PLANKTON STUDIES

PRELIMINARY NOTES UPON NEW OR INTERESTING SPECIES

BY

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PART I.

COPEPODA

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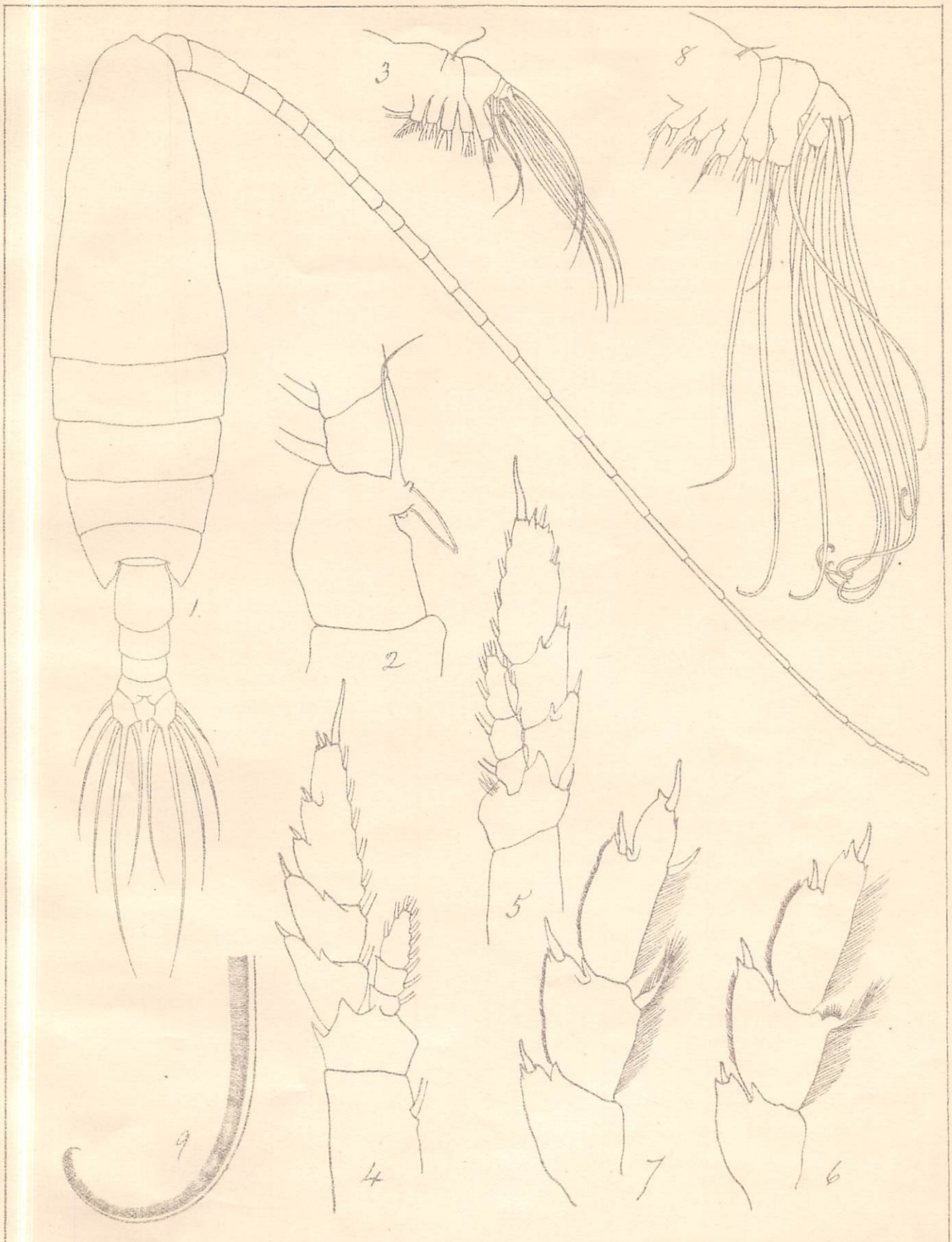


MEGACALANUS: Brady (♀ 1, 2, 4, 5 ; ♂ 3, 6) AND Giesbrecht (♂ 7, 8, 9, PART OF BRISTLE OF 8).

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,

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.*

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.

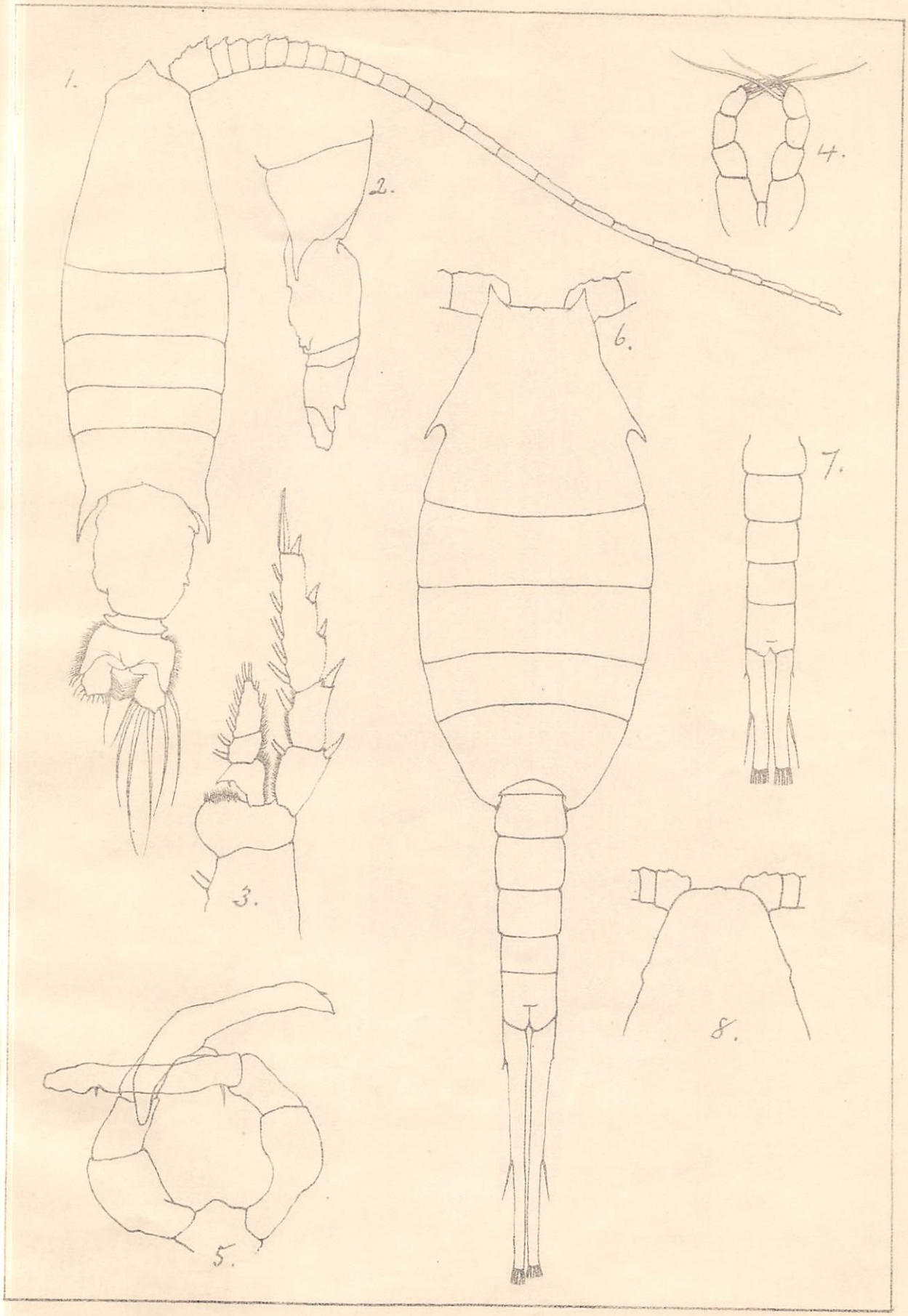
Metridia Scotti. Giesbt., *Zool. Anzeiger*, vol. xx. Giesbt. and Schmeil, 'Tierreich,' p. 107.

♀ 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.

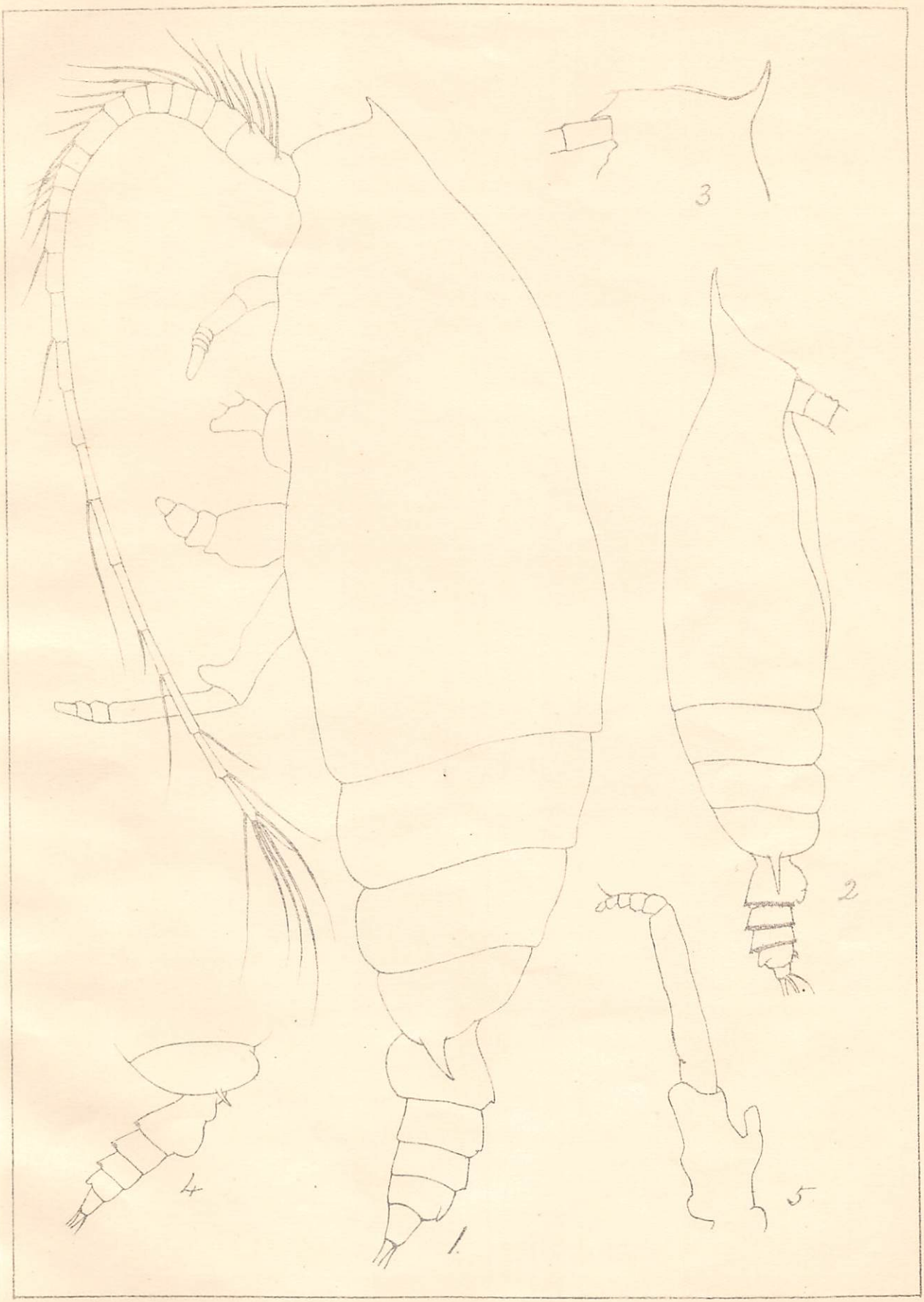
AA = twenty-three, longer than whole body by four and a half joints; on the first and second segments are strong, broad-based spines, not recurved; on the fourth, fifth, and sixth, smaller spines. *Mx*, *P.F.J.* (B 1 : B 2 : Ri = 20 : 18 : 28) and *A.F.J.* like *Pleuromamma*. *Mn*, Ri much longer than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



GAUSSIA MELANOTICA (♀ 1, 2, 3, 4; ♂ 5). **LUCICUTIA**: BICORNUTA (♂ 6) AND GRANDIS (♂ 7, 8).



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

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.

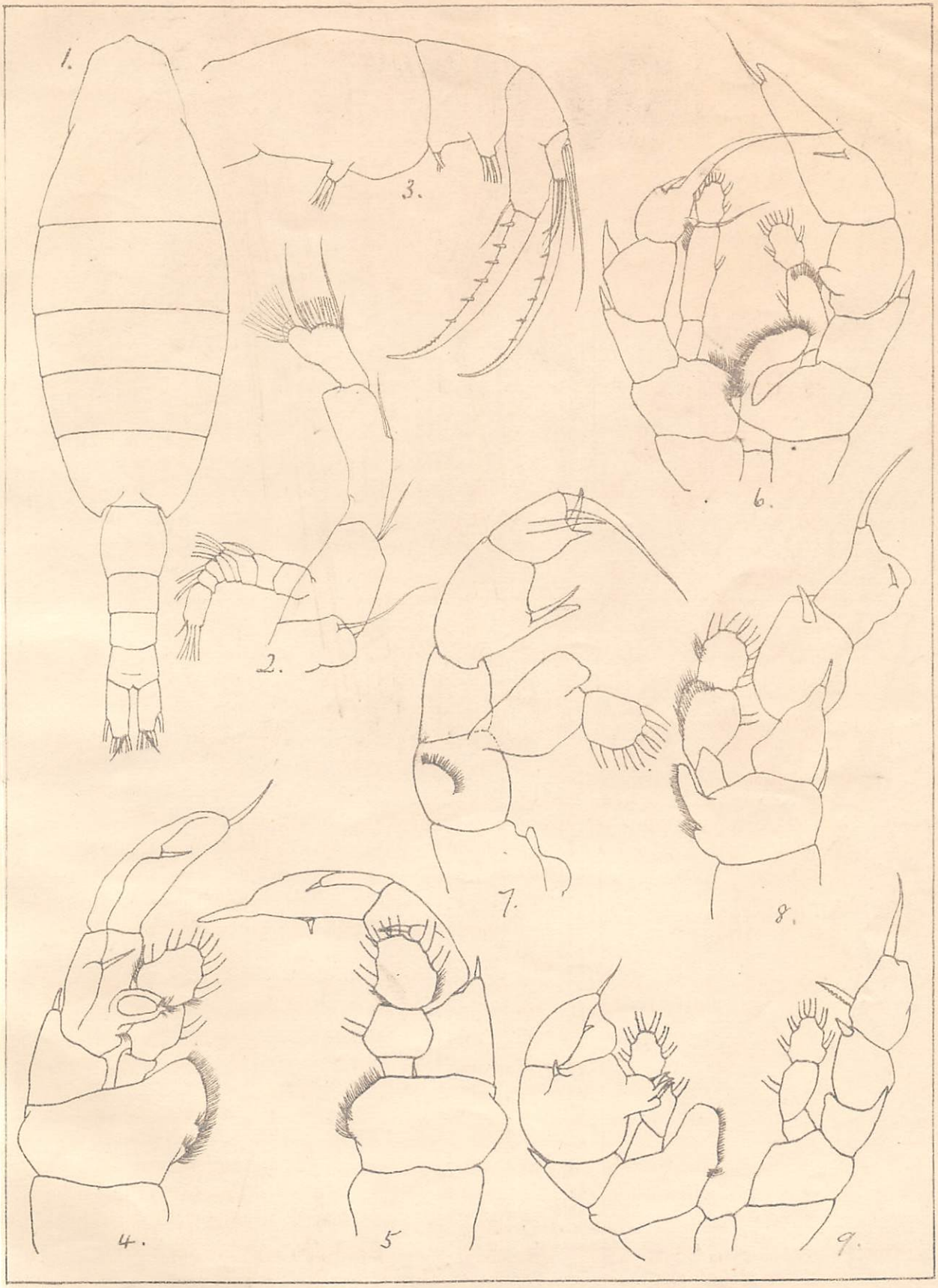
The *Anterior Footjaws* have the proximal lobes small; the fourth with three thin bristles, and a fourth thin but rather longer; the fifth elongated, with one very thick strong curved hook with about six strong teeth wide apart, and one thin bristle; the sixth lobe short, with a hook similar to the foregoing 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.



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

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.

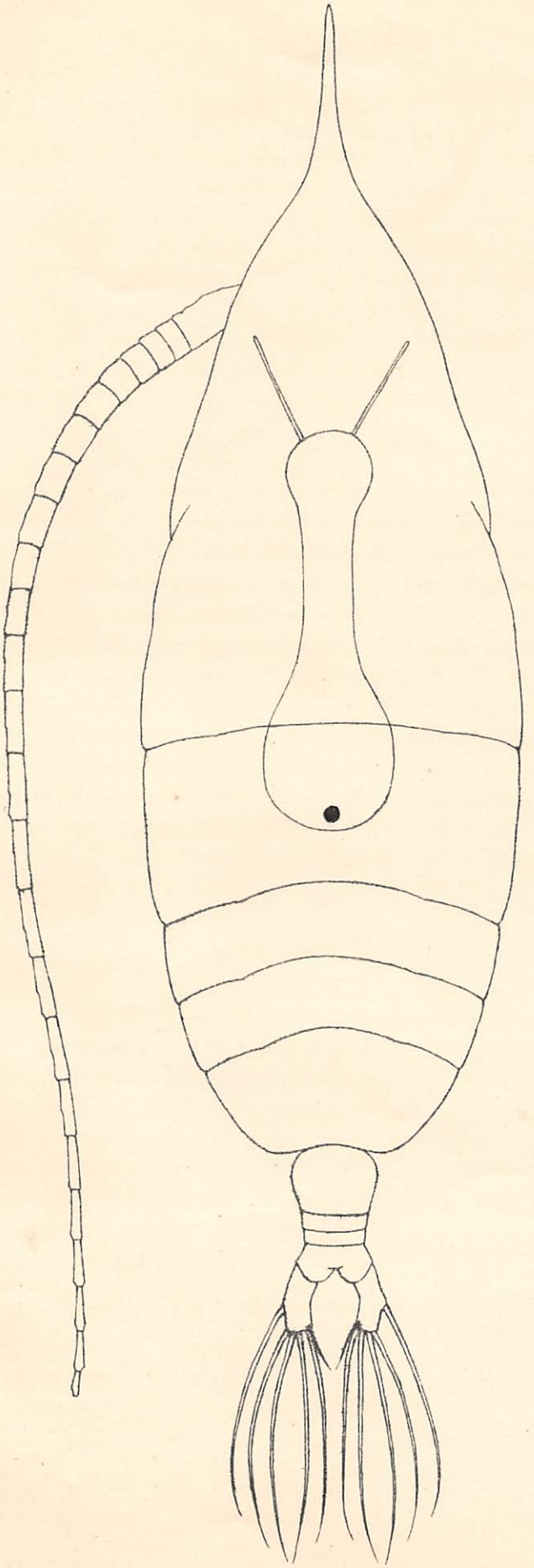
It belongs to the same group as *H. major* and *longicornis*, except for the short fifth lobe of the anterior footjaw. The antennæ and fifth feet are entirely different from *H. longicornis*. It differs from *vipera* in mandibles, third and fourth feet and fifth feet, and also from *brevicornis*, Dahl; 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.



HALOPTILUS OCELLATUS.

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.

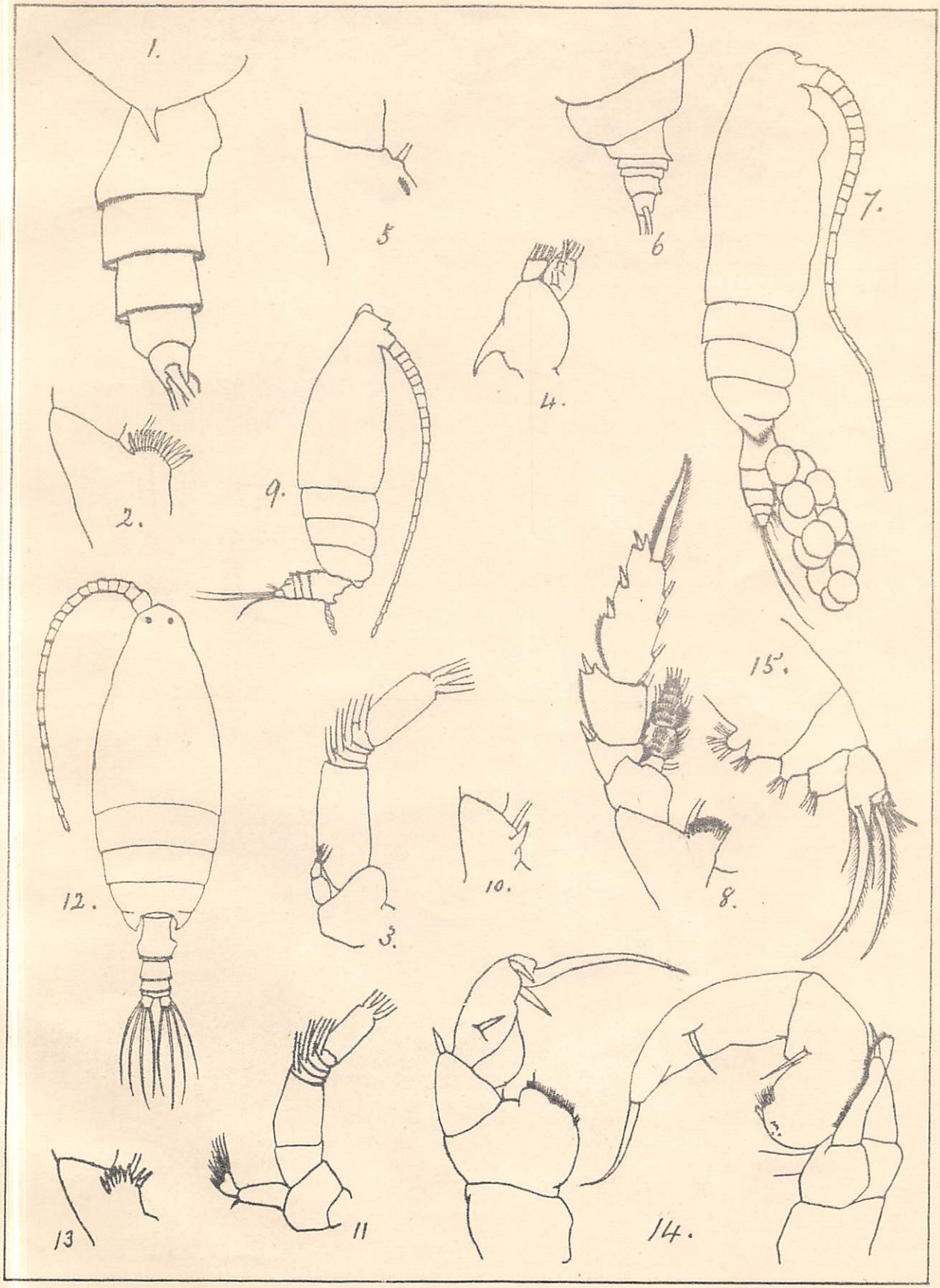
The mouth parts resemble the same organs in *M. minor*, Gbt.

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.



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

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 *Undeuchæta* 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 *Undeuchæta* 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.

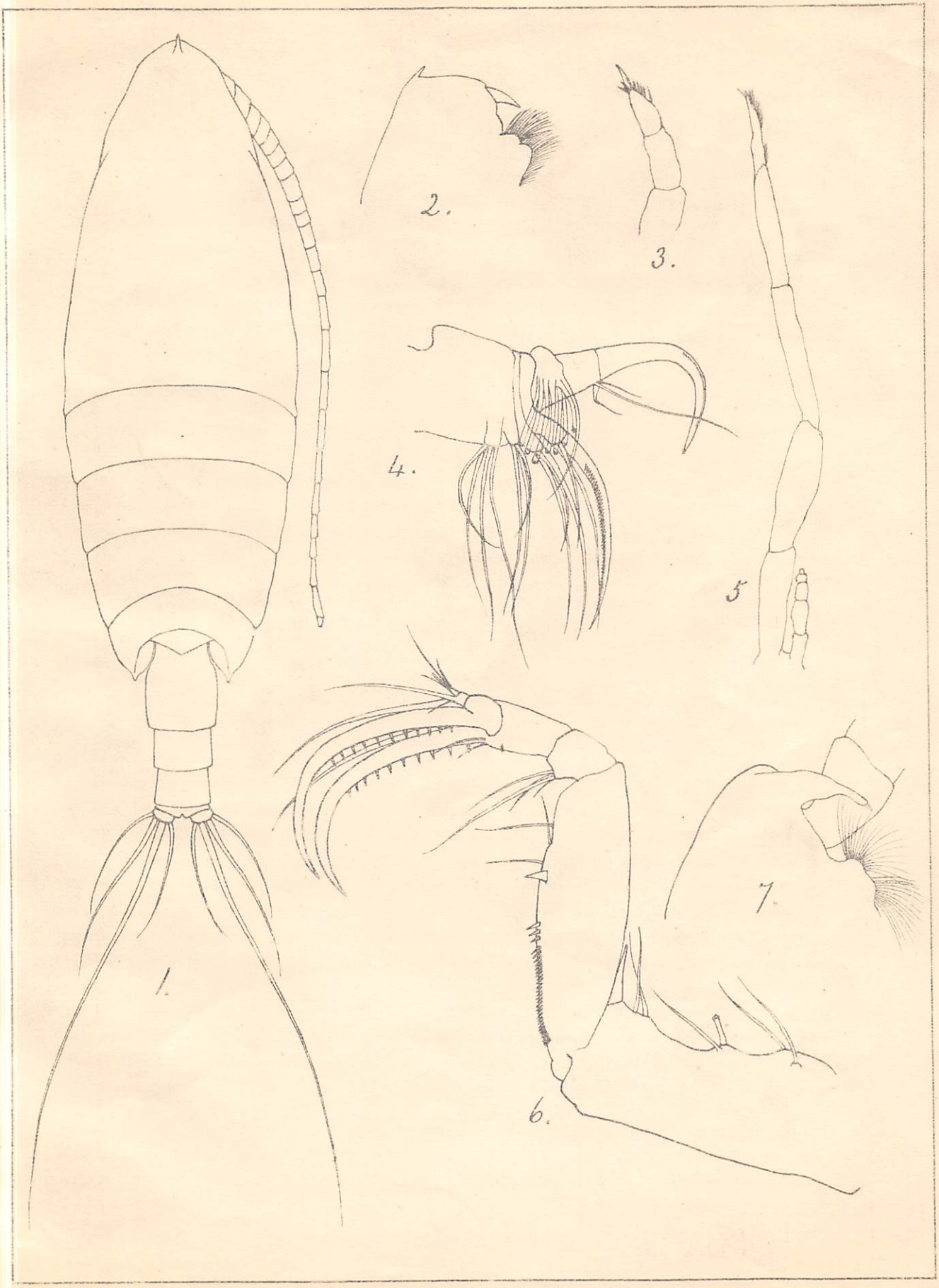
The resemblance to *E. curticauda* is very great, this being, however, a Pacific Ocean species.

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



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

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. 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 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.*)

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.