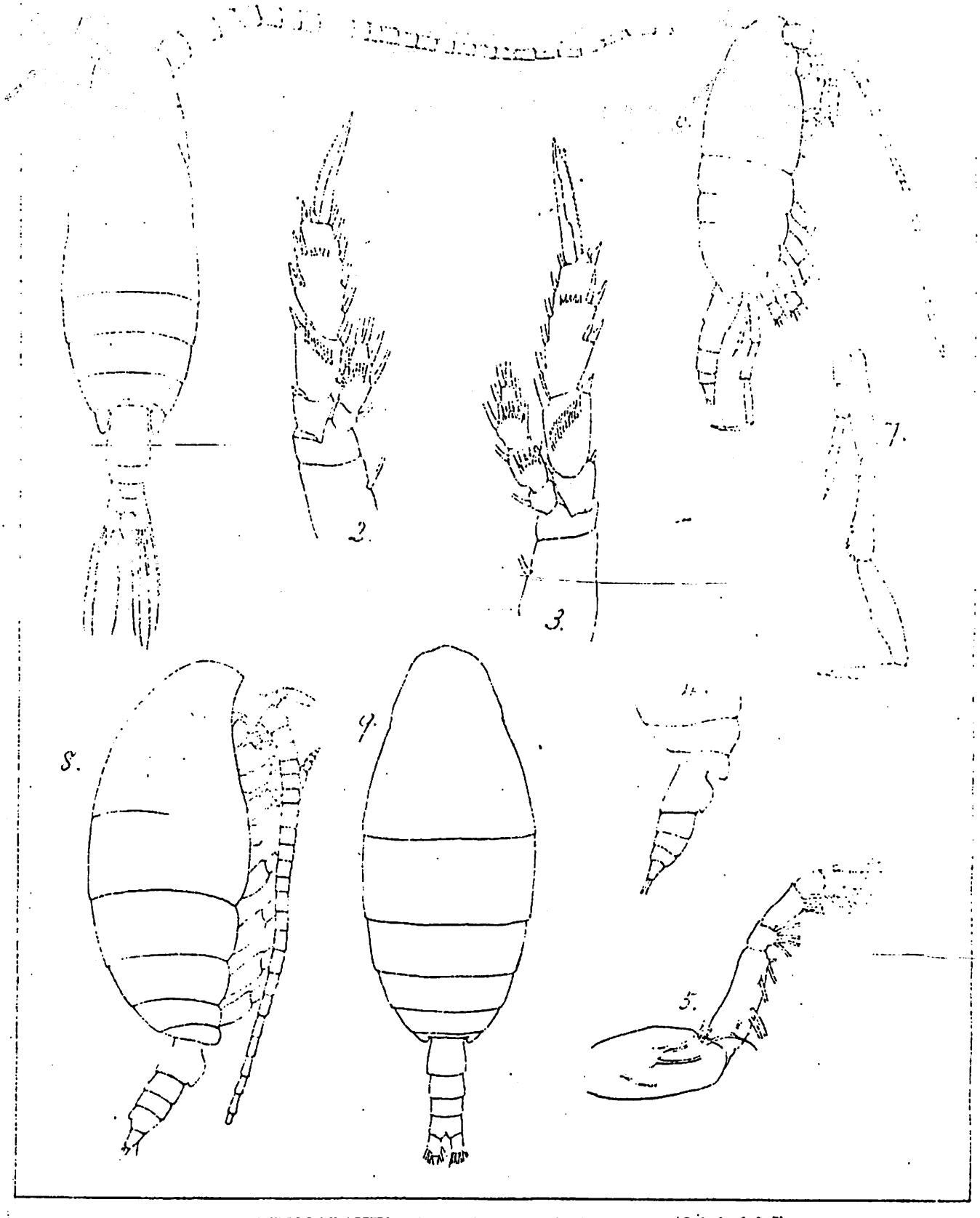
Second feet: B 1 with Si, B 2 without; Ri = 2, Re = 3. Re 1 small, with one Se and one Si; Re 2 with long stout Se, and a short spine internal to it and one Si; Re 3 with three Se, the distal one much larger than the two proximal, four Si, and long closely-toothed saw longer than Re 3. Ri 1 small with one Si; Ri 2 three times as long as Ri 1 with five Si.

Fourth feet: B 1 with Si, B 2 without. Ri and Re = 3 each. Re 1 < Re 2 < Re 3; marginal Se of Re 2 and 3 rather larger than the others; saw closely toothed and much longer than Re 3. Re 3 not quite twice as long as Re 2. Se = 1 : 1 : 3; Si = 1 : 1 : 4.

Ri more than half as long as Re. Ri 1 < Ri 2 < Ri 3. Ri 2 with short spine, inner distal margin. Si = 1 : 1 : 5.

No fifth feet.

This species differs from the following (*A. Minor*) in its much greater size, stronger points on the last Thoracic segment, and in small particulars in the structure and number of bristles of the oral organs.

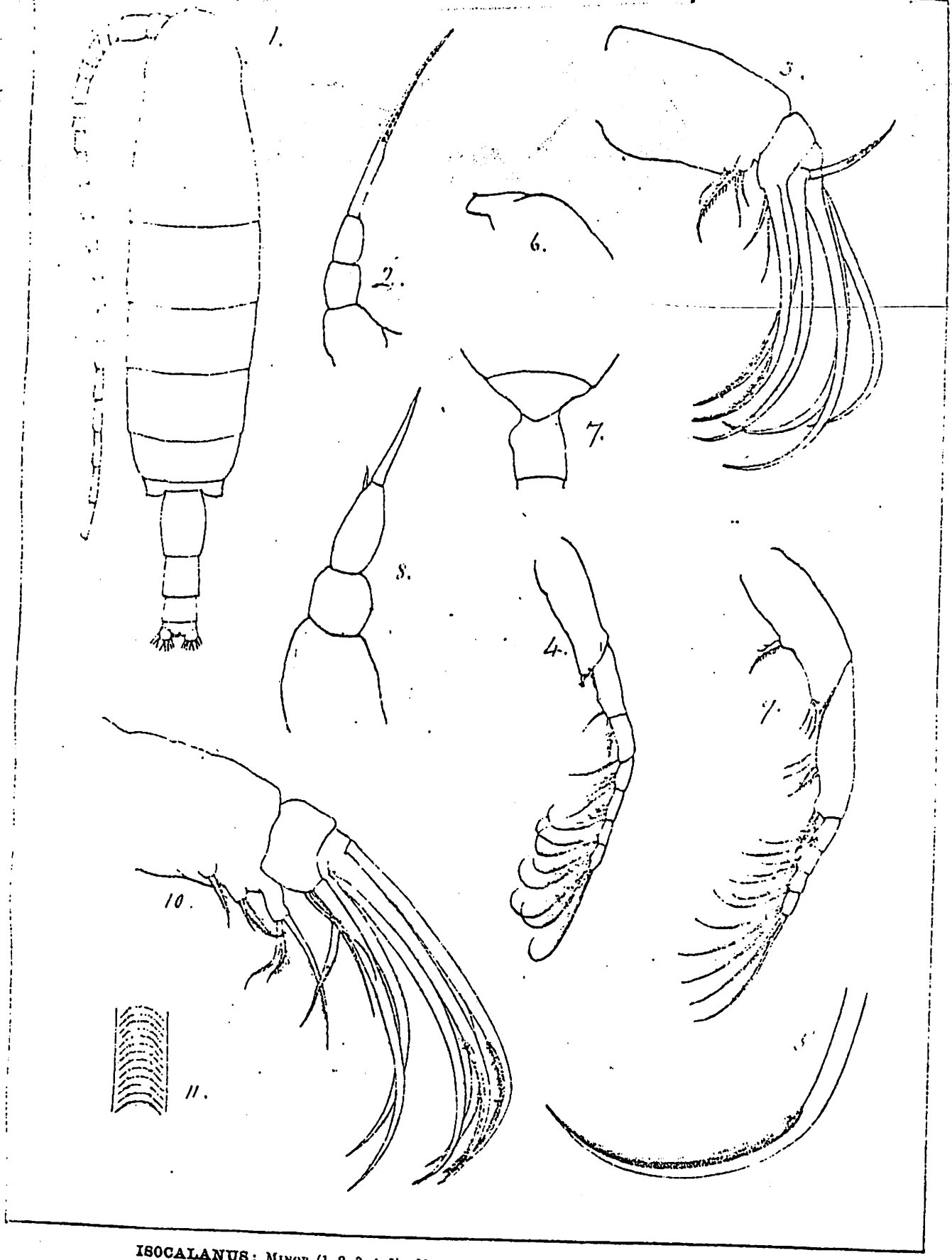


SPINOCALANUS: MAGNUS (1, 2, 3, 4, 5); ANTARCTICUS (♀ 8, 9, ♂ 6, 7).

copy had no Pl. XV

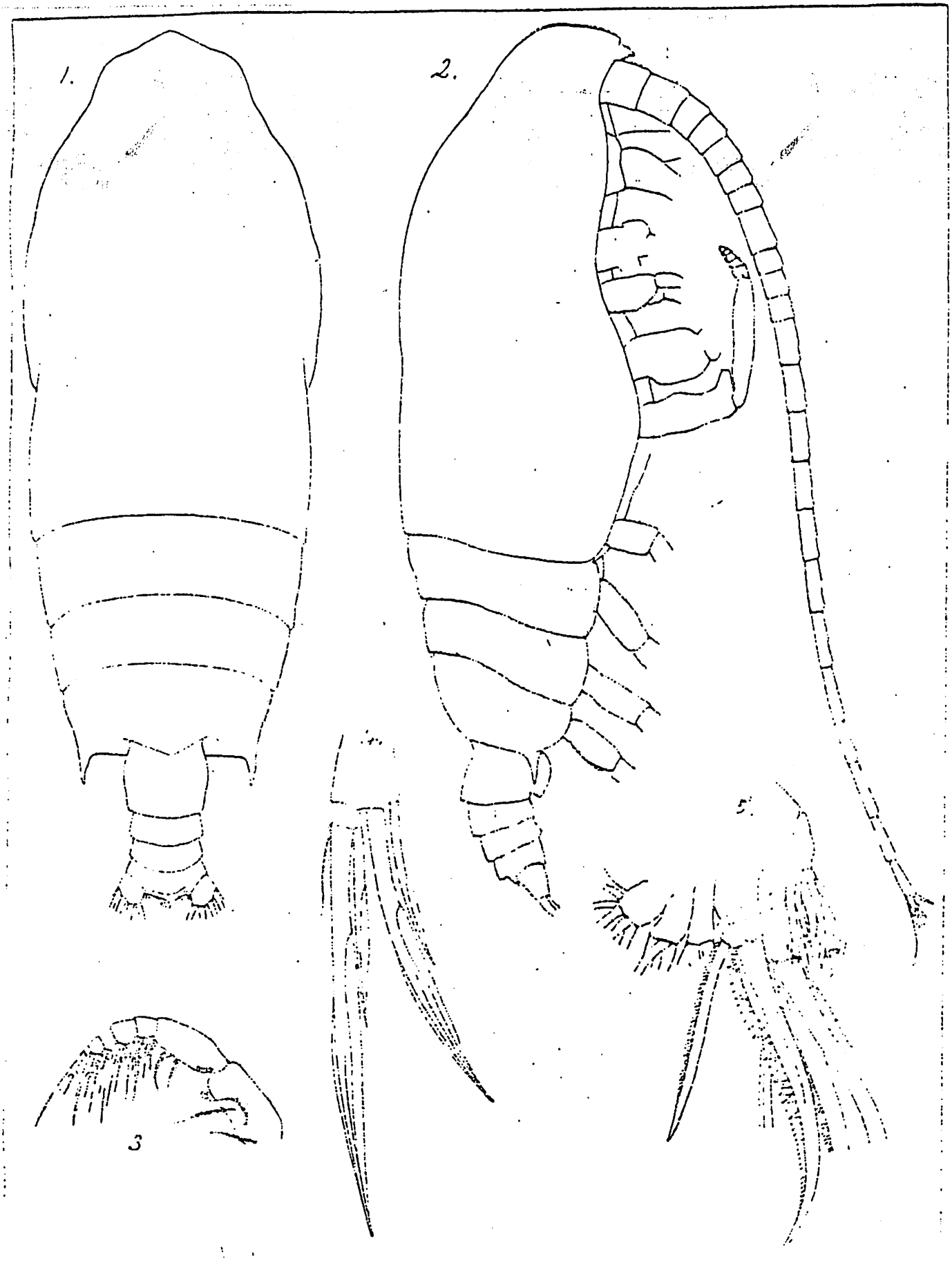
AUTANEPSIUS: MAJOR (1); MINOR (2, 3, 4, 5).

NOTE.—Only two of the bristles of the P.F.J. are drawn with sensory processes. Fig. 4, a small portion of one of them magnified

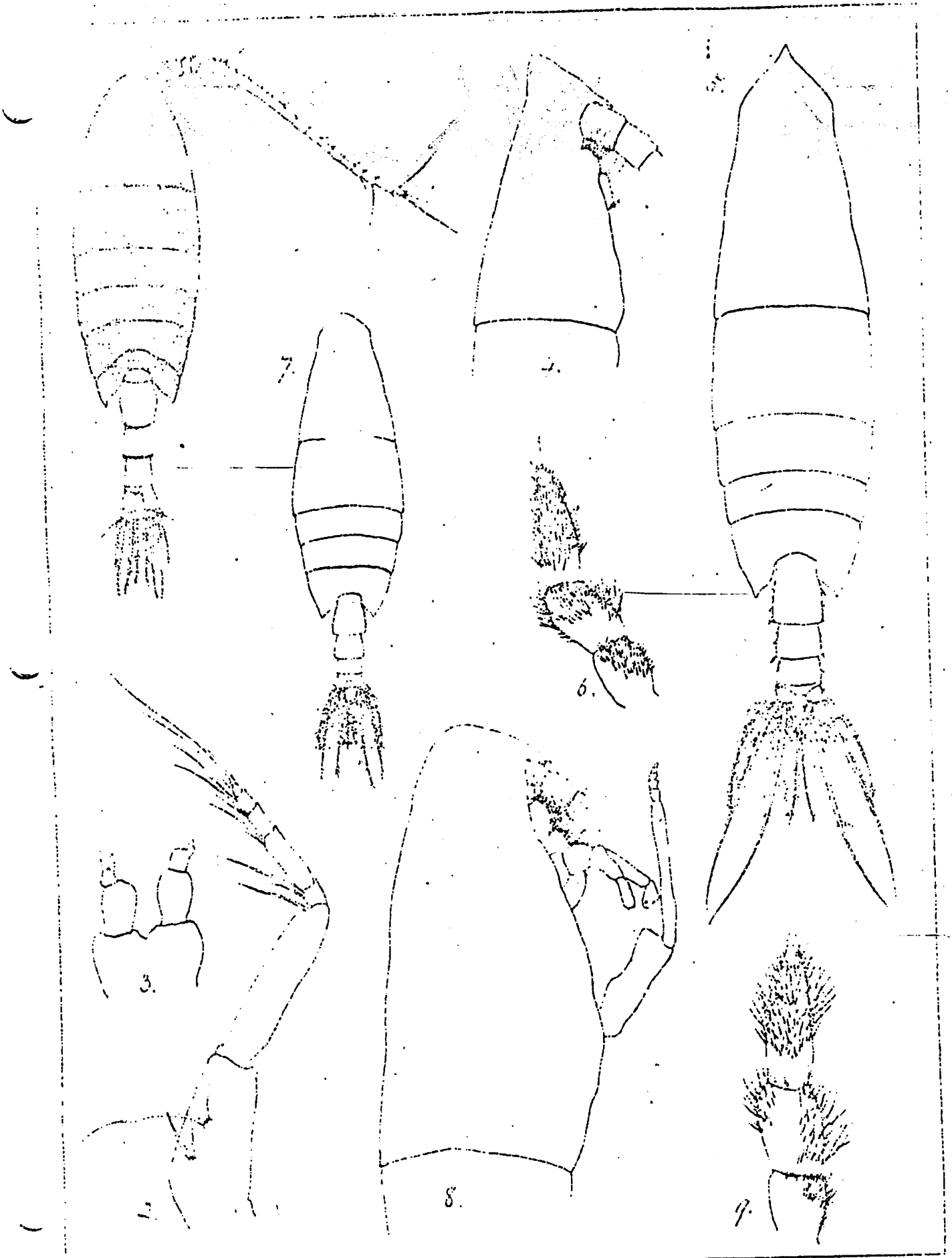


ISOCALANUS: MINOR (1, 2, 3, 4, 5): MAJOR (6, 7, 8, 9, 10; 11, a portion of a bristle of the A.F.J.).

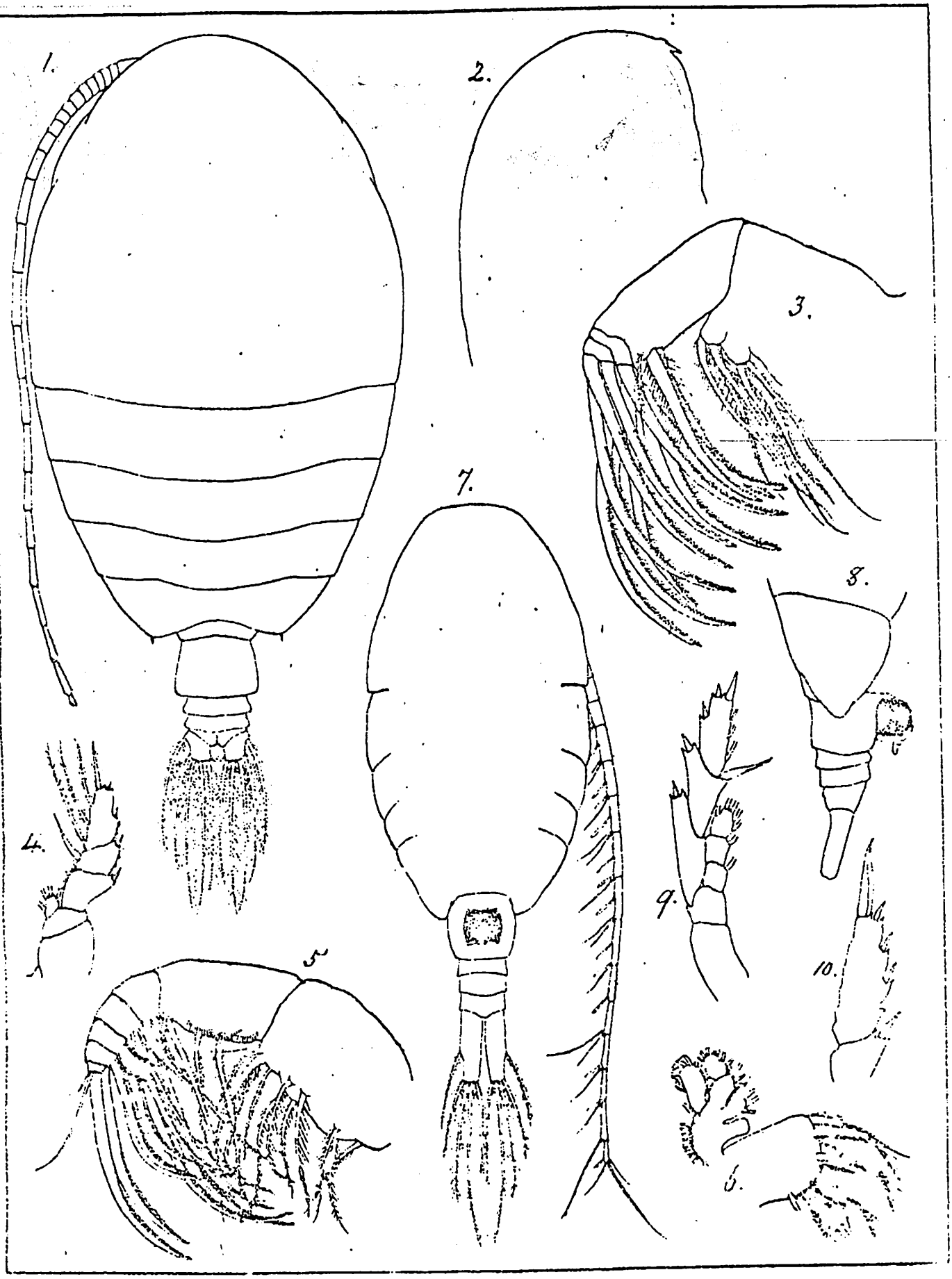
NOTE.—Only two hooks on the A.F.J. are drawn ciliated, but all are similar.



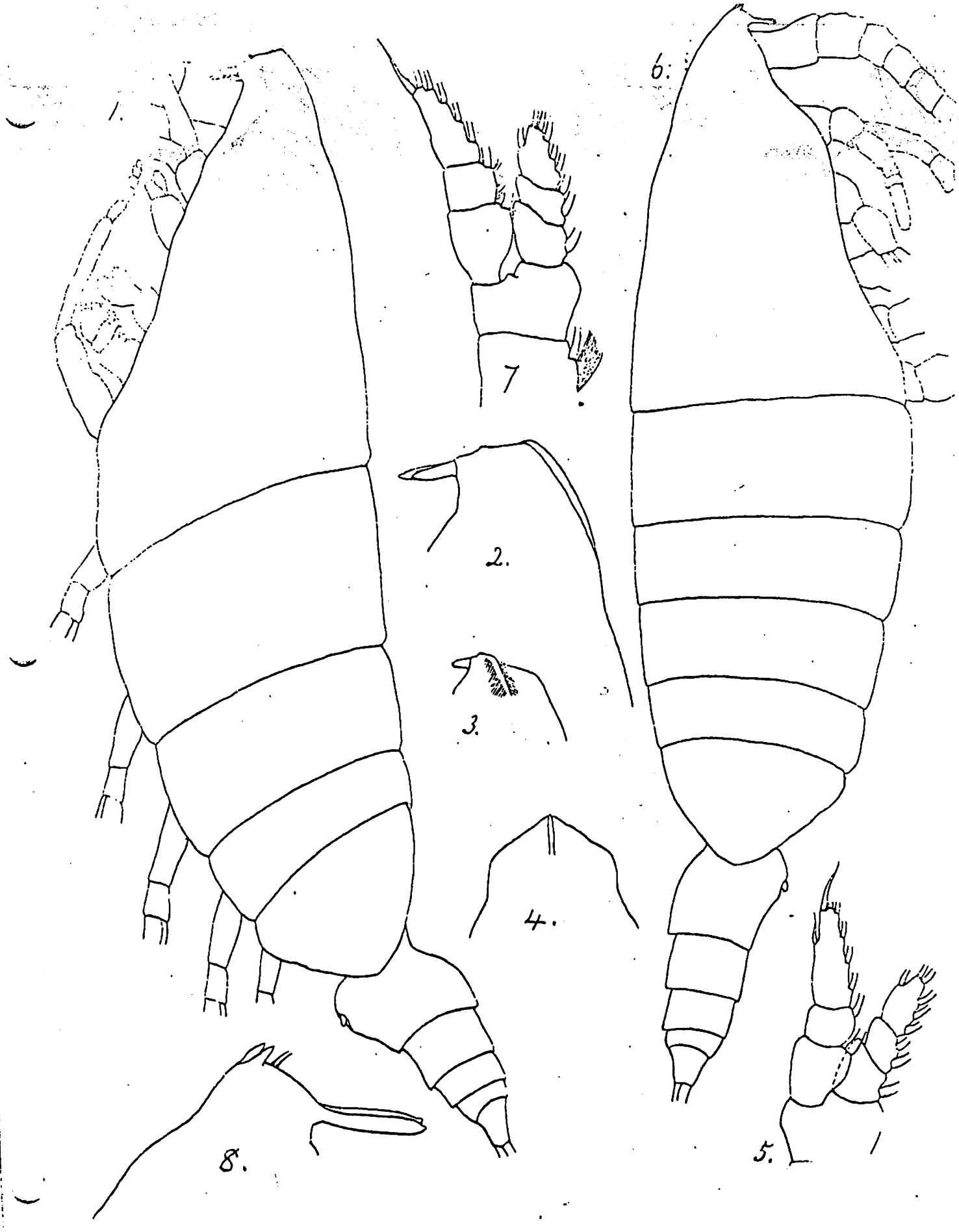
GAIDIUS MAXIMUS (1, 2). XANTHOCALANUS CALAMINUS (3, 4, 5).



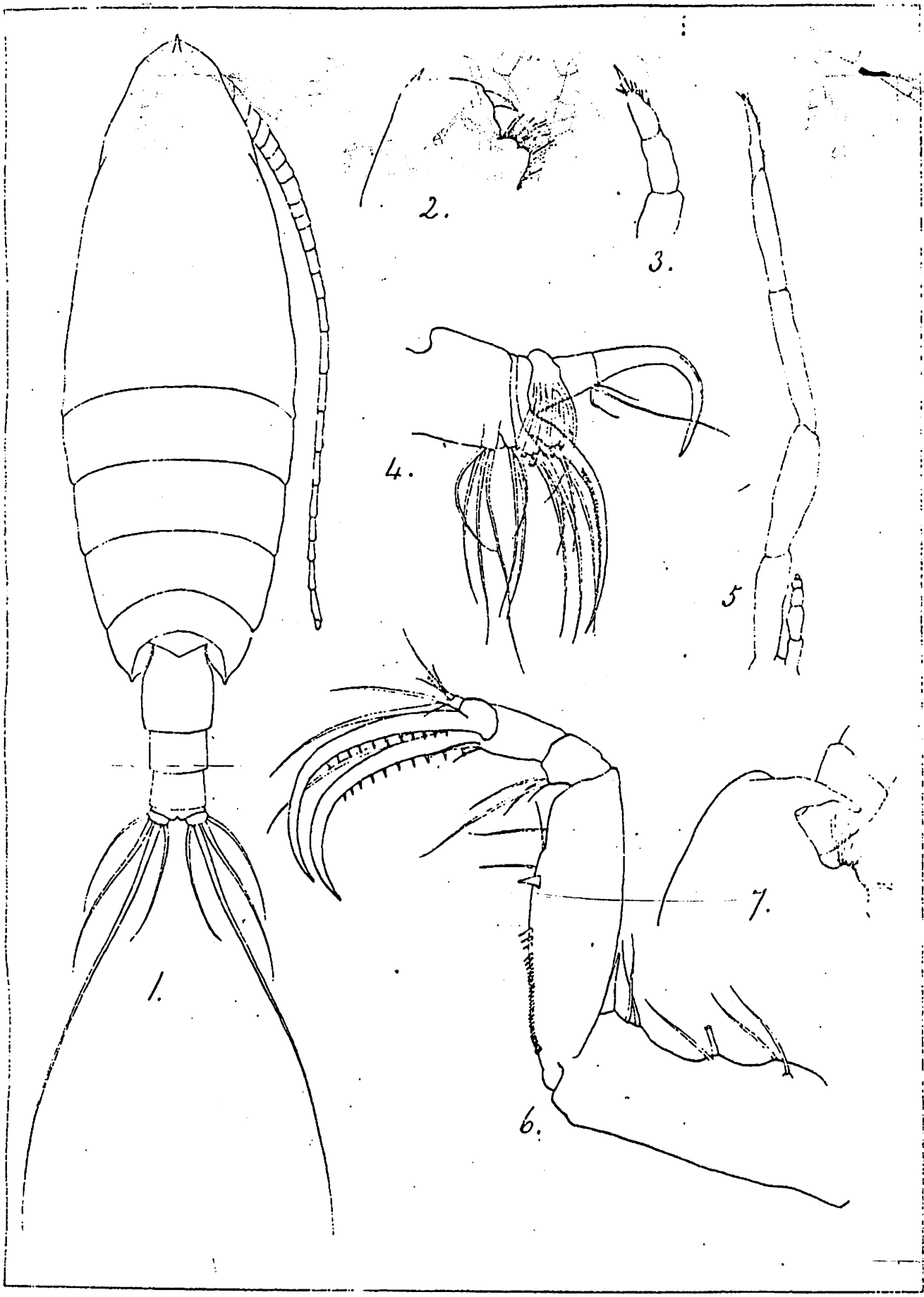
XANTHOCALANUS: SIMPLEX (1, 2, 3); SUBCRISTATUS (4 5, 6); MAGNUS (7, 8, 9).



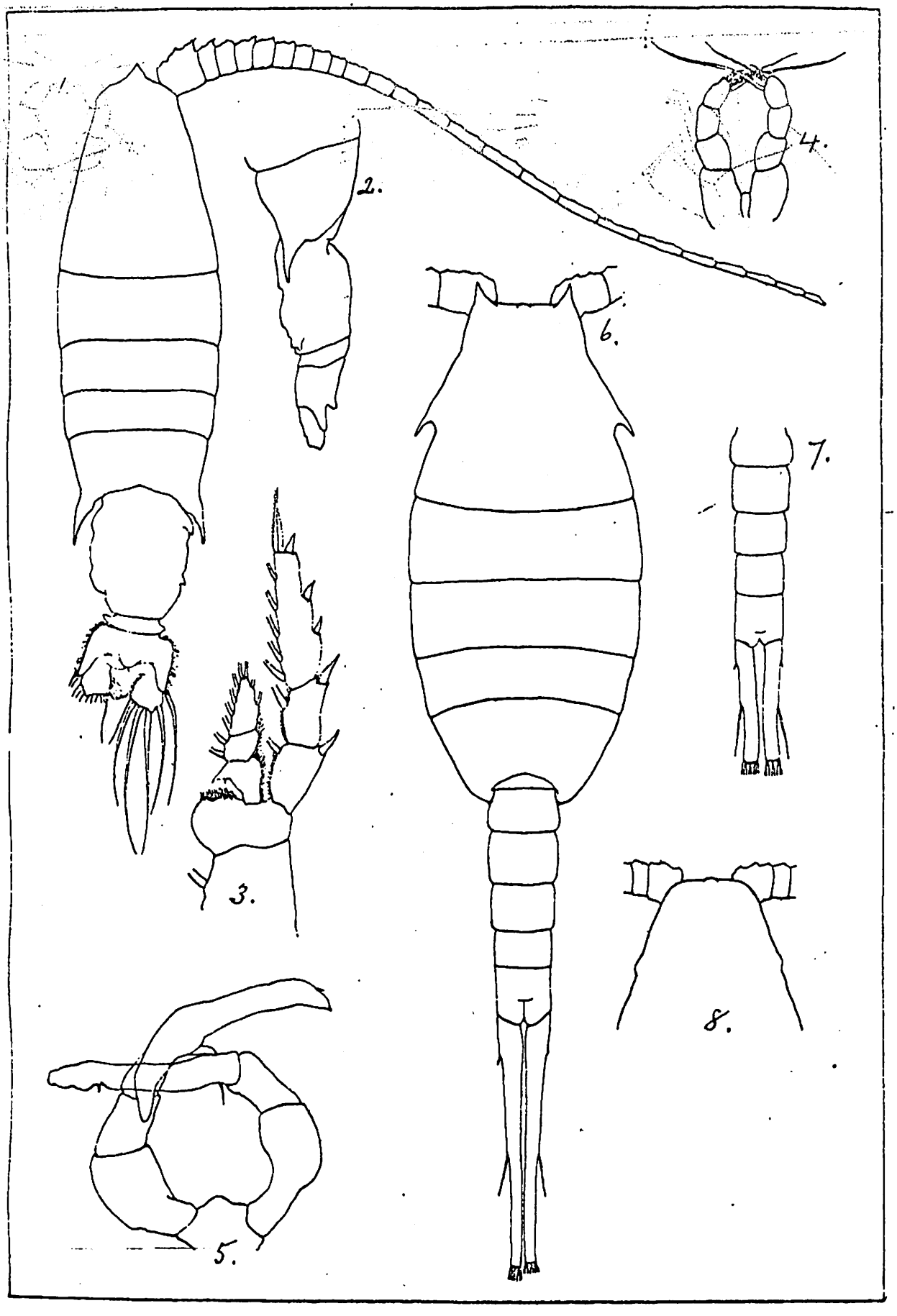
HALOPTILUS LONGIMANUS (1, 2, 3, 4, 5, 6). **LUCICUTIA** OVALIS (7, 8, 9, 10).



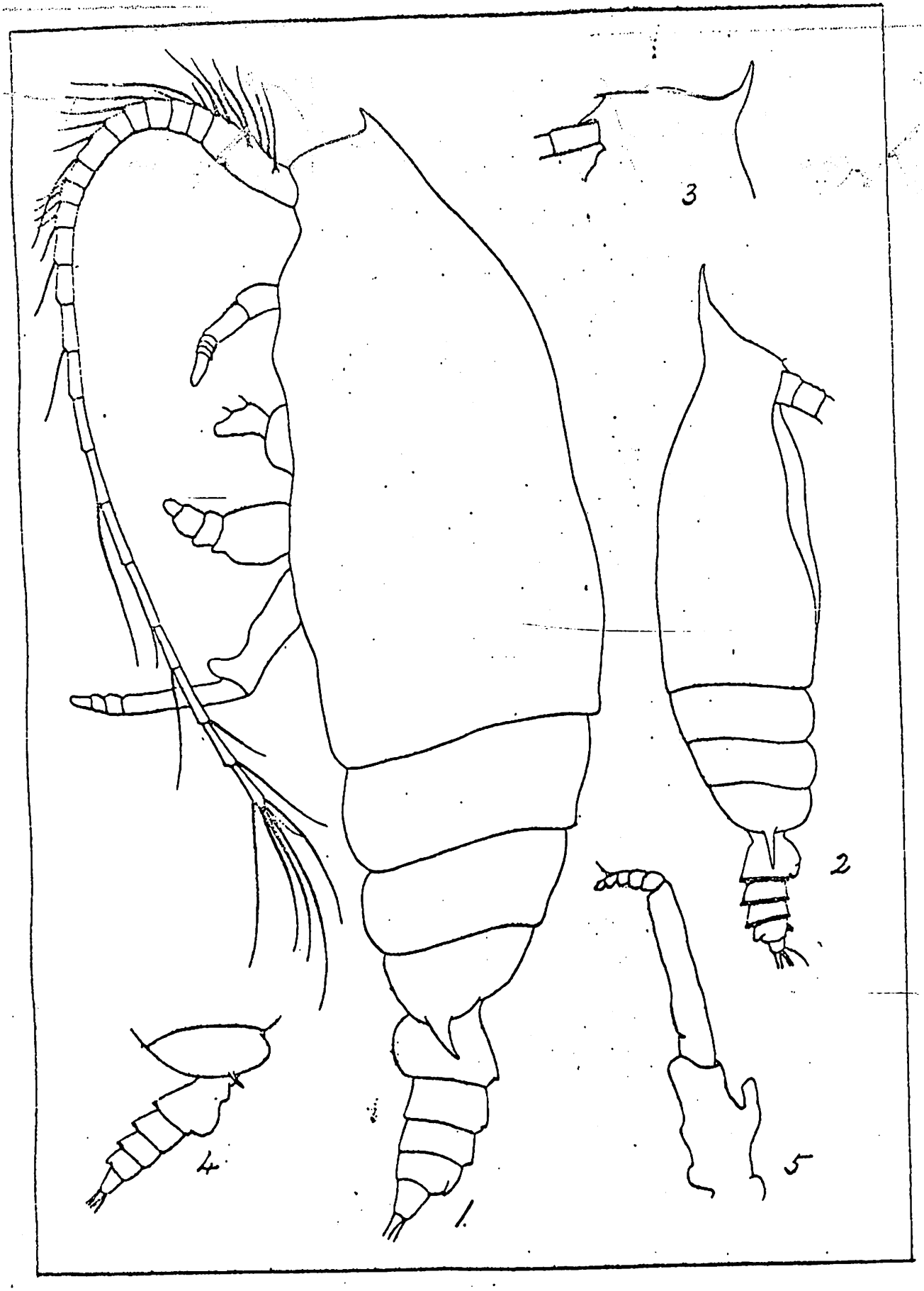
HETEROCALANUS MEDIUS (1, 2, 3, 4, 5). BATHYCALANUS (6, 7, 8).



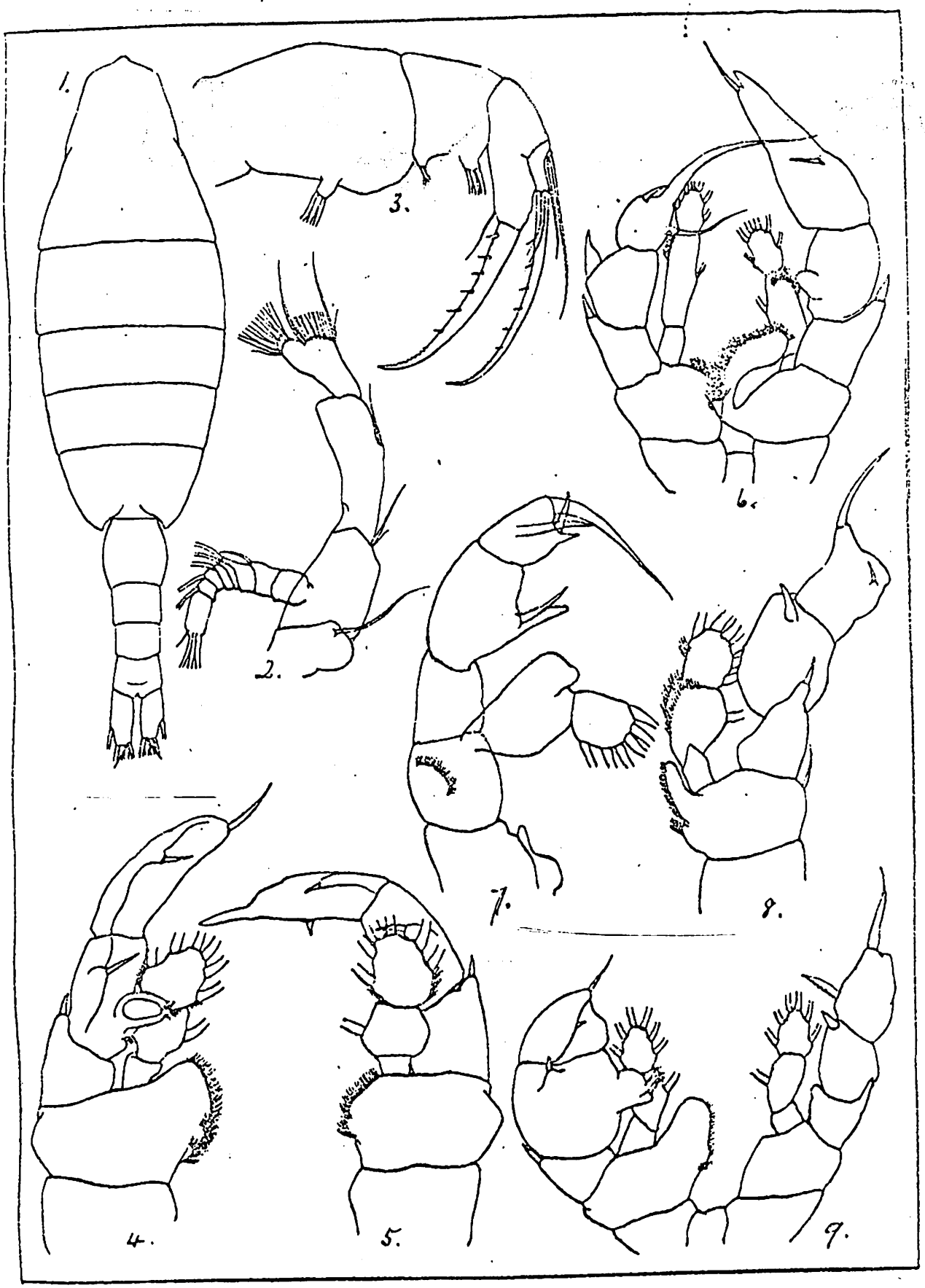
CORNUCALANUS (♀ 1, 2, 3, 4, 6; ♂ 5, 7).



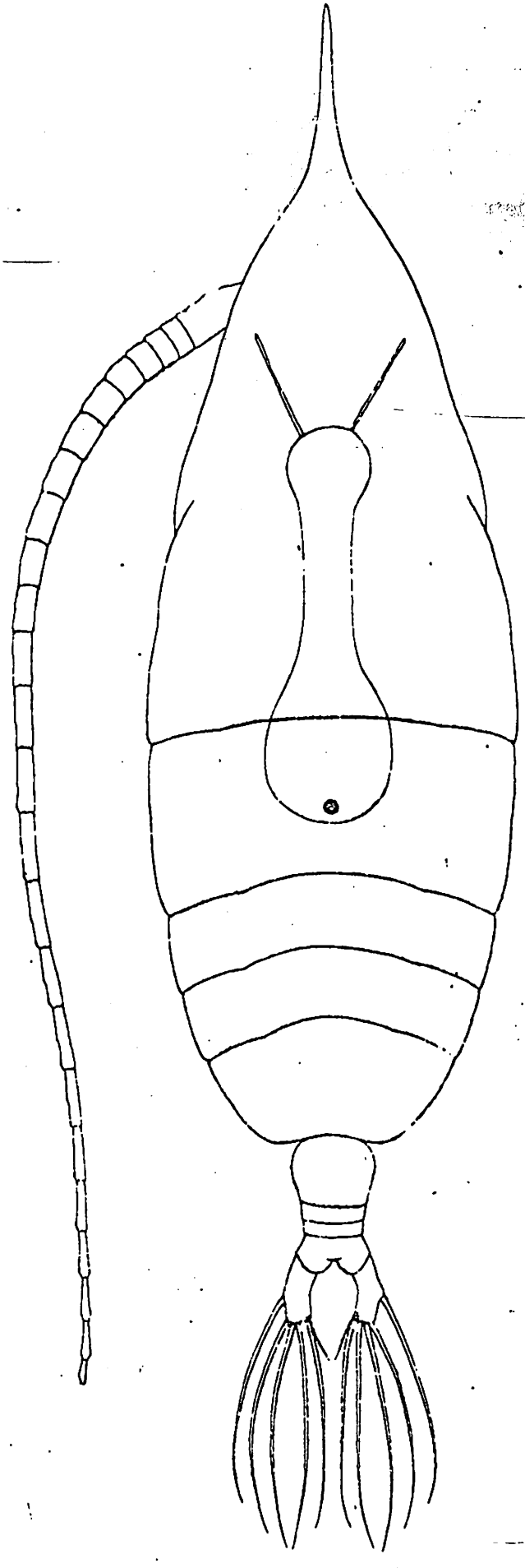
GAUSSIA Scotti (♀ 1, 2, 3, 4; ♂ 5). LUCICUTIA: Bicornuta (♂ 6) and Grandis (♂ 7, 8).



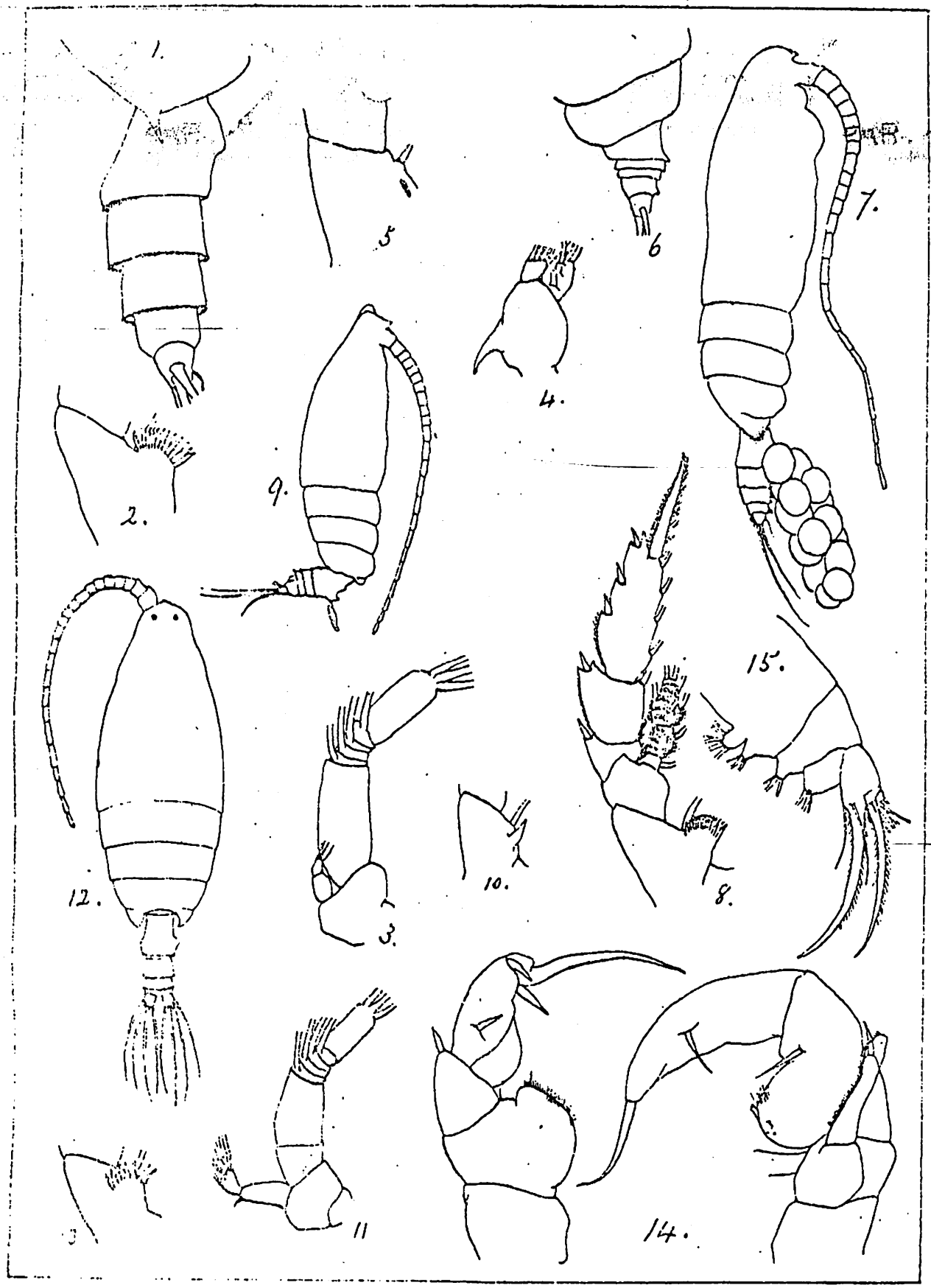
GAIDIUS INTERMEDIUS (4, 5). GAETANUS: ANTARCTICA (1), LONGISPINUS (3), AND CAUDANI (2).



HETERORHABDUS : BREVICAUDATUS (1, 2) ; GRIMALDII (3, 4, 5) ; PROFUNDUS (6) ; GRANDIS (7, 8) : AUSTRINUS (9).



HALOPTILUS OCELLATUS.



EUCHIRELLA: MAXIMA (9, 10, 11); BREVIS (3, 4, 5, 6); ELONGATA (12, 13); SPINOSA (1, 2); HIRSUTA (7, 8).
HETERORHABDUS: MAJOR (♂ 14); BREVICAUDIA (15).

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PART II.

[Note.—Professor G. O. Sars has informed me that the genus *Megacalanus* (Wolfenden) is identical with his genus *Macrocalanus* (Sars) (*Bull. du Musée Océanog. de Monaco*), and *Megacalanus Bradyi* is the same as his species *Macrocalanus longicornis*, and that my name. *Megacalanus*, however, has the priority over *Macrocalanus*. He also informs me that the species described by me as *Megacalanus princeps* = *Calanus princeps* (Brady) is not that species, but = *Bathycalanus Richardi* (G. O. Sars), 'and that Brady's *Calanus princeps* is a true *Megacalanus*, differing from *M. longicornis* (G. O. S.) = *Megacal. Bradyi* (Wolfenden), in the strongly recurved frontal appendages, somewhat shorter Anterior Antennæ, and the dense ciliation of the spines on the Anterior Maxillipedes, which otherwise are quite normal in appearance.

'The genus *Bathycalanus* differs from *Megacalanus* in the peculiar armature of the frontal part and in the somewhat different structure of the maxillæ and maxillipedes (both pairs), and in the structure of the first pair of feet, which are without the hooked process of the second basal, and have the outer ramus composed of only two joints.'

By the kindness of Dr. Calman, I have had the opportunity of examining the original (mounted) specimen of Brady's *Calanus princeps* at the Natural History Museum, Kensington. The only parts available for examination are preserved on a slide.. The head appears to be somewhat pressed out of shape, but is produced frontally, without appearance of any crest or of spines (as in *Bathyc.*); the rostral processes are stiff, thick, like *Bathycal.*; the maxilla resembles that of *Heterocalanus*; the bristles of the Anterior Footjaw are also alike, and those of the Posterior Footjaw are delicate and short, and the first feet have a three-jointed Re.

Nor can Brady's *Cal. princeps* be regarded as a *Megacalanus*, differing in the rostrum, Anterior Footjaws, hook of the first pair, and joints of the Anterior Antennæ. Except for the crested head, it bears a close resemblance to *Heterocalanus*. Unfortunately, in the absence of a whole specimen, it is impossible to completely identify Brady's original specimen with certainty, beyond saying that it is not *Megacalanus* or *Bathycalanus*. The description given by Professor Sars of the genus *Bathycalanus* (Sars) is:

Rostral appendages rather delicate, straight, and ending in acute points; maxillipedes strongly developed, anterior very thick, and with the exterior spines extremely prolonged and delicate, ending in hooks; the posterior rather elongated, with the three terminal spines very strong, and curved in the form of a scythe; Re of first pair of only two segments.

> *B. Richardi* 10·20 m. long. CT more than three times as long as Ab., fusiform, more retracted in front than behind. Ce | Th 1; front a little prominent, and immediately in front of the rostral spines, are two little horns. AA very delicate, and nearly twice as long as the CT. Feet like *Megacalanus*; genital segment a little prominent ventrally. Furcal segments short.

With regard to Brady's illustrations of his *Calanus princeps* in the '*Challenger* Report,' it must be remarked that these are defective as regards the drawing of the maxilla; and the

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head, which is not figured by Brady in his specimen, is produced in front above the rostrum, but is without armature or spines or hairs; and the rostrum is formed by two stiff prolonged rami, without spines or filaments, and is quite different from a *Megacalanus* rostrum or head. The Anterior Footjaw has the long, ribbon-shaped, terminal bristles, densely ciliated, as in Brady's drawing; the Posterior Footjaw has only very slender and short bristles, the terminal ones not ciliated, and only as long as the B 2 + Ri of this organ. The Re of the maxilla appear to be rather longer than the B 2.

The first feet have the Re of three segments, with only two Se, and no trace of a hook on the B 2.

The head of Brady's specimen is somewhat pressed out of shape, and it is not easy to identify the animal with any certainty.

In further elucidation of the species described by me in the preceding paper as *Megacalanus princeps* = *Cal. princeps* (Brady) = *Bathycalanus* (Sars), I give a figure of the head (Plate VIII.). This is seen to be suddenly narrowed anteriorly, armed with two little spines in the front and two short bristles, and to have two long, stiff, rostral processes, of quite peculiar character. In the latter it agrees with Brady's specimen; not, however, with the shape or armature of the front of the head, and *Megacal. princeps* also differs from Brady's specimen in the long, ribbon-like, densely-ciliated bristles of the *Posterior Footjaw* (as well as of the Ant. Footjaw) in the first feet, which have no *external marginal setæ*, except on Re 3; and also in the *Maxilla*, in which the Re does not extend beyond the distal margin of the Ri 3, nor is it so recurved.

It is, therefore, clearly not identical with Brady's *C. princeps*. As to its identity with *Bathycalanus Richardi* (G. O. Sars), the following points of difference seem to exist:

Cephalothorax only twice as long as the Abdomen (not over three, as in Sars' species), the first feet with Re of three segments (only two in Sars' species). The rostral processes are not '*assez grêles*,' but strong, and rather thick and rigid.

The largest specimen I have met with was 12·50 mm. long, and in this the furcal segments had been broken off, so it appears to be of greater size than Sars' *B. Richardi*.

Consequently, I feel justified in describing it as another species, which I designate *Bathycalanus maximus* (see Plate I.) = *Megacalanus princeps* (Wolfenden)].

Another remarkable example which does not appear to agree with either *Megacalanus* or *Bathycalanus* I describe below.

HETEROCALANUS (*n. gen.*).

Distinguished from *Megacalanus* and *Bathycalanus* by the shape of the head, which has a prominent dorsal crest, ending in front in a small helmet, by the very globose genital segment, the Anterior Footjaws armed with broad and very long ciliated bristles, as in *Bathycalanus*, the posterior jaws with only weak bristles, and the first foot with a three-jointed exopodite, without Se on the first two segments.

Heterocalanus Medius (*nov. sp.*). Plate VIII.

Size.—♀ 10·75 mm. Cephalothorax about four times as long as the Abdomen. The breadth of the former is over twice that of the Abdomen in its widest part (Genital Segment). Head separate from Th 1; last two thoracic segments rounded, and but little produced at the margins. Head not narrowed in front, as in the last genus, but dorsally triangular-shaped, and with prominent keel; in the three-quarter aspect quite distinct as a short, frontal helmet process. No spines or bristles on the front as in the last genus; only a very little tubercle above the rostral processes, which are strong, stiff, straight processes, of rather unequal length, without terminal filaments or spines, and closely resembling the same in the last genus. The Abdomen is stout, the genital segment very globular, a little broader than long, and half as broad again as the next segment; in lateral aspect above very concave, below very convex ventrally, with a cleft in the middle. Anal segment (fourth) very small, and furcal segments one-fifth longer than broad, and about as long as Ab 3 + Ab 4. (All tail setæ unfortunately broken.) Anterior Antennæ unfortunately broken.

Posterior Antennæ with Re only a little longer than Ri, and of eight segments. An extremely small bristle on B 1, and two similar on B 2.

Maxillæ with Re large, oval, and extending beyond the end of Ri. B 2 rather pyriform; Ri small, with three imperfect segments. Bristles are: Le 1 = 7; Re = 11; B 2 = 2, very short and delicate; Ri 1 + 2, with one very short; Ri 3, with four long and one very short; Li 3 = 2 short; Li 1 = 10 hook bristles.

Anterior Footjaws like *Megacalanus princeps* (Wolfenden); very short, delicate bristles on proximal lobes, and very long, ribbon-shaped and densely-ciliated bristles on the last lobe and endopodite, twice as long as the whole limb.

Posterior Footjaws proportions of B 1 : B 2 : Ri = 20 : 19 : 10. B 1 nearly three times as long as broad, B 2 nearly five times as long as broad. Ri about half as long as each of the two basals. Bristles of all very delicate, short and thin; the terminal bristles of Ri not so long as Ri + B 2; those of Ri 1, 2, 3, not more than half the length of the end bristles.

In the bristles of the Post. Footjaw this species closely resembles the original *C. princeps* of Brady—*i.e.*, they are thin and weak.

All feet of three segmented Re and Ri, and of the type resembling those of *Megacalanus* and the last genus.

First feet: Re and Ri = 3. Re 1 and Re 2 without external marginal spine. One occurs on Re 3. Si of Re = 1 : 1 : 5. No hook on basal.

Second feet: Ri only just reaching beyond the end of Re 2. Re 3 longer than Re 1 + 2, and over twice as long as broad, with three Se and an end-saw half as long as Re 3. Si of Re = 1, 1, 5.

Fourth feet: Re greater than Re 1 + 2; end-saw not quite half as long as Re 3. Re 3 with three Se. Si of Re = 1, 1, 5.

Fifth feet generally like the others, but smaller; only three-quarters as long as the fourth pair. Re 2 with, however, only two marginal Se; end-saw three-quarters as long as Re 3. Si of Re = 1, 1, 4. Basals not so convex on inner margin as in the other feet, being nearly straight.

Of the three genera described in this work:

1. *Megacalanus* (Wolfenden) (*M. Bradfji*) has a dorsally, rather triangular-shaped head, rostrum of ordinary type, head not narrowed in front, but produced between the Antennæ into a round process, also visible dorsally. A.F.J. and P.F.J. with bristles of ordinary character. First feet, Re = 3 segments, with three Se, and hook on B 2.

2. *Bathycalanus* (Sars) (*B. maximus*, Wolfenden), head very narrowed in front; two little frontal spines; long, stiff peculiar rostrum. A.F.J. with long, ribbon-shaped, densely-ciliated bristles. P.F.J. with terminal bristles of the same character in this species. Mx with Re not quite so prominent as in the next species, otherwise greatly resembling the two allied genera. First feet, Re with two (*B. Richardi*), three (*maximus*) segments, and (in *B. maximus*) only one Se.

3. *Heterocalanus*. — If *Bathycalanus* is distinguished generically from *Megacalanus*, especially by the shape of the head, proportions of the body, structure of the maxillipedes and first feet, then this specimen must be considered generically distinct on the ground that:

The head is different, being triangular and crested.

The Abdomen and especially the genital segment is much more robust than in the others.

The Anterior and Posterior Footjaws are dissimilar in their armature; the former with strong, thick, long, ciliated, terminal bristles; the latter with short, delicate bristles.

The first feet have a three-jointed Re, of which Re 2 and Re 3 have each a marginal Se.

GENUS LUCICUTIA.

Lucicutia Ovalis (*nov. sp.*). Plate IX.

♀ length 1·5 mm. CT over twice as long as Ab., and not twice as long as broad. Anterior body very broadly oval in shape, head evenly rounded, and last segment with rounded margins. CT of four segments clearly defined at the edges but not on the back. Whole animal of delicate build. Abdomen with large genital segment, nearly as long as the next three segments, the anal a little longer than the preceding, and the furcal segments nearly three times as long as broad, and two and a half times as long as the anal. The furcal segments are divided into two equal portions along the outer margin by the origin of the Se. Of the four apical and similarly thick bristles, one on each side is much longer than the rest. The genital segment is very protuberant ventrally, and bears the same dark-coloured egg-shaped swelling, with downward prolongation, found in many *Lucicutias*.

AA of twenty-five joints, and about three joints longer than the whole body, the twenty-fourth joint a little longer than the twenty-third, and twice as long as the twenty-fifth. All bristles of the antennæ joints short.

PA with Re and Ri of about the same length, the Re of eight joints, the distal one as large as the preceding six segments.

Mandible masticatory plate with eight teeth of about equal length, the outer five triangular, and larger than the inner teeth.

A.F.J. with weak lobes, and bristles of usual Lucicutia type.

P.F.J. B 1 : B 2 : = 12 : 14 : 14, the R of five distinct segments, R 1 > Ri 2 > Ri 3 > Ri 4 > Ri 5 ; all bristles weak.

First feet with Ri of two segments, and a tube process on the second basal.

Second to fourth feet with Ri and Re, and Re of first, each of three segments, the Ri short (not reaching beyond the distal margin of Re 2).

In the second pair Re 3 with five Si, three Se with large secondary spines ; end saw : Re 3 = 8 : 13.

In the fourth pair Re 3 with five Si, and three Se, but below the proximal Se is a deep excavation of the margin (without trace of Se).

Re 3 longer than Re 1 + 2, and end-saw : Re 3 = 9 : 14½.

Fifth feet long, Ri very short, not half the length of Re, and of three segments with respectively 1, 1, 5, bristles.

Re 1 longer than Re 2 or Re 3, which are about equal.

Re 2 at its inner distal margin bears a short sabre bristle, and the end-saw of Re 3 is very short, and not more than one-third the length of the Re 3.

GENUS HALOPTILUS.

Haloptilus Longimanus (*nov.*). Plate IX.

♀ 6·72 mm. long. (CT 5·4, Ab. 1·3.) Abdomen only a quarter as long as the forebody. Head evenly rounded and not triangular. Genital segment large, longer than the remaining segments. Furca about as long as the last two segments. Anal segment very small. *Anterior Antennæ* not reaching the furca, and of twenty-five segments.

Post. Antennæ : Re about one-quarter longer than Ri, and of eight joints, the last very long.

Mandibles : Masticatory plate stout with strong teeth ; B 2 with three bristles, Ri longer than Re.

Maxillæ : The first inner lobe very large and square-shaped, Li 2 a large lobe with four bristles (not shown in the figure), Li 3 small and with four bristles, B 2 short and with three bristles. Ri small, unsegmented, and with five bristles. Re large and with nine bristles. The basal and inner lobes are extremely small in comparison with the large square inner first lobe. Le 1 small, square-edged, and with nine long bristles.

Anterior Footjaws about as long as the posterior pair. First basal with only two very small lobes distally, each with three bristles. B 2 elongated and with two long hooks and one short bristle at the distal end. Ri small, distinctly three-segmented, and with nine long, curved hooks, tooth-combed in the distal half.

Posterior Footjaws comparatively short, and with broad basals, and Ri much narrower. B 1, B 2, Ri = 12 : 8 : 6. B 1 three-quarters as broad as long. Ri distinctly five segments, with eight long, curved hooks as in the Ant. Footjaws, the terminal two the stoutest ; all tooth-combed in the distal half, two short dorsal bristles on Ri 5.

Autanepsius Minor (*nov. sp.*). Plate XIII.

♀ 4·8 mm. long. CT nearly four times as long as the Abdomen; the former of five segments, the head separate from the first thoracic segment, the last segment with slightly pointed distal margins. Head in front evenly rounded, with no prominence and rostrum as in the last species. Abdomen of four segments, the genital a little swollen ventrally.

Anterior Antennæ of twenty-four segments, short (not as long as the CT), and with long and numerous bristles.

Posterior Antennæ with Ri and Re about equal, the latter of eight segments.

Mandibles: Re twice as long and thick as Ri, the former of four, the latter of two segments; B 2 with only one marginal bristle. The masticatory plate with powerful short teeth. Bristles of Ri not half as long or as thick as those of Re.

Maxillæ: Le 1 with eight, Re with eleven, B 2 with five, Ri with fourteen bristles; Li 1 with thirteen hooks, Li 2 with four bristles; B 2 and Ri coalesced, long, and broad; Re very small.

Anterior Footjaws: B 1 long comparatively; B 2 and Ri small, but the latter distinctly three segmented. Lobes all small, the proximal especially so, and rather crowded together. L 1, L 2, L 3, L 4 with three bristles each; L 5 with two bristles. The six bristles of Ri are strong, curved outwards, and densely feathered in the distal third.

Posterior Footjaws: B 1 : B 2 : Ri as 22 : 22 : 9. Ri very short, of five distinct segments, the second the largest. B 1 three times as long as broad, B 2 nearly four times as long as broad; the marginal bristles of both basal lobes much reduced. The bristles of Ri long, nine of them armed with very peculiar processes, not stalked as in Augaptilus and not bearing any resemblance to the cups of this genus, but as in the last species.

Swimming Feet.—First pair: Ri = 1, Re = 3. Re 1 without Se; Re 2 with long Se. Si = 0 : 1 : 4.

Second pair: Ri = 2. Re in both feet broken.

Third and fourth pairs: Ri = 3. Re in both pairs broken, but probably = 3.

No fifth pair.

The feet were much broken in this, the only specimen occurring in *Gauss* sample from station, October 9, 1903; vert. 3,000 metres.

GENUS SPINOCALANUS.

Spinocalanus Magnus (Wolfenden, *J. M. Biol. Ass.*, vol. vii., April, 1904). Plate XIV.

This species, which was briefly described by me as above, and subsequently also by Farran (Report Fisheries Iceland, 1905), appears to have a very much wider area of distribution than imagined. In the *Gauss* collections I have met with many examples not far north of the ice, and in my own collections I have taken it in the Atlantic at the entrance to the Straits of Gibraltar.

The species from the latter locality agrees closely with that from the West of Ireland,

and I have no doubt that they are identical. That from the Antarctic seas also agrees generally, but there are certain points in which it differs, enough to justify making a new species. As my former notes (*J. M. B. Ass.*) were very brief, I here supplement them with a fuller description of this species, which appears to be a deep-water form. For instance, in the *Gauss* collections, it appeared at Station 3, iv., 03, in a ground collection at 3,223 metres, and at three other stations in vertical hauls from 3,000 and 1,200 metres respectively, and at Station 43 (Straits of Gibraltar) of the *Silver Belle* at 360 fathoms, in the closing net.

♀ 2·75 to 2·80 mm. CT three and a half times as long as the Abdomen. Head evenly rounded, dorsally roughly triangular. The Cephalothorax is two and three-quarters as long as broad, the broadest part of the body being posterior to the mid line of the animal. The separation of head from the first segment is indicated only by a faint dorsal line. Rostrum is entirely absent. The two last segments of the Thorax are separate, the posterior are produced forwards, with rounded margins, and overlapping the upper half of the genital segment.

The Abdomen of four segments has the genital rather protuberant, and as large as the next three, the second, third, and fourth segments equal in size, the furcal segments a little longer than the anal, and rather longer than broad. The furcal bristles are four apical and one very delicate and short on the inner margin, and one of the bristles of the left side is much thickened (and elongated ?).

Anterior Antennæ of twenty-four segments (the eighth and ninth coalesced, twenty-fourth separate from twenty-fifth) reach just a little beyond the end of the furca. The basal joints are thick; the distal joints taper, and are narrow distally.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
19	19	10	10	11	11	11	24	10	10	11	12	12	15	15	16	16½	16½	15	14	14	14	12	7

Posterior Antennæ with six-jointed Re, which is only a little longer than the Ri. Re 2 equal in length to Re 6, and not twice as long as broad.

Mandibles with rami of nearly equal length, basal longer than broad, with three marginal bristles, the proximal the strongest, the distal one naked, the Ri 1 rather large. The masticatory plate with one very large, conical, sharply-pointed external tooth, and four sub-equal thinner teeth, and a deeply-trifid inner tooth.

Maxillæ with Li 1 large with proximal bristle very long; Li 2 with five, Li 3 with four bristles; B 2 about as long as broad with five bristles; Ri broad and distinctly segmented, Ri 3 very small with fifteen bristles. The Re reaches to the end of Ri 2, and has eleven bristles. Le 2 without bristle, and Le 1 with rather straight margin.

Anterior Footjaws with very short Ri, L 1 and L 5, with four bristles each, the others with three. L 4 with a rather stout, broad hook toothcombed on the inner side, and with stiff hairs externally. Outer margin of B 2 not very convex.

Posterior Footjaws with B 1 rather longer than B 2, and Ri longer than either basal; Ri 2 long. A stout and long feathered bristle dorsally on Ri 4. On the surface of B 2 are a few spines.

First feet, Ri = 1, Re = 3. Re 3 with four Si, the Se of this ramus are long and thin, B 1 without, B 2 with long marginal bristle, and on this segment at distal inner margin is a group of species with hairs proximally.

Second feet, Ri = 2, Re = 3. Ri 1 and Re 1 are small, Ri 2 over two as long as broad, an accessory lobe with eight long strong spines. Re 3 = Re 1 + 2, and is three as long as broad, the saw as long as Re 3, lanceolate and broad proximally, with crenated and not toothed margin. No spines on basals, but a row of stout short spines on the surface of Re 3, and on Re 2 an oblique row of nine long spines.

Third feet, Re 3 is three as long as broad, and its saw a little shorter than the segment. No spines on basals, but a row of seven long spines on Ri 2 and Ri 3, and a row of eleven or twelve long spines on Re 2, and six short ones distally on Re 3.

Fourth feet, B 1 extended, and a row of several stiff spines encircling the segment just at the insertion of the Si; Ri 2 and Ri 3 with rows of long spines on the surface.

Fifth feet absent.

Only young and immature males were found.

Spinocalanus Antarcticus (*nov. sp.*). Plate XIV.

The animal which occurs in the Antarctic Ocean is very closely allied to the Atlantic species, and but for the different shape of the Cephalothorax would undoubtedly be regarded as the same species. This is, however, so distinct that it may be preferable to distinguish them as separate species.

♀ 2·25 to 2·30 mm. Cephalothorax four times as long as the Abdomen, with rounded head and no trace of rostrum. The dorsal curve of the body is more pronounced than in the other species, and the greatest breadth is anterior to the middle of the body, and occurs where the imperfectly-marked line of segmentation between the head and Th 1 is evident. The thorax is only two and a quarter times as long as broad. The last two segments are separated, and the lateral prolongations of the last segment are much less pronounced than in the Atlantic specimens. The Genital segment is not longer than the next two combined, and the furcal segments are a little longer than broad. The Anterior Antennæ do not reach beyond the end of the third abdominal segment, and are thus much shorter than in the previous species. In other respects, as regards mouth organs and feet, the two species are identical.

The ♂ is much smaller—viz., 1·8 mm. (Plate XIV.)—and possesses a fifth pair of feet, of which the right is the longest, two and a half times longer than the other. Each is of five segments.

Left foot: B 1 : B 2 : Re 1 : Re 2 : Re 3 = 10 : 8 : 7 : 7 : 4. The last segment pear-shaped, with short, delicate terminal spine.

Right foot: B 1 : B 2 : Re 1 : Re 2 : Re 3 : = 27 : 24 : 30 : 14 : 5. B 2 with a club-shaped extremity and tuft of short hairs on the inner distal margin; Re 1 with a tuft of short, marginal bristles; Re 3 spoon-shaped with margin doubled over.

GENUS AMALLOPHORA (*Scott*).

Amallophora Rotunda (*nov. sp.*). Plate XV.

♀ 2·15 mm. Head quite evenly rounded, without any trace of crest, and with rather long, delicate bifurcate rostrum. Ce~Th 1, the last segment of which has evenly rounded and not produced margins, the two last segments being separate. Abdomen not more than a third as long as the Cephalothorax, the Genital segment as large as the following three segments, the anal very short, and, together with the furcal segments, only three-quarters as long as the genital. The furcal segments are only as long as broad, and as long as the anal segment. Each of the abdominal segments is fringed with pectinations.

The animal, though small, is robust, the Cephalothorax just half as broad as long, and thus much more rotund than any other species of *Amallophora*, except *A. brevicornis* (Sars). The Anterior Antennæ were broken off. Posterior Antennæ with rami nearly equal, the Re a little longer than Ri, Mandibles with Ri longer than Re.

Anterior Footjaws small: B 1 longer than B 2, the lobes small and compressed, with respectively 3, 2, 3, 3, bristles, the last lobe with one delicate hook bristle, the endopodite with three amalliform processes and two vermiform, long and thin.

Posterior Footjaw: B 1 : B 2 : Ri = 20 : 26 : 16. The first basal much wider than the second; Ri of five distinct segments, the second the largest.

First feet: Ri = 1, Re = 3 with three Se.

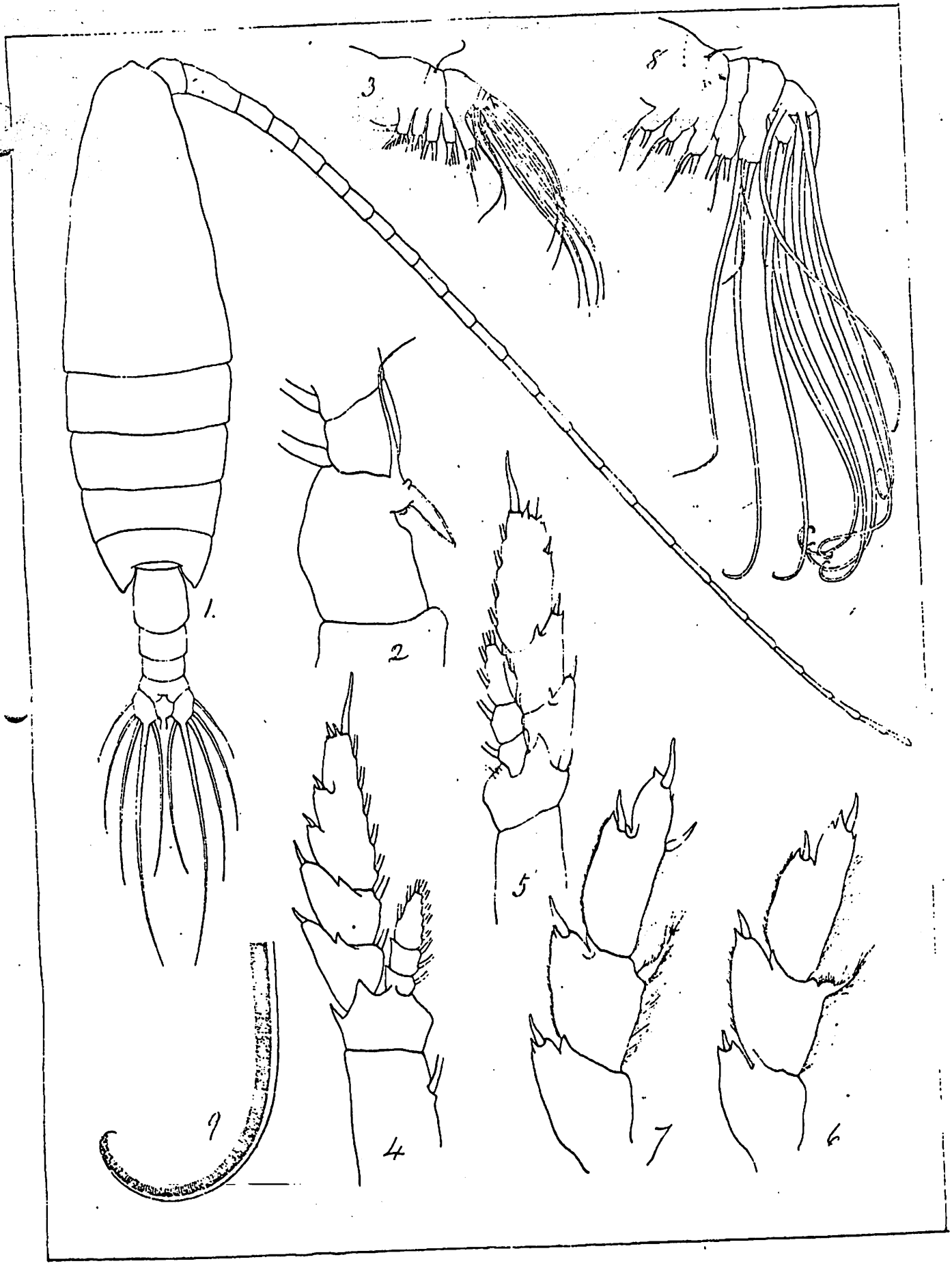
Second feet: Ri = 2. Ri 2 very long, with a few scattered prickles on the surface.

Third feet: Ri = 3, Re = 3. Re 1, 2 and 3 with rows of small prickles on the surface.

Fourth feet completely broken.

Fifth feet: A common basal and a long segment imperfectly divided into a short proximal, a middle, and a short distal joint. The latter has, at the junction of the two distal segments on the outer margin, a short spine, and apically on the last segment a very short external spinelet and longer spine internal. On the inner margin, at the junction of the middle and distal segment, is a long, rather thick and slightly denticulated bristle, in length equal to the foot, excepting the basal portion.

This copepod bears considerable resemblance to *A. brevicornis* (Sars)—'Crustacea of Norway,' vol. iv., 1903, Plate 36—but differs in being slightly larger, the furcal segments shorter, the head more rounded, and especially in the three-jointed outer ramus of the first feet possessing three well-formed Se; and also in the slightly different form of the fifth feet, which are imperfectly three-segmented, have two (instead of one) denticles apically, and the large inner Si is only the length of the foot, instead of being twice as long, as in *A. brevicornis*. *A. obtusifrons* (Sars)—*Bull. du Musée Océanog. de Monaco*—is twice the size, though the fifth feet appear to resemble. Captured by the *Silver Belle* at Station lat. 48° 12′ N., long. 16° 26′ W., 1904.



MEGACALANUS: BRADY, (♀ 1, 2, 4, 5; ♂ 3, 6) AND PRINCEPS 7, 8, 9, PART OF BRISTLE OF 8).

ERRATA.

Page 22, line 6 *et seq.*: *for* 'Re 1 long and narrow with rudimentary Ri,' etc., *read* 'Re 1 long and narrow; Re 3 represented by stylet process. Left foot short, of four segments, the end segment very short, and with short spine at the end.'

Plate VI.: *for* 'brevicaudia' *read* 'brevicaudatus.'

COPEPODA

GENUS MEGACALANUS (*nov.*). (*Wolfenden.*)

Megacalanus. (Wolfenden, *Journ. Mar. Biol. Assoc.*, April, 1905.)

Generic Characters.—Head separate from first segment; last two thoracic segments separate. Abdomen of four segments; five pairs of feet. In general characters resembling Calanus, but the third segment of each exopodite with three external spines and end-saw; first feet with extraordinary hook process on the basal; fifth feet without denticulation on the inner margins of the basal.

Megacalanus Bradyi : (*nov. sp.*). Plate I.

The animal is distinguished by its great size—viz., 10 mm., in the adult female. (Cephalothorax 7·9 mm.; abdomen 2·1 mm. long). The *Cephalothorax* is of six segments, the head separate from the first thoracic segment; the fifth and sixth segments also separate. The greatest breadth of the thorax is 2·35 mm., about one-third the length. The head is slightly produced anteriorly between the antennæ, possessing a strong two-pointed rostrum, and with a perfectly even dorsal curve. The last segment of the thorax is produced into wing-like points, resembling *Cal. hyperboreus*.

The *Abdomen* consists of four segments, the genital segment very little longer than broad (as 17 : 15), Ab 2>Ab 3>Ab 4; the furcal segments about the same length as the anal, and very little longer than broad, each with five tail bristles and a short inner accessory bristle. The next to the innermost bristle of each side is much thicker and longer than the others.

The *Anterior Antennæ* comprise twenty-five segments, and are longer than the whole body by about the last eight segments; all except terminal bristles very short.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
8	13	8	7	9	9	10	8	10	11½	12½	14	16½	16	16½	16½	17	17	17	12½	11½	12½	11	7½	8½

The twelfth and thirteenth segments have a row of fine teeth on the under surface.

The *Posterior Antennæ* have the inner and outer rami of about equal length; first basal with marginal basal hump and one strong bristle, second basal with two bristles, first segment of the endopodite four times as long as broad.

The mandible has the inner ramus a little longer than the outer, the first segment of the endopodite with a lateral swelling. The masticatory plate is half as broad as long, and has

six strong bifid teeth. The first segment of the inner ramus has a strong marginal projection (like that of *Calanus gracilis*). The second basal rather long, with four stout marginal bristles.

The *Maxilla* is of the usual Calanus shape, the exopodite oval and nearly as long as the endopodite, the latter small and much narrower than the second basal, but distinctly three-segmented. There are fourteen bristles on the endopodite and four on the second basal; eleven on the exopodite, nine on the first outer lobe; second outer lobe with one, second inner lobe with four bristles.

The *Anterior Footjaw* is short and compact, the fifth lobe much longer than any of the others, with a long, thin hook; no hooks on lobes four or six, and all the bristles with stiff hairs wide apart like Calanus.

The *Posterior Footjaw*, of the usual Calanus form, has the first basal much longer than the second; the endopodite smaller than the latter—relative proportions 20 : 14 : 11; each basal twice as long as broad. The bristles are of the usual character.

Five pairs of *Swimming Feet*, each with outer and inner rami of three segments, the first basal segments of the second and fourth pairs with a very convexly projecting inner margin. The first pair with respectively one, two, six bristles on the segments of the endopodite, and a remarkable arrangement on the second basal. At the distal margin of the posterior surface of the segment are two strong hooks, the lower one very thick and strong, and projecting downwards, backwards, and outwards (very prominent in profile), and an upper hook process, broad below, tapering to a whip-like extremity directed straight upwards and more than half the length of the endopodite. Each segment of the exopodite with long flagellate external marginal spine. The second feet with second basal with three spines (one external and two central) on the distal margin; endopodite not much more than half the length of the exopodite; the first and second segments of the endopodite ending in points at the distal outer margin (similar in third and fourth pairs); the third segment of the exopodite comparatively large, broad at the base and narrow distally; the segment divided by the external spines into portions respectively 14 (prox.) : 8 : 14½ (distal), the terminal saw not as long as the last part of the segment. The third and fourth pairs rather similar generally, the last segment of the exopodite in the latter with the proximal portion much the largest (19½ prox. : 11 : 13 distal), and the saw rather longer than the distal third of the segment. The endopodite of the second pair with one, two, eight bristles respectively; outer margins of second segment and proximal part of third segment of the exopodites of second to fifth feet thickly haired, saws in all cases broad at base and lanceolate, foliaceous, with ribs very numerous, which at first sight resemble teeth, but the unserrated margin of the folia can be distinguished beyond them. In the fourth foot, at the external distal margin of the second basal, besides the short spine is a delicate short-feathered bristle.

All external marginal spines are small.

The fifth pair resembles the other feet, except that they are short, and the external margin of the last segment of the exopodite has only two marginal spines instead of three. Between the terminal saw of each foot and the outer marginal spine is another small apical spine. The inner margin of the first basal of the fifth foot has neither teeth nor hairs.

Colour of the animal greenish-yellow when fresh, with no pigmentation.

The general resemblance of this copepod to a Calanus is very great, especially in the mouth organs. In the '*Challenger* Report,' Brady describes under the head of *Calanus princeps* a copepod 12 mm. long, but which, from the spinulation of the feet, is certainly not a Calanus, as Giesbrecht has pointed out (abdomen three segments, last but one joint of the Antennæ very small; Maxilla with short unsegmented endopodite, sawed terminal spines of the feet, etc.).

The animal here described might, so far as the feet as figured by Brady are concerned, belong to the same species, but there are in this no such setæ on the Anterior Footjaw as Brady figures; the Maxilla is totally different as regards its bristles, the segmentation of the Anterior Antennæ, and of the abdomen, etc. It is therefore certainly not Brady's *Calanus princeps*, and the presence of three external spines on the Re 3 of the second and fourth feet as clearly removes it from any other species of the genus Calanus.

The ♂ resembles the ♀, but the *Anterior Antennæ* are more closely beset with æsthetasks; the *abdomen* consists of five segments, and the fifth feet differ somewhat. The foot of one side is also somewhat different from that of the opposite side. In one the inner margin of the second exopodite segment bears at its outer distal margin a stumpy process, which ends distally in a spine and stout bristle. The upper and inner and outer margins are also covered with hairs. The third segment, just below its distal extremity, has often an upright spine varying in length in different individuals, but extending a little beyond the end of the joint. The outer margin of the third exopodite joint has only one spine, distal of the middle. The foot of the opposite side has no process on the second exopodite segment. (A difference in the feet of the two sides is also noticed in the closely allied *M. princeps*.) The basals of the fifth feet are without teeth; the first basal is very long comparatively, and the bristles of the endopodite are 0, 1, 6. This copepod was abundant in the *Gauss* collection, and occurred twice in my collection of 1903 from the West of Ireland.

Megacalanus Princeps (Syn. *Cal. princeps*, Brady; '*Chall.* Rep.,' p. 36.) Plate I.

This copepod does not strictly belong to the Northern Fauna, its habitat being mid-Atlantic, and it is in abundance in the *Gauss* collections made in the Atlantic traverse. It is reported to have been once met with, however, in the Atlantic west of Ireland, and as it may perhaps be met with occasionally north of Lat. 60°, it must be noticed. In all the author's collections north of this latitude it has never once occurred. Brady, in the '*Challenger* Report,' very briefly described it as having been taken in two deep-water dredgings, of 1,240 and 1,250 fathoms respectively, and also off Sandy Hook at 1,250 fathoms. It has an extensive area of distribution throughout the deep water of the Atlantic north and south of the equator.

♀ 10·9 to 11 mm. long,* the *Cephalothorax* of five segments, the last two being coalesced. *Head* narrowed in front, the forehead slightly produced and bearing two short spines, with two short hairs below them, the rostral processes long and stiff, ending bluntly, without filaments. The posterior margins of the *thorax* are rounded and but slightly produced. The *Abdomen* of four segments, with the genital twice as long as the following one. *Anterior Antennæ* at least four joints longer than the whole body, and of twenty-five segments, the basal joints small,

* One large example from the Southern Ocean measured 12 mm. long.

from the eighth to the nineteenth gradually increasing in size, the twentieth to the twenty-third shorter, the twenty-fourth only half the length of the twenty-third, and the twenty-fifth not quite twice as long as the twenty-fourth. The *Posterior Antennæ* and mandibles are as in the last species. In the *Maxillæ* the second basal and endopodite are rather pyriform in shape, the endopodite partially segmented, only on the inner margin, the second outer lobe small, and apparently without bristle. The *Anterior Footjaws* with short, weak bristles on the proximal lobes; the fifth and sixth and also the endopodite with very thick and very long, ribbon-shaped bristles, densely feathered on the proximal side. These bristles are very characteristic of the species. The *Posterior Footjaws* have a very thick, spiniform seta densely feathered, and a second thin bristle, both arising from the distal lamellar projection of the first basal, and both as long as the second basal. The bristles of the last joint of the endopodite are long broad, and resemble those of the Anterior Footjaw. The first four pairs of swimming feet have three segmented rami, and in general resemble those of the last species, having three marginal spines on the last joint. The first pair has no trace of the hooks which characterize the last species, and the first and second joints of the exopodite have no marginal setæ externally. The fifth pair has only two external spines on the last exopodite segment, four inner marginal bristles, and an end-saw three-quarters the length of the segment. There are no teeth on the margins of the basals. The saws of the feet have numerous fine, closely-set teeth. (They may be identical with the last species, but, having been preserved in spirit, may have lost the fine membranous protective sheath occurring in fresh specimens of *M. bradyi*.)

The ♂ differs chiefly in the shape of the head (which has not the two small frontal spines of the ♀), the last two segments of the thorax are separate, the abdomen has five segments, the posterior footjaw is weaker, but the terminal bristles are thick and ribbon-shaped, and the fifth feet are otherwise formed. In them the last segment of the exopodite has only one external marginal spine, and a very short apical spine, representing the end-saw; one inner marginal seta, which is modified, being short, thick, and spine-like, curved, and standing more or less at right angles from the segment. There is one inner marginal seta on the second joint, which is without the stumpy process which occurs in the last species. As in the latter species, however, the two feet are not quite symmetrical, the inner marginal seta of the second joint being absent in one foot. The first basal is not so elongated as in the last species, and there are no teeth on the inner margin; the second basal is, however, very convex distally on the internal margin, and has strong bunches of hairs.

The *diagnosis* between these two species may be expressed:

1. First pair of feet with a pair of hooks on each second basal; the bristles of the endopodites of Anterior and Posterior Footjaws of ordinary character = *M. bradyi*.

2. First feet without hooks; bristles of endopodites of footjaws very broad, extremely long, and, distally, densely feathered = *M. princeps*.

Size of ♂ and ♀ 10 to 12 mm.

Both are deep-water species, with a distribution extending from the west of Ireland to far in the Southern Ocean (as far as Lat. 60° S.).

[Note.—In Sars' recently published 'Liste préliminaire des Calanoïdés, etc.' (in *Bulletin du Musée Océanographique de Monaco*, No. 26, March 20, 1905), is briefly described a new genus,

Macrocalanus, and species, *M. longicornis*. It is impossible, without further description or figures, to accurately locate this genus, but probably it is identical with *Megacalanus*, the brief description of which, accompanied by figures, was published by me in the *Journ. Brit. Mar. Biol. Assoc.* in April, 1904, thus antedating Sars' description by about a year.]

GENUS GAUSSIA (*nov.*).

Generic Characters.—Resembling *Metridia* in the structure of the feet and *Pleuromamma* in the form of the body, but no trace of pigmented 'ocellus.'

Gaussia Scotti (*nov. sp.*). Plate II.

Pleuromamma princeps. Scott, *Trans. Linn. Soc.*, 1889.

Metridia Scotti. Giesbt., *Zool. Anzeiger*, vol. xx. Giesbt. and Schmeil, 'Tierreich,' p. 107.

♀ 10 to 10·3 mm. long; whole fore-part of body, legs, and mouth organs deep blue-black; genital segment deep sienna coloured. Cephalothorax twice as long as Abd. Ce with short crest, prolonged into frontal process like *Pleuromamma ziphias*, with short rostrum. Last thoracic segments on each side prolonged into stout spines, slightly curved, and not half the length of the genital segment. Abdomen of only three segments (first and second coalesced to form an unsymmetrical laterally and ventrally swollen segment, 20 long and 17 broad). Second segment very small and not half as long as the anal. On the upper and right side dorsally of the first segment is a strong curved hook. Genital openings and swellings occupy whole lower half of the segment. Anal segment twice as broad as long, with dorso-lateral flaps extending over the furcal segments. Furcal segments as long as broad, with strongly haired margins, two outer and two apical, and two inner marginal seta (innermost thin and short), the two apical three-quarters as long as the whole abdomen. Very large and haired epistomal cushion.

AA = twenty-three, longer than whole body by four and a half joints; on the first and second segments are strong, broad-based spines, not recurved; on the fourth, fifth, and sixth, smaller spines. *Mx*, *P.F.J.* (B 1 : B 2 : Ri = 20 : 18 : 28) and *A.F.J.* like *Pleuromamma*. *Mn*, Ri much longer than Re (B 2 extended on inner side) and with four marginal hairs on B 2.

Second feet, with clusters of small spines on surface of B 1, B 2 very convex, both feet with hooks on Ri 1 (outer much longest). *Third feet* without deep curve of margin of Re 1, saw of Re 3 of normal shape, not bent like *Pleuromamma*. *Fourth feet*, end-saw short. *Fifth feet*, each of four segments, last two about same size; no bristles on one, two, or three, but three end bristles on fourth; innermost very long, middle only half its length, outermost very short; margins of all joints without hairs.

♂ a little smaller than the female, *Ce* separate from *Th* 1. Last thoracic segment on each side ending in stumpy prolongations, but without the spines of the female. Clasping Antenna on the right side, with three joints beyond the elbow; joints before the elbow broadened out a little; joint immediately distal to the elbow with two spine processes on the upper margin, one

distal, not more than one-third the length of the joint, one proximal. At end (distal) of the segment a short, blunt, rounded spiny projection, just reaching beyond the end of the segment; joint preceding elbow without spines or teeth, proximal joint to this with short spine reaching a little beyond end of segment. Mouth with strong upper and lower lip, as in ♀; crest of head a little weaker than in ♀, and mouth organs like those of ♀, but weaker. Abdomen with five segments, anal very broad and longer than the rather square-shaped furcal segments.

Fifth feet peculiar, best understood from the figure.

There is an entire absence of pigment 'ocellus,' as in *Pleuromamma*. The body has a great resemblance to *Pleuromamma*, especially in the asymmetrical female abdomen, but is quite unlike any *Metridia*. The fifth feet of the ♂ differ from either genus. It seems to partake of the characters of both genera, and to belong properly to neither.

Many specimens occur in the *Gauss* collection gathered in the North Atlantic. I have little doubt that it is identical with the description of *Pleuromamma princeps* by Scott,* of which one male only formed the subject of the description. Scott does not speak of the pigment ocellus, nor does he mention any pigmentation of the animal. In all the *Gauss* specimens this is very striking. Giesbrecht (*Zool. Anzeiger*, xx., p. 253) referred the species to *Metridia*, changing the name to *Met. Scotti*, as *M. princeps* was already appropriated, and remarking that the structure of the feet relegated it to the genus *Metridia*. Scott was probably more accurate in referring it to *Pleuromamma*. With the exception of this single specimen of Scott's, the animal has, I believe, as yet remained undescribed again. The striking form of the female and the difficulty of referring it to either genus induce me to suggest that it is preferable to create for its reception another and distinct genus, for which I suggest the name 'Gaussia.'

GENUS GAIDIUS. (*Giesbrecht.*)

Gaidius Intermedius (*nov. sp.*). Plate III.

♀ 4·5 to 4·8 mm. *Head* rounded, with short one-pointed rostrum. First cephalic segment larger than the remaining three segments. Head only partially divided from the first segment by a dorsal line. Last segment rounded, and with very short lateral and thin spines, curved and bent in a ventral direction. *Abdomen*, one-third as long as the cephalothorax. Genital segment ventrally protuberant, and nearly as long as the next two segments. *Furcal segments* equal in length to the anal. *Anterior Antennæ* of twenty-three joints not quite reaching the end of the genital segment. *Posterior Antennæ* with Re greater than Ri by one-third, and a tubercular projection on the Re 1. *Anterior Footjaw* with hook on the fourth lobe larger and stouter than that of the fifth. *Maxilla* with Re longer than Ri. *Posterior Footjaw*, B 1 : B 2 : Ri = 11 : 3 : 4½, the three bristles of B 2 short; B 1 with extraordinary lamellar hump, of transparent colour on the outer margin.

First feet, Ri = 1, Re = 3, but no Se on Re 1.

* *Trans. Linn. Soc. of London.*

Second feet, Ri = 2, Re = 3.

Third and fourth feet, Ri and Re = 3 segments, the fourth feet with special tubal bristles, as in other *Gaidius*.

The characters of the Posterior Footjaw and Posterior Antennæ resemble *Gaetanus* more than *Gaidius*; the absence of any spine on the head and its evenly rounded contour alone prevent its inclusion in the former genus. It is not very common, but occurred at two of the *Gauss* stations near the ice (March 10, 1903, and March 27, 1903).

GENUS GAETANUS. (*Giesbrecht.*)

Gaetanus Antarctica (*nov. sp.*). Plate III.

8 mm. long. Body thick, with rather gibbous dorsal swelling of the first segment, which, consisting of the coalesced head and first thoracic segment, is more than twice the length of the next three segments. The last segment is produced laterally into short, stout, curved spines, directed dorsally. The *head* is in front rather square, and the dorsal cephalic spine very short, thick basally, and directed forwards. The *Abdomen* is short and thick, not, altogether, a quarter the length of the cephalothorax. The *Anterior Antennæ* are not more than 7 mm. long—*i.e.*, not as long as the whole animal; they consist of twenty-three segments, of which the eighteenth, nineteenth, and twenty-first are much longer than the twentieth. They are sparingly setiferous.

Ri of the *Posterior Antennæ* more than half as long as Re.

Posterior Footjaw with lamella on the outer margin of B 1.

Maxilla, Li 2 and 3, each with four bristles; B 2 with five; Ri small and two-jointed. Re small, and less than half the length of B 2.

First feet, Re of three segments, quite distinct, and with three marginal spines. Ri of one segment.

Second feet, Ri distinctly two-jointed.

Third and fourth, Ri and Re of three joints each. B 2 with tubal bristles.

Much larger than *G. caudani* or *G. miles*; is nearly related to the former. It occurred at the *Gauss* station, March 27, 1903, vert. 2,000 m.—*i.e.*, at the edge of the ice.

Gaetanus Longispinus (*nov.*). Plate III.

Head with very strong dorsal spine, broad based, and curved, but directed quite backwards. Space between this and the rostrum almost straight, with a clear chitin line representing a rudimentary crest. Just above the rostrum a small chitinous tubercle; rostrum very short but strong. *Anterior Antennæ* not reaching the end of the abdomen. Last segment of the thorax with spines arising at the frontal margin of the segment, strong and long (as long as the genital segment), a little curved, the tips directed backwards. In the dorsal aspect they appear to be very wide apart. Posterior Footjaws with small lamella on

basal. First feet, Re with three segments and three Se. Second feet, Ri of two segments. B 1 of fourth feet with the characteristic tubal bristles.

This quite differs from *Gaetanus miles* (Giesb.), and *Gaetanus caudani*, and does not appear to be identical with any of the four new species described by Sars (*loc. cit.*), one of which—viz., *G. inermis*, 'sans aucune trace d'une corne pariétale'—does not appear to be a *Gaetanus* at all.

Size.— ♀ (Cephalothorax, 3·72; Abdomen, 1·02 mm.), 4·74 mm.

Occurred in my Atlantic collection of 1904 at Lat. 44° 5′ N., and Long. 20° 34′ W.

GENUS LUCICUTIA. (*Giesbrecht.*)

Lucicutia Grandis. (*L. grandis*, Gbt., *Bull. Mus. Harv.*, v., 25; Gbt. and Schmeil, 'Das Tierreich,' p. 111; Wolfenden, *Journ. Mar. Biol. Assoc.*, April, 1904.) Plate II.

♀ 7 mm. long, or a little over. Cephalothorax of five segments; *head* separate from first thoracic segment; the last thoracic segment rounded on each side; the dorsum of the front segments rather gibbous. Genital segment very prominent, and with large ventral swelling. *Furcal segments* six times as long as broad. Proportionate length of abdominal segments, 6 : 4 : 3 : 4 : (and furca) 12. The latter about six times as long as broad.

Anterior Antennæ of twenty-five joints, with very many very long æsthetasks.

Posterior Antennæ with endopodite longer than the exopodite.

Mandibles with endopodite longer than the exopodite, the second basal and endopodite extended.

Maxillæ: first outer lobe with five bristles, exopodite large and oval; masticatory plate with strong teeth; B 2 with three bristles.

Swimming feet: all pairs with three-jointed exopodites and endopodites; the second basal of the first pair with a tubal process; the fifth pair with curved Heterochæta-like bristle on the inner side of the second segment of the exopodite.

Many examples appeared in the *Gauss* collection even down to the southernmost stations. The females are, I believe, identical with the examples I captured in the Atlantic, off the West Coast of Ireland, in 1904, and described by me in the *Journ. Mar. Biol. Assoc.*, April, 1904. The ♂'s agree with Giesbrecht's *L. grandis* ♂ described by him in *Bull. Mus. Harv.*, v., 25. The female was hitherto unknown. (See note appended, Lucicutia.)

GENUS HETERORHABDUS. (*Giesbrecht.*)

Heterorhabdus Grandis. (Wolfenden, *Journ. Mar. Biol. Assoc.*, April, 1905.) Plate IV.

♀ 7 mm. long (CT over twice as long as Abd.). Last thoracic segment ending in rounded produced margins anteriorly. Genital segment as long as the next three, and rather protuberant ventrally; fine pectinations on Abd. 1 and 2.

Anterior Antennæ about four joints longer than the whole body; twenty-fourth two and a half times as long as the twenty-fifth.

Posterior Antennæ with Ri longer than Re.

Mandibles with Ri longer than Re; no thickened teeth, all equidistant.

Anterior Footjaws with fifth lobe a little longer than the fourth. The three bristles of lobe 4 are long and thin, with wide-apart hairs; only the distal bristle of lobe 5 is a hook with comb hairs on the inner margin. It is shorter than its two fellows (with wide-apart marginal bristles), and the proximal thin and sparingly feathered bristle is the shortest and finest of the four. Of the three bristles of lobe 6 the anterior one is a delicate hook with comb bristles on the inner margin. The bristles of Ri are long and thick, two of them as long as the hook of the sixth lobe.

Posterior Footjaws without spine on B 1.

Maxilla rather Calanoid in form; Le 1 with five long and two short proximal bristles; Li 1 broad, with eight delicate hooks and four bristles; Li 2 small, with one bristle; Li 3 with three bristles; B 2 short and broad, with four marginal bristles; Ri large and unsegmented, with nine bristles; Re large, oval, with six long thick and five very thin apical bristles, the two proximal very long.

Third foot has the Re 3 wider than in the second and fourth pairs; the end-saw only one-third the length and curved at the tip.

Fifth feet comparatively short; Re 3 not as long as the two proximal joints, with two outer marginal spines, four Si, and a short end-saw with unserrated edge; Re 1 and 2 without Si; at the outer distal margin of Re 2 are two strong upright curved teeth, the outer one the largest.

Ri with segments not very unequal; Ri 2 a little the longest; the outer distal margins of Ri 1 and 2 prolonged into short spines, the Si of these segments short, and not thicker than the other bristles, but quickly tapering to delicate whiplike bristles and densely haired.

Two adult females occurred at 400 and 700 fathoms respectively in the deep Atlantic trough west of Ireland. Both were very transparent, and the chitin covering apparently thin.

♂ a little less than the female. Plate IV.

Anterior Antenna (the geniculating) with a spine on the joint before the elbow, nearly parallel to the segment, not extending to the end, and with four segments beyond the geniculation.

Oral organs like the female.

Fifth feet very peculiar and characteristic.

Right foot: B 2 with upright lamellar process, small, and haired on inner margin; Re 2 very globular proximally, with a very stout, broad-based, short, and rather curved spine, and short tooth below it; Re 3 rather oblong and short, with hump on external distal margin and rather long spine arising from the inner margin.

Ri 2 broad in the middle, the inner margin very convex.

Left foot: B 2 with globose swelling of inner margin, with short marginal hairs; Re 2 with strong spine on the inner margin, and longer thinner spine below it; Re 3 with stout

inner marginal spine, two short apical spines, and continued into a very stout, long spine bent over like a hook.

Ri 2 large, broad, and distally with a bilobed lamellar appendage.

Several examples occurred in a *Gauss* gathering at station, October 9, 1903, both males and females, and are identical with the specimen described before.

Heterorhabdus Grimaldi. (Richard, *Bull. Soc. Zool. France*, vol. xviii., p. 151.)

♀ 9·0 m. long (CT = 6·6; Abd. = 2·4). Ce rounded with papilla; no spine. Genital segment large, and with prominent ventral swelling.

Anterior Antennæ reach beyond the end of the genital segment, last joint very small, last but one three times as long and about ten times as long as broad.

Posterior Antennæ with Ri much longer and thicker than Re.

Mandibles with outer tooth thickened, alike in both.

Anterior Footjaws resemble those of the ♂; the strong, broad hooks of the fifth and sixth lobes similar.

Posterior Footjaws without spine on B 1.

Maxillæ as in the ♂, only Li 1 has nine weak hooks.

Third and fourth feet alike.

Fifth feet very squat; Re short, with broad segments; Ri short, and the bristles of Re 1 and 2 short, not thicker than the others, but stiff and haired in the distal half. End-saw of Re 3 short, only one-third as long as Re 3.

This, the largest *Heterorhabdus* known, is distinguished from all other members of the group to which it belongs (*grandis*, *major*, *longicornis*, *brevicornis*, *vipera*) by its size and the peculiar character of the long hooks of the Anterior Footjaws. It would closely agree with the *H. Grimaldi* of Richard, except that the fifth feet appear to differ somewhat.

The ♂ resembles the ♀ generally, and is 9·0 mm. long. Plate IV.

The *Anterior Footjaws* have the proximal lobes small; the fourth with three thin bristles, and a fourth thin but rather longer; the fifth elongated, with one very thick strong curved hook with about six strong teeth wide apart, and one thin bristle; the sixth lobe short, with a hook similar to the foregoing lobe, but weaker; the Ri with four bristles of unequal length, the longest only three-quarters the length of the hooks.

The *Maxillæ* with very large and oval-shaped Re, with five very long and thin bristles; Ri with six, B 2 with one, Li 1 with four or five weak hooks, Li 2 with one; no Li 3.

Third and fourth feet similar.

Fifth feet: Ri 2 not elongated, and about same length as Ri 3; Ri 2 and 3 very broad in proportion to length, with respectively two and six similar bristles.

B 2 on *right* side with prominent upright enlargement, with stiff hairs over most of the margin; Re 2 with prominent ovoid enlargement of the inner margin, with distal tuft of hairs; Re 3 only a little longer than Re 2, curved, ending in a rounded point with short stiff bristle not half the length of the joint.

On *left* side: B 2 with rounded inner margin, thickly beset with hairs; Re 2 and 3 about equal, curved; Re 3 with rounded end and stiff short prolongation resembling a spine.

The ♂ of this very large species has hitherto remained unknown, and the species itself has been regarded as rather doubtful, but there is no doubt that it is a good species.

It occurred at the *Gauss* station, October 8, 1903, 3,000 metres, and several others.

Heterorhabdus Major. (Dahl, *Verh. d. Zool. Gesellsch.*, p. 79.) Plate IV.

Only briefly mentioned in Giesbrecht and Schmeil's 'Tierreich': 'Sonst verwandt mit *H. longicornis* aber L über 5 mm.,' and noted by Dahl (*Verh. d. Zool. Gesellsch.*, p. 94, 1894) as having 'Posterior Footjaw with weak bristles, long tap lobe on Anterior Footjaw, teeth of Mandible little different in thickness; Re of third pair like second and fourth. Anterior Antennæ very long, and over 5 mm.'

A ♂ occurring at *Discovery* station, November 6, 1902, was 4·8 mm. long; *Anterior Antennæ* very long; Mandible teeth alike, and not thickened; *Anterior Footjaws* with the fifth lobe elongated; thick hook without combs; one thick hook on the fourth lobe, smaller than that of the fifth lobe; the bristles of Ri very long. *Posterior Footjaws* without spine; *Maxilla* of Heterorhabdus type.

Third feet like the fourth.

Fifth feet peculiar: right foot with long upright process on B 2, haired marginally; Re 2 broad, with marginal projection; Re 3 with stout based apical spine; right Ri with very narrow Ri 2; Ri 3 comparatively broad; Ri 2 with thick marginal bristle.

Left foot: B 2 with haired marginal projection; R 3 with long, stout, apical spine, three-quarters the length of the Re, and short distal inner marginal spine; Ri 2 broad, with rather thick marginal bristle.

I suggest that this may be the ♂ of Dahl's species. It naturally falls into the group to which it and *longicornis* belong, and is certainly not the latter.

Heterorhabdus Brevicornis. (Dahl, *Verh. d. Zool. Gesells.*, p. 59.)

This species is little more than mentioned by Dahl, and described as like *H. vipera*, only the series of spines on the B 2 of the Maxillipedes are finer, thicker, and longer; the last but one joint of the Anterior Antennæ is not double (in place of three times) as long as broad (Giesbt. and Schmeil, 'Tierreich,' p. 116).

♀ 2·55 mm. long. CT nearly four times as long as Abd., and very broad (more than half as broad as long); head with frontal papilla; furcal segments short, but asymmetrical. *Anterior Antennæ* not as long as the CT, the last joint but one about four times as long as broad. *Posterior Antennæ* with two very thick bristles on the inner margin of the B 2. *Mandibles* thickened outer teeth. *Maxilla* of Heterorhabdus type, Ri extended with three bristles, B 2 small, and with two bristles, Re small with five bristles, Le 1 with five bristles, Li 2 with two,

Li 1 very large. *Anterior Footjaws* with the fourth lobe with two long bristles and short proximal bristle; fifth lobe very long, with long curved comb bristle; sixth lobe with a thinner comb bristle; bristles of Ri long.

Posterior Footjaws without spine bristle.

Third feet broader than the fourth.

Fifth feet with very thick slightly curved inner marginal bristle on Re 2.

Ri 2 not lengthened, and all bristles of Ri similar.

I assume this to be the same animal as meant by Dahl under the above name. (*Gauss* station, November 12, 1903, 3,000 metres.)

Heterorhabdus Brevicaudatus (*nov. sp.*). Plate IV.

♀ 3·15 mm. long. Head with papilla, but no spine. Cephalothorax a little over twice as long as Abd. Genital segment very protuberant.

Anterior Antennæ as long as the body. *Posterior Antennæ* with Ri three times as long as Re and much wider.

Mandibles with Ri longer than Re, basal longer than wide, masticatory plates with outer teeth, not thickened, and about equidistant.

Anterior Footjaws with hook on the fifth lobe (not toothcombed, but with short bristles on the convex outer side); sixth lobe with similar but weaker hook; one simple bristle on this lobe, and two very thin bristles on the fifth lobe. Bristles of Ri very long.

Posterior Footjaws without spine on B 1.

Maxillæ like those of *H. grandis*. Li 1 large, with nine hooks and three bristles; Li 2 large, with two bristles; Li 3 with one bristle; B 2 has two, Ri has four, and the Re is very large and oval (bristles defective). Le 1 with straight margin and four bristles.

The third foot is not broadened, but resembles the fourth.

The fifth have broad Re; Re 1 without Si, Re 2 with thin curved inner distal bristle about as long as the Re 3.

Ri with outer distal margins of first and second segments strongly produced into spines, the Si of all three segments alike.

In the structure of the mouth organs (Post. Ant., Mandibles, Footjaws, Maxillæ), this animal resembles the type, *H. grandis*.

It was captured in June, 1903, in the Atlantic, south-west of Valencia, at 375 fathoms.

Heterorhabdus Profundus. (Dahl, *Verh. d. Zool. Gesellsch.*, p. 80.) Plate IV.

This species again has only been briefly described by Dahl, and Giesbrecht and Schmeil (*loc. cit.*): 'Verwandt mit *H. norvegicus*: aber: die distale Borste am Engl. des rechten Exp. des 5 B des ♂ sagt weit über das Gliedende hinaus: das proximale Stück des Endgl. des linken Exp. ist verdickt und trägt aus Innenrande eine Borste, die bis zur Mitte des Gl. reicht.—L.'

♂ 3·2 mm. long; Abd. 1·2·3, with margins of segments pectinated. Head with small papilla. *Anterior Antennæ* with five joints beyond the elbow, reaching a little beyond the

furca. *Posterior Antennæ*, Ri longer than Re. *Mandibles* with strongly thickened outer teeth. *Anterior Footjaw* with one comb hook on lobe 6, one on lobe 5 with a file bristle very nearly as long, on the fourth lobe two file bristles and one bristle half the length; bristles of Ri at least half as long as the last comb bristle. *Posterior Footjaws* with curved spine bristle on B 1 as long as the rest of the organ. Fifth feet of *norvegicus* type, but differing.

Right Re with long, narrow, upright, curved and marginally-haired process on B 2; Re 2 with projection haired at tip, and second projection below it, with two very short teeth on the distal margin, leaving a triangular space between these two projections; Re 3 rather long, outer distal end rounded, with short spine, and internal to it a rather long bristle reaching a long way beyond the end of the segment.

Left foot B 2 convex and haired marginally, Re 1 and 2 with strong triangular outer marginal spines; Re 3 broadened below, gradually tapering to a long curved spine, an inner marginal bristle arising in the middle of the broadened part and half the length of the terminal bristle; the outer distal margin of Re 3 with short strong spine.

Ri 2 of both sides very long.

Occurred at *Gauss* station, March 23, 1903, 400 metres.

The diagnosis between this species and *H. abyssalis* and *norvegicus* is not easy.

Heterorhabdus Austrinus ♂ (*nov.*). (*H. austrinus*, Gbt., '*Belgica*' *Report*). Plate IV.

The ♀ of this species has been described and figured by Giesbrecht.

The ♂ is 4·0 mm. long, head rounded, with frontal papilla.

Anterior Antennæ (geniculating left) with four joints beyond the elbow, the first two very long, the last but one three times as long as the end joint.

Mandibles with thickened outer teeth.

Anterior Footjaws with very long tap lobe, two distal comb hooks, long but rather weak; the fourth lobe with a shorter hook bristle and two others, the proximal of which is only about half the length of the comb; bristles of Ri about three-quarters as long as the last comb.

Fifth feet quite peculiar. Right B 2 strongly projecting and rounded, with fine marginal hairs proximally, Re 2 with protuberance of peculiar shape.

Re 3 short and wide, with short end spine not as long as the segment. Left foot with basal wide but without process; Re 3 with short terminal spines on inner margin and short, very thick curved process arising about the middle of the segment, armed on the lower surface with short broad teeth. Ri of both sides with broad but not very unequal segments, the marginal bristles similar.

Heterorhabdus Atlanticus (*nov. sp.*).

♂ 3·7 mm. long (CT 2·4, Abd. 1·3). Ce with frontal papilla. *Anterior Antennæ* only reaching a little beyond the end of the genital segment. Clasping antenna with four joints

distinct beyond the elbow, respectively long 50 : 48 : 22 : 10, the last but one four and a half times as long as broad, the last three as long as broad. Relative length of the last five joints of the normal antenna, 19 : 18 : 20 : 12 : 9, the last but one two and a half times as long as broad. Antennæ clothed with long æsthetasks. *Posterior Antennæ* with Ri much longer than Re. *Mandibles* with Ri longest, teeth not thickened, and equidistant. *Marilla* of ordinary type, long Re (oval) with six bristles, Ri small with four, B 2 with two, Li 2 with two, Li 3 with one bristle. *Anterior Footjaws* weak, fifth lobe with a curved hook, combed, and two short, thin bristles; sixth lobe with hook without combs, but wide apart, short bristles on both sides. *Posterior Footjaws* thin, without curved spine on B 1.

Third feet like fourth.

Fifth, B 2 of right foot with short distal projection, upper half of margin haired; Re 2 with long process, haired distally, and carrying a short, rather thick bristle; Re 3 short, square, and with very thick long bristle at the distal inner margin. Left foot with B 2 only slightly projecting, and with fine marginal hairs; Re 2 with two long, thin spines; Re 3 continued into a curved hook with a long spine (more than half its length) internal to it. Ri of right side with second joint elongated, and very thick and long inner marginal bristle. Ri of left side with very elongated second joint, but no marginal bristle.

It belongs to the same group as *H. major* and *longicornis*, except for the short fifth lobe of the anterior footjaw. The antennæ and fifth feet are entirely different from *H. longicornis*. It differs from *vipera* in mandibles, third and fourth feet and fifth feet, and also from *brevicornis*, Dahl; from *brevicaudatus* in being larger, and especially in the maxilla, which is distinctly Heterorhabdoid in form, the former being Calanoid. It occurred in the deep water (600 fathoms) of the Atlantic off the West Coast of Ireland (St. E. 15, 1903). It is only provisionally regarded as a new species, which may ultimately prove to be incorrect, but certainly does not appear to quite agree with any known species.

GENUS HALOPTILUS. (*Giesbrecht.*)

Haloptilus Ocellatus (*nov. sp.*). Plate V.

♀ From tip of frontal spine to end of furca 8·75 mm. long (CT 7·5 mm., Abd. 1·25). Furca over three times as long as broad; first cephalothoracic segment longer by one-third than the remaining segments of the anterior body; last two segments of the thorax united. On the second thoracic segment, in the middle of the back, is a rounded pigment spot, a so-called 'ocellus,' giving a very characteristic appearance to the animal, with its transparent body and black 'ocellus.' The frontal spine is extremely long, broad-based, tapering, and curved a little downward distally. The distance from the tip of the spine to the base of the antennæ is equal to the distance between the base of the antennæ to nearly the distal end of the second cephalic segment.

Anterior Antennæ reach about four joints beyond the furca.

Posterior Antennæ, Re with six segments; only a faint indication of division of the most distal segment (which would make seven); the first segment very long, and nearly as long as the distal five joints.

Maxillæ with small and one-jointed Ri carrying five bristles, the outermost of which is much the longest and stoutest.

Anterior and Posterior Footjaws like *H. ornatus*.

All feet with Re and Ri of three segments each; the fifth feet with Re 2 with bristles resembling Re 3.

This copepod is most nearly related to *H. spiniceps* and *H. ornatus*, but is distinguished by great size, the dorsal 'ocellus,' the Ri of the maxilla, the fifth feet, and the length of the anterior antennæ. It occurred with frequency in the *Gauss* collections made in the South Atlantic to the more southerly stations.

GENUS LUBBOCKIA.

Lubbockia Minuta (*nov. sp.*).

One example only occurred in a vertical haul from 500 fathoms off the West Coast of Ireland.

♀ length 1·3 mm. (Cephalothorax 0·6, Abdomen 0·7), the head scarcely at all produced, and rounded. The head only partially divided by dorsal line from the first thoracic segment; last thoracic segment rounded. Abdomen of four segments, of respective lengths of 22 (genital), 15, 17, 8. Furca 11; the latter about five times as long as broad.

Anterior Antennæ distinctly of seven joints of respective lengths—

1	2	3	4	5	6	7
4	4½	3	6	3	2½	2½

and very short. *Posterior Antennæ* with the endopodite one-third longer than the basals, carrying six bristles at the distal margin, of which one (marginal) is as long as the endopodite. On the opposite margin are two bristles, one short proximal, and one comparatively long distal one.

The *Posterior Footjaws* claw-shaped, but without any spines on the claw (as in *L. Squillimana*).

The swimming feet in all pairs (except the fifth) with the endopodites and exopodites distinctly of three segments, the latter much shorter than the endopodites; but in the first and second pairs the last segment bearing three marginal spines as well as the terminal saw, thus differing from *L. Squillimana* and *aculeata*, in which this segment in all feet bears only two marginal spines; the two distal spines rather close together, the proximal the shortest.

The third and fourth feet in this species have only two marginal spines on the last segment of the exopodite; fifth pair of feet very slender and short, the inner distal bristle (the largest) not being much more than half the length of the genital segment, lancet-shaped, but not so broad as in *L. Squillimana*; the outer bristle simple and short.

The animal differs from both *L. Squillimana* and *aculeatus* in its very much smaller size, its seven-jointed antennæ, the spines of the swimming feet,* and the small fifth pair; and also in the segmentation of the abdomen.

GENUS MORMONILLA.

Mormonilla Atlantica (*nov. sp.*).

Size of ♀ 1·2 mm. to 1·3 mm.; the cephalothorax not quite three times as long as the abdomen, the furca the same length as the latter; the Anterior Antennæ a very little longer than the cephalothorax, in all specimens examined, of four segments; these two segments together shorter than the middle segment (as 21 : 27). The long furcal segments are marginally divided by the external bristle into portions of which the distal is five times as long as the proximal.

First, second, and third feet with three-jointed exopodites; the endopodite of the first pair three-jointed, of the second pair two-jointed, of the third and fourth pairs one-jointed. In the fourth pair the exopodites are, however, only two-jointed, resembling *M. minor*, Gbt. The segmentation of the feet differs, however, from that of *M. minor* ♀ as follows:

	Mormonilla minor.	*Mormonilla atlantica.*
First pair,	Re=3, Ri=2	Re=3, Ri=3.
Second pair,	Re=3, Ri=2	Re=3, Ri=2.
Third pair,	Re=3, Ri=1	Re=3, Ri=1.
Fourth pair,	Re=2, Ri=1	Re=2, Ri=1.

The mouth parts resemble the same organs in *M. minor*, Gbt.

But for the different segmentation of the feet and the distinctly four-segmented Anterior Antennæ there would have been no hesitation in regarding this as identical with Giesbrecht's *M. minor*. The latter examples were taken from the Pacific. The specimens here referred to, of which there were about a dozen, were taken in a vertical haul with the open net from 500 fathoms to the surface at a station (E. 6) off the South-West Coast of Ireland. Having regard to the structural differences of the swimming feet as well as the very different localities of distribution, it is perhaps better to regard this as a new species, rather than a variety of the Pacific form.

* First foot, Re 3 with three spines and four inner bristles; Ri 3=Ri 1+2; not longer than Exop.

Second foot, Re 3 with three spines and five inner bristles; Ri 3<Ri 1+2; Re and Ri nearly equal length; saw as long as whole Re.

Fourth foot, Re 3 with two spines and five inner bristles; Ri 3<Ri 1+2; Ri much>Re; saw as long as whole Re. In *L. Squillimana* and *aculeata* Re with 1, 1, 2 spines in all pairs.

GENUS EUCHIRELLA. (*Giesbrecht.*)

The *Gauss* collections are rich in examples of this genus, several new species occurring. In Sars' latest work, *Bulletin du Musée Océanographique*, March 20, 1905, four new species of *Undeuchaeta* are mentioned, which I think should undoubtedly be referred to the genus *Euchirella*.

In the allied genera *Gaidius*, *Gaetanus*, *Euchirella*, the characters of the modified tubal or spine appendages of the first basals of the fourth feet form a useful and satisfactory generic distinction. *Euchirella* is distinguished by the constant occurrence of such spines in all except one species, and another strong generic character is found in the structure of the *Posterior Antennæ*, in which the *Ri* varies from a rudimentary structure to not more than half to three-quarters the length of the *Re*.

Both types of *Undeuchaeta* hitherto known (*U. major* and *U. minor*) are distinguished generically by the peculiar characteristics of the *abdominal segments* (spines on the genital segment), the total absence of spines on the *fourth feet*, the unequal length of the bristles of the Re of the Maxilla, and the more equal size of the *Re* and *Ri* of the *Posterior Antennæ*; while the characters of the genus *Euchirella* differ in all these respects—no spines on the genital segment, spines on the fourth feet (in all except one species, *E. carinata*), equal size of the bristles of *Re* of the *Maxilla*, and very short *Ri* of the *Posterior Antennæ*. The species enumerated by Sars (*U. dubia*, *U. scopularis*, *U. pustulifera*, *U. obtusa*) answer to these generic characters, and the variable segmentation of the rami of the first and second feet is not of great generic value, since in several genera of this subfamily this is rather inconstant.

Euchirella Hirsuta (*nov.*). Plate VI.

♀ 8·5 to 9 mm. long. Cephalothorax over five times as long as Abd. *Head* moderately narrow in front, rounded, without crest, but with short and strong rostrum. Last two segments of the thorax imperfectly divided, the posterior one prolonged laterally into blunt triangular wings, rounded at the tips. Abd. very short, with large genital segment, as long as the next three, and very broad.

Anterior Antennæ long, reaching nearly to the furca.

Posterior Antennæ with Ri a little more than half as long as Re, the Ri with eight and six bristles. *Maxillæ*, Ri with fifteen, B 2 with five, Re with eleven bristles. *Posterior Footjaws* with lengthened B 2, over seven times as long as broad: B 1 : B 2 : Ri = 19 : 30 : 12.

First feet, Re with three segments; second feet, Ri distinctly two; fourth feet, Bi 1 with prominent cushion, on which are fourteen strong and equal teeth; the second and third segments densely covered with short hairs. The margins of the last thoracic segment and the abdominal segments are very hirsute.

Several examples were met with in the *Gauss* collection from Station 12, November, 3,000 metres, to 13 February, 1903.

Specimens from the Southern Ocean are rather larger (9·8 mm.) than those from the Atlantic.

Euchirella Rostrata, *var. Magnus.*

The ♀, 6·2 to 6·5 mm. long, resembles the *E. rostrata* of the Mediterranean and Faroe Channel in all particulars except its large size, which is constantly nearly twice as great as the Mediterranean samples.

Euchirella Venusta (Gbt.).

♀ 4·8 mm. long; very rounded *head* with strong rostrum, but no dorsal crest; last two segments of the thorax partially divided; lateral margins evenly rounded, with a few rather long marginal hairs. Abdomen more than one-third as long as CT. Genital segment protuberant ventrally and dorso-laterally; swollen on the right side with prominent projection. Anterior Antennæ reaching nearly to the furca; Posterior Antennæ with Ri quite rudimentary, bearing seven very short bristles. First feet, Re only two, with three spines; second feet, Ri = 1; fourth feet with two stout spines on B 1, the proximal rather the largest.

Probably identical with Giesbrecht's Pacific Ocean species.

Euchirella Maxima (*nov.*). Plate VI.

♀ 8·7 mm. long. *Head* with strong frontally-directed triangular crest, and in front with small rostrum. *Anterior Antennæ* reaching beyond the end of the thorax, the last segment of the latter ending in front in small triangular wings with points. Head and first thoracic segment united, last two segments separate, but the hinder one very small. *Abdomen* one-fourth as long as the cephalothorax; genital segment large, and with strong protuberance in the centre ventrally and below, excavated above (short spermatophore attached). *Posterior Antennæ* with Ri very short, only one-fourth the length of Re, and with five and five very short naked bristles, the outer ones twice as long as the inner.

Maxillæ, B 2 with two very short bristles; Ri 1 with one; Ri 2 with three; Re with eleven. *Basals of fourth feet* with one strong, thick-based, short and curved tooth.

This copepod occurred at September 26, 3,000 metres, and September 30, 1,500 metres, *Gauss* stations.

Euchirella Brevis (?). (Sars, *E. brevis; Bull. Mus. Océanog. de Monaco*, No. 26.) Plate VI.

♀ 3·65 mm. (Cephalothorax, 3·1; Abd., ·55). The *head* rounded and broad, without dorsal crest, and with small rostrum. The *Abdomen* extremely short, not much more than one-sixth the length of the cephalothorax; the first (genital) segment very broad, and distally ending in a point dorsally, the second and third crowded together. The *Anterior Antennæ* not reaching the end of the thorax. *Posterior Antennæ* with almost rudimentary Ri

of two segments, and three very short apical bristles. *Mandibles* with broad B 2, with extraordinary thick curved hook on the inner margin. *Maxillæ*, B 2 with two, Ri with four, Re with seven bristles.

Fourth feet, B 1 with seven extremely short but broad-pointed spines.

It occurred at many of the *Gauss* Atlantic stations, and the characters of the mandible are quite distinctive.

But for the difference in the number of spines on the basals of the fourth feet and in the length of the antennæ, I should have little hesitation in regarding this as identical with the species referred to by Sars.

Euchirella Elongata (*nov.*). Plate VI.

♀ 7·7 mm. long (CT, 6·0 mm.; Abd., 1·7 mm.). *Head* evenly rounded, and narrower dorsally than the distal portion of the first segment, produced in front into a short, but strong, one-pointed rostrum; no crest. Head and first segment only partially divided; last two segments separate, the last one prolonged into triangular wings ending in points, the tips curved inwards, the right more so than the left. *Abdomen* with segments pectinated at distal margins; genital segment a little swollen below laterally, but genital orifice on slightly elevated cushion in the upper half of the segment.

Anterior Antennæ not longer than the thorax, and of only twenty-two distinct segments, 1∽2, 8∽9, 24∽25. *Posterior Antennæ* with Re about twice as long as Ri. *Anterior Footjaws* and *Maxillæ* of *Euchirella* type, the latter having B 2 with five, Ri with fifteen, Le 1 with seven long and two short, and Re with eleven equally long bristles. *Posterior Footjaws*, B 1 : B 2 : Ri = 16 : 28 : 8, the B 2 slender, and seven times as long as broad.

First feet, Re = 3, with three spines; second feet, Ri = 1; fourth feet with seven large thin spines on B 1, the inner longer than the outer.

This copepod occurred at *Gauss* station, March 10, 1903.

Euchirella Spinosa (*nov.*). Plate VI.

♀ 6·2 mm. long (CT, 4·7 mm.; Abd., 1·4 mm.). *Head* rounded, with short, strong, one-pointed rostrum; two last thoracic segments united, the last one having laterally short, strong spines directed downwards and about half the length of the genital segment; the abdominal segments fringed distally with pectinations, the genital segment not swollen laterally and only a little ventrally in the upper part. *Anterior Antennæ* not as long as the body, of twenty-three segments, the twentieth smaller than the twenty-first or nineteenth segments. *Posterior Antennæ* with Re twice as long as Ri. *Posterior Footjaws*, B 1 : B 2 : Ri = 12 : 23 : 7. B 2 very attenuated, eight times as long as broad. The mouth organs of *Euchirella* type. First feet, Re 1 and 2 imperfectly segmented with three spines, the first very thin and delicate. Second feet, Ri = 2. Fourth feet, B 1 with a cushion carrying thirteen or fourteen strong spines, the inner ones rather longer than the outer.

The short, strong spines of the last thoracic segment of this species are distinctive. It occurred at *Gauss* station, October 8, 3,000 metres.

Euchirella Atlantica. (*E. curticauda, var. Atlantica*; Wolfenden, *Journ. Mar. Biol. Assoc.*, April 1, 1904.)

In a former paper I described this as a variety of *E. curticauda*, Giesb., and remarked that it might perhaps be considered to be a new species. In my plankton from the station Lat. 42° 01′ N.; Long. 10° 48′ W., in 1904, I have again met with the same copepod. The difference in the spinulation of the fourth feet being constant, I think it must be regarded as a new species. The *head* is armed with a triangular and prominent helmet-shaped crest directed forwards; rostrum is absent, the genital segment very protuberant, the anal segment with dorsal prolongation between the furcal segments; the whole abdomen very short, only one-eighth as long as the cephalothorax; last two thoracic segments only partially separate. *Anterior Antennæ* about as long as the body. *Posterior Antennæ* with Ri almost rudimentary, with three and two very short, weak bristles distally. Re 1 with marginal tubercle. *Maxillæ*, Ri with only three bristles. First feet, Re only two segments, with three Se. Second feet, Ri only one segment. Fourth feet with six short spines on the first basal.

The resemblance to *E. curticauda* is very great, this being, however, a Pacific Ocean species.

Size.— ♀ 4·08 mm. (CT, 3·6; Abd., 0·48 mm.).

GENUS CORNUCALANUS (*nov.*).

This is very nearly related to *Xanthocalanus*, but chiefly differs in the shape of the head and the extraordinary claw-shaped appendages of the Posterior Footjaws. As in all *Xanthocalanidæ*, the last lobe of the Anterior Footjaws carries a strong hook, which is characteristic of the genus mentioned, only in *Cornucalanus* it is of quite exceptional size and strength. The Ri of this organ is furnished with seven brush sensory appendages and one long vermiform appendage, and there is a similar brush appendage on the Posterior Footjaw. The head is quite characteristic, with a strong, though short, dorsal horn. In the lateral view the front is square-shaped, and the appearance of the head is like a *Gaetanus* with small horn. The mouth has a very large epistomal process, strongly haired. Feet segmented as in *Xanthocalanus*, with a pair of very small and almost rudimentary fifth feet. While resembling *Xanthocalanus* in many particulars, the form of the head and the Posterior Footjaws especially are so different as to justify its inclusion in another, though very closely allied, genus.

So far as I understand Sars' description, this does not appear to agree with his genus '*Onchocalanus*' (*Bull. du Musée Océanographique de Monaco*, March 20, 1905), which is characterized by rostral appendages formed of 'bifurcated chitinous lamellæ, Anterior Footjaws

ending in a very strong and acutely curved claw, Posterior Footjaws "grêles et allongés," all feet covered with fine spines.'

In *Cornucalanus* the character of the head with its dorsal horn is quite distinctive. A strong hook on the last lobe of the Anterior Footjaw, simple or elongated Posterior Footjaws, the surfaces of the segments of the feet densely spinose and hirsute, are characteristic of *Xanthocalanus*, of which many examples occur in my collections. Brush sensory processes on the footjaws, especially the Ri of the Anterior Footjaws, are especially characteristic. These are not, however, mentioned by Sars in his description.

Cornucalanus Magnus (*nov.*). Plate VII.

♀ 8 mm. long. CT over three times as long as the Abdomen.

Head with strong, short, dorsal horn, and between that and the rostrum the line almost straight, and head very square. A strong, short, bifurcated rostrum. Prominent epistomal processes.

Ce—Th 1, and Th 5 only partially separated from Th 6. The last thoracic segment produced laterally into triangular wings with blunt rounded margins projecting well over the genital segment.

Abdomen short and of four segments, and very hirsute.

Anterior Antennæ not longer than the cephalothorax, of twenty-four segments.

Maxillæ like *Xanthocalanus*, well shaped Re with ten, B 2 with five, Ri with nine bristles.

Anterior Footjaws, proximal lobes crowded together, posterior margin proximally excavated, with strong prominence in front, last lobe produced into very strong, thick, and long-curved claw, with three bristles (two short, and one as long as the claw) at the end of the lobe (and base of the claw). Ri small, with seven brush sensory processes and one long vermiform appendage.

Posterior Footjaws, B 2 with teeth along proximal part of the inner margin, bristles very small; Ri 2 large and with Ri 3, each carrying a strong, thick, curved claw, with teeth set wide apart. B 1 with a brush sensory appendage.

Feet all with broad segments. First pair Ri 1 with a bunch of spines on the distal outer margin. Second pair Ri 2, each with bunches of strong spines on the surface, the segments of Re very broad (Re 3 is three-quarters as broad as long), end-saw larger than Re 3; strongly toothed, and as in the fourth pair, with a second row of teeth basally.

Fourth pair with bunches of spines on the surfaces of Re 2 and Ri 2, all the segments with many small prickles.

Fifth pair exceedingly small, and not longer than the B 1 of the fourth pair. Each of three segments, not very distinctly divided, with scattered and not dense marginal hairs, and one terminal short spine, into which the last joint is apparently produced.

♂ 5·8 to 6 mm. long. Head without the dorsal spine and roundly oval, broadly triangular, separated from CT 1 by a faint dorsal line; last segment produced into lateral wings like the female. Abdomen of five segments.

Anterior Antennæ of twenty-three joints, the twentieth very small and not half the length of

the nineteenth; basal joints thick and well supplied with bristles and æsthetasks. Oral organs somewhat retrograded and footjaws without claws. First, second, third feet like the female, but fourth pair unsymmetrical: on one side Re with only two segments and no Se distally, and with only five bristles apically and on the inner margin; the opposite foot normal, with three segments in Re. (This is probably abnormal development.) Fifth feet, right comparatively very long; two broad basals; Re 1 long and narrow, with rudimentary Ri, and Re 3 represented by a long stylet process. Left foot shorter, of four segments, the end segment long and narrow, square-ended, with short spine at the end. This was found in a sample containing only females of the former species, and is probably the male of the same.

This species occurred in several of the *Gauss* samples.

Cornucalanus Simplex (*nov.*).

Whether this should be a new species or only a variety of the former is difficult to say, only one example having been met with. From the form of the genital segment it appeared to be adult, and the only essential difference between the two is the entire absence of dorsal cephalic horn and the evenly rounded oval head. Claws on the Anterior and Posterior Footjaws occur precisely as in the former species, and the structure of the feet is similar.

[Note.—In 'Ann. and Mag. N. Hist.,' vol. xii., p. 21 and Table V., is described by I. C. Thompson a copepod which probably belongs to this genus, but is named by Thompson *Scolecithrix chelifer*. The description is very unsatisfactory. The Anterior Footjaw is figured and described as a mandible, and the maxilla as the Anterior Footjaw. From the drawing of the Posterior Footjaw, the two strong terminal claws seem to resemble the same organs in the species above described, but no dorsal cephalic spine is mentioned. The species, however, is probably not a *Scolecithrix*. The specimens appear to have been immature males, according to Thompson of 6·0 mm. length.

Note to Page 8.

The brief description of *Lucicutia grandis* ♀ published by me in April, 1904, was followed by the publication of the description of *L. maxima* by Steuer in *Zool. Anzeiger*, in June, 1904. As he was apparently unaware of my earlier publication, so was I unaware of his article in the *Zool. Anzeiger* until recently. I have in my possession a large number of examples of *Lucicutia*, varying in size from 5 mm. to 7 mm. length—none so large as Steuer's example of 8·7 mm. length—and the discrimination of these species is by no means easy. I am of the opinion that *L. grandis* ♀ described by me (*loc. cit.*), the ♂ of which was originally described by Giesbrecht, and *L. maxima* of Steuer are one and the same animal. There is a second species, which I shall mention further on, which must, I think, be regarded as distinct; but with regard to *L. grandis vel maxima*, it does not seem rational to make any distinction between the specimens (of adult females) between those of 5 mm. and those of 7 mm. length. The variations in important particulars in this genus are considerable, and have already been drawn attention to by Giesbrecht (in the 'Fauna u. Flora, Neapel.,' vol. xix., p. 359). Especially is this the case

with *L. clausi*, in some examples of which Giesbrecht met with teeth on the sides of the head, 'resembling *Pontella*,' while in others the side hooks were replaced by 'Ausbuchtungen,' or these failed altogether. The length and breadth of the body, and the proportions of thorax to abdomen, varied also considerably. Both *L. flavicornis* and *L. clausi* are, however, comparatively small animals, at the most of 2 mm. length, even from the great oceans. These Atlantic examples are three to four times the size, and the specimen described by Brady ('*Challenger* Report,' p. 50) as *Leuckartia flavicornis*, 6·2 mm. long, is no doubt identical with *L. grandis*, formerly described by me, and in all probability with Steuer's *L. maxima*. (Brady's *L. scapularis* is undoubtedly a *Heterorhabdus*.) Occurring throughout the Atlantic Ocean, the examples from the Southern Ocean are usually the largest. The following points refer to animals occurring at different regions:

1. ♀. No trace of side hooks, F = 20, Abd. = 36. Abdominal segments 10 (GS) : 7 : 7 : 10 (anal). Anterior Antennæ extend to end of furca. Size, 6-8 mm. (Southern Ocean.)

2. ♀. No side hooks, F = 13, Abd. = 26. Anterior Antennæ extend to end of furca. Size, 5·1 mm.

3. ♀. No side hooks, F = 12, Abd. = 26. Anterior Antennæ extend a little beyond furca. Size, 6·4 mm.

4. ♀. No side hooks, F = 12, Abd. = 30. Anterior Antennæ extend a little beyond furca. Size, 6·1 mm.

5. ♀. No side hooks. Anterior Antennæ extend a little beyond furca. Size, 5·7 mm.

6. ♂. No side hooks, F = 17, Abd. = 20. Anterior Antennæ extend to end of furca. Size, 6·0 mm.

7. ♂. Very small lateral hooks; none in front. F = 19, Abd. = 25. Anterior Antennæ extend to end of furca. Size, 5·2 mm.

In all females, and in males the nongeniculating antennæ, reach to the end of the furca, or are only a little longer; the furca in the female is not more than half the length of the abdomen, and in the ♂ is not three-quarters of the same; the head is without side hooks (only occurring in one young and undeveloped female, which might be a young example of the next species), though often there are more or less prominent lateral projections. The furca in the ♀ is six to seven times as long as broad; in the ♂ the proportionate length is rather greater.

A typical mid-ocean example is as follows:

♀, 6·0 mm. long; head without side hooks; furca half as long as the abdomen; segments of abdomen proportionally (GS) 8 : 4 : 3 : 11 (anal). Antennæ reaching end of furca; maxilla with three bristles on B 2; Ri of first foot with eight bristles; fifth foot endsaw only half the length of Re 3; Re 1 only about two-thirds the length of Re 3, the Ri short, not reaching to the base of the inner big seta of Re 2.

♂, 6·0 mm. long. Furca : whole abdomen : 18 : 28 (more than half as long). Anterior Antennæ 19-25 segments of geniculating antenna > 14-18. Ri of fifth on each side with three segments and resembling that of *L. flavicornis*, except that the Ri 3 of the right side is broader and has six long bristles, that of the left side only five, and the Ri 3 extends beyond the end

of Re 2. B 2 of this side has an upright marginal protuberance with seven marginal teeth. Head with short side hooks.

The ♂ and ♀ are therefore very similar to *L. flavicornis*, except for size and small difference in the fifth feet of the ♂, which are subject to variation. The same feet in the ♀ appear to differ considerably in being stouter, in the proportions of the joints of the Re, and specially of the stout bristle of the Re 2.

The maxilla of ♀ and ♂ appears to constantly differ from that of *flavicornis* in having only three bristles on B 2. The Li 1 of the Anterior Footjaw in both ♀ and ♂ has five bristles and small spine, while Steuer describes for *L. maxima* only four bristles, and the B 2 of the Posterior Footjaw is constantly four times as long as broad. The differences, therefore, between Steuer's *L. maxima* and the numerous Atlantic specimens under observation is very small, except as to size; but this varies greatly, as also does the absence of an indication of rudimentary side hooks of the head. And while there can be no doubt that the species is distinct from *L. flavicornis*, it is more rational to regard all these Atlantic specimens (*L. grandis*, W., *L. maxima*, S.) as one and the same species. The second example of *Lucicutia*, however, differs so much that it merits specific designation, the characters of the head being widely different from any other species.

L. Bicornuta (*nov.*). Plate II.

♀, 6·75 mm. long. Anterior Antennæ extend about four joints beyond the furca. The furca longer than the abdomen. Lengths: Furca : Abdomen : Thorax = 37 : 30 : 68. Proportionate lengths of abdominal segments: 9 (genital) : 7 : 5 : 8 (anal). The genital and anal segments are therefore different in proportion from the last species. Furcal segments of unequal length.

The Ri of mandible not haired; B 2 of maxilla with three bristles. P.F.J., B 1 : B 2 : Ri = 10 : 11 : 10, the B 2 not four times as long as broad, and with a row of stiff, short bristles on the margin.

All feet with Ri and Re of three segments, with tubal process on B 2 of first pair, in which Ri has seven bristles. In the fifth pair Ri all together only a little longer than Re 1; Re 1 and Re 3 about the same length; the endsaw a little more than half as long as Re 3; Ri with seven bristles, the sabre bristle of Re 2 not much thicker (basally) than the others.

The head is characteristic. Frontally are two strong broad-based triangular spines, one on each side, and laterally two downward and outwardly bent large hooks (see Figure).

♂, 6·7 mm. long (another specimen 6·9 mm. long), with geniculating antenna on the left side, head like the ♀, and feet and oral organs like the ♀. Fifth feet, left side, Ri extends beyond proximal margin of Re 2, indistinctly of three segments; Ri 3 with five bristles; B 2 with an upright process with two teeth. Right side, Ri = only two segments, second very broad and with six bristles. B 2 very convex, and on margin a stumpy tubercular process. In two male specimens examined, the fifth feet exhibited small variations, maintaining the character of the genus for variation. Altogether, three males and one female were met with in a sample from the *Gauss* station, October 9, 1903.

(To be continued.)

First to fourth pair of feet Ri and Re=3; in all Ri very short and Re broad.

Fifth feet: Re 2, with short, thick bristle tapering to a point at the distal inner margin of Re 2; end-saw of Re 3 nearly as long as Re 3. Ri of only one segment not reaching beyond end of Re 1, very short with four marginal bristles. Of the Haloptilus with rounded heads (*chierchiæ*, *longicornis*, *plumosus*, *ornatus*) this animal approaches more nearly to *Ornatus* than the others. It is, however, much larger. The bristles of the Maxilla, length of Antennæ, large size of Posterior Footjaws, characters of the bristles of this and of the Anterior Footjaws, and the fifth feet, distinguish it from any of them.

Occurrence: Station 19, x. 1901, 500 metres. (*Gauss.*)

GENUS XANTHOCALANUS.

Xanthocalanus Simplex (*nov. sp.*) Plate X.

♀ 1·45 mm. long (Cephalothorax 1·08; Abdomen 0·4 mm.). Head rounded, cephalothorax of six distinct joints, head separate from first segment and fifth from sixth, last segment ending laterally in points, and the whole dorsal surface covered with fine prickles. Abdomen of four segments, the anal segment very small and only visible on the ventral surface, the genital very large, the posterior margins of the first and second segments dorsally pectinated; fureal segments longer than the anal, and with four bristles on each side, and a short accessory dorsal bristle.

Anterior Antennæ not as long as the cephalothorax, and of twenty-four segments (the eighth and ninth coalesced), the twenty-fourth separated from the twenty-fifth by an oblique line, the penultimate joint longer than either of the two preceding ones. Æsthetasks absent, except for one long one on the last joint; few and short bristles.

Posterior Antennæ with the exopodite nearly twice as long as the endopodite. Mandibles, the endopodite much longer and also broader than the expodite, the second joint of the former with seven, the third joint of the latter with five, bristles, the second basal longer than broad, and with two marginal bristles; the masticatory plate three times as long as broad, with six (or seven ?) pointed thin teeth, the outer one only being large, and with a row of long fine bristles marginally, as long as the teeth.

Anterior Footjaws small, and lobes compressed and of about equal size, the fourth and fifth lobes with plain hook bristles, endopodite very small, and with four long vermiform processes.

Posterior Footjaws rather long and thin, second basal longer than the first, and longer than the endopodite, the second joint of the latter very long (rather longer than the three last joints); very short bristles on the first basal, and none on the second, those of the endopodite very few and thin.

Maxillæ, with first outer lobe very square-shaped and only three bristles; first inner lobe large, with eight hooks; second lobe short, with two bristles very long, one of which is much thicker than the other; third inner lobe attenuated, with three thin bristles; second basal

twice as long as broad, with four bristles; endopodite short, with six bristles and clearly segmented from the basal, exopodite longer than broad, upright, and with only two thin bristles.

First pair of feet with endopodite of only one segment, long and narrow (and with marginal lobe), as long as the first two joints of the exopodite. The latter of three segments, each with external marginal spine. The two basals without inner marginal setæ.

Second feet, endopodite of two segments, exopodite of three segments, comparatively broad, marginal spines long and thin, end-saw very broad, and with toothed margin; last segment with three external marginal spines and four inner marginal setæ.

Third and fourth pairs of feet with three jointed endopodites and exopodites, and inner marginal setæ on first basal, absent in the second pair.

Fifth feet extremely small and readily overlooked, each of a broad basal and two distal segments, the last small, and with two short terminal spines on the left foot, the right foot with the last segment rounded, and one external spine only (probably abnormal).

The segments of the exopodites in second to fourth feet are very broad, those of the endopodites very narrow, and only half the breadth of the exopodites, and in the second pair even less broad in proportion, and the terminal saws are especially broad at the base (and comparatively short). There is an entire absence of spines on the surfaces of the feet segments.

The animal is an adult female, with spermatophore attached to the genital segment. Both anal segment and fifth pair of feet are so small that they are only discovered upon close examination. It possesses characters which make it difficult to assign it to either the genus Scolecithrix or Xanthocalanus, the segmentation of the thorax especially being unlike the former, the absence of brush sensory processes and spinulation of the feet, amongst other peculiarities, being very unlike a Xanthocalanus. The pointed last segment of the thorax of the fifth feet, the proportions of the second to fourth pairs of feet, the Posterior Footjaw, are, amongst other things, peculiar, and it is only provisionally that I venture to include it in the genus Xanthocalanus. It is a deep-water species, and was taken at a depth of 500 fathoms at station E. 6 (South-West Coast of Ireland).

Xanthocalanus Subcristatus (*nov. sp.*). Plate X.

♀ 7·1 mm. CT nearly four times as long as Ab.

Ce~Th 1. Fifth segment united with sixth. Head narrowed in front, with strong dorsal crest, laterally rather triangular, and bifurcated rostrum. Head not unlike a Lophothrix, very prominent and bristled epistome. Last segment of thorax produced over genital segment, and triangular, with short apical points.

Abdomen very short, and very hirsute; genital segment very little swollen ventrally, and one-third longer than next. Anal and Furcal segments very short.

Anterior Antennæ of twenty-four joints (twenty-fourth separate from twenty-fifth), reaching to end of genital segment.

P.A.: Re a little longer than Ri. *Mn*, Ri much longer than Re. B 2 with three bristles. *Mx*, B 2 extended and narrow; Ri with ten bristles; Li 1 long and narrow, with eight long-bristles, only four of which are hooks. Li 2=2, Li 3=4, B 2=4, bristles. Re conical and rather small; Le 1 small, square shaped.

Ant. Footjaw: Basal deeply excavated proximally, convex distally, B 1, B 2, Ri, deeply cleft on outer margin; a strong hook on last lobe, and terminal, appendages, brush, and vermiform.

P.F.J.: B 1, B 2, Ri = 9 : 22 : 12; all bristles comparatively weak; the two distal ones very long and weak, hook-shaped. A thick brush sensory process on B 1.

First feet, Ri = 1, with strong corona of spines. Re = 3 (Re 1 + 2), hirsute on outer margins, the Se long and thin.

Second feet, Ri = 2, Re = 3; the Se dagger-shaped, with serrated edges; no surface spines.

Fourth feet, B 1 and B 2 outer margins with strong stiff bristles; B 2 on outer distal margin a stout spine; inner distal margins of Ri 1 and 2 produced into strong spines; Ri 1 with stiff bristles on outer margin; Ri 2 with similar bristles inner margin. Re with stiff bristles on surfaces and margins of Re 2 and 3, none on Ri or Re 3.

Fifth feet, each of three segments, distal the longest and tapering, ending in two short spines, the smaller one external. First joint with stiff hairs inner margin; second joint the same bristles all along inner margin, and a bunch distally on outer margin; third joint both margins and surface and just below the distal end two short spines on the surface.

Examples were met with at the *Gauss* Stations 10 and 11, which varied considerably in size from 6 to 7 mm., but which were apparently the same species. They also very nearly resemble the species briefly described by me (*Journ. of the Mar. Biol. Assoc.*, April, 1904), and of which I gave figures of the head and fifth feet, under the name *Xanthocalanus cristatus*. The differences between the two appear to be as follows:

Xanthocalanus cristatus.	*Xanthocalanus subcristatus.*
AA, reach the end of the furca.	AA, reach only the genital segment.
PA, Re = Ri.	PA, Re larger than Ri.
Mn, Re = Ri.	Mn, Ri longer than Re.
Mx, B 2 with 2, Ri with 13 bristles.	Mx, B 2 with 4, Ri with 10 bristles.
P.F.J., B 1 : B 2 : Ri = 12 : 16 : 8.	P.F.J., B 1 : B 2 : Ri = 9 : 22 : 12.
Bristles comparatively strong.	Bristles weak.
Feet very spinulose.	Feet only very little spinulose.

Xanthocalanus Magnus (*nov. sp.*). Plate X.

♀ 8·8 mm. Cephalothorax three times as long as the Abdomen. Head imperfectly separated from the first segment; last two segments with an imperfect line of separation, produced into triangular processes with very short blunt points. Head narrowed in front, and produced frontally, but evenly rounded, without trace of crest, prolonged below into stout bifurcated rostrum, each with delicate filament. Very large and strongly-haired epistomal process. Abdomen stout; genital segment as long as the next three, very swollen ventrally, with lateral flap on each side guarding the genital orifice. Fourth segment and furcal segments very short; the abdominal segments fringed with a row of fine pectinations at posterior extremities, and all segments very hirsute. Tail Se 4 in number.

Anterior Antennæ reach about half the length of the genital segment, of twenty-four joints (8 ♂ 9).

Posterior Antennæ with Ri longer than Re.

Mandibles: Ri and Re about equal.

Maxillæ: Re reaching to end of B 2; Ri large; Le 1 twice as long as broad; bristles of B 2 = 5, Re = 10, Ri 7 + 3, Li 1 = 6 long hooks and 3 thin bristles, Le 1 = 9, Li 2 = 3, Li 3 = 4.

Anterior Footjaws with basal proximally deeply excavated, distally strongly convex; the segments deeply cleft; an extraordinarily strong hook curved and denticulated on the last lobe, at least three times thicker than the slightly thickened bristle of the lobe before it; sensory processes seven brush and one long vermiform, the former not very large.

Posterior Footjaws rather stout; B 1 : B 2 : Ri = 13 : 17 : 10, the Ri therefore more than half as long as the B 2, the latter five times as long as broad. Terminal bristles not strong.

First feet: Ri = 1, Re = 3.

Second feet: Ri = 2, Re = 3. Ri reaching only to distal end of Re 2. Ri 1 and 2 with coronas of long spines; segments of Re covered with prickles. B 2 distally a strong tooth at outer angle. All Se of Re very large and strong, dagger-shaped, with proximal margins finely serrated. The Re 3 is rather more than half as broad as long, and the terminal saw very stout, with strong marginal teeth, and as long as Re 3.

Third and fourth feet: Ri = 3, Re = 3.

In the fourth pair Ri short, only reaching to end of Re 2. Ri 2 with corona of spines; Ri 1 and 2 with outer distal margins prolonged into teeth. No spines on Re, but segments covered with fine prickles. Re 3 about half as broad as long, the end-saw only about three-quarters as long as the segment.

Fifth pair very small, not as long as B 1 + B 2 of the fourth feet; of three segments, 1st > 2nd > 3rd, the last joint about four times as long as broad, but differing in thickness on each side, tapering towards the end with two short end and two lateral spines; the two basal joints with stiff, long, marginal bristles. The spines at the end and sides of the last joint articulate, and are not mere prolongations of the joint.

In another example which is not quite so large (8·65 mm.) the agreement with the above is very close, but with the following differences:

The anterior footjaws have sensory brush processes of much greater size, two of them of extraordinary size; the posterior footjaw has slightly different proportions, B 1 : B 2 : Ri = 22 : 30 : 15, the Ri thus only half as long as the B 2; the fifth feet are different, the end joint being twice as long as the second, conical, tapering, and with two spines at the end, which are not articulated, but continuations of the joint; all joints with long stiff hairs. In addition, the Cephalothorax is over three times as long as the Abdomen; the genital segment one-third longer than the next, but without ventral protuberance.

On the whole, I think, these must be regarded as the same species, the latter only an immature form of the first described species.

Xanthocalanus Calaminus (*nov. sp.*). Plate XI.

♀ 5·5 mm. long. CT four and a half times as long as the Abdomen. Head evenly rounded, without any trace of crest and with a very small bifid rostrum. The last two segments of the thorax separate, the posterior one forming bluntly triangular lateral lappets. Head indistinctly separated from first thoracic segment. Furcal segments just as broad as long, and as long only as the anal segment.

Anterior Antennæ along with tail bristles completely broken.

Posterior Antennæ with rami of equal length; Re 2 and Ri 1 elongated joints, bristles apparently absent on the basals.

Mandibles with rami subequal, masticatory plate elongated, four times as long as broad, and with very small teeth.

Anterior Footjaws short and stout; the fourth lobe with an extremely stout curved hook, very broad basally, and armed its whole length with very large triangular teeth; the fifth lobe with two longer very finely-toothed hooks (both unfortunately broken); the Ri with seven strong brush and two vermiform processes.

Posterior Footjaws comparatively short and stout. B 1 : B 2 : Ri = 16 : 12 : 14; the two basals twice as long as broad; two of the bristles of each of the last four Ri segments very peculiar—rather like quills, each armed with a broad chitin edge delicately serrated on the margin, extending throughout the distal two-thirds. Ri 1 and Ri 2 have each three, Ri 3 and Ri 4 each two, Ri 5 two long ones and two very short bristles (see Fig. 4).

Maxillæ. Le 1 very small, with seven bristles; Re twice as long as broad, with ten bristles; B 2 and Ri rather elongated; Li 1 very elongated, three times as long as broad.

First feet: Ri = 1, Re = 3, with three Se, the two proximal ones very small.

Second feet: Ri = 2, Re = 3; a strong corona of spines on the surface of Ri 2.

Fifth feet very small, each of three segments, about equal in length, the two proximal much thicker than the distal, which is more or less conical-shaped, with short spine at the extremity and two short spines on the external margin; a short spine on the inner margin of the second joint at the distal extremity, and proximal to it three or four marginal small teeth, with a few similar teeth on the inner margin of the first joint.

In some respects this appears to resemble Sars' new species *X. muticus*, in which, however, the Anterior Footjaws are 'munis de deux épines très fortes et unguiforme l'extérieur tout lisse, l'intérieur grossièrement dentelée en dedans. Maxillipèdes postérieurs assez robustes quelques unes des soies sortant de la partie terminale transformées en épines fortes.' The structure of the Posterior Footjaws especially differs, in which in my specimen there are no strong spines, but the bristles are quite peculiar. The fifth feet also appear to differ, in Sars' species of two segments, in mine of three. I hesitate, therefore, to regard the two as identical, and provisionally regard the example briefly described as new. The specimen was taken in the Bay of Biscay in September, 1904, by the *Silver Belle*.

GENUS GAIDIUS.

Gaidius Maximus (*nov. sp.*). Plate XI.

♀ 8 mm. Cephalothorax over four times as long as broad. Ce 2, Th 1, and last two segments of the thorax united, on each side prolonged into short, but stout, and slightly curved and divergent spines. The head is on the dorsum somewhat narrowed and elevated, forming a slight keel; in front prolonged into short, stout, one-pointed rostrum (without filaments), with a chitinous thickening of the forehead above the base of the rostrum. The first segment is dorsally very gibbous. The Abdomen is short, stout, the genital segment very prominent ventrally, and as large as the next two, the anal segment, with dorsal flap produced over the furcal segments, which are a little longer than broad, with four Se, the place of the fifth Se (external), represented by a short spine, and on each side is a comparatively long accessory bristle.

Anterior Antennæ of twenty-four segments, reaching about two joints beyond the end of the furca. The twenty-fourth and twenty-fifth segments separate.

Posterior Antennæ, with Re larger than Ri, of seven joints; B 1 with one; B 2 with two bristles.

Maxillæ, B 2 extended, twice as long as broad, with five bristles; Ri small, with fourteen bristles; Re very small, only half as long as B 2, with eleven bristles; Le 1 with eight bristles.

Anterior Footjaws, the basal narrow proximally, with strong swelling distally.

Posterior Footjaws, B 1 : B 2 : Ri = 17 : 22 : 7. B 2 four times as long as broad; Ri very short; B 1 with very large lamellar process.

First feet, Ri = 1, Re = 3, with 3 Se.

Second feet, Ri = 2, Re = 3; Re 3 two and a half times as long as broad, the end-saw with strong teeth, as long as the Re 3.

Fourth feet, with the peculiar modified tube process on the first basal, as in other species of this genus. They are not half the length of the bristles of the second and third feet (B 1), and much thicker, ending in fine-pointed extremity.

No fifth feet.

This is by far the largest species of *Gaidius* known, and two specimens occurred in the *Gauss* haul at station, November 10, 1901.

GENUS ISOCALANUS (*nov.*).

Head separate from thorax, rostrum a stumpy plate of chitin ending in blunt extremity and without filaments. Anterior Antennæ of twenty-two or twenty-three joints. Rami of Posterior Antennæ and Mandibles about equal. Posterior Footjaws comparatively slender, with basals and endopodite not very unequal. Anterior Footjaws with proximal lobes suppressed; Ri strong and with five or six long stout curved hooks; tooth combed in distal part. First feet with one jointed endopodite, and four Si on Re 3; second feet with five Si on Re 3. A pair of fifth feet, only one ramus each, of three segments, and a long spine-like bristle.

In segmentation of feet and number of Si on Re 3 the animals resemble *Spinocalanus*, but are quite different from this genus in rostrum, structure of footjaws, and possession of fifth feet. The armature of the Anterior Footjaws is quite exceptional. Both were subtropical species, from 0° to 20° N. and S., and probably deep-water species, the first found in a capture from 1500, the second in one from 3,000 m. (*Gauss*).

Isocalanus Minor (*nov. sp.*). Plate XII.

♀ 2·6 mm. Cephalothorax about three times as long as the Abdomen.

The former three and a half times as long as broad, the latter nearly four as long as broad, and not more than one-third as broad as the Cephalothorax.

Head rounded, with blunt rostrum as in the next species. Cephalothorax of six segments, Ce separate from Th 1, and Th 5 and 6 separate, the last segment with evenly-rounded margin. Abdomen of four segments. Genital segment rather longer than the next two, and scarcely protuberant at all ventrally; anal segment very small; furcal segments short, and rather broader than long, each with four setæ; the next to the outermost on each side very long and thicker than the rest, one-third longer than the whole abdomen.

Anterior Antennæ of twenty-three segments, reaching to the end of Ab 2; basal twelve joints well supplied with æsthetasks, bristles almost conspicuously absent on the antennæ.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
13	12	5	6	6	5	6	11	6½	7	9	16	17	16	15	14	14	16	15	16	19	20	19

Posterior Antennæ, Ri and Re equal in length, Ri very thick; the first segment about one-third as thick as long. Re of six segments.

Mandibles, with rami about equal; masticatory plate weak, and with irregular teeth, the outer one strong, with considerable space between it and the next also strong tooth, three small triangular weak inner teeth; no Si, apparently, but inner edge of the plate with fine hairs.

Anterior Footjaws of peculiar structure. B 1 elongated and thick, but without lobes or bristles; B 2 short, with one lobe carrying three short bristles and one short stout comb bristle; Ri large, and with six very long robust hooks, strongly curved, and in their distal third combed with rows of short stiff bristles and a series of ridges; one short curved comb on external aspect, only one-fourth the length of the long comb bristles, and a much shorter thick bristle at the proximal end.

Maxillæ, Re large, much longer than B 2, and with ten bristles; Le 2 with one bristle; Li 2 and 3 small lobes, with each one bristle; Li 1 without hooks, but only plain bristles.

Posterior Footjaws very slender. B 1 : B 2 : Ri = 5 : 4 : 4. B 1 a little more than three times as long as broad; B 2 four times as long as broad. B 1 without any lobes or bristles, but inner distal end much produced, and with a short curved hook on it. B 2 with only two bristles in the middle, the distal one the strongest, and one short bristle at the distal

extremity. Ri of four joints, the second the largest, each segment respectively with four, four, two, five bristles, the proximal very short, those of the last segment moderately long.

First feet, Ri = 1; second Ri = 2; third and fourth Ri = 3.

Re in all four pairs = 3.

In the first pair Re 3 has four Si, and is without Se on Re 1 or 2.

In the second pair Re 3 has three Se and five Si. Re 1 very small, Re 2 nearly twice as long, Re 3 as long as Re 1 and 2, and the end-saw three-fourths as long as Re 3, and with numerous teeth. The Re 3 is four times as long as broad, the Si of Re 2 is (as in the third and fourth pairs) thicker than the Si of Re 1 or Re 3. The marginal Se are comparatively large and slightly recurved.

The third and fourth pairs of feet were very much broken.

Fifth feet, each of three segments and a long spine-like terminal bristle, the first segment one and a half times as broad as the second and a little longer, the end bristle nearly twice as long as the two basal segments.

Isocalanus Major (*nov. sp.*). Plate XII.

♀ 3·9 mm. CT more than three and a half as long as Ab. CT of four segments, with head partially divided from the first Th segment by dorsal line, not carried to ventral side, last two segments almostly completely fused, and produced laterally with rounded margins. Head evenly rounded, and ending in front in quite peculiar rostrum, a stiff chitinous prolongation, triangular at extremity, and pointed, with two small spines on the top before the terminal piece. This rostral projection is not bifurcated.

Abdomen of four segments. From its appearance, the animal is probably not quite adult, but the genital swelling is commencing to form.

First, second, and third segments nearly equal in size, anal much larger than any of the others. Furcal segments broadest at base, truncated, and about as long as broad in greatest dimensions; one very thick apical bristle on each side, and a very short accessory ventrally-placed bristle.

Anterior Antennæ of twenty-two joints, about as long as the Cephalothorax. The first ten joints crowded the next six, enlarged and thickened from side to side, the last three the largest of all. Very few bristles.

Posterior Antennæ, with rami about equal.

Mandibles, Re a little larger than Ri; masticatory plate short with strong teeth, Si thick, and a bunch of very strong stiff hairs, with three smaller bunches on the surface of the plate. Two inner teeth sharp and thin, two middle thick and short, two outer broad-based, curved, and pointed, with some distance between.

Maxillæ, outer lobes poorly developed. Le 1 with only four, Re large, curved inwards at apex, with only nine bristles; Li 1 with fourteen bristles, hooks thin and long; Li 2 and 3 each comparatively large, with only one bristle each; Ri 1 and B 2 coalesced into a small lobe, with only one apical bristle.

Anterior Footjaws comparatively powerfully built. B 1 and B 2 similarly long, proximal

lobes small, with L 1=1, L 2=1, L 3=3, short bristles; L 4 with five—two short (one a combed hook), and one a long, broad-based, curved comb hook. Ri with five very long, broad-based, comb hooks, curved inwards towards apex, and with armature only on distal third. These hooks resemble those in the last species.

Posterior Footjaws, with B 1 : B 2 : Ri = 6 : 6 : 4. B 1 thicker than B 2, and nearly one-half as thick as long; only one bristle in middle, and three at inner distal end.

B 2, with three short bristles distal of the middle, the most distal one twice as thick as the two others, and densely feathered.

Two bristles at inner distal extremity, one very minute, the other thick.

Ri with three, three, two, five bristles; first three joints distinct, fourth and fifth less distinct. Ri 1 and 2 equal, and a little longer than the similarly equal Ri 3 and 4. Ri 5 very short.

All the bristles of the Posterior Footjaw are extremely short, the largest terminal bristles only as long as the whole Ri.

First feet: Ri = 1, Re = 3.

B 1 and B 2 each with Si. Re 3 longer than Re 1 and 2; no Se on Re 1 or Re 2, but two on Re 3: one in the middle of the outer margin, and one at the end. Saw nearly as long as the whole Re, and armed with fine teeth. Four Si on Re 3. Ri elongated and extending beyond the distal margin of Re 2.

Second, third, and fourth pairs, Ri = 3, Re = 3.

In the *second* pair the whole Ri is only as long as Re 1 and 2, Ri 2 being nearly twice as long as Ri 1, Ri 3 as long as Ri 1 and 2, Ri 1, with outer distal margin ending in spine.

Re 3 as long as Re 1 and 2, Re 2 twice as long as Re 1; end-saw shorter than Re 3, and with strong teeth. Si = 5, Se = 3.

B 1 with Si; B 2 without Si.

Third feet: Re 2, with a long thin Se at outer distal margin.

Re 3, with three small Se, the segment long, as in the fourth pair.

Fourth feet: B 2, with only a small external marginal Se. Re 2 much larger than Re 1, Re 3 longer than Re 1 and 2, and end-saw with strong teeth, and half as long as Re 3. Re 3, with three Se and five Si. Ri 1 smaller than Ri 2, Ri 3 much longer than Ri 1 and 2.

Fifth feet, with three segments, basal much the largest; second and third small, a rather long spine at the end, nearly as long as the two last joints, and a very small spine also at the apex of the last segment.

The two preceding species differ in size and shape of body, in the characters of the rostrum, to a smaller extent in the Posterior Footjaws and Maxillæ, and in the segmentation of the second pair of feet. They, however, agree very much in the peculiar anatomy of the Anterior Footjaws and fifth feet, and in the number of spines and bristles on the exopodites of the feet, and the relative size of the segments. On this ground I group them together, especially as in the latter the anatomy of the abdomen indicates that the animal in not fully adult. It may be desirable eventually to separate these species into other genera. The characters of the Anterior Footjaw are quite peculiar, and unlike any other known genus.

AUTANEPSIUS* (*nov. gen.*).

Body long in proportion to Abdomen, with or without proper rostrum, angles of last Thoracic segment pointed, Abdomen of ♀ 4 segmented. First feet, Ri of 1; second feet, Ri of 2; and in third and fourth feet of three segments. No fifth pair. Anterior Antennæ short, Posterior Antennæ with both rami nearly equal in length, Anterior Footjaws short, Posterior pair extraordinarily long, and the distal bristles with very peculiar armature. Mandibles with Ri very small, Maxillæ with basal very large, outer and inner lobes and Re very small.

This genus has a resemblance to *Augaptilus* only in the fact that the bristles of the Posterior Footjaw are armed with very peculiar sensory processes, not cups as in the first-named genus, but wing-shaped membranous-looking processes, which at first sight and under low magnification recall *Augaptilus*, but under higher magnification are seen to be quite different. The new genus *Pontoptilus*, recently established by Professor G. O. Sars, resembles it in some particulars, but is strikingly different in others—*e.g.*:

Pontoptilus.	*Autanepsius.*
Abdomen of four segments.	Abdomen of four segments.
Re of Posterior Antennæ much longer than Ri.	About equal.
Maxillæ, basal large, other lobes rounded and with short bristles.	Basals large, inner lobes well developed with long bristles.
Feet, five pairs.	Feet only four pairs.
Posterior maxillipedes, with or without "buttons," in size more or less equal to the Anterior pair.	Without "buttons," but with peculiar appendages of large size.

Clearly, the two species mentioned below differ in most important points from *Pontoptilus* (Sars), though related to this and to *Augaptilus*, in the fact of bristles of the maxillipedes being transformed into sensory organs.

Autanepsius Major (*nov. sp.*). Plate XIII.

♀ 8·15 mm. long. (Cephalothorax, 6·6; Abdomen, 1·55 m. long.) Abdomen short, not quarter the length of the thorax. Head oval, rounded, ending in front in a short blunt one-pointed rostrum; broadest part of the CT about the middle; Ce ∼ Th 1, last two segments separate, last segment on each side with short blunt lateral points; head as long as the rest of the Cephalothorax.

Abdomen of four segments, the genital as broad as long, and as long as the rest of the abdomen; furcal segments as broad as long, and a little longer than the anal, broader at the base than at the end. The bristles are much broken; the innermost, however, which is preserved, is twice as long as the abdomen, the one external to it is nearly as thick (length

* αὐταν́ψιος—Greek, a cousin.

unknown), the outer one is very thin and short. In addition to these three apical bristles is a similarly thin and short bristle arising from the middle of the external margin; the inner margins of the furcal segments are haired. The abdominal segments along their posterior margins are strongly pectinated.

Anterior Antennæ: not quite as long as the CT, and of twenty-four segments ($8 \sim 9$) very densely bristled, many bristles being very long, especially on the third, seventh, eighth, eleventh, thirteenth, fourteenth, twentieth, twenty-third, and twenty-fourth segments. The eighth joint twice as long as the joints before and after, from the ninth to twentieth all nearly the same length, the twenty-first shorter than the twenty-second; the twenty-fourth only half as long as the twenty-third.

Posterior Antennæ: Re a little longer than Ri; the former of seven segments.

Mandibles: Basal and Re of normal size and shape; Ri very small, only half as broad or long as Re, and with two segments. Ri 1 with one short bristle, Ri 2 with five very short weak bristles. Masticatory plate with five outer powerful teeth; the innermost spine shaped with a strong bunch of hairs at the base.

Maxillæ, B 2 lengthened with short Ri; Re small. Li 2 and 3 well developed lobes. Le 1 small, with nine bristles. Re = 11 : Ri = 15 : B 2 = 5 : Li 3 = 4 : Li 2 = 3 : Li 1 = 10 hook bristles.

Anterior Footjaws comparatively very small, the lobes small and rather compressed; Ri distinctly of three segments, its bristles stout, 'file'-like, two of the three bristles of the fifth lobe of the same character, the lobe itself longer than the proximal four lobes, which are about equal size, with three stout bristles in each lobe, two of them at least twice as long as the third, and densely feathered with widely-apart bristles.

Posterior Footjaws of extraordinary length and size, more than three times as long as the Anterior pair, and one and a half as long as the fourth feet: B 1 : B 2 : Ri = 28 : 30 : 8. Ri is thus very small, of five segments, with ten long slightly curved broad-based and tapering bristles with extraordinary sensory processes upon them in the distal half, as in the next species (*A. Minor*).

First pair of feet: Ri = 1, Re = 3. The two basals without Si, but with haired inner margins. Re 1 without Se or Si; Re 2 with very strong Se and one Si; Re 3 with four Si and one Se.

Second feet: B 1 with Si, B 2 without; Ri = 2, Re = 3. Re 1 small, with one Se and one Si; Re 2 with long stout Se, and a short spine internal to it and one Si; Re 3 with three Se, the distal one much larger than the two proximal, four Si, and long closely-toothed saw longer than Re 3. Ri 1 small with one Si; Ri 2 three times as long as Ri 1 with five Si.

Fourth feet: B 1 with Si, B 2 without. Ri and Re = 3 each. Re 1 $<$ Re 2 $<$ Re 3; marginal Se of Re 2 and 3 rather larger than the others; saw closely toothed and much longer than Re 3. Re 3 not quite twice as long as Re 2. Se = 1 : 1 : 3; Si = 1 : 1 : 4.

Ri more than half as long as Re. Ri 1 $<$ Ri 2 $<$ Ri 3. Ri 2 with short spine, inner distal margin. Si = 1 : 1 : 5.

No fifth feet.

This species differs from the following (*A. Minor*) in its much greater size, stronger points on the last Thoracic segment, and in small particulars in the structure and number of bristles of the oral organs.

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PART II.

[Note.—Professor G. O. Sars has informed me that the genus *Megacalanus* (Wolfenden) is identical with his genus *Macrocalanus* (Sars) (*Bull. du Musée Océanog. de Monaco*), and *Megacalanus Bradyi* is the same as his species *Macrocalanus longicornis*, and that my name. *Megacalanus*, however, has the priority over *Macrocalanus*. He also informs me that the species described by me as *Megacalanus princeps* = *Calanus princeps* (Brady) is not that species, but = *Bathycalanus Richardi* (G. O. Sars), 'and that Brady's *Calanus princeps* is a true *Megacalanus*, differing from *M. longicornis* (G. O. S.) = *Megacal. Bradyi* (Wolfenden), in the strongly recurved frontal appendages, somewhat shorter Anterior Antennæ, and the dense ciliation of the spines on the Anterior Maxillipedes, which otherwise are quite normal in appearance.

'The genus *Bathycalanus* differs from *Megacalanus* in the peculiar armature of the frontal part and in the somewhat different structure of the maxillæ and maxillipedes (both pairs), and in the structure of the first pair of feet, which are without the hooked process of the second basal, and have the outer ramus composed of only two joints.'

By the kindness of Dr. Calman, I have had the opportunity of examining the original (mounted) specimen of Brady's *Calanus princeps* at the Natural History Museum, Kensington. The only parts available for examination are preserved on a slide. The head appears to be somewhat pressed out of shape, but is produced frontally, without appearance of any crest or of spines (as in *Bathyc.*); the rostral processes are stiff, thick, like *Bathycal.*; the maxilla resembles that of *Heterocalanus*; the bristles of the Anterior Footjaw are also alike, and those of the Posterior Footjaw are delicate and short, and the first feet have a three-jointed Re.

Nor can Brady's *Cal. princeps* be regarded as a *Megacalanus*, differing in the rostrum, Anterior Footjaws, hook of the first pair, and joints of the Anterior Antennæ. Except for the crested head, it bears a close resemblance to *Heterocalanus*. Unfortunately, in the absence of a whole specimen, it is impossible to completely identify Brady's original specimen with certainty, beyond saying that it is not *Megacalanus* or *Bathycalanus*. The description given by Professor Sars of the genus *Bathycalanus* (Sars) is:

Rostral appendages rather delicate, straight, and ending in acute points; maxillipedes strongly developed, anterior very thick, and with the exterior spines extremely prolonged and delicate, ending in hooks; the posterior rather elongated, with the three terminal spines very strong, and curved in the form of a scythe; Re of first pair of only two segments.

> *B. Richardi* 10·20 m. long. CT more than three times as long as Ab., fusiform, more retracted in front than behind. Ce | Th 1; front a little prominent, and immediately in front of the rostral spines, are two little horns. AA very delicate, and nearly twice as long as the CT. Feet like *Megacalanus*; genital segment a little prominent ventrally. Furcal segments short.

With regard to Brady's illustrations of his *Calanus princeps* in the '*Challenger* Report,' it must be remarked that these are defective as regards the drawing of the maxilla; and the

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head, which is not figured by Brady in his specimen, is produced in front above the rostrum, but is without armature or spines or hairs; and the rostrum is formed by two stiff prolonged rami, without spines or filaments, and is quite different from a *Megacalanus* rostrum or head. The Anterior Footjaw has the long, ribbon-shaped, terminal bristles, densely ciliated, as in Brady's drawing; the Posterior Footjaw has only very slender and short bristles, the terminal ones not ciliated, and only as long as the B 2 + Ri of this organ. The Re of the maxilla appear to be rather longer than the B 2.

The first feet have the Re of three segments, with only two Se, and no trace of a hook on the B 2.

The head of Brady's specimen is somewhat pressed out of shape, and it is not easy to identify the animal with any certainty.

In further elucidation of the species described by me in the preceding paper as *Megacalanus princeps* = *Cal. princeps* (Brady) = *Bathycalanus* (Sars), I give a figure of the head (Plate VIII.). This is seen to be suddenly narrowed anteriorly, armed with two little spines in the front and two short bristles, and to have two long, stiff, rostral processes, of quite peculiar character. In the latter it agrees with Brady's specimen; not, however, with the shape or armature of the front of the head, and *Megacal. princeps* also differs from Brady's specimen in the long, ribbon-like, densely-ciliated bristles of the *Posterior Footjaw* (as well as of the Ant. Footjaw) in the first feet, which have no *external marginal setæ*, except on Re 3; and also in the *Maxilla*, in which the Re does not extend beyond the distal margin of the Ri 3, nor is it so recurved.

It is, therefore, clearly not identical with Brady's *C. princeps*. As to its identity with *Bathycalanus Richardi* (G. O. Sars), the following points of difference seem to exist:

Cephalothorax only twice as long as the Abdomen (not over three, as in Sars' species), the first feet with Re of three segments (only two in Sars' species). The rostral processes are not '*assez grêles*,' but strong, and rather thick and rigid.

The largest specimen I have met with was 12·50 mm. long, and in this the furcal segments had been broken off, so it appears to be of greater size than Sars' *B. Richardi*.

Consequently, I feel justified in describing it as another species, which I designate *Bathycalanus maximus* (see Plate I.) = *Megacalanus princeps* (Wolfenden)].

Another remarkable example which does not appear to agree with either *Megacalanus* or *Bathycalanus* I describe below.

HETEROCALANUS (*n. gen.*).

Distinguished from *Megacalanus* and *Bathycalanus* by the shape of the head, which has a prominent dorsal crest, ending in front in a small helmet, by the very globose genital segment, the Anterior Footjaws armed with broad and very long ciliated bristles, as in *Bathycalanus*, the posterior jaws with only weak bristles, and the first foot with a three-jointed exopodite, without Se on the first two segments.

Heterocalanus Medius (*nov. sp.*). Plate VIII.

Size.— ♀ 10·75 mm. Cephalothorax about four times as long as the Abdomen. The breadth of the former is over twice that of the Abdomen in its widest part (Genital Segment). Head separate from Th 1; last two thoracic segments rounded, and but little produced at the margins Head not narrowed in front, as in the last genus, but dorsally triangular-shaped, and with prominent keel; in the three-quarter aspect quite distinct as a short, frontal helmet process. No spines or bristles on the front as in the last genus; only a very little tubercle above the rostral processes, which are strong, stiff, straight processes, of rather unequal length, without terminal filaments or spines, and closely resembling the same in the last genus. The Abdomen is stout, the genital segment very globular, a little broader than long, and half as broad again as the next segment; in lateral aspect above very concave, below very convex ventrally, with a cleft in the middle. Anal segment (fourth) very small, and furcal segments one-fifth longer than broad, and about as long as Ab 3 + Ab 4. (All tail setæ unfortunately broken.) Anterior Antennæ unfortunately broken.

Posterior Antennæ with Re only a little longer than Ri, and of eight segments. An extremely small bristle on B 1, and two similar on B 2.

Maxillæ with Re large, oval, and extending beyond the end of Ri. B 2 rather pyriform; Ri small, with three imperfect segments. Bristles are: Le 1 = 7; Re = 11; B 2 = 2, very short and delicate; Ri 1 + 2, with one very short; Ri 3, with four long and one very short; Li 3 = 2 short; Li 1 = 10 hook bristles.

Anterior Footjaws like *Megacalanus princeps* (Wolfenden); very short, delicate bristles on proximal lobes, and very long, ribbon-shaped and densely-ciliated bristles on the last lobe and endopodite, twice as long as the whole limb.

Posterior Footjaws proportions of B 1 : B 2 : Ri = 20 : 19 : 10. B 1 nearly three times as long as broad, B 2 nearly five times as long as broad. Ri about half as long as each of the two basals. Bristles of all very delicate, short and thin; the terminal bristles of Ri not so long as Ri + B 2; those of Ri 1, 2, 3, not more than half the length of the end bristles.

In the bristles of the Post. Footjaw this species closely resembles the original *C. princeps* of Brady—*i.e.*, they are thin and weak.

All feet of three segmented Re and Ri, and of the type resembling those of *Megacalanus* and the last genus.

First feet: Re and Ri = 3. Re 1 and Re 2 without external marginal spine. One occurs on Re 3. Si of Re = 1 : 1 : 5. No hook on basal.

Second feet: Ri only just reaching beyond the end of Re 2. Re 3 longer than Re 1 + 2, and over twice as long as broad, with three Se and an end-saw half as long as Re 3. Si of Re = 1, 1, 5.

Fourth feet: Re greater than Re 1 + 2; end-saw not quite half as long as Re 3. Re 3 with three Se. Si of Re = 1, 1, 5.

Fifth feet generally like the others, but smaller; only three-quarters as long as the fourth pair. Re 2 with, however, only two marginal Se; end-saw three-quarters as long as Re 3. Si of Re = 1, 1, 4. Basals not so convex on inner margin as in the other feet, being nearly straight.

Of the three genera described in this work:

1. *Megacalanus* (Wolfenden) (*M. Bradyi*) has a dorsally, rather triangular-shaped head, rostrum of ordinary type, head not narrowed in front, but produced between the Antennæ into a round process, also visible dorsally. A.F.J. and P.F.J. with bristles of ordinary character. First feet, Re = 3 segments, with three Se, and hook on B 2.

2. *Bathycalanus* (Sars) (*B. maximus*, Wolfenden), head very narrowed in front; two little frontal spines; long, stiff peculiar rostrum. A.F.J. with long, ribbon-shaped, densely-ciliated bristles. P.F.J. with terminal bristles of the same character in this species. Mx with Re not quite so prominent as in the next species, otherwise greatly resembling the two allied genera. First feet, Re with two (*B. Richardi*), three (*maximus*) segments, and (in *B. maximus*) only one Se.

3. *Heterocalanus*. — If *Bathycalanus* is distinguished generically from *Megacalanus*, especially by the shape of the head, proportions of the body, structure of the maxillipedes and first feet, then this specimen must be considered generically distinct on the ground that:

The head is different, being triangular and crested.

The Abdomen and especially the genital segment is much more robust than in the others.

The Anterior and Posterior Footjaws are dissimilar in their armature; the former with strong, thick, long, ciliated, terminal bristles; the latter with short, delicate bristles.

The first feet have a three-jointed Re, of which Re 2 and Re 3 have each a marginal Se.

GENUS LUCICUTIA.

Lucicutia Ovalis (*nov. sp.*). Plate IX.

♀ length 1·5 mm. CT over twice as long as Ab., and not twice as long as broad. Anterior body very broadly oval in shape, head evenly rounded, and last segment with rounded margins. CT of four segments clearly defined at the edges but not on the back. Whole animal of delicate build. Abdomen with large genital segment, nearly as long as the next three segments, the anal a little longer than the preceding, and the furcal segments nearly three times as long as broad, and two and a half times as long as the anal. The furcal segments are divided into two equal portions along the outer margin by the origin of the Se. Of the four apical and similarly thick bristles, one on each side is much longer than the rest. The genital segment is very protuberant ventrally, and bears the same dark-coloured egg-shaped swelling, with downward prolongation, found in many *Lucicutias*.

AA of twenty-five joints, and about three joints longer than the whole body, the twenty-fourth joint a little longer than the twenty-third, and twice as long as the twenty-fifth. All bristles of the antennæ joints short.

PA with Re and Ri of about the same length, the Re of eight joints, the distal one as large as the preceding six segments.

Mandible masticatory plate with eight teeth of about equal length, the outer five triangular, and larger than the inner teeth.

A.F.J. with weak lobes, and bristles of usual Lucicutia type.

P.F.J. B 1 : B 2 : = 12 : 14 : 14, the R of five distinct segments. R 1 > Ri 2 > Ri 3 > Ri 4 > Ri 5 ; all bristles weak.

First feet with Ri of two segments, and a tube process on the second basal.

Second to fourth feet with Ri and Re, and Re of first, each of three segments, the Ri short (not reaching beyond the distal margin of Re 2).

In the second pair Re 3 with five Si, three Se with large secondary spines ; end saw : Re 3 = 8 : 13.

In the fourth pair Re 3 with five Si, and three Se, but below the proximal Se is a deep excavation of the margin (without trace of Se).

Re 3 longer than Re 1 + 2, and end-saw : Re 3 = 9 : 14½.

Fifth feet long, Ri very short, not half the length of Re, and of three segments with respectively 1, 1, 5, bristles.

Re 1 longer than Re 2 or Re 3, which are about equal.

Re 2 at its inner distal margin bears a short sabre bristle, and the end-saw of Re 3 is very short, and not more than one-third the length of the Re 3.

GENUS HALOPTILUS.

Haloptilus Longimanus (*nov.*). Plate IX.

♀ 6·72 mm. long. (CT 5·4, Ab. 1·3.) Abdomen only a quarter as long as the forebody. Head evenly rounded and not triangular. Genital segment large, longer than the remaining segments. Furca about as long as the last two segments. Anal segment very small. *Anterior Antennæ* not reaching the furca, and of twenty-five segments.

Post. Antennæ : Re about one-quarter longer than Ri, and of eight joints, the last very long.

Mandibles : Masticatory plate stout with strong teeth ; B 2 with three bristles, Ri longer than Re.

Maxillæ : The first inner lobe very large and square-shaped, Li 2 a large lobe with four bristles (not shown in the figure), Li 3 small and with four bristles, B 2 short and with three bristles. Ri small, unsegmented, and with five bristles. Re large and with nine bristles. The basal and inner lobes are extremely small in comparison with the large square inner first lobe. Le 1 small, square-edged, and with nine long bristles.

Anterior Footjaws about as long as the posterior pair. First basal with only two very small lobes distally, each with three bristles. B 2 elongated and with two long hooks and one short bristle at the distal end. Ri small, distinctly three-segmented, and with nine long, curved hooks, tooth-combed in the distal half.

Posterior Footjaws comparatively short, and with broad basals, and Ri much narrower. B 1, B 2, Ri = 12 : 8 : 6. B 1 three-quarters as broad as long. Ri distinctly five segments, with eight long, curved hooks as in the Ant. Footjaws, the terminal two the stoutest ; all tooth-combed in the distal half, two short dorsal bristles on Ri 5.

Autanepsius Minor (*nov. sp.*). Plate XIII.

♀ 4·8 mm. long. CT nearly four times as long as the Abdomen; the former of five segments, the head separate from the first thoracic segment, the last segment with slightly pointed distal margins. Head in front evenly rounded, with no prominence and rostrum as in the last species. Abdomen of four segments, the genital a little swollen ventrally.

Anterior Antennæ of twenty-four segments, short (not as long as the CT), and with long and numerous bristles.

Posterior Antennæ with Ri and Re about equal, the latter of eight segments.

Mandibles: Re twice as long and thick as Ri, the former of four, the latter of two segments; B 2 with only one marginal bristle. The masticatory plate with powerful short teeth. Bristles of Ri not half as long or as thick as those of Re.

Maxillæ: Le 1 with eight, Re with eleven, B 2 with five, Ri with fourteen bristles; Li 1 with thirteen hooks, Li 2 with four bristles; B 2 and Ri coalesced, long, and broad; Re very small.

Anterior Footjaws: B 1 long comparatively; B 2 and Ri small, but the latter distinctly three segmented. Lobes all small, the proximal especially so, and rather crowded together. L 1, L 2, L 3, L 4 with three bristles each; L 5 with two bristles. The six bristles of Ri are strong, curved outwards, and densely feathered in the distal third.

Posterior Footjaws: B 1 : B 2 : Ri as 22 : 22 : 9. Ri very short, of five distinct segments, the second the largest. B 1 three times as long as broad, B 2 nearly four times as long as broad; the marginal bristles of both basal lobes much reduced. The bristles of Ri long, nine of them armed with very peculiar processes, not stalked as in Augaptilus and not bearing any resemblance to the cups of this genus, but as in the last species.

Swimming Feet.—First pair: Ri = 1, Re = 3. Re 1 without Se; Re 2 with long Se. Si = 0 : 1 : 4.

Second pair: Ri = 2. Re in both feet broken.

Third and fourth pairs: Ri = 3. Re in both pairs broken, but probably = 3.

No fifth pair.

The feet were much broken in this, the only specimen occurring in *Gauss* sample from station, October 9, 1903; vert. 3,000 metres.

GENUS SPINOCALANUS.

Spinocalanus Magnus (Wolfenden, *J. M. Biol. Ass.*, vol. vii., April, 1904). Plate XIV.

This species, which was briefly described by me as above, and subsequently also by Farran (Report Fisheries Iceland, 1905), appears to have a very much wider area of distribution than imagined. In the *Gauss* collections I have met with many examples not far north of the ice, and in my own collections I have taken it in the Atlantic at the entrance to the Straits of Gibraltar.

The species from the latter locality agrees closely with that from the West of Ireland,

and I have no doubt that they are identical. That from the Antarctic seas also agrees generally, but there are certain points in which it differs, enough to justify making a new species. As my former notes (*J. M. B. Ass.*) were very brief, I here supplement them with a fuller description of this species, which appears to be a deep-water form. For instance, in the *Gauss* collections, it appeared at Station 3, iv., 03, in a ground collection at 3,223 metres, and at three other stations in vertical hauls from 3,000 and 1,200 metres respectively, and at Station 43 (Straits of Gibraltar) of the *Silver Belle* at 360 fathoms, in the closing net.

♀ 2·75 to 2·80 mm. CT three and a half times as long as the Abdomen. Head evenly rounded, dorsally roughly triangular. The Cephalothorax is two and three-quarters as long as broad, the broadest part of the body being posterior to the mid line of the animal. The separation of head from the first segment is indicated only by a faint dorsal line. Rostrum is entirely absent. The two last segments of the Thorax are separate, the posterior are produced forwards, with rounded margins, and overlapping the upper half of the genital segment.

The Abdomen of four segments has the genital rather protuberant, and as large as the next three, the second, third, and fourth segments equal in size, the furcal segments a little longer than the anal, and rather longer than broad. The furcal bristles are four apical and one very delicate and short on the inner margin, and one of the bristles of the left side is much thickened (and elongated ?).

Anterior Antennæ of twenty-four segments (the eighth and ninth coalesced, twenty-fourth separate from twenty-fifth) reach just a little beyond the end of the furca. The basal joints are thick; the distal joints taper, and are narrow distally.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
19	19	10	10	11	11	11	24	10	10	11	12	12	15	15	16	16½	16½	15	14	14	14	12	7

Posterior Antennæ with six-jointed Re, which is only a little longer than the Ri. Re 2 equal in length to Re 6, and not twice as long as broad.

Mandibles with rami of nearly equal length, basal longer than broad, with three marginal bristles, the proximal the strongest, the distal one naked, the Ri 1 rather large. The masticatory plate with one very large, conical, sharply-pointed external tooth, and four sub-equal thinner teeth, and a deeply-trifid inner tooth.

Maxillæ with Li 1 large with proximal bristle very long; Li 2 with five, Li 3 with four bristles; B 2 about as long as broad with five bristles; Ri broad and distinctly segmented, Ri 3 very small with fifteen bristles. The Re reaches to the end of Ri 2, and has eleven bristles. Le 2 without bristle, and Le 1 with rather straight margin.

Anterior Footjaws with very short Ri, L 1 and L 5, with four bristles each, the others with three. L 4 with a rather stout, broad hook toothcombed on the inner side, and with stiff hairs externally. Outer margin of B 2 not very convex.

Posterior Footjaws with B 1 rather longer than B 2, and Ri longer than either basal; Ri 2 long. A stout and long feathered bristle dorsally on Ri 4. On the surface of B 2 are a few spines.

First feet, Ri = 1, Re = 3. Re 3 with four Si, the Se of this ramus are long and thin, B 1 without B 2 with long marginal bristle, and on this segment at distal inner margin is a group of species with hairs proximally.

Second feet, Ri = 2, Re = 3. Ri 1 and Re 1 are small, Ri 2 over two as long as broad, an accessory lobe with eight long strong spines. Re 3 = Re 1 + 2, and is three as long as broad, the saw as long as Re 3, lanceolate and broad proximally, with crenated and not toothed margin. No spines on basals, but a row of stout short spines on the surface of Re 3, and on Re 2 an oblique row of nine long spines.

Third feet, Re 3 is three as long as broad, and its saw a little shorter than the segment. No spines on basals, but a row of seven long spines on Ri 2 and Ri 3, and a row of eleven or twelve long spines on Re 2, and six short ones distally on Re 3.

Fourth feet, B 1 extended, and a row of several stiff spines encircling the segment just at the insertion of the Si; Ri 2 and Ri 3 with rows of long spines on the surface.

Fifth feet absent.

Only young and immature males were found.

Spinocalanus Antarcticus (*nov. sp.*). Plate XIV.

The animal which occurs in the Antarctic Ocean is very closely allied to the Atlantic species, and but for the different shape of the Cephalothorax would undoubtedly be regarded as the same species. This is, however, so distinct that it may be preferable to distinguish them as separate species.

♀ 2·25 to 2·30 mm. Cephalothorax four times as long as the Abdomen, with rounded head and no trace of rostrum. The dorsal curve of the body is more pronounced than in the other species, and the greatest breadth is anterior to the middle of the body, and occurs where the imperfectly-marked line of segmentation between the head and Th 1 is evident. The thorax is only two and a quarter times as long as broad. The last two segments are separated, and the lateral prolongations of the last segment are much less pronounced than in the Atlantic specimens. The Genital segment is not longer than the next two combined, and the furcal segments are a little longer than broad. The Anterior Antennæ do not reach beyond the end of the third abdominal segment, and are thus much shorter than in the previous species. In other respects, as regards mouth organs and feet, the two species are identical.

The ♂ is much smaller—viz., 1·8 mm. (Plate XIV.)—and possesses a fifth pair of feet, of which the right is the longest, two and a half times longer than the other. Each is of five segments.

Left foot: B 1 : B 2 : Re 1 : Re 2 : Re 3 = 10 : 8 : 7 : 7 : 4. The last segment pear-shaped, with short, delicate terminal spine.

Right foot: B 1 : B 2 : Re 1 : Re 2 : Re 3 : = 27 : 24 : 30 : 14 : 5. B 2 with a club-shaped extremity and tuft of short hairs on the inner distal margin; Re 1 with a tuft of short, marginal bristles; Re 3 spoon-shaped with margin doubled over.

GENUS AMALLOPHORA (*Scott*).

Amallophora Rotunda (*nov. sp.*). Plate XV.

♀ 2·15 mm. Head quite evenly rounded, without any trace of crest, and with rather long, delicate bifurcate rostrum. Ce~Th 1, the last segment of which has evenly rounded and not produced margins, the two last segments being separate. Abdomen not more than a third as long as the Cephalothorax, the Genital segment as large as the following three segments, the anal very short, and, together with the furcal segments, only three-quarters as long as the genital. The furcal segments are only as long as broad, and as long as the anal segment. Each of the abdominal segments is fringed with pectinations.

The animal, though small, is robust, the Cephalothorax just half as broad as long, and thus much more rotund than any other species of *Amallophora*, except *A. brevicornis* (Sars). The Anterior Antennæ were broken off. Posterior Antennæ with rami nearly equal, the Re a little longer than Ri, Mandibles with Ri longer than Re.

Anterior Footjaws small: B 1 longer than B 2, the lobes small and compressed, with respectively 3, 2, 3, 3, bristles, the last lobe with one delicate hook bristle, the endopodite with three amalliform processes and two vermiform, long and thin.

Posterior Footjaw: B 1 : B 2 : Ri = 20 : 26 : 16. The first basal much wider than the second; Ri of five distinct segments, the second the largest.

First feet: Ri = 1, Re = 3 with three Se.

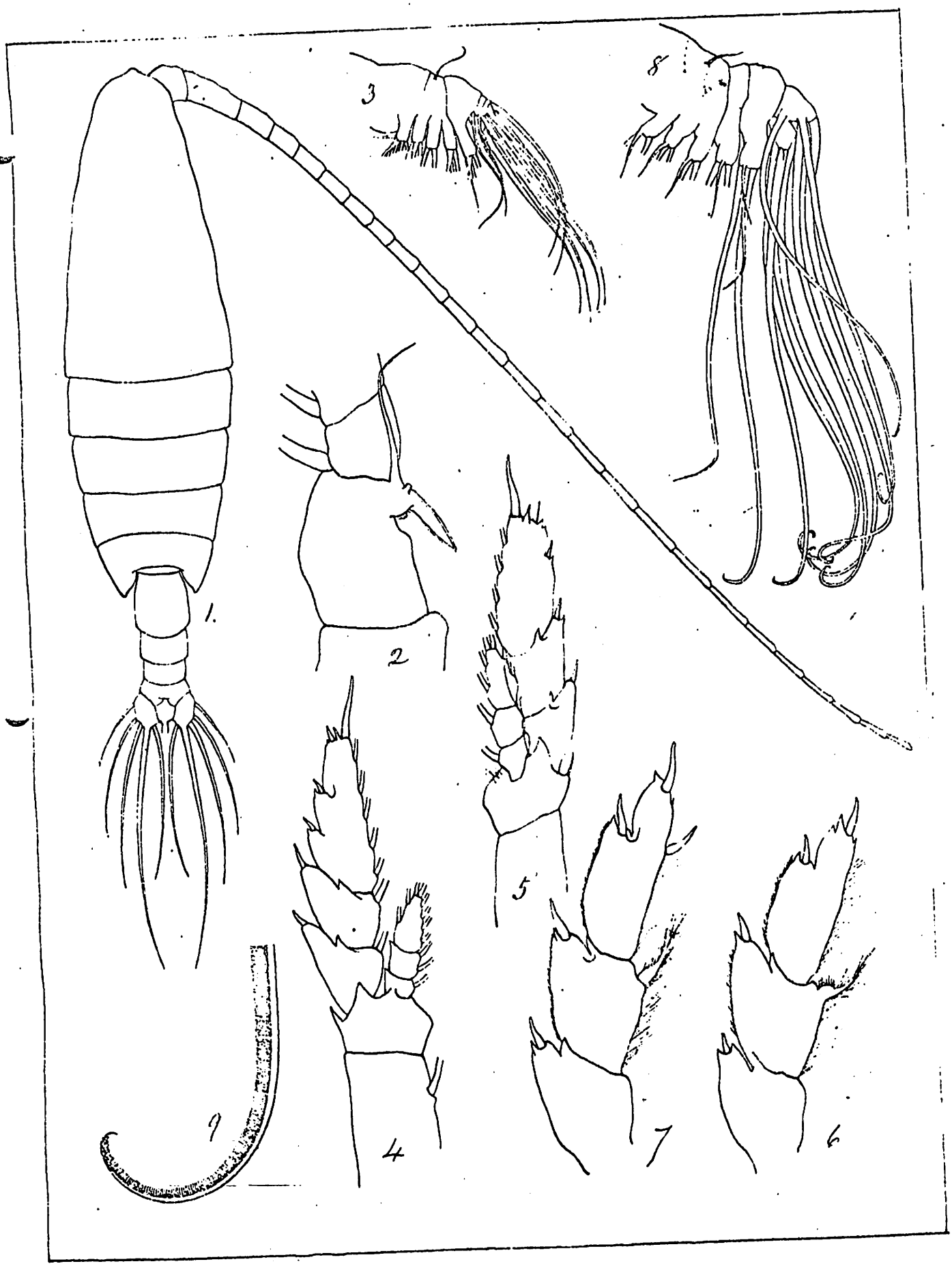
Second feet: Ri = 2. Ri 2 very long, with a few scattered prickles on the surface.

Third feet: Ri = 3, Re = 3. Re 1, 2 and 3 with rows of small prickles on the surface.

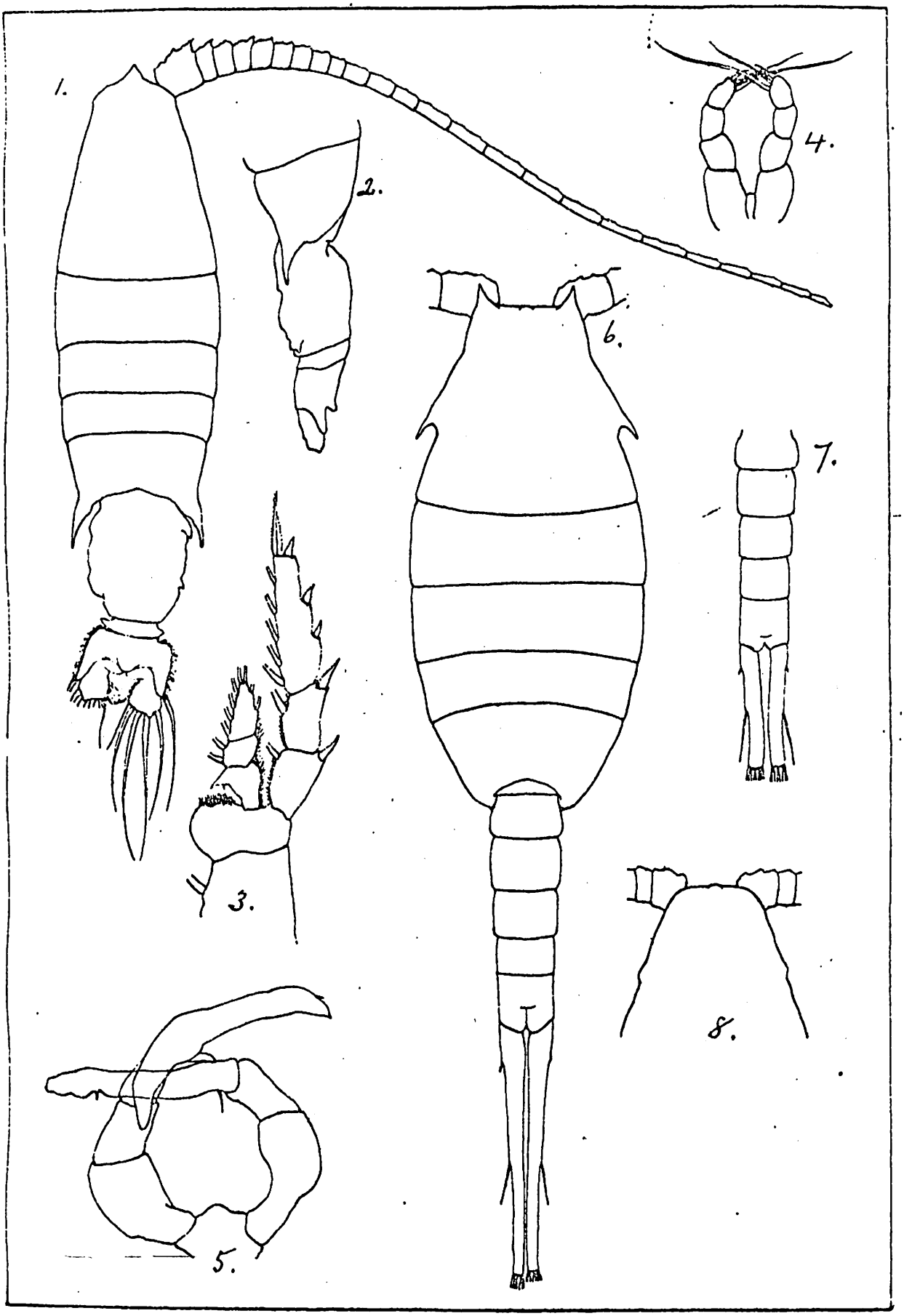
Fourth feet completely broken.

Fifth feet: A common basal and a long segment imperfectly divided into a short proximal, a middle, and a short distal joint. The latter has, at the junction of the two distal segments on the outer margin, a short spine, and apically on the last segment a very short external spinelet and longer spine internal. On the inner margin, at the junction of the middle and distal segment, is a long, rather thick and slightly denticulated bristle, in length equal to the foot, excepting the basal portion.

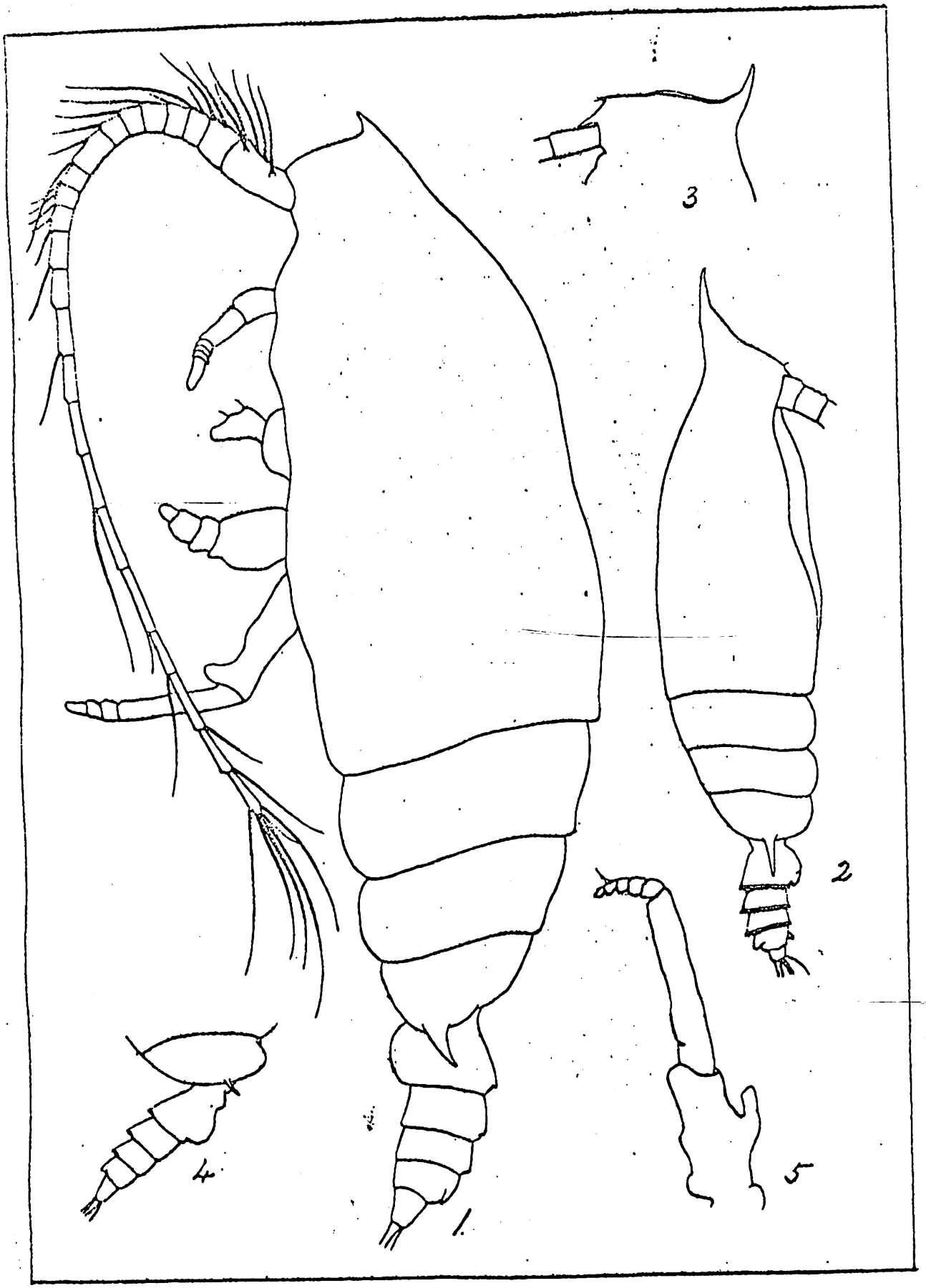
This copepod bears considerable resemblance to *A. brevicornis* (Sars)—'Crustacea of Norway,' vol. iv., 1903, Plate 36—but differs in being slightly larger, the furcal segments shorter, the head more rounded, and especially in the three-jointed outer ramus of the first feet possessing three well-formed Se; and also in the slightly different form of the fifth feet, which are imperfectly three-segmented, have two (instead of one) denticles apically, and the large inner Si is only the length of the foot, instead of being twice as long, as in *A. brevicornis*. *A. obtusifrons* (Sars)—*Bull. du Musée Océanog. de Monaco*—is twice the size, though the fifth feet appear to resemble. Captured by the *Silver Belle* at Station lat. 48° 12′ N., long. 16° 26′ W., 1904.



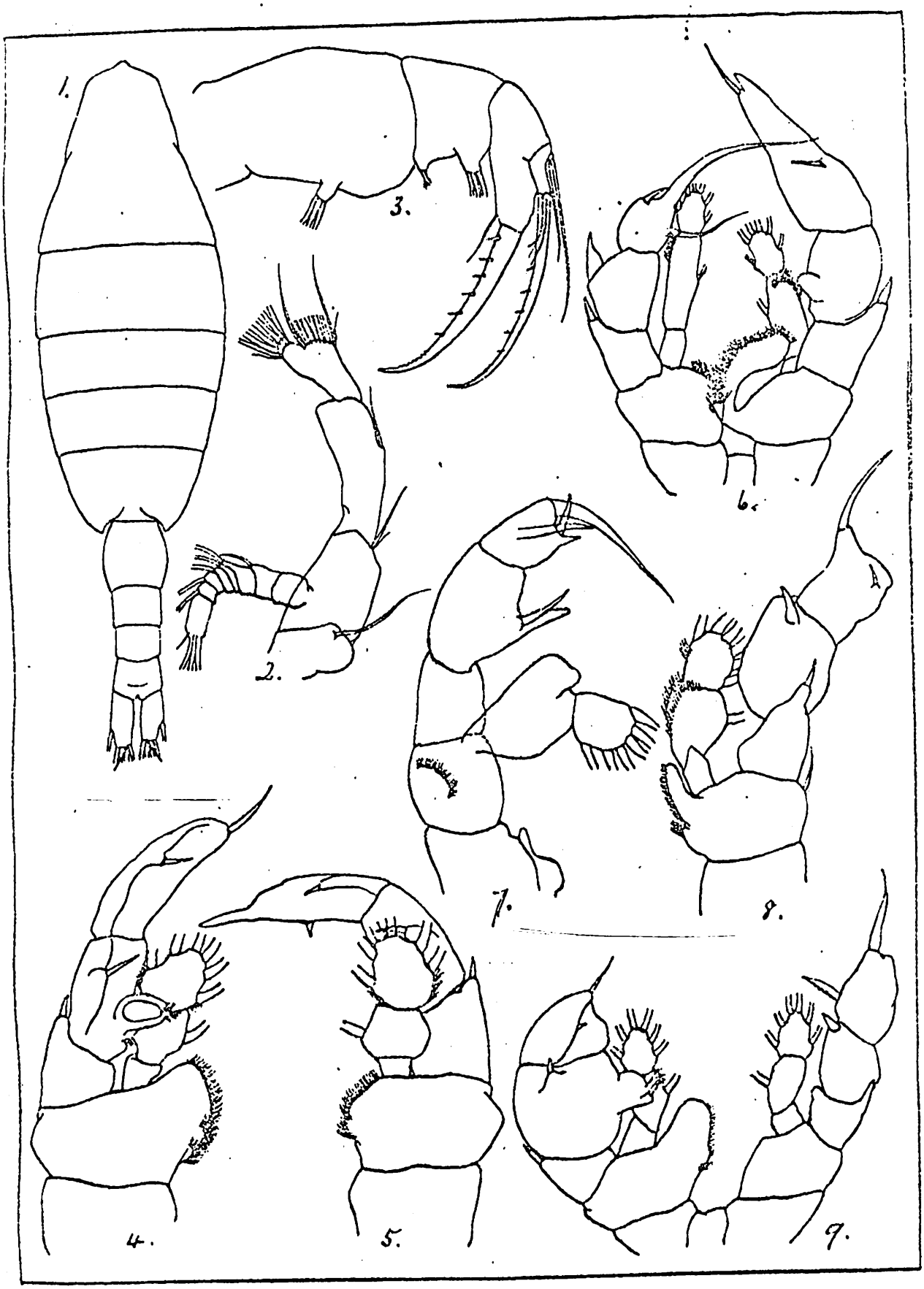
MEGACALANUS: BRADY, (♀ 1, 2, 4, 5; ♂ 3, 6) AND PRINCEPS 7, 8, 9, PART OF BRISTLE OF 8).



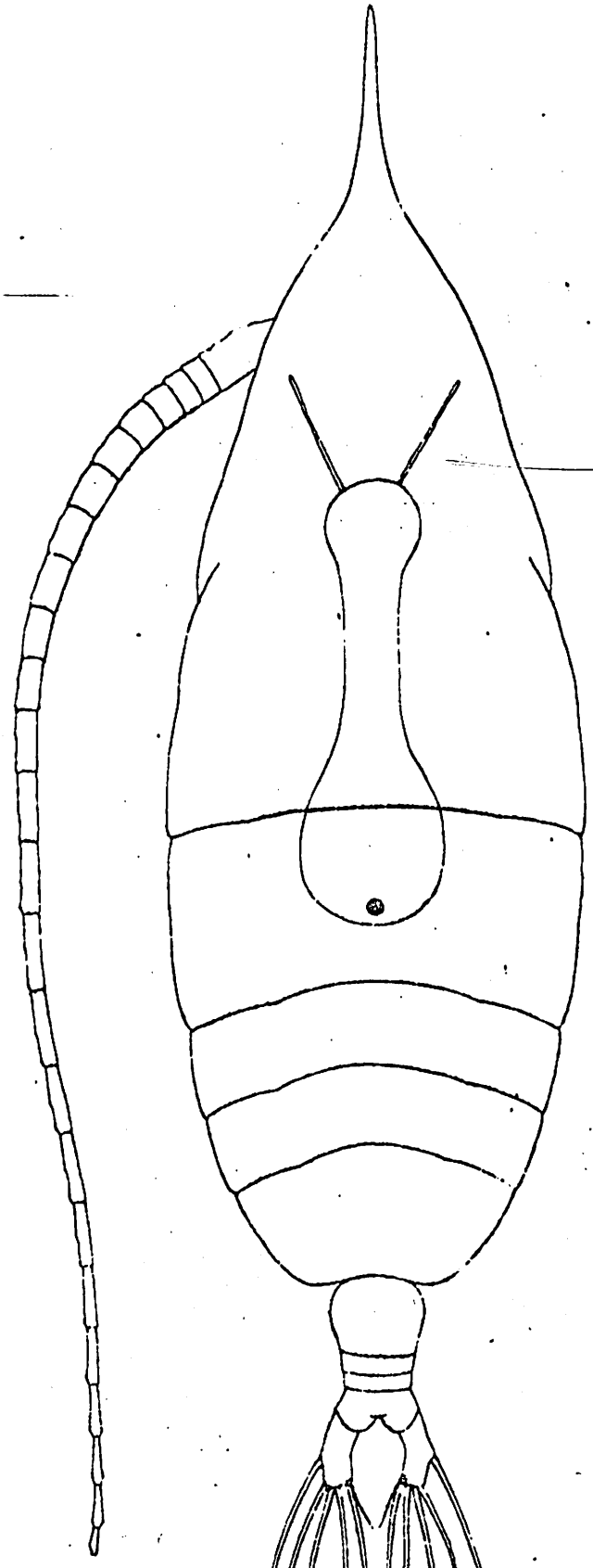
GAUSSIA Scotti (♀ 1, 2, 3, 4; ♂ 5). LUCICUTIA: Bicornuta (♂ 6) and Grandis (♂ 7, 8).



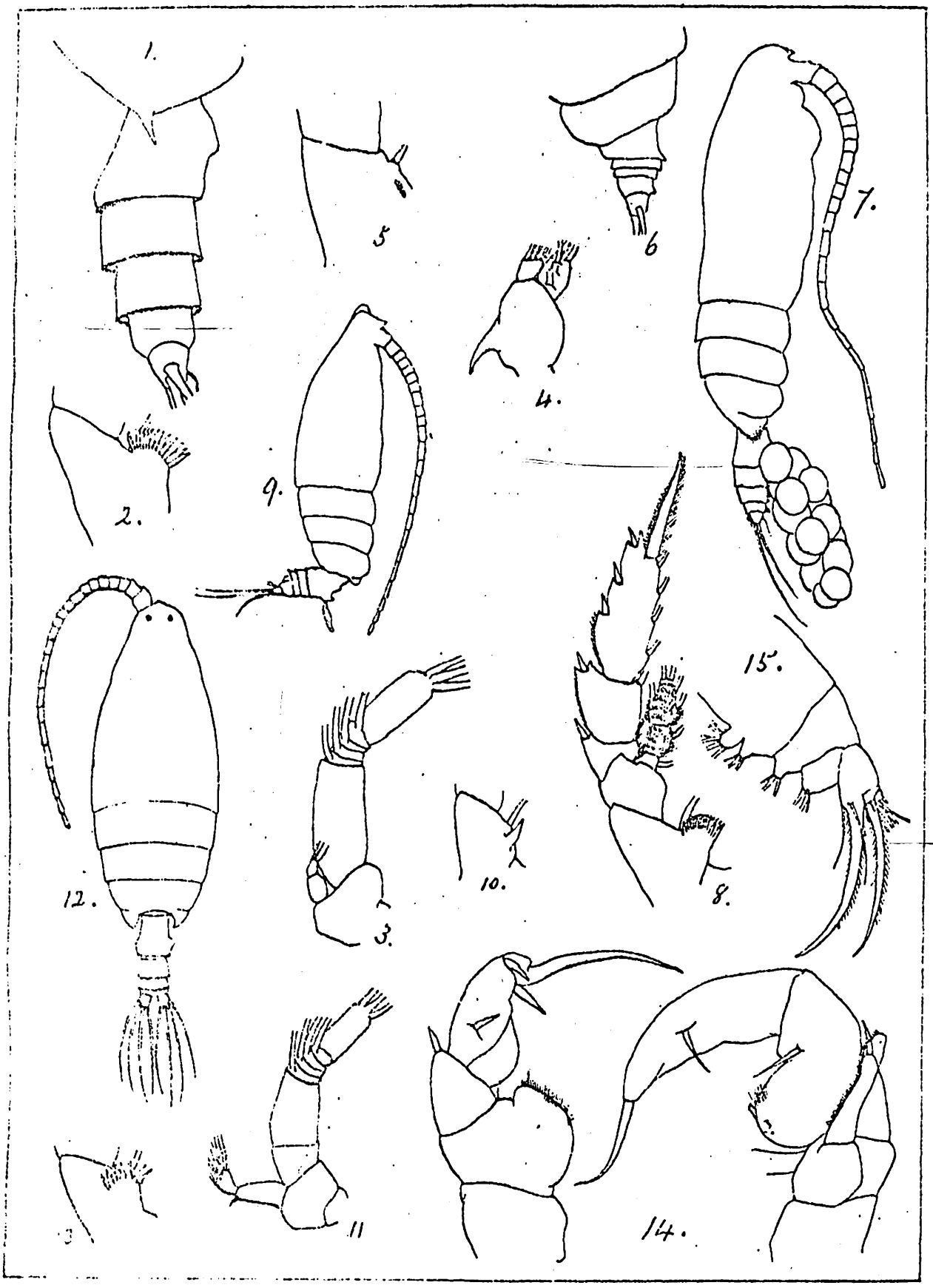
GAIDIUS INTERMEDIUS (4, 5). GAETANUS: ANTARCTICA (1), LONGISPINUS (3), AND CAUDANI (2).



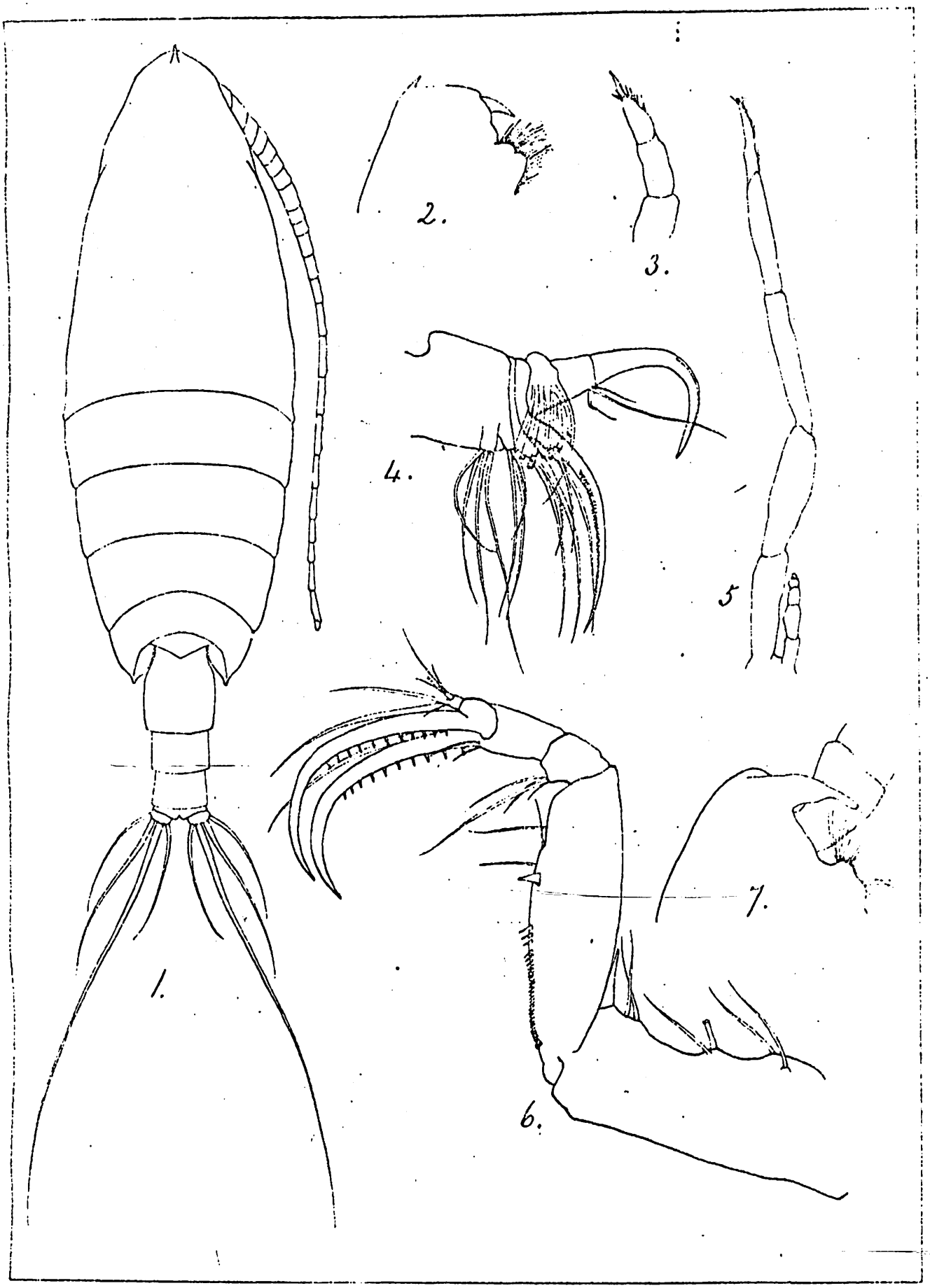
HETERORHABDUS : BREVICAUDATUS (1, 2) ; GRIMALDII (3, 4, 5) ; PROFUNDUS (6) ; GRANDIS (7, 8) : AUSTRINUS (9).



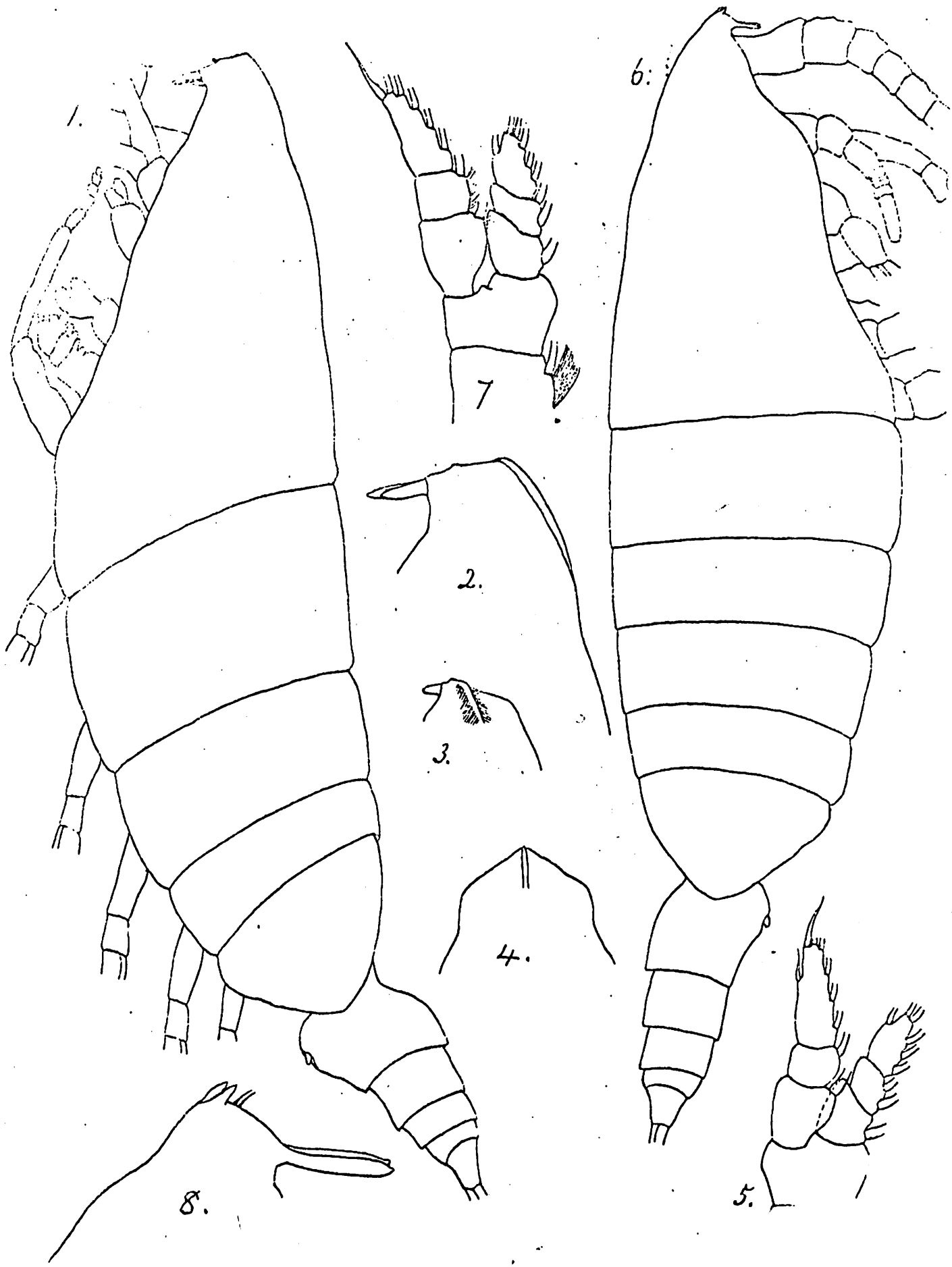
HALOPTILUS OCELLATUS.



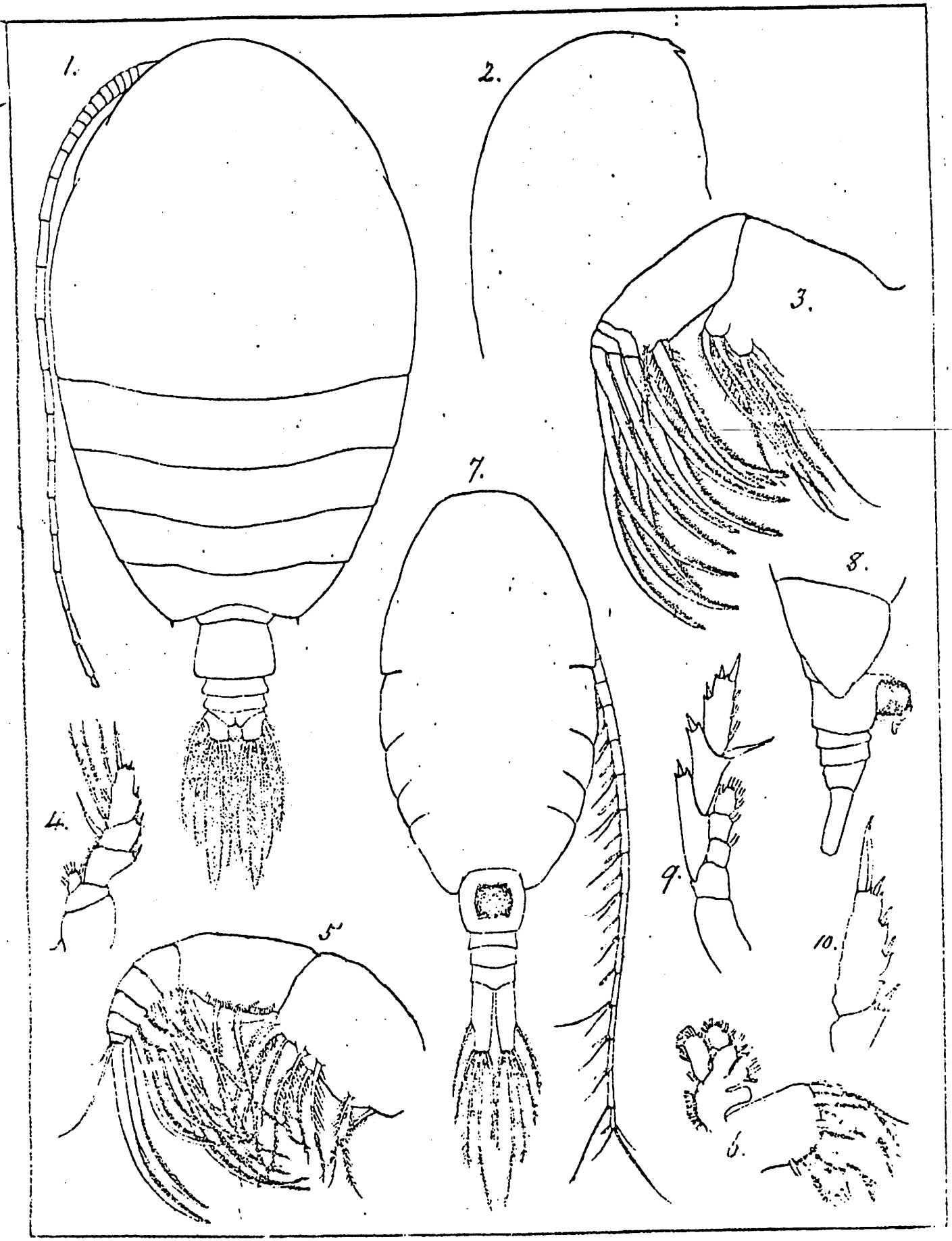
EUCHIRELLA: MAXIMA (9, 10, 11); BREVIS (3, 4, 5, 6); ELONGATA (12, 13); SPINOSA (1, 2); HIRSUTA (7, 8).
HETERORHABDUS: MAJOR (♂ 14); BREVICAUDIA (15).



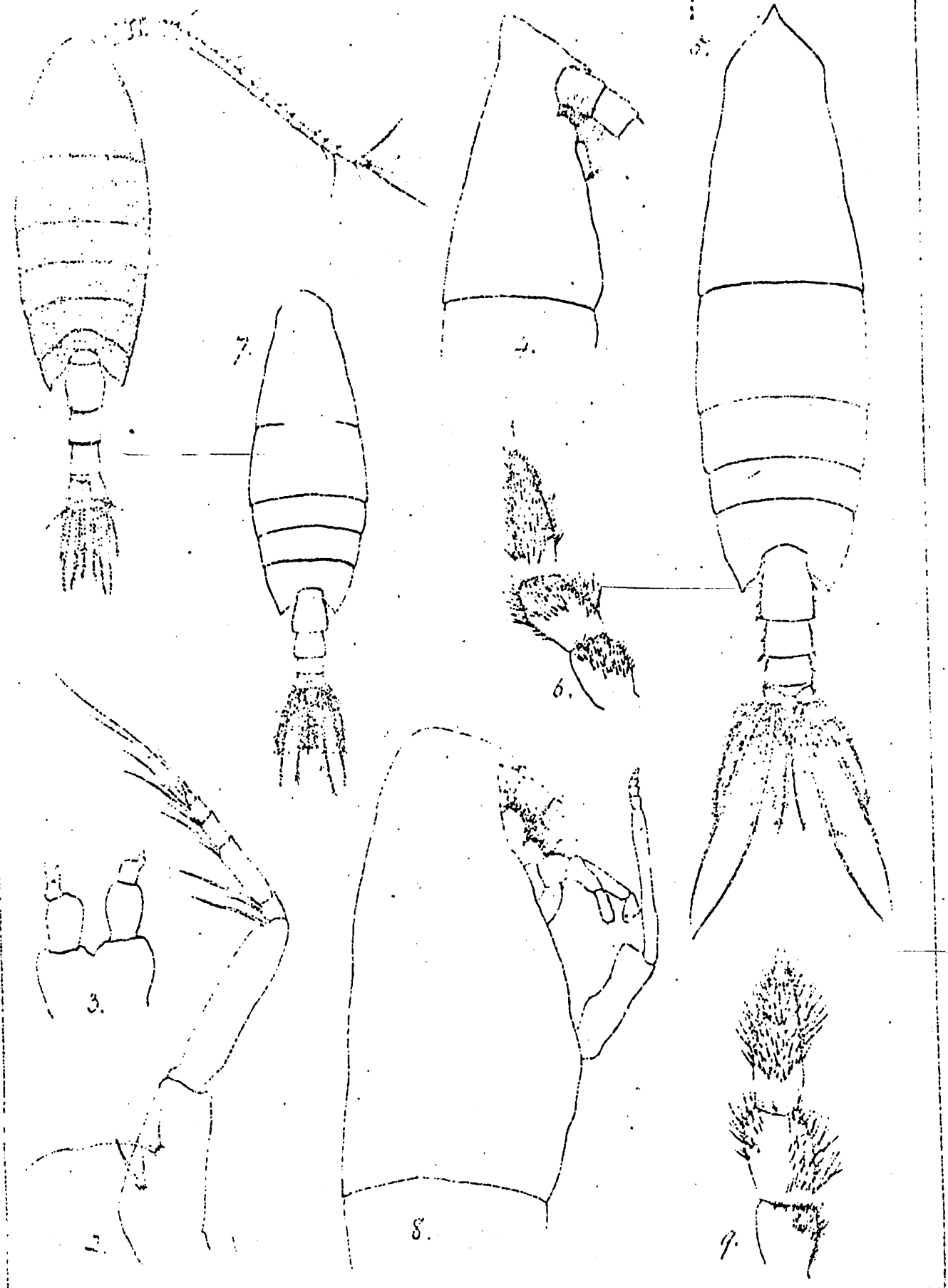
CORNUCALANUS (♀ 1, 2, 3, 4, 6; ♂ 5, 7).



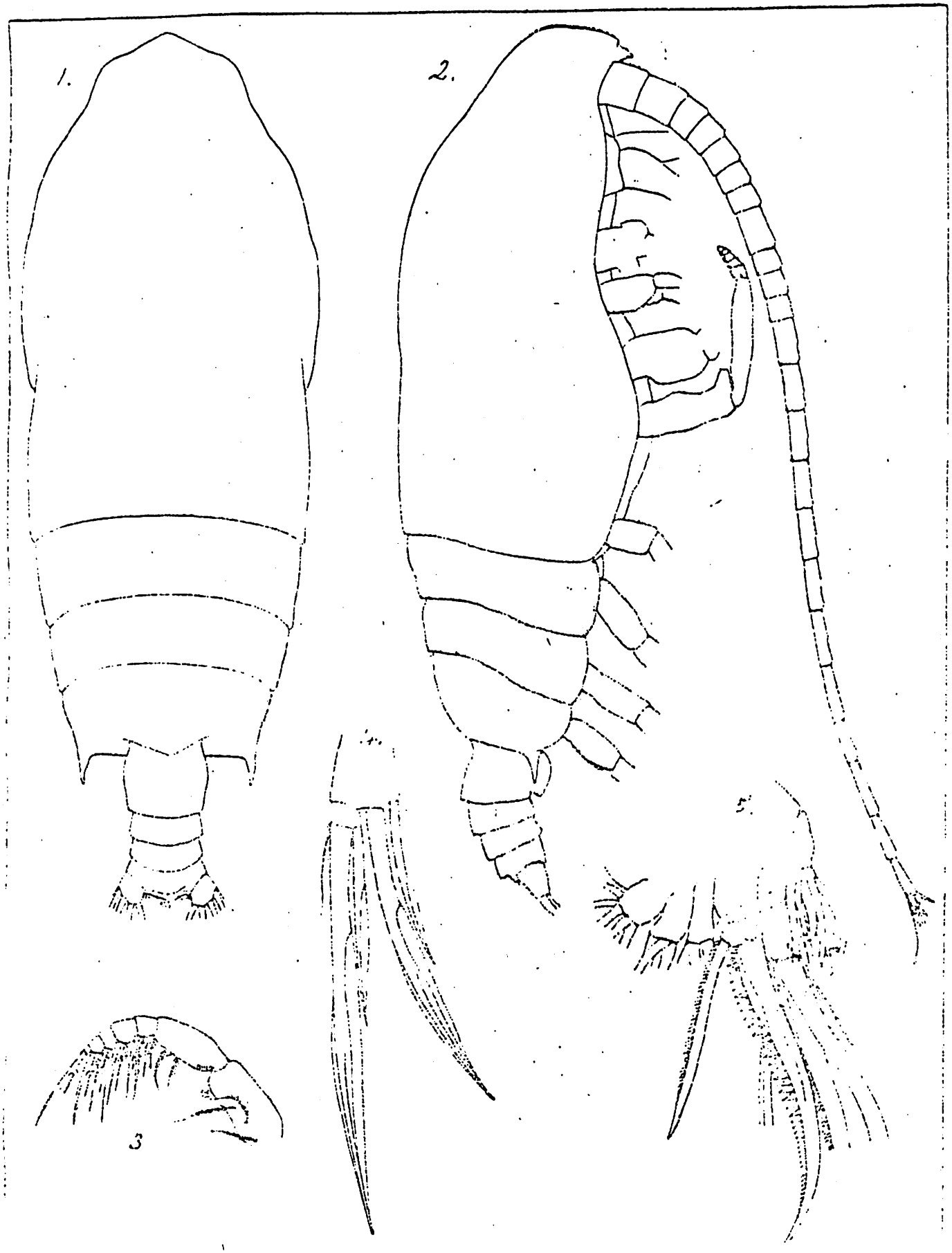
HETEROCALANUS MEDIUS (1, 2, 3, 4, 5). **BATHYCALANUS** (6, 7, 8).



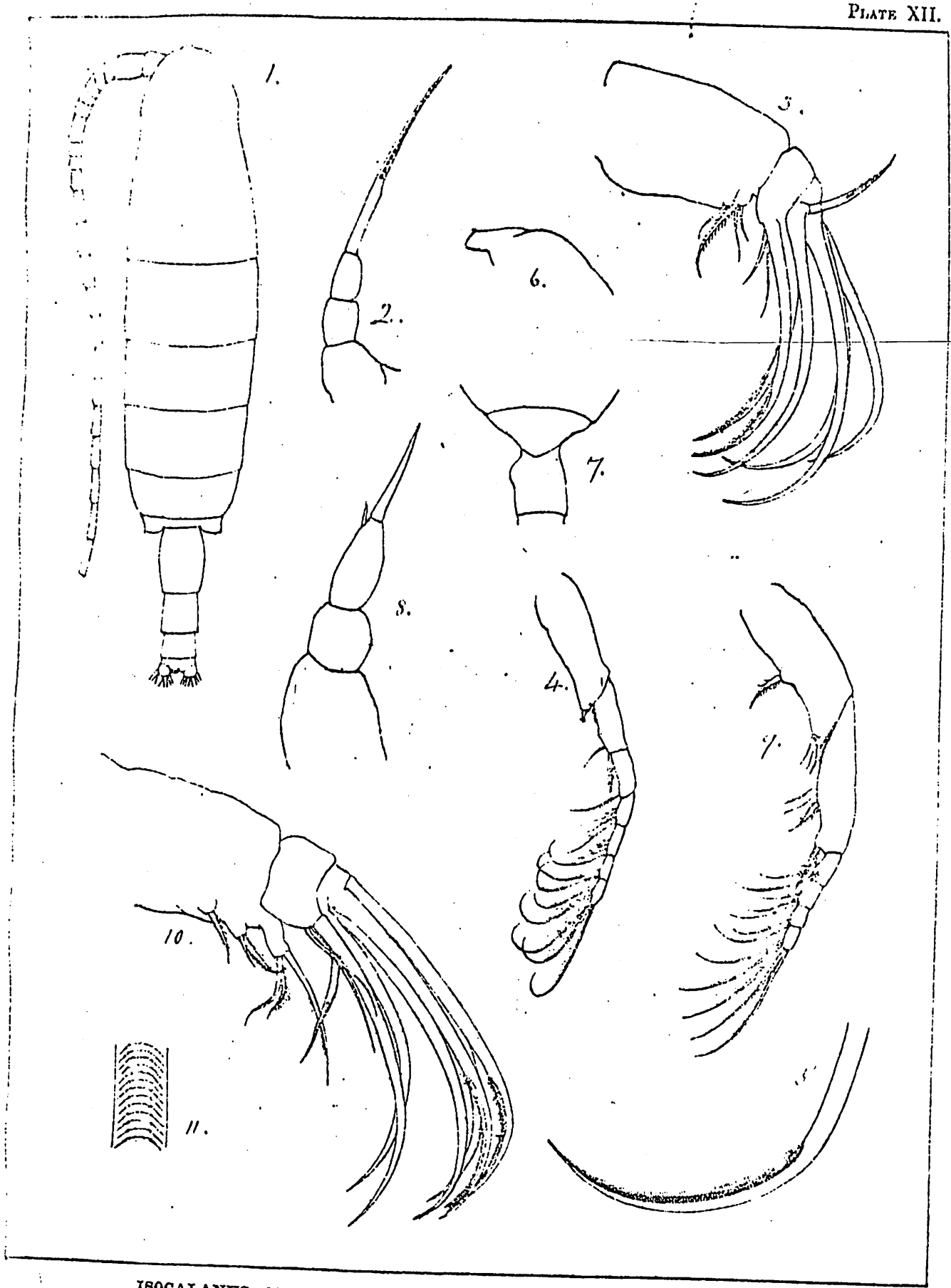
HALOPTILUS LONGIMANUS (1, 2, 3, 4, 5, 6). **LUCICUTIA** OVALIS (7, 8, 9, 10).



XANTHOCALANUS: SIMPLEX (1, 2, 3); SUBCRISTATUS (4 5, 6); MAGNUS (7, 8, 9).

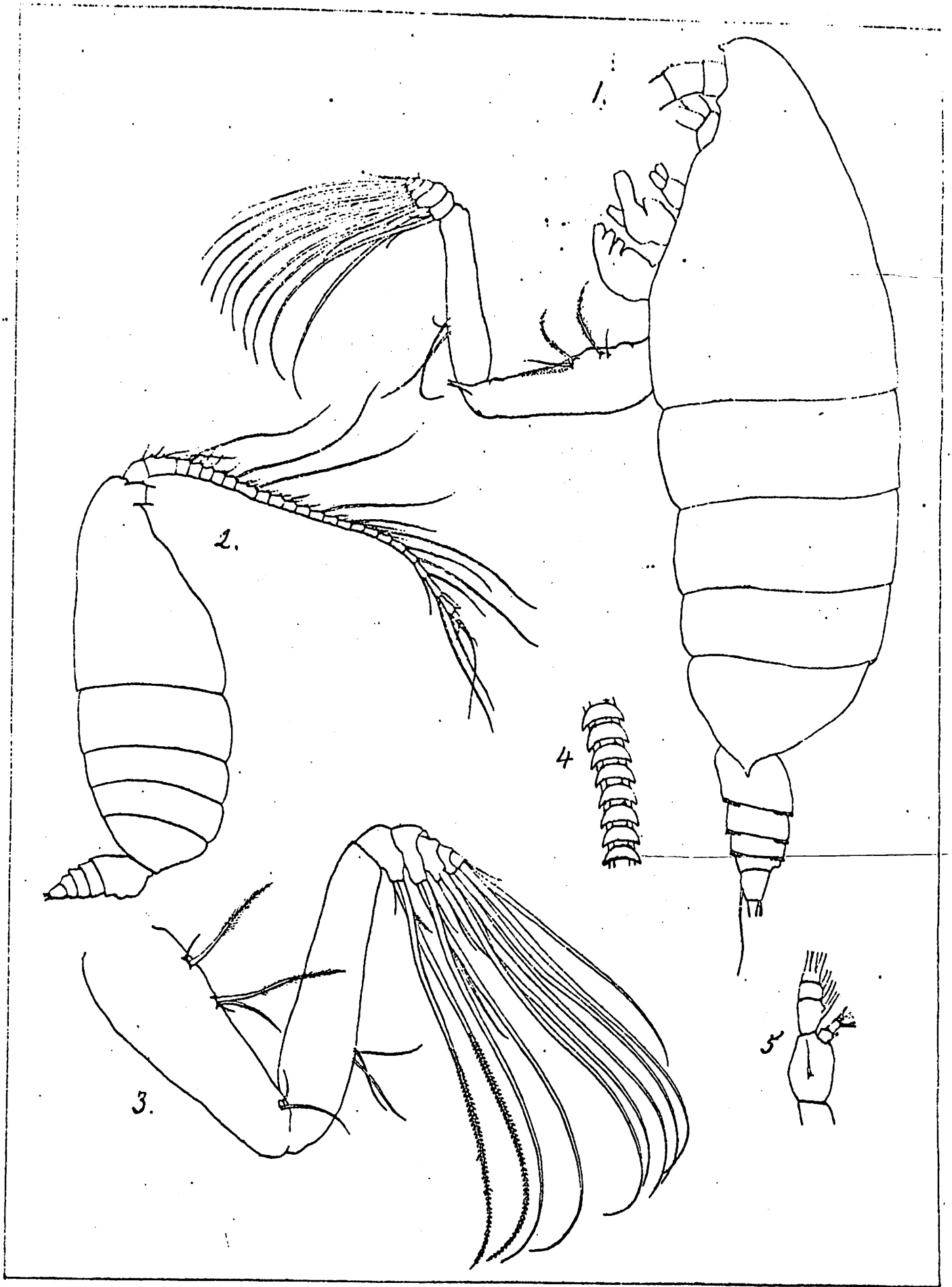


GAIDIUS MAXIMUS (1, 2). **XANTHOCALANUS** CALAMINUS (3, 4, 5).



ISOCALANUS: MINOR (1, 2, 3, 4, 5); MAJOR (6, 7, 8, 9, 10; 11, a portion of a bristle of the A.F.J.).

NOTE.—Only two hooks on the A.F.J. are drawn ciliated, but all are similar.



AUTANEPSIUS: MAJOR (1); MINOR (2, 3, 4, 5).

NOTE.—Only two of the bristles of the P.F.J. are drawn with sensory processes. Fig. 4, a small portion of one of them magnified