

AN ACCOUNT  
OF THE  
**CRUSTACEA**  
OF  
**NORWAY**

WITH SHORT DESCRIPTIONS AND FIGURES OF ALL THE SPECIES

BY

G. O. SARS

VOL. IV

**COPEPODA**  
**CALANOIDA**

PART I & II

CALANIDÆ, EUCALANIDÆ, PARACALANIDÆ,  
PSEUDOCALANIDÆ, ÆTIDEIDÆ (part)

WITH 16 AUTOGRAPHIC PLATES



**BERGEN**  
PUBLISHED BY THE BERGEN MUSEUM

SOLD BY

ALB. CAMMERMEYER'S FORLAG, CHRISTIANIA

1901

## INTRODUCTION.

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Of all the orders of Crustacea, that of the *Copepoda* is perhaps the most extensive one, comprising, as it does, an immense number of forms, which, both as to structure and habits, exhibit quite wonderful variation. Some of them lead a free existence as pelagic organisms, and are comparatively highly organized; some are more sedentary in habits, being restricted to the bottom, or are partly semiparasitic; and a considerable number are true parasites, becoming so much degenerated in the adult state, that they sometimes even hardly admit of being recognized as Crustacea, but look more like worms. It is easy to believe that the parasitic forms have originally descended from free-living forms; and indeed, the semiparasitic Copepoda form a well-marked transition between the 2 groups. In consequence of this, the most primitive characters must be sought for not among the parasites, but among the free-living forms. During the development, which is always at true metamorphosis, all the Copepoda pass through some free-living stages, the earliest of which is the well-known, so-called *Nauplian* stage, also found in some other Crustacea, for instance the *Phyllopoda* and the *Euphausiidae*. This very primitive stage is characterised by a rounded or oval, unsegmented body, which only carries 3 pairs of movable appendages, viz., the antennulæ, the antennæ, and the mandibular legs, the mouth being protected in front by a large flap-shaped lip. The segmentation of the body takes place gradually in the succeeding stages, but never attains that elaborate arrangement found in the higher Crustacea (the Malacostraca), and is sometimes again wholly lost in the parasitic life. As is clearly shown by the development of the *Euphausiidae*, and by the structure of the *Phyllocarida*, one of the chief divisions found in the higher Crustacea (Malacostraca), and often constituting by far the greater part of the body, viz., the mesosome, never comes to development in the Copepoda. On the other hand the posterior part of the body is, as a rule, like that in the *Phyllocarida*, divided into 2 sharply defined

sections, the metasome and urosome, the former carrying the natatory legs, evidently answering to the pleopoda in the Malacostraca, whereas the latter never carries any true appendages, and is terminated by the so-called furca or caudal rami. The division anterior to the metasome may more properly be termed the cephalosome, though very often confluent with the 1st segment of the metasome. It carries, as a rule, 6 pairs of movable appendages, viz., the anterior and posterior antennæ, the mandibles, the maxillæ, and 2 pairs of maxillipeds. At about the middle of this division, below, the oral aperture occurs, in the free-living forms bounded in front by a flap-shaped anterior lip and behind by a bilobate posterior lip. These lips in some of the parasitic forms are prolonged into a siphon receiving the styloform masticatory parts of the mandibles. A more or less pronounced reduction of the cephalic appendages may be observed in the most degenerate parasites (*Lernæoïda*); and even in one peculiar group of free-living forms, the *Monstrilloïda*, this reduction is so far advanced, that only the anterior antennæ are left, not even the slightest trace of either the posterior antennæ or any of the oral appendages being visible, at any rate in the adult state.

As to the classification of the Copepoda, the views of the several authors differ considerably, according to the characters which have been selected as the basis for the classification. The well-known classification of the Copepoda by T. Thorell into 3 great divisions, *Gnathostoma*, *Pocillostoma* and *Siphonostoma*, refers exclusively to the structure of the oral parts, and was at first much esteemed by carcinologists. As, however, quite gradual transitions in the structure of the oral parts between these 3 types have been found to exist, and moreover, by accepting these groups, otherwise evidently nearly-allied forms would be separated from each other in an unnatural manner, this classification cannot at present be regarded as fully satisfactory. The establishment by Dr. Giesbrecht of the 2 great divisions, or sub-orders, *Gymnoplea* and *Podoplea*, is certainly more natural; but these divisions do not nearly suffice for the comprising of all the Copepoda, as they apparently relate only to the pelagic form examined by that author. Nor, I believe, can the recent subdivision of the Copepoda proposed by Dr. E. Canu, according to the structure of the female genital openings, into the *Monoporodelphia* and *Diporodelphia*, lay any claim to general acceptance. There are, I think, 7 distinct types among the Copepoda, which may indicate as many great divisions or sub-orders. These types are represented by the following well-known genera: *Calanus*, *Harpacticus*, *Cyclops*, *Notodelphys*, *Monstrilla*, *Caligus* and *Lernæa*. In accordance herewith, 7 divisions are adopted in the present work, viz., *Calanoïda*, *Harpacticoida*, *Cyclopoida*, *Notodelphyoida*, *Monstrilloïda*, *Caligoïda* and *Lernæoïda*, each comprising a number of distinct families, which may be referred to 2 or

more sections. The first-named division, which forms the subject of the present Volume, answers to the sub-order *Gymoplea* of Dr. Giesbrecht, and comprises the most highly organized Copepoda.

The free-living marine Copepoda of Norway have been partly studied by the late A. Boeck, who, in the Transactions of the Christiania Scientific Society, has given a preliminary account of the species observed by him. I have myself, during a long series of years, given my attention both to the marine and fresh-water forms of our country, and have long since published a synopsis of the latter. Among foreign naturalists who have made these Crustacea the object of special study, may be named the late Prof. C. Claus, to whom we are indebted for a rather full account of the internal anatomy and development of Copepoda, and Prof. G. S. Brady, whose monograph of the British free and semiparasitic Copepoda is especially valuable for the knowledge of the northern forms. More recently a standard-work on these Crustacea has been published by Dr. W. Giesbrecht, forming one of the admirable series of treatises edited by the Zoological Station of Naples. This excellent work, which, however, only relates to the strictly pelagic forms, comprises, besides Mediterranean species, also forms from all parts of the Oceans, and thus gives by far the most complete account of the species of this kind. Both the descriptions and figures are far superior to any formerly given, and it is only to be regretted that the arrangement of the figures on the plates is such, that no little trouble is entailed to find at once the details relating to each species. Though I do not venture to think that the modest account here given will in any way compete with Dr. Giesbrecht's splendid work, I hope that its arrangement may be found somewhat more convenient by students for an easy determination of the northern species.

## CALANOIDA.

The chief characters of this great division have been well pointed out by Dr. Giesbrecht, and consist in the firm conjunction of the last pedigerous segment with the preceeding one, with which it is not infrequently even wholly coalesced, whereas in most other Copepoda this segment forms a very movable articulation with the former, and is firmly connected with the 1st segment of the urosome, thus giving it the appearance of belonging more properly to that section of the body. In all the forms the anterior division of the body, comprising the cephalosome and metasome, is much broader than the posterior (urosome), which is abruptly narrowed and very movably connected with the former. The female genital openings occur generally close together on the ventral face of the 1st caudal segment, whereas in the male only a single such opening is found lying asymmetrically, generally on the left side.

As to the several appendages, the anterior antennæ are as a rule much elongated, sometimes of the very same appearance in the two sexes, but more generally transformed in the male, either by a reduction of the number of articulations combined with a much more abundant supply of the peculiar sensory appendages named by Dr. Giesbrecht "aesthetascs", or by a geniculated structure of one, generally the right, antenna. The posterior antennæ are always biramous, with the inner ramus (endopodite) biarticulate, the outer (exopodite) multiarticulate, though the latter, in some cases, is much reduced in size. The mandibles generally have the masticatory part exceedingly dentate, and are provided with a well-developed biramous palp, which, like the posterior antennæ, is subservient to locomotion. The maxillæ generally exhibit a rather complicated structure, though the same chief parts as in the 2 preceding pairs of appendages may easily be demonstrated, with the addition of 3 setiferous lobes, the generally large vibratory plate outside the basal part, and the 2 much smaller appendicular lobes occurring close together inside between the basal part and the palp. The 2 pairs of

maxillipeds always form simple stems furnished with procurved setæ or claws, and on them may be easily distinguished a basal and a terminal part, the former generally biarticulate, the latter multiarticulate. As a rule, the posterior maxillipeds are more slender than the anterior; but in some cases this pair is much reduced in size, whereas the anterior pair may be very powerfully developed. Of legs generally 5 pairs occur, the 4 anterior of which are always natatory and biramous, whereas the last pair are only exceptionally of that character, but in the female are more generally much reduced, not infrequently even wholly absent, and in the male are transformed into prehensile organs, by the aid of which the spermatophores are grasped and transferred to the female. The normal number of caudal setæ is 5 on each ramus; but this number is sometimes reduced to 4 or even to 3. In every case, in addition to the true caudal setæ, a slender bristle may be observed on the inner corner of each ramus, generally extending dorsally, more rarely ventrally. The ovisac, when present, is always simple, more or less flattened in form, and attached to the ventral face of the genital segment.

As to the internal organisation, the Calanoida are prominently distinguished by the presence of a well-developed heart occurring dorsally at the limit between the 1st and 2nd pedigerous segments. The male generative organ is asymmetrical, the efferent duct being located on one side, generally the left. The asymmetrical structure of the last pair of prehensile legs is apparently in accordance with this circumstance.

By far the greater number of the Calanoida are marine; but there are also several forms peculiar to fresh or brackish water, especially of the families *Centropagidæ*, *Diaptomidæ* and *Temoridæ*. In the Oceans some forms, especially of the genus *Calanus*, often occur in immense shoals, forming the bulk of the "Zooplankton". These animals therefore are of great importance as fish-food, and in some cases even form the chief nourishment of the great whales.

The exact subdivision of the Calanoida is connected with no small difficulty, owing to the great variation in the leading characters. Dr. Giesbrecht, in his beautiful work, has however tried to make such a subdivision. His two primary sections, *Amphascandria* and *Heterarthrandria*, are very natural, though I think that a 3rd such section ought to be added, comprising those forms in which the anterior antennæ are alike in both sexes. For this section I propose to use the name *Isokerandria*, applied by Dr. Giesbrecht also to a section of the *Cyclopoida*. According to Dr. Giesbrecht's classification the 1st section only includes a single family, the *Calanidæ*, whereas the 2nd comprises 3 families, viz., the *Centropagidæ*, *Candacidæ* and *Pontellidæ*. The 2 first

families are again divided into a great number of sub-families, whereas the 3rd only includes a single such sub-family, and the 4th only 2. The disproportion of this classification is very obvious. In my opinion the number of true families accepted by Dr. Giesbrecht is much too small in proportion to the numerous Calonoid genera established, and I have therefore felt justified in raising the several sub-families to the rank of true families, though some of them, it is true, are rather closely allied. I think that thus a more uniform and convenient arrangement of the genera may be obtained.

As the very great majority of the Calanoida are pronouncedly pelagic animals, often occurring in the open sea at a considerable distance from the coast, the limits of the fauna-domain ought in this case to be considerably more extended than is generally allowed for the bottom-forms. I therefore refer to the Norwegian fauna all forms that have been found anywhere in those parts of the Ocean surrounding the Norwegian coast, viz., the Skagerak, the North Sea, that part of the North Atlantic generally termed the Norwegian Sea, and bounded on the west by the Shetland Isles, Iceland and Jan Mayen, and on the east by Spitsbergen and Bear Island, and finally the Barents Sea, which washes the greater part of the Finmark coast. Indeed, any form that has been observed even at the outer limits of these parts of the Ocean, may be assumed occasionally also to occur in the immediate neighbourhood of the Norwegian coast.

Though the distribution of some Calanoid species has proved to be extraordinarily wide, we must, I think, admit that several of the forms found off the Norwegian coast are of true arctic origin, others peculiar to the North Atlantic, and others again of still more southern rise; for it is very likely that northern forms may occasionally be carried far away from their true home by currents, and, *vice versa*, southern forms may be carried in the same manner northwards, beyond the limits of their true domain. It may thus easily happen that species of very different origin may be found in the very same tract of the Ocean, though perhaps at different seasons of the year. In the great depths of the Norwegian fjords, a peculiar Calanoid fauna was long ago proved to occur. By the recent investigations of the plankton-organisms taken during Nansen's Polar Expedition, it has been ascertained by the present author that the greater number of these peculiar deep-water Calanoids are of true arctic origin, the same species occurring also in the Polar basin, often at the very surface of the sea. They must accordingly be regarded as relict arctic forms, existing in the depths of the fjords from ancient times (the glacial period), when the sea surrounding the Norwegian coast still exhibited a purely arctic character.

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## Section 1.

# Amphascandria.

This section is chiefly characterised by the fact that both of the anterior antennæ in the male are alike and only slightly transformed, never exhibiting any geniculate structure, but only differing from those in the female by a more or less pronounced coalescence of some of the articulations, and in the much more abundant supply of sensory appendages. In the greater number of genera the adult male is moreover distinguished by a very conspicuous transformation of the oral parts, some of which appear greatly reduced. In some cases also the external appearance of the male is so very different from that of the female, that it becomes rather difficult to recognise both as belonging to the same species.

All the Amphascandria, as yet known, are marine, and by far the greater number lead a true pelagic life, though there are a few forms that seem to be more restricted to the bottom, being as yet only found close to the ground in moderate depths, e. g. the species of the genera *Undinopsis*, *Bryaxis* and *Pseudophaënna*. On the other hand, some of the forms, e. g. *Paracalanus parvus*, are almost constantly found at the very surface of the sea, and are often thrown by the waves upon the shore, where they may be found in considerable numbers, left in tidal pools.

The Norwegian forms belonging to this section may be referred to 8 different families, of which diagnoses are given below.

## Fam. 1. Calanidæ.

*Characters.*—Cephalosome well defined, or coalescent with the 1st pedigerous segment; front carrying below 2 soft posteriorly curving tentacular filaments. Last pedigerous segment not confluent with the preceding one, and having the lateral corners but slightly produced. Urosome not very slender, consisting in female of 4, in male of 5 segments, caudal rami comparatively short, with the normal number of setæ. Eye simple, very small, subventral. Anterior antennæ in female long and slender, consisting of 25 articulations, which are supplied anteriorly with comparatively short and uniform bristles; penultimate and antepenultimate articulations each having behind an unusually strong and densely plumous seta extended straight backwards. Anterior antennæ in male thickened at the base, with some of the proximal articulations fused together and supplied below with a restricted number of comparatively short sensory appendages. Posterior antennæ with the rami of about equal length. Oral parts of normal structure, being but slightly transformed in male. Legs with both rami 3-articulate, terminal joint of outer ramus with only 2 spines outside. 5th pair of legs in female of a similar structure to that in the preceding pairs, in male more or less transformed, left leg the stronger.

*Remarks.*—This family, answering to the subfamily *Calaninae* of Dr. Giesbrecht, is chiefly characterised by the structure of the 5th pair of legs, which, at any rate in the female, are natatory and of a similar appearance to that of the preceding pairs. Moreover, the long and slender anterior antennæ, with the 2 remarkably developed subapical setæ, furnish an easily recognizable character. The family comprises as yet only 2 genera, viz., *Calanus* Leach, and *Undina* Dana. These 2 genera, it is true, have been combined by Dr. Giesbrecht; but I think that they ought more properly to be kept apart, as the structure of the last pair of legs in the male differs conspicuously in the 2 genera. In the northern seas only the first-named genus is represented.

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### Gen. 1. *Calanus*, Leach, 1816.

Syn: *Cetochilus*, Roussel de Vauzème, Baird, Claus.

*Generic Characters.*—Body comparatively slender, with the anterior division oblong subcylindric in form, and more than twice as long as the posterior.

Cephalosome generally well defined from the 1st pedigerous segment, and slightly carinated dorsally in the male, frontal part obtuse, and more or less projecting between the insertions of the anterior antennæ. Lateral corners of last pedigerous segment generally rounded off. Urosome symmetrical, with the genital segment in female comparatively short and but slightly protuberant below. Caudal rami well defined from the anal segment, and in male movably articulated to it, admitting of being spread outwards, 2nd caudal seta (from within) longer than the others. Anterior antennæ generally longer than the body, and much more strongly built in male than in female, with the first 2 articulations fused together into a broad, somewhat flattened segment. Posterior antennæ with the outer ramus 7-articulate. Posterior maxillipeds with the terminal part longer than either of the basal joints, and 5-articulate, setæ of the outer edge in male remarkably developed and densely plumous. Legs comparatively slender, inner ramus well developed, though considerably shorter than the outer, its 2nd joint (except in last pair) having 2 natatory setæ inside. Last pair of legs with the 1st basal joint denticulate along the inner edge, but without the plumose seta present in the other pairs; outer ramus in male without any natatory setæ, and more strongly developed on left side, though imperfectly prehensile; inner ramus in both legs well developed, and resembling that in female.

*Remarks.*—In the restriction here adopted, this genus is chiefly characterised by the imperfect prehensility of the last pair of legs in the male, this pair still preserving its natatory character, whereas in the 2nd genus, *Undina*, it is very much transformed, the left leg being quite enormously developed and pronouncedly prehensile. Otherwise these 2 genera are closely related. The present genus comprises several species, and seems to be represented in all parts of the Oceans. To the Norwegian fauna belong 3 nearly-allied species, one of which, however, has generally been confounded with the type species.

### 1. *Calanus finmarchicus*, (Gunnerus).

(Pl. I, II, III.)

*Monoculus finmarchicus*, Gunnerus, Acta Hafnia, Vol. X, p. 175, figs. 20—23.

Syn: *Cetochilus septentrionalis*, Goodsir.

„ *Calanus spitsbergensis*, Kröyer ♀.

„ — *quinqueannulatus*, Kröyer ♂.

*Specific Characters.*—*Female.* Anterior division of body, seen dorsally, oblong oval in form, greatest width equalling  $\frac{1}{3}$  of the length and occurring about in the middle, frontal part but slightly produced; seen laterally, somewhat dilated anteriorly, with the frontal margin broadly rounded and forming, together

with the dorsal one, a perfectly even curve. Lateral corners of last pedigerous segment slightly produced, but rounded at the tip. Urosome about half the length of the metasome; caudal rami somewhat longer than the anal segment. Anterior antennæ, when reflexed, extending beyond the caudal rami by about the last 3 articulations.

*Male*.—Cephalosome more sharply defined behind than in female, forming at the end dorsally a small gibbous projection, and distinctly carinated above, frontal part somewhat more prominent; lateral corners of last pedigerous segment less produced. Urosome rather slender, with the 2nd segment much the largest. Subapical plumose setæ of anterior antennæ less developed than in female, and somewhat unequal in length. Last pair of legs with the outer rami not very different in appearance, the left one, however, somewhat longer than the right, with the terminal joint obpyriform in shape and nearly as long as the preceding joint, corresponding inner ramus reaching beyond the middle of the 2nd joint of the outer one.

*Colour*.—Body pellucid, more or less tinged with light red, anterior antennæ often bright red.

*Size*.—Usual length of adult female about 4 mm., of male 3.60 mm. Maximum length of arctic specimens 5 mm.

*Remarks*.—This is apparently the form at first recorded by Gunnerus as *Monoculus finmarchicus*. It has, however, been confounded by most authors with the succeeding nearly-allied species, from which, on a closer examination, it may be easily distinguished in both sexes, chiefly by the more evenly rounded frontal part, the longer caudal rami, and the less elongated outer ramus of the left last leg in the male. It also attains a considerably larger size than does the above-mentioned species. The 2 supposed species described by Krøyer as *Calanus spitsbergensis* and *C. quinqueannulatus* are unquestionably both referable to the present species, the former being the female and the latter the male.

*Occurrence*.—Of all the marine Calanoids of Norway, this form is by far the most common, occurring often in enormous shoals, and thus sometimes giving the sea a conspicuously reddish hue. It is found everywhere in the open sea, more frequently at the very surface, though at times it may also descend to greater depths, or be carried by the waves and currents towards the shores or into the bays and fjords. Off the Norwegian coast, I have met with it from Vadsø to Jæderen (Tananger); but farther east it seems to be superseded by the succeeding species. It moves rather rapidly, with abrupt bounds caused by energetic strokes of the natatory legs. At times, however, it is seen quietly suspended in the water, with the anterior antennæ spread out to each side at right

angles to the body, or proceeding slowly by rapid vibrations of the posterior antennæ and the mandibular palps. The male is still more agile than the female, and the motion effected by the posterior antennæ and mandibular palps is more energetic, in accordance with the somewhat stronger development of these appendages and the pertaining muscles, being changed to a somewhat jerky leap through the water. At some seasons male specimens are by no means rare, though the female sex always preponderates considerably in number. This Calanoid is eagerly devoured by some of our common food-fishes, for instance the herring and the mackerel, and in some cases, as stated by Prof. Rob. Collett, forms almost the exclusive nourishment of one of our great whales, *Balenoptera borealis*.

*Distribution*.—The present species seems to be especially characteristic of the arctic zone, occurring abundantly in almost all samples of plankton taken in that part of the Ocean, from Greenland in the west to the Behring Islands in the east. In the icy Polar basin crossed by Nansen, it occurred everywhere, and often in great abundance, up to and beyond 85° of latitude. The former statements about the extraordinarily wide distribution of the present species southwards, cannot be regarded as reliable, owing to its having been confounded with the succeeding species.

## 2. *Calanus helgolandicus*, (Claus).

(Pl. IV.)

*Cetochilus helgolandicus*, Claus, Die frei lebenden Copepoden, p. 171, Pl. XXVI, figs. 2—9.

Syn: *Calanus finmarchicus*, Brady, Giesbrecht etc. (not Gunnerus).

*Specific Characters*.—*Female*. Anterior division of body, seen dorsally, narrow oblong in form, greatest width not attaining  $\frac{1}{3}$  of the length, frontal part angularly produced between the insertions of the anterior antennæ; seen laterally, scarcely dilated at all anteriorly, frontal margin abruptly and narrowly curved. Lateral corners of last pedigerous segment but very slightly produced and obtusely rounded. Urosome exceeding half the length of the metasome, caudal rami rather short, scarcely longer than the anal segment. Anterior antennæ, when reflexed, reaching beyond the caudal rami by about the last 2 articulations. *Male* resembling that of the preceding species, but having the frontal part considerably more produced. Last pair of legs more asymmetrical, the outer ramus of left leg being considerably elongated, with the terminal joint scarcely exceeding half the length of the penultimate one, inner ramus extending but little beyond the 1st joint of the outer ramus. Body in both sexes very pellucid, with a slight reddish pigment

especially along the ventral side. Length of adult female but little exceeding 3 mm., of male 2.80 mm.

*Remarks.*—As above stated, this form has generally been confounded with *C. finmarchicus*, to which species it certainly bears a very close resemblance. It is, however, rather inferior in size, and, on a closer examination, may moreover be easily distinguished by the somewhat more slender form of the body, the more produced and narrowly rounded frontal part, the shorter caudal rami, and the considerably more elongated outer ramus on the left leg of the last pair in the male. The *Cetochilus helgolandicus* of Claus is unquestionably this species, and this is also certainly the case with the form recorded by Brady from the Challenger Expedition, and with that described by Dr. Giesbrecht from the Mediterranean.

*Occurrence.*—I have met with this species very frequently in the Christiania Fjord, for instance at Drøbak, as also in several other places on the southern coast of Norway. I have no certain evidence of its occurrence farther north, though in all probability it also extends for some distance along the western coast.

*Distribution.*—Its range is evidently a more southern one than that of *C. finmarchicus*. It has been recorded from Heligoland by Claus, from the British Isles by Brady, the western coast of France by Dr. Canu, the Mediterranean by Dr. Giesbrecht, the Black Sea by W. Karawaien, and it is even said by Brady to occur in the Southern Ocean, off New Zealand, though in this case a confusion with a nearly allied species may perhaps be presumed to have taken place.

### 3. *Calanus hyperboreus*, Krøyer.

(Pl. V.)

*Calanus hyperboreus*, Krøyer, Gronlands Amphipoder, p. 84, Pl. IV, fig. 23.

Syn: *Calanus magnus*, Lubbock.

— *finmarchicus*, var. major, auctorum.

*Specific Characters.*—*Female.*—Anterior division of body very large, seen dorsally oblong fusiform, greatest width about equalling  $\frac{1}{3}$  of the length, and occurring in the middle, frontal part but slightly prominent and, seen laterally, evenly rounded. Lateral corners of last pedigerous segment somewhat produced, forming at the tip an acute angle. Urosome not nearly attaining half the length of the metasome, caudal rami comparatively short, scarcely longer than the anal segment. Anterior antennæ, when reflexed, reaching beyond the caudal rami by about the last 3 articulations. *Male* resembling that of the 2 preceding species, but having the frontal part less prominent, and the lateral corners of last pedigerous segment angularly produced, as in female. Last pair of legs but slightly asymmetrical, outer ramus of left leg scarcely longer than that of the right, though

differing in the fact that the terminal joint is narrower and generally incurved; inner ramus of same leg reaching beyond the middle of this joint. Body in both sexes highly pellucid, with the oral area slightly tinged with red. Length of adult female reaching to 9 mm., of male to 6½ mm.

*Remarks.*—This species was established in the year 1838 by Krøyer, but was very imperfectly characterised, for which reason it was not accepted by subsequent authors as a distinct species, but only as a large variety of *C. finmarchicus*. Dr. Giesbrecht has, however, recently vindicated its claim to be regarded as distinct, having pointed out some distinctive characters of the female. The structure of the hitherto unknown male also confirms the correctness of Dr. Giesbrecht's opinion about the distinctness of this form. It may be easily recognized from the 2 preceding species, not only by its large size (it is indeed one of the largest Calanoids known), but also by the angularly produced lateral corners of the last pedigerous segment, and the comparatively short urosome. The male, too, is fairly well marked by the less prominent frontal part, but especially by the structure of the last pair of legs.

*Occurrence.*—This form is occasionally found off the Finmark coast and the Lofoten Islands, together with *Calanus finmarchicus*; but farther south it seems to be wholly restricted to the great depths of the fjords, occurring under such circumstances as far south as in the Christiania Fjord. It must evidently be regarded here as a relict form, representing a remnant of the glacial fauna which prevailed around our coasts in ancient times (the glacial period).

*Distribution.*—About the arctic character of this species no doubt can arise, it being met with throughout the Polar Sea from Greenland to the Behring Strait, and often in great abundance at the very surface of the water. In the Polar basin explored by Nansen it was very common, occurring in the greater number of the plankton-proofs examined.

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## Fam. 2. Eucalanidæ.

*Characters.*—Body, as a rule, very slender, with the cephalosome and the 1st pedigerous segment generally coalesced, frontal part more or less produced, with 2 soft tentacular filaments below. Last pedigerous segment imperfectly developed. Urosome comparatively short, consisting in female, as a rule, of only 3 segments, caudal rami partly confluent with the anal segment and somewhat

asymmetrical, caudal setæ present in the normal number. Anterior antennæ long and slender, with the articulations somewhat reduced in number, and having some of the setæ much elongated, those attached behind to the penultimate and antepenultimate articulations, as in *Calanus*, densely plumose. Posterior antennæ with the inner ramus longer than the outer. Oral parts on the whole normal. Legs comparatively short, especially the 1st pair, the rami of which have the number of joints more or less reduced; terminal joint of outer ramus in 2nd to 4th pairs with 3 spines outside. Last pair of legs, when present, very small, simple, not natatory.

*Remarks.*—The forms belonging to this family are easily recognizable by their slender, pellucid body—the cephalic part of which is generally much produced—, by the very long and slender anterior antennæ, and the comparatively short urosome. They differ, moreover, very essentially from the *Calanidæ* in the structure of the legs, especially the last pair, which are much reduced, and not natatory in either of the sexes. According to Dr. Giesbrecht, this family comprises as yet 3 genera, viz., *Eucalanus* Dana, *Rhincalanus* Dana, and *Mecynocera* Thompson. All the species belonging to these genera are southern in distribution, none of them having hitherto been recorded from northern latitudes. I am, however, now enabled to state the occurrence of at least one species so far north as to admit of being referred to the fauna of Norway.

## Gen. 2. *Rhincalanus*, Dana, 1852.

*Generic Characters.*—Cephalosome produced in front to a nose-like projection carrying the rostral filaments below. Last pedigerous segment very small, with the epimeral parts imperfectly developed. Urosome in female 3-articulate, anal segment confluent with the caudal rami, which are only slightly asymmetrical, and carry 2 of the setæ outside, middle apical seta on left ramus greatly elongated. Anterior antennæ much longer than the body, and consisting (in female) of 23 articulations only, the first 2 and the 7th and 8th being fused together. Posterior antennæ with the inner ramus moderately produced, outer ramus 8-articulate, with the terminal joint very small. Posterior maxillipeds with the terminal part shorter than either of the basal joints. First pair of legs with both rami biarticulate, outer ramus of the 3 succeeding pairs with the spines of the outer edge not defined from the joints. Last pair of legs (in female) 3-articulate.

*Remarks.*—This genus is chiefly characterised by the nose-like anterior projection of the head, a character which has, indeed, given rise to the generic

name proposed by Dana. From the type genus, *Eucalanus* Dana, it is moreover clearly distinguished by the presence of a 5th pair of legs, which in the female of *Eucalanus* are wholly absent. Three species of this genus are as yet known, one of them being now for the first time stated to occur also in the northern oceans.

#### 4. *Rhincalanus nasutus*, Giesbrecht.

(Pl. VI & VII).

*Rhincalanus nasutus*, Giesbrecht, Pelagische Copepoden (Fauna und Flora des Golfes von Neapel XIX), p. 154, Pl. 3, fig. 6; Pl. 9, figs. 6, 14; Pl. 12, figs. 9—12, 14, 16, 17; Pl. 35, figs. 46, 47, 49.

*Specific Characters.*—*Female.* Body exceedingly slender and elongated, with the anterior division, seen dorsally, narrow oblong in form, greatest width not even attaining  $\frac{1}{4}$  of the length, and occurring behind the middle, cephalic part gradually attenuated, though slightly widening at the insertions of the anterior antennæ, and produced beyond the latter to a conical anteriorly-pointing projection; rostral filaments not visible in the dorsal view of the animal. Anterior body-segment (the combined cephalosome and 1st pedigerous segment) nearly twice as long as the remaining part of metasome. 2nd, 3rd and 4th pedigerous segments each with 2 small subdorsal, and 2 lateral denticles on the hind edge. Urosome about equalling in length  $\frac{1}{3}$  of the anterior division, genital segment with 2 small dorsal denticles in the middle. Caudal rami somewhat instricted in their outer part, left ramus a little longer than right, innermost seta of both rami much shorter than the others. Anterior antennæ exceedingly elongated, when reflexed, reaching beyond the caudal rami by about  $\frac{1}{3}$  of their length, and inserted at rather a long distance from the posterior antennæ and the oral parts, which are closely crowded together. Last pair of legs very small, each of the 2 outer joints with a ciliated seta inside, terminal joint moreover carrying at the tip a similar seta and, outside it, a slender unciliated spine. Body highly pellucid, and almost without any pigment. Length of adult female 5.40 mm.

*Remarks.*—This species was first described by Dr. Giesbrecht from the western part of the Mediterranean. It is easily recognized by the shape of the frontal projection, and the exceedingly long and slender anterior antennæ. It is moreover distinguished from the type species, *R. cornutus* Dana, by a somewhat different structure of the last pair of legs.

*Occurrence.*—Two well-preserved female specimens of this peculiar Calanoid were found in a sample of plankton taken during the cruise of the "Michael Sars" at Stat. 10, located at some distance east of Iceland, the depth being stated to be between 250 and 400 meters. Another female specimen was found at an

earlier date in a sample taken by Dr. Hjort in the North Sea, about midway between Scotland and Norway. Though not yet found in the immediate vicinity of the Norwegian coast, this form certainly has a claim to be included in the fauna of Norway.

*Distribution.*—Western part of the Mediterranean, off Gibraltar, the Pacific from the Magellan strait northwards to Lat. 6° N. (Giesbrecht); Atlantic Ocean from Lat. 6° N. til 48° N (Cleve); ? N. of Scotland (Moebius).

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### Fam. 3. Paracalanidæ.

*Characters.*—Body less slender, with the cephalosome not produced in front, and, as a rule, coalesced with the 1st segment of metasome, rostral filaments as in *Calanus*. The last 2 segments of metasome fused together. Urosome short, in female generally 4-articulate; caudal rami well defined, with only 4 of the apical setæ distinctly developed. Anterior antennæ in female 25-articulate, sub-apical setæ not plumose, those in male greatly thickened at the base, with the proximal articulations much reduced in number, and clothed with comparatively short, club-shaped sensory appendages. Posterior antennæ with the outer ramus scarcely longer than the inner, and having the terminal joint comparatively short. Oral parts in female normal, in male much reduced. Legs rather slender, inner ramus in 1st pair biarticulate, in the 3 succeeding pairs 3-articulate, and partly spinulose on the hind face, outer ramus in the latter with the terminal joint narrow and armed with only 2 spines outside. Last pair of legs, when present, poorly developed, not natatory, left leg in male longer than right, which is sometimes wholly wanting.

*Remarks.*—In the structure of the several appendages, the forms belonging to this family agree on the whole with those of the *Calanidæ*, differing, however, rather materially in the circumstance of the 5th pair of legs not being natatory in either of the sexes, but very small and simple, or wholly wanting in the female. The adult male has the anterior antennæ transformed in a similar manner to that in the *Calanidæ*, but is distinguished by the great reduction of the oral parts, especially the maxillipeds. The family comprises as yet 3 genera, viz., *Paracalanus* Boeck, *Acrocalanus* Giesbrecht, and *Calocalanus* Giesbrecht. Only the first of these genera is represented in the northern oceans.

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Gen. 3. **Paracalanus**, Boeck, 1864.

*Generic Characters.*—Body comparatively short and stout. Cephalosome wholly coalesced with the 1st pedigerous segment, and slightly carinated dorsally in the male; frontal part rounded. Lateral corners of last pedigerous segment not produced. Urosome in female distinctly 4-articulate, with the genital segment comparatively short. Caudal rami short, obtusely truncated at the tip, apical setæ but slightly divergent. Anterior antennæ scarcely longer than the body, their proximal part exhibiting in male 2 large segments clothed below with short sensory appendages. 1st pair of legs with a well-marked deflexed seta at the end of the basal part inside. Terminal joint of outer ramus in the 3 succeeding pairs finely denticulate along the outer edge. Last pair of legs in female very small, bi-articulate; left leg in male 5-articulate, right leg as in the female.

*Remarks.*—This genus was established in the year 1864 by Boeck, to comprise a small Calanoid formerly described by Claus as *Calanus parvus*. It may, however, be remarked, that the genus *Calanus*, as defined by Claus, does not answer to Leach's genus, and in reality comprises several genera not even belonging to the family *Calanidae* in the restriction here adopted. Besides the type species described below, another nearly-allied species has been recorded by Dr. Giesbrecht as *P. aculeatus*, and the imperfectly characterised *Calanus pygmaeus* of Claus probably also belongs to the same genus.

5. **Paracalanus parvus**, (Claus).

(Pl. VIII & IX).

*Calanus parvus*, Claus, Die frei lebenden Copepoden, p. 173, Pl. XXVI, figs. 10—14, Pl. XXVII, figs. 1—4.

*Specific Characters.*—*Female.* Anterior division of body, seen dorsally, oblong oval, somewhat more tapering behind than in front, greatest width about equalling  $\frac{1}{3}$  of the length. Anterior body-segment (combined cephalosome and 1st pedigerous segment) about twice the length of the remaining part of metasome, front evenly rounded. Lateral corners of last pedigerous segment rounded off. Urosome about equalling  $\frac{1}{3}$  of the length of the anterior division, genital and anal segments of about equal length and much larger than either of the 2 middle segments. Caudal rami scarcely exceeding the anal segments in length, sublinear in form, apical setæ of moderate length, the innermost but one the longest. Anterior antennæ, when reflexed, scarcely reaching beyond the penultimate caudal segment, some of the articulations less distinctly defined. Posterior antennæ with the outer

ramus a little shorter than the inner, and 7-articulate. 2nd joint of inner ramus in the 2nd and 3rd pairs of legs with an obliquely transverse row of spinules on the hind face. Last pair of legs with the distal joint narrow linear, carrying on the tip a slender spine, outside which a much smaller spinule is secured.

*Male* differing considerably in its external appearance from the female. Cephalosome somewhat incrassated and exhibiting along the dorsal face an obtuse keel, front considerably more prominent than in female. Urosome rather slender, 5-articulate, with the 2nd segment the largest; caudal rami, as in the male of *Calanus*, mobile. Anterior antennæ rather strongly built, the 2 basal segments defined by a conspicuous constriction, the distal one the longer and consisting of 5 united articulations. Posterior antennæ with the outer ramus consisting of only 6 joints, the last very small, and having only a single seta. Anterior maxillipeds quite rudimentary, knob-like. Posterior maxillipeds likewise much reduced, terminal part indistinctly articulated and carrying behind 3 strong plumose setæ, in front only slight rudiments of bristles. Left leg of last pair with the terminal joint a little shorter than either of the 2 preceding joints, somewhat lamellar, and carrying on the tip 2 small unequal spinules.

*Colour.* Body of femal pellucid with a bluish tinge, and often exhibiting a broad transverse band of a dark red hue across the middle of the anterior division. Body of male generally of a more uniform yellowish hue.

Length of adult female scarcely exceeding 1 mm., of male about the same.

*Remarks.*—Dr. Giesbrecht is inclined to believe that the form observed by Boeck might be different from Claus's species. This is certainly not the case, as may be proved by comparing the figures here given with those of Claus and Giesbrecht. It is one of the smallest known Calanoids, and thus fairly deserves its specific name.

*Occurrence.*—I have found this form rather plentiful in the Christiania Fjord, as also off the southern coast of Norway. It does not seem to occur farther north, however; for Mr. Nordgaard, who has subjected the marine Copepoda of the neighbourhood of Bergen to a careful examination, has not seen any specimen of this form, nor have I myself ever found it in the numerous samples of plankton from the northern ocean that I have examined. It is generally met with at the very surface of the water, both in the open sea and close to the shores, not infrequently even in pools left by the tide.

*Distribution.*—The range of this Calanoid is pronouncedly southern and quite extraordinarily wide, it having been recorded from the western part of the Baltic, the North Sea, the British Channel, the western coast of France, the Mediterranean, the Atlantic Ocean and the Pacific from Lat. 61° N. to 52° S.

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## Fam. 4. Pseudocalanidæ.

Syn: *Clausocalaninæ*, Giesbrecht (part).

*Characters*.—Cephalosome, at any rate in female, coalesced with the 1st segment of metasome, front unarmed, or provided below with 2 soft tentacular filaments, as in *Calanus*. Last segment of metasome united with the preceding one, lateral corners not produced. Urosome in female 4-articulate, in male 5-articulate and having the anal segment shortened. Caudal rami well defined, with only 4 of the marginal setæ developed. Anterior antennæ in female 24-articulate, 8th and 9th articulations being coalesced, in male thickened at the base and clothed with slender, sabre-like sensory appendages, number of articulations reduced. Posterior antennæ with the outer ramus always longer than the inner. Oral parts in female normal, in male much reduced. Legs slender, inner ramus of 1st pair uniarticulate, of 2nd pair biarticulate, of 3rd and 4th pairs 3-articulate; terminal joint of outer ramus in 2nd to 4th pairs narrow, with 3 spines outside, apical spine coarsely serrate. Last pair of legs in female small, simple and 3-articulate, or wholly wanting; those in male likewise simple, but rather slender, left leg 5-articulate, right more or less styliform.

*Remarks*.—This family answers to the subfamily *Clausocalaninæ* of Dr. Giesbrecht. As, however, the genus *Pseudocalanus* is of much earlier date than *Clausocalanus*, the family ought to be named as above. From the *Paracalanidæ* this family chiefly differs in the structure of the legs, partly also in that of the posterior antennæ. Dr. Giesbrecht refers to this family the following 6 genera: *Clausocalanus* Giesbr., *Ctenocalanus* Giesbr., *Pseudocalanus* Boeck, *Drepanopus* Brady, *Spinocalanus* Giesbr. and *Moebianus* Giesbr. The last-named genus (= *Stephos* Scott) ought, however, in my opinion to be discarded and transferred to a separate family in the section' *Isokerandria*, to be treated of farther on. Of the remaining 5 genera, 2 are represented in the fauna of Norway.

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### Gen. 4. *Pseudocalanus*, Boeck, 1872.

Syn: *Clausia*, Boeck (not Claparède).

*Lucullus*, Giesbrecht.

*Generic Characters*.—Body of comparatively slender form, with the cephalosome and 1st segment of metasome coalesced in both sexes, front rounded and carrying 2 soft tentacular filaments below. Urosome in both sexes very slender,

with the caudal rami sublinear in form. Anterior antennæ shorter than the body, in the male with the 2 proximal articulations coalesced to a large flattened segment, the succeeding 5 articulations well defined. Posterior antennæ with the outer ramus 7-articulate, terminal joint rather large. Inner ramus of 2nd to 4th pairs of legs without any spinules on the hind face. Last pair of legs wholly wanting in female, those in male very slender, right leg styliform and shorter than the left.

*Remarks.*—This genus, established by Boeck, was first named *Clausia* in honour of the late Prof. C. Claus. As however this name had been previously appropriated by Claparède to designate a genus of parasitic Cyclopoida, it was subsequently by the same author changed to *Pseudocalanus*. Dr. Giesbrecht, on describing the Copepoda from the bay of Kiel, did not at first recognize Boeck's genus, to which the name *Lucullus* was applied; but in a postscript to his treatise he has admitted the identity of these 2 genera. Besides the well-known form described below, 2 other species have been added by the present author from Nansen's Polar Expedition, viz., *P. major* and *P. pygmaeus*. The latter, however, I am now inclined to regard as belonging to a new nearly-allied genus, for which the name *Microcalanus* may be proposed.

## 6. *Pseudocalanus elongatus*, Boeck.

(Pl. X & XI).

*Clausia elongata*, Boeck, Oversigt over de ved Norges Kyster iagttagne Copepoder.

Chr. Vid. Selsk. Forh. 1864, p. 234.

Syn: *Lucullus acuspes*, Giesbrecht.

„ *Calanus Clausii*, Brady.

*Specific Characters.*—*Female.*—Anterior division of body, seen dorsally, oblong oval in shape, greatest width but slightly exceeding  $\frac{1}{3}$  of the length, frontal part but little prominent, and, seen laterally, narrowly rounded; lateral corners of last segment of metasome obtusely rounded. Urosome somewhat exceeding half the length of the anterior division, genital segment considerably larger than any of the others and slightly dilated in front. Caudal rami exceeding in length the anal segment, and transversely truncated at the tip, exhibiting a small dentiform projection outside the apical setæ. Ovisac present, of irregular rounded form, but easily detached, and containing a very limited number of ova. Anterior antennæ, when reflexed, scarcely reaching beyond the 2nd caudal segment, the 2 basal articulations imperfectly separated. Posterior antennæ with the outer ramus about  $\frac{1}{4}$  longer than the inner. 1st pair of legs much smaller than the others, terminal joint with only a single setiform spine outside.

*Male* rather unlike the female, and of considerably smaller size. Cephalosome slightly dilated in front, but scarcely carinated dorsally. Urosome very narrow, with the anal segment shorter than in female, and somewhat dilated distally; caudal rami very mobile, finely ciliated inside, and having the terminal edge somewhat produced in the middle. Anterior antennæ with the number of articulations considerably reduced, a fusion having taken place, not only of the 2 proximal ones, but also of the 8th to 12th and of the 20th and 21st articulations. Last pair of legs rather asymmetrical, left leg much the longer, with the 2nd and 3rd joints slightly dilated distally, terminal joint very small and tipped with a slender spinule; right leg not nearly reaching to the end of the penultimate joint of left, and terminating in a straight, subulate point.

*Colour*.—Body in both sexes very pellucid, though generally with a faint reddish yellow tinge; oral area, as a rule, tinged with crimson, and the genital protuberance of the female with light green.

Length of adult female 1.40 mm., of male 1.10 mm.

*Remarks*.—This form was first recorded by Boeck from the Norwegian coast under the name of *Clausia elongata*, and was subsequently rediscovered in the bay of Kiel, by Dr. Giesbrect, who described it as *Lucillus acuspes*. It is easily recognized from the other Norwegian *Amphuscanthria* by its slender and elongated tail, a character which has, indeed, given rise to the specific name proposed by Boeck.

*Occurrence*.—I have met with this form very frequently along the whole Norwegian coast from the Christiania Fjord to Vadsø, both in the open sea and close to the shores, where it is occasionally left in tidal pools. It often occurs at the very surface of the water; but it sometimes also seems to descend to greater depths, though on the whole it may be regarded as a true pelagic form. Specimens are not infrequently found carrying a small number of ova enclosed in a thin-skinned, rounded ovisac, which, as usual, is appended to the ventral side of the genital segment; but this ovisac is so very fragile, that at the slightest touch it may become detached. Male specimens are much more scarce than females and, when alive, may be easily recognizable even to the naked eye by their somewhat different jerky movements.

*Distribution*.—Unlike *Paracalanus parrus*, this Calanoid has a pronouncedly northern range, the most southern place where it has been observed being the northern coast of France (Canu). On the other hand, it is distributed throughout the whole northern Ocean from Baffin's Bay in the west to the New Siberian Isles in the east. It also inhabits the Baltic together with other forms of evidently arctic origin.

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Gen. 5. **Spinocalanus**, Giesbrecht, 1892.

*Generic Characters.*—Body comparatively short, with the urosome not nearly so elongated as in *Pseudocalanus*. Front quite unarmed, without any tentacular filaments below. Anterior antennæ longer than the body, and very flexible; those in male transformed in a manner similar to that in *Pseudocalanus*. Posterior antennæ with both rami rather produced, the outer one being the longer. Posterior maxillipeds unusually slender, with the terminal part much elongated and armed distally with coarsely ciliated procurved setæ. Legs very slender, inner ramus of 2nd to 4th pairs densely spinulose on the hind face. Last pair of legs wanting in female, in male of comparatively small size, right leg not styliform.

*Remarks.*—This genus was established in the year 1892 by Dr. Giesbrecht, to include a small Calanoid procured from very great depths in the tropical part of the Pacific. The genus differs from *Pseudocalanus* chiefly in the total absence of the usual tentacular filaments at the front, the less slender urosome, the very long anterior antennæ, the peculiar shape of the posterior maxillipeds, and finally in the spiny armature of the inner ramus of the 2nd to 4th pairs of legs. In the northern ocean this genus is represented by a species closely allied to the typical one, and first described by the present author from Nansen's Polar Expedition. This species has proved also to belong to the fauna of Norway.

7. **Spinocalanus longicornis**, G. O. Sars.

(Pl. XII).

*Spinocalanus longicornis*, G. O. Sars, The Norwegian North Polar Expedition. V. Crustacea, p. 75, Pl. XXII.

*Specific Characters.*—*Female.* Anterior division of body, seen dorsally, oblong oval, greatest width somewhat exceeding  $\frac{1}{3}$  of the length, front obtusely rounded; seen laterally, evenly vaulted above, with the front narrowly produced and without any trace of a rostrum or tentacular filaments below. Lateral corners of last segment of metasome obtusely rounded off. Urosome scarcely exceeding in length  $\frac{1}{4}$  of the anterior division, genital segment comparatively short and greatly protuberant below; caudal rami very short, being scarcely longer than they are broad, apical setæ about as in *Pseudocalanus*. Anterior antennæ exceeding the body by about  $\frac{1}{5}$  of their length, penultimate joint provided in front with an unusually long and slender bristle. Posterior maxillipeds with the 2nd joint of the terminal part fully as long as the 3 succeeding joints combined.

Outer ramus of 2nd to 4th pairs of legs provided with scarcely any spinules on the hind face, apical spine exceedingly slender, exceeding the length of the terminal joint. Length of adult female 1.60 mm.

*Remarks.*—As stated above, this species was first described by the present author from Nansen's Polar Expedition. It is closely allied to the type species, *S. abyssalis* Giesbrecht, but is apparently distinct, the spiny armature of the legs and maxillipeds being, to judge from the figures given by Dr. Giesbrecht, much coarser in the latter species.

*Occurrence.*—I have not myself ever observed this form off the coast of Norway; but Mr. O. Nordgaard has recently found it in the Osterfjord near Bergen at the considerable depth of from 400 to 600 meters, together with other relict arctic forms. The figures here given are from a well-preserved female specimen kindly sent to me by that naturalist.

*Distribution.*—The Polar Sea in about the 80th degree of latitude, at 2 different Stations.

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## Fam. 5. Ætideidæ.

*Characters.*—Body, as a rule, not very slender, the anterior division being more or less tumefied. Cephalosome coalesced with the 1st segment of metasome, front generally projecting below into a highly chitinised bifid or simple mucronate rostrum, more rarely quite unarmed. Last segment of metasome united with the preceding one, and generally having the lateral corners produced behind. Urosome in female 4-articulate, in male, as usual, 5-articulate and very narrow, with the anal segment much shortened. Caudal rami generally short, with only 4 of the marginal setæ distinctly developed, in male mobile as in the preceding families. Eye generally well developed, though in some cases wholly absent. Anterior antennæ in female of moderate length, or comparatively short, with the 8th and 9th articulations confluent; those in male transformed in a manner similar to those in the *Pseudocalanidæ*, though having the sensory appendages more densely crowded together on the proximal part, and very long and band-like. Posterior antennæ with the outer ramus generally longer than the inner. Oral parts in female on the whole normal; posterior maxillipeds, however, with the terminal part reflexed. Oral parts in male considerably reduced. Legs of a structure similar to that in the *Pseudocalanidæ*, though considerably more strongly built. Last pair of legs always wanting in female, in male generally rather simple in structure.

*Remarks.*—This family, answering to the subfamily *Ætidiina* of Giesbrecht, forms, as it were a transition between the *Pseudocalanida* and *Euchætida*. One of the forms, indeed, now comprised within the present family was referred by Boeck to the genus *Pseudocalanus* and another form to the genus *Euchæta*. I think, however, that Dr. Giesbrecht is right in keeping these forms apart from both the above-named families. This family comprises as yet no less than 9 different genera, 4 of which are represented in the fauna of Norway.

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Gen. 6. *Ætideus*<sup>1)</sup>, Brady, 1883.

SYN: *Pseudocalanus* Boeck (part).

*Generic Characters.*—Cephalosome in female highly vaulted anteriorly, almost carinated dorsally, and projecting below into a strong bifurcate rostrum, in male far less vaulted, and without any trace of a rostrum. Last segment of metasome produced behind on each side to a strong mucroniform process more developed in female than in male. Urosome in female comparatively short, genital segment very protuberant below, caudal rami less shortened than in the other forms, with the appendicular bristle of the inner corner unusually long and slender, outermost (5th) apical seta only present as a rudiment. Urosome of male very slender, with the anal segment considerably shortened, almost inconspicuous. Eye subventral, of a somewhat irregular form and obliquely disposed, with a distinct lenticular body below. Anterior antennæ in female comparatively slender, with some of the bristles of the anterior edge rather elongated, last joint very small and imperfectly defined from the penultimate one; those in male shorter, with the 7 proximal articulations well defined, whereas a fusion has taken place of some of the others. Posterior antennæ with the outer ramus but little longer than the inner, and 7-articulate. Posterior maxillipeds not much elongated, 2nd basal joint fusiform, terminal part comparatively short, reflexed. Inner ramus of 2nd pair of legs imperfectly biarticulate. Left leg of last pair in male very slender, 5-articulate, right leg wholly wanting.

*Remarks.*—This genus was established in the year 1883 by Brady, to include a Calanoid procured during the Challenger Expedition in the Indian Ocean, and regarded as new to science. The genus, though insufficiently charac-

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<sup>1)</sup> This name is spelt by Brady *Ætidius*; but, as recently observed by Dr. Giesbrecht, this is unquestionably incorrect, as it is derived from the Greek word *ἀετίδεϋς*, an eagle.

terised, was accepted by Dr. Giesbrecht, who describes a form from the Mediterranean, which he regards as identical with Brady's species. though in some respects it seems to differ rather conspicuously. Neither of these authors was aware that a very similar form was recorded many years ago from the Norwegian coast by Boeck, who applied to it the very same specific name as that proposed by Brady. The validity of these 3 forms as distinct species is perhaps still somewhat questionable, the similarity of the Norwegian form with that described by Brady being in particular so very close, that I should have been much inclined to regard the two as identical, if the widely remote occurrence of these 2 forms did not seem to forbid such an identification. The genus is easily recognized, at any rate in the female sex, by the very strong and highly chitinized bifurcate rostrum, the boldly vaulted cephalosome, and the coarse mucroniform projections of the last segment of the metasome.

### 8. *Ætideus armatus*, Boeck.

(Pl. XIII & XIV.)

*Pseudocalanus armatus*, Boeck. Nye Slægter og Arter af Saltvands Copepoder. Christiania Vid. Selsk. Forhandl. 1872, pag. 6.

*Specific Characters.*—*Female.* Anterior division of body, seen dorsally, oval fusiform, greatest width considerably exceeding  $\frac{1}{3}$  of the length and occurring in the middle, anterior extremity more narrowed than the posterior, and projecting somewhat between the insertions of the anterior antennæ; seen laterally, strongly vaulted in front, with the dorsal margin of cephalosome forming a bold and continuous curve up to the tip of the rostrum, the latter scarcely incrassated at the base, rami sharply pointed and separated by an even emargination. Lateral corners of last segment of metasome gradually exerted to strong mucroniform processes pointing straight behind, and reaching about to the end of the genital segment. Urosome scarcely exceeding in length  $\frac{1}{3}$  of the anterior division, genital segment comparatively short and rather dilated in the middle. Caudal rami considerably longer than the anal segment, sublinear, finely ciliated inside, innermost but one of the apical setæ much longer than the others. Anterior antennæ, when reflexed, reaching to about the base of the caudal rami.

*Male* considerably smaller than female, and of much more slender form of body, front narrowly rounded and quite unarmed; posterior projections of last pedigerous segment far less developed than in female. Urosome exceedingly narrow, and exceeding in length  $\frac{1}{3}$  of the anterior division; caudal rami generally spread to each side. Anterior antennæ, when reflexed, scarcely reaching to the

end of the 2nd caudal segment. Left leg of last pair nearly as long as the urosome, 3rd joint the longest, terminal one rather small and finely ciliated.

*Colour*.—Body in both sexes very pellucid, in female being banded transversally with light red. Length of adult female 1.80 mm., of male 1.45 mm.

*Remarks*.—No doubt can arise as to this being the true *Pseudocalanus armatus* of Boeck. If the form recorded by Brady should prove to be a different species, it must consequently have another specific name. In any case these 2 forms are very closely related, whereas the Mediterranean form described by Dr. Giesbrecht seems to differ from the Norwegian form in several respects. At the base of the rostrum, for instance, there is a conspicuous thickening not found in the latter form, and the posterior projections of the last segment of the metasome are much coarser, reaching, according to the figures given, beyond the 2nd caudal segment. The colouring of the animal is also rather different, to judge from the coloured figure given on Pl. 2.

*Occurrence*.—Boeck found this form at Haugesund, west coast of Norway, at a depth of 30 fathoms. I have myself observed it, though in rather small numbers, at about the same depth in 2 different localities, viz., in the upper part of the Christiania Fjord (Bundefjord), and in the Brevik Fjord near Langesund. Moreover some few specimens were found in a sample of plankton taken during the cruise of the "Michael Sars" in the Storfjord (Nordmøre), and in another sample from Stat. 11 (north of Iceland). A solitary specimen was finally found in a sample taken off the Finmark coast NW. of Nordkyn. Mr. Nordgaard has observed this form in the neighbourhood of Bergen.

*Distribution*.—If the form recorded by Brady should in reality prove to be identical with Boeck's species, the distribution of this Calanoid would be quite perplexing; but I still regard the identification of these 2 forms as somewhat questionable, and I should indeed be more inclined to believe that the present form is exclusively a North Atlantic species. It is, however, certainly not of arctic origin, since it did not occur in any of the numerous samples of plankton taken during Nansen's Polar Expedition, and has never been found anywhere in the Arctic Ocean.

Gen. 7. **Chiridius**, Giesbrecht, 1892.Syn: *Euchæta*, Boeck (part.)

*Generic Characters*.—Cephalosome but slightly vaulted in front, rostral projection very small, bifid, or wholly absent. Last segment of metasome produced behind on each side to a more or less developed spiniform process. Urosome about as in *Ætideus* but with the genital segment in female less protuberant below. Caudal rami very short, with the appendicular bristle not prolonged, and proceeding from the lower face of the rami. Eye comparatively large, and placed less ventrally than in *Ætideus*. Anterior antennæ much shorter than the body, but rather slender, and resembling in structure those in the above-named genus. Posterior antennæ with the outer ramus much longer than the inner. Mandibles in female with the masticatory part very largely developed, inner ramus of the palp, however, unusually small. Masticatory parts of mandibles and maxillæ in male quite rudimentary. Anterior maxillipeds in female normal, in male much reduced. Posterior maxillipeds with the 2nd basal joint long and slender, terminal part comparatively short and reflexed. Natatory legs of a structure similar to that in *Ætideus*. Both legs of last pair in male well developed, 5-articulate, the right one being the stronger, 2nd joint in each leg sometimes with a small appendage inside (rudiment of an inner ramus).

*Remarks*.—This genus was established by Dr. Giesbrecht in the year 1892, to include a Mediterranean species, *C. Poppei*, which, however, is rather imperfectly figured. In the year 1900, I was able to state that this genus is well represented also in the northern ocean, 3 different species having been described from Nansen's Polar Expedition, one of them being at that time considered to be identical with Boeck's *Euchæta armata*. The genus is closely allied to *Ætideus*, from which it differs, however, in the far less developed rostrum, the different shape of the cephalosome, and partly also in the structure of the posterior antennæ, mandibles and posterior maxillipeds. Finally, both legs of the last pair in the male are well developed. 3 species, to be described below, belong to the Norwegian fauna.

9. **Chiridius armatus**, (Boeck).

(Pl. XV &amp; XVI.)

*Euchæta armata*, Boeck, Nye Slægter og Arter af Saltvands-Copepoder. Christ. Vid. Selsk. Forhandl. p. 39.

*Specific Characters*.—*Female*.—Anterior division of body somewhat tumid, seen dorsally, oblong oval in form, anterior extremity slightly contracted, but

scarcely projecting at all between the insertions of the anterior antennæ, posterior subtruncate, with the lateral corners drawn out to comparatively short and somewhat divergent acute projections; seen laterally only slightly vaulted anteriorly, front narrowly rounded and armed below with a very small bifid rostrum. Urosome considerably exceeding  $\frac{1}{3}$  of the length of the anterior division, genital segment but slightly dilated. Caudal rami scarcely longer than the anal segment and somewhat divergent, apical setæ of moderate length and densely plumous. Eye unusually large and distinctly bilobate, dark red in colour. Anterior antennæ, when reflexed, reaching to about the middle of the 2nd caudal segment. Posterior antennæ with the outer ramus about  $\frac{1}{3}$  longer than the inner. 1st pair of legs with a well-marked setiform spine outside the 1st joint of the outer ramus; 2nd pair with the inner ramus distinctly biarticulate.

*Male* nearly as large as female, but of more slender form; rostral projection and lateral processes of last segment of metasome about as in female. Urosome, as usual, 5-articulate, with the anal segment shortened, and the caudal rami mobile. Anterior antennæ considerably shorter than in female, not nearly so long as the anterior divisions, and somewhat incrassated at the base, consisting of 23 articulations, the proximal ones with long band-like sensory appendages. Mandibular palps much more strongly built than in female, with the inner ramus well developed and carrying at the tip very coarse diverging setæ. Last pair of legs well developed, the right leg being considerably stronger than the left, both with a small unarticulate appendage inside the 2nd joint, representing a rudiment of the inner ramus, 3rd joint of right leg somewhat curved, and much larger than the others, 4th joint slightly dilated distally, 5th transformed to a slender claw, obtuse at the tip.

*Colour*.—Body in both sexes pellucid with a faint rosy tinge, intestine in female translucent with a bright red colour, ovarial tubes opaque whitish.

Length of adult female 4 mm., of male about the same.

*Remarks*.—This form was recorded in the year 1872 by Boeck as *Euchæta armata*; but the characterisation of the species was very insufficient, for which cause it has not been recognized by subsequent authors, even as regards its generic relation. By comparing the drawings left by that author, however, I have convinced myself that the form here under consideration is the true *Euchæta armata* of Boeck. On the other hand, the form from Nansen's Polar Expedition, previously described by the present author under this name, has turned out to be a different, though closely allied, species, as subsequently shown.

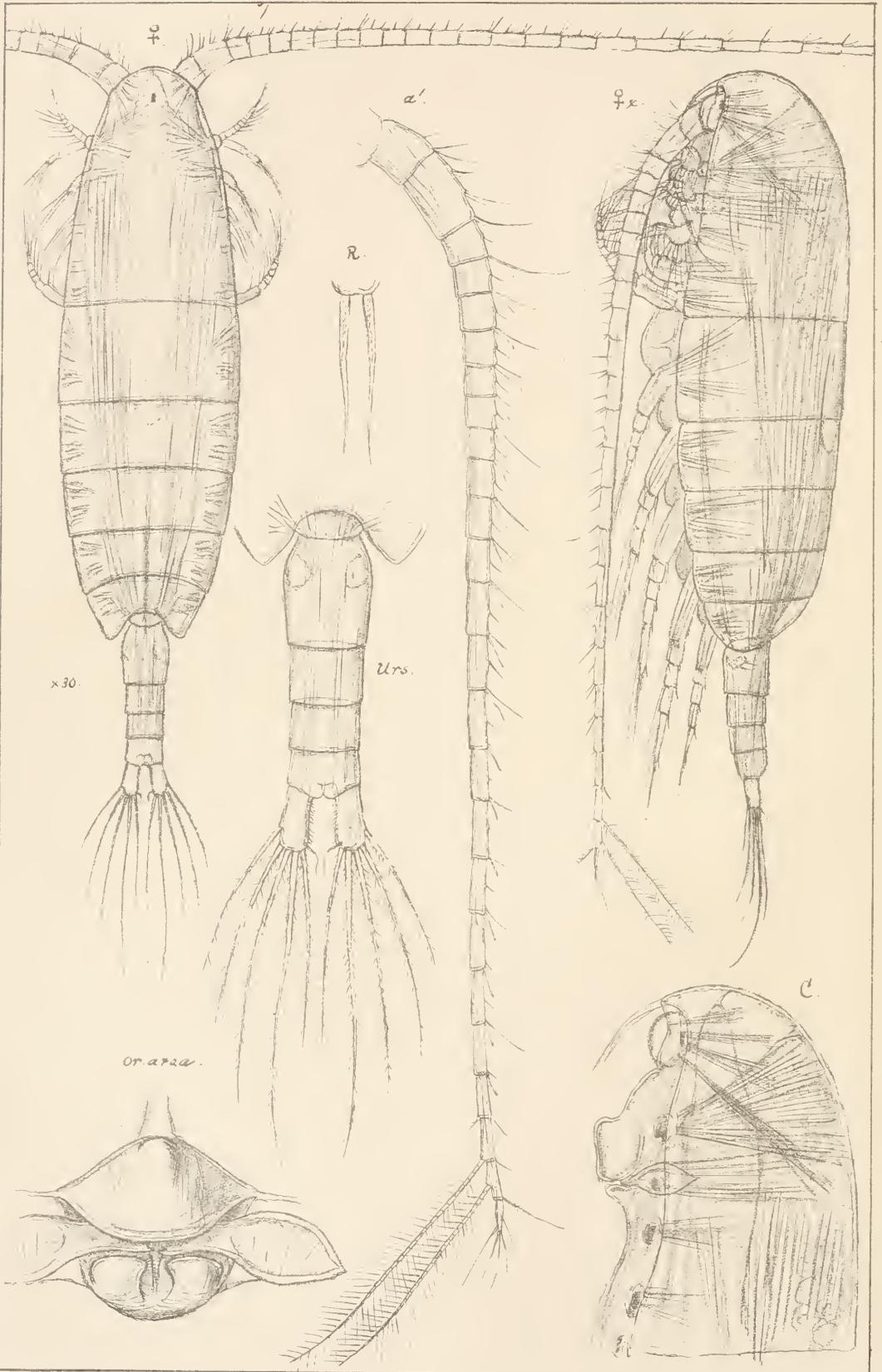
*Occurrence*.—Boeck found this form at Skudesnæs, west coast of Norway, at a depth of 300 fathoms. I have myself met with this Calanoid in great

# Copepoda

Calanidæ

Calanoida

Pl. I.



G. O. Sars autogr

*Calanus finmarchicus*, (Gunner.)

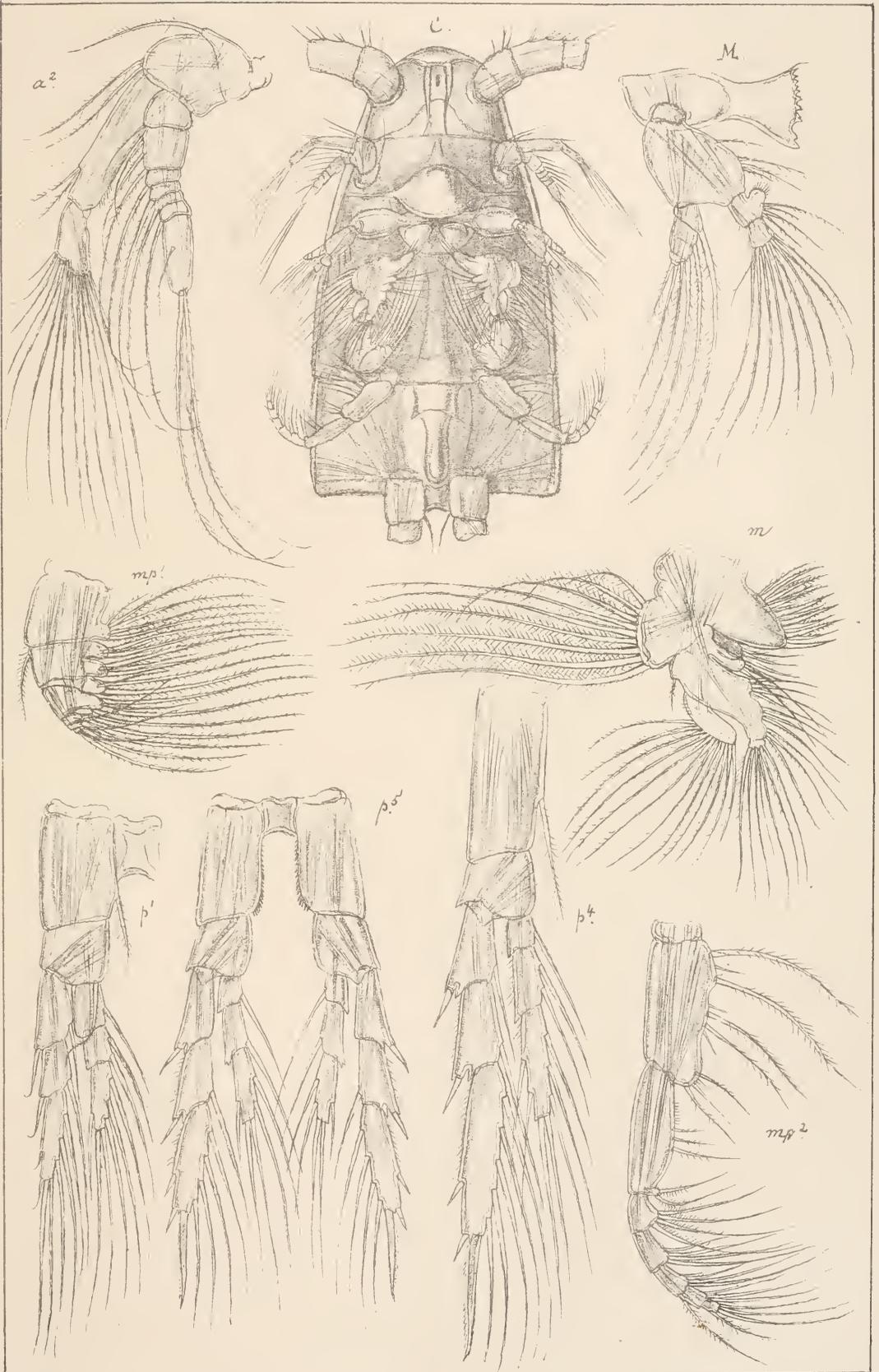
Trykt i den private Opmaaling, Chra

# Copepoda

Calanidæ.

Calanoida

Pl. II.



G.O. Sars autogr.

Trykt i den private Opmaaling, Chna

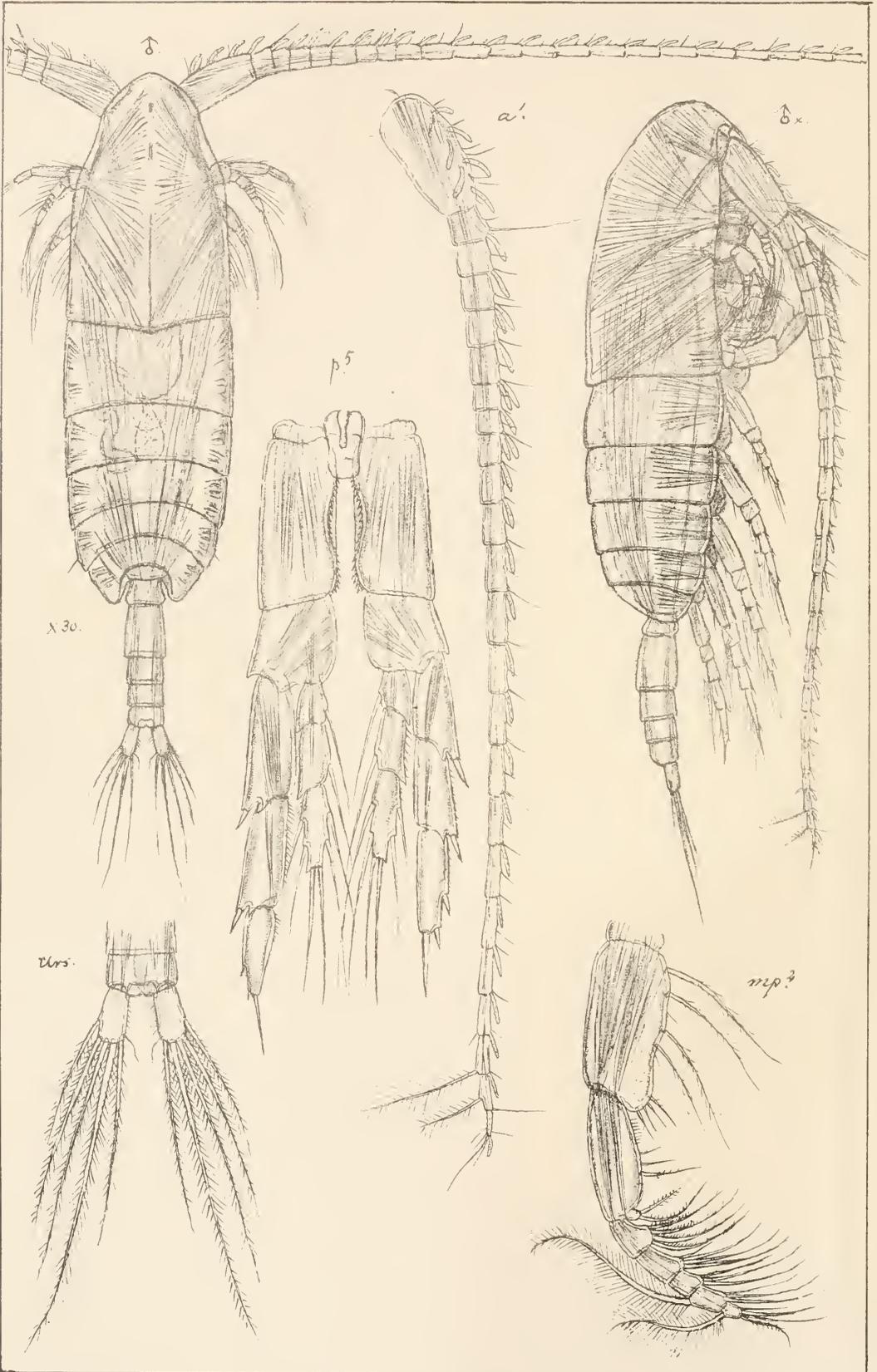
*Calanus finmarchicus*, (Gunner.)  
continued

# Copepoda

## Calanoida

Calanidæ.

Pl. III.



G.O. Sars autogr.

*Calanus finmarchicus*, (Gunner.)  
(male.)

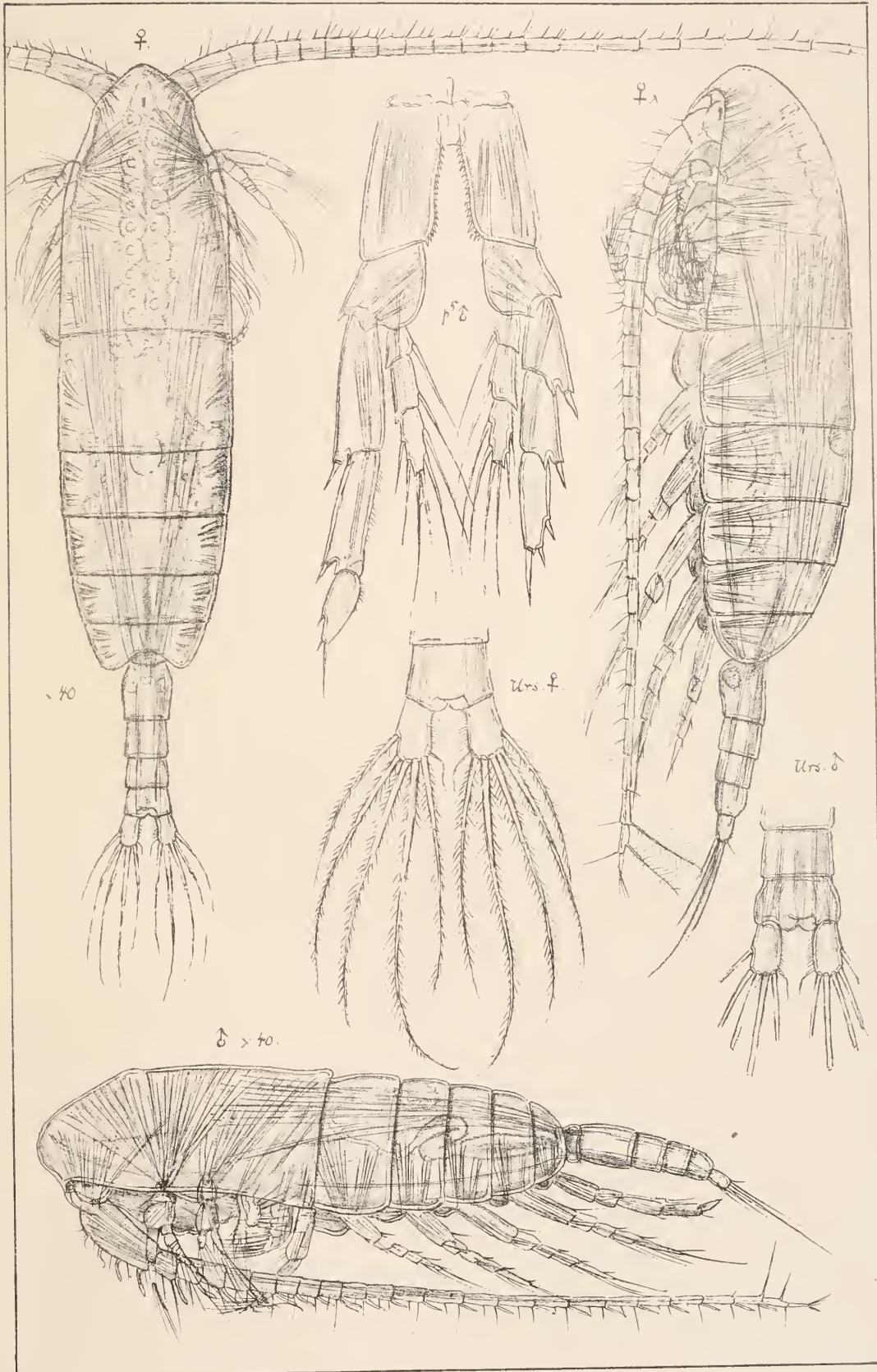
Trykt i den private Opmaaling, Chra

# Copepoda

Calanidæ.

Calanoida

Pl. III.



G.O. Sars autogr.

*Calanus helgolandicus* (Claus.)

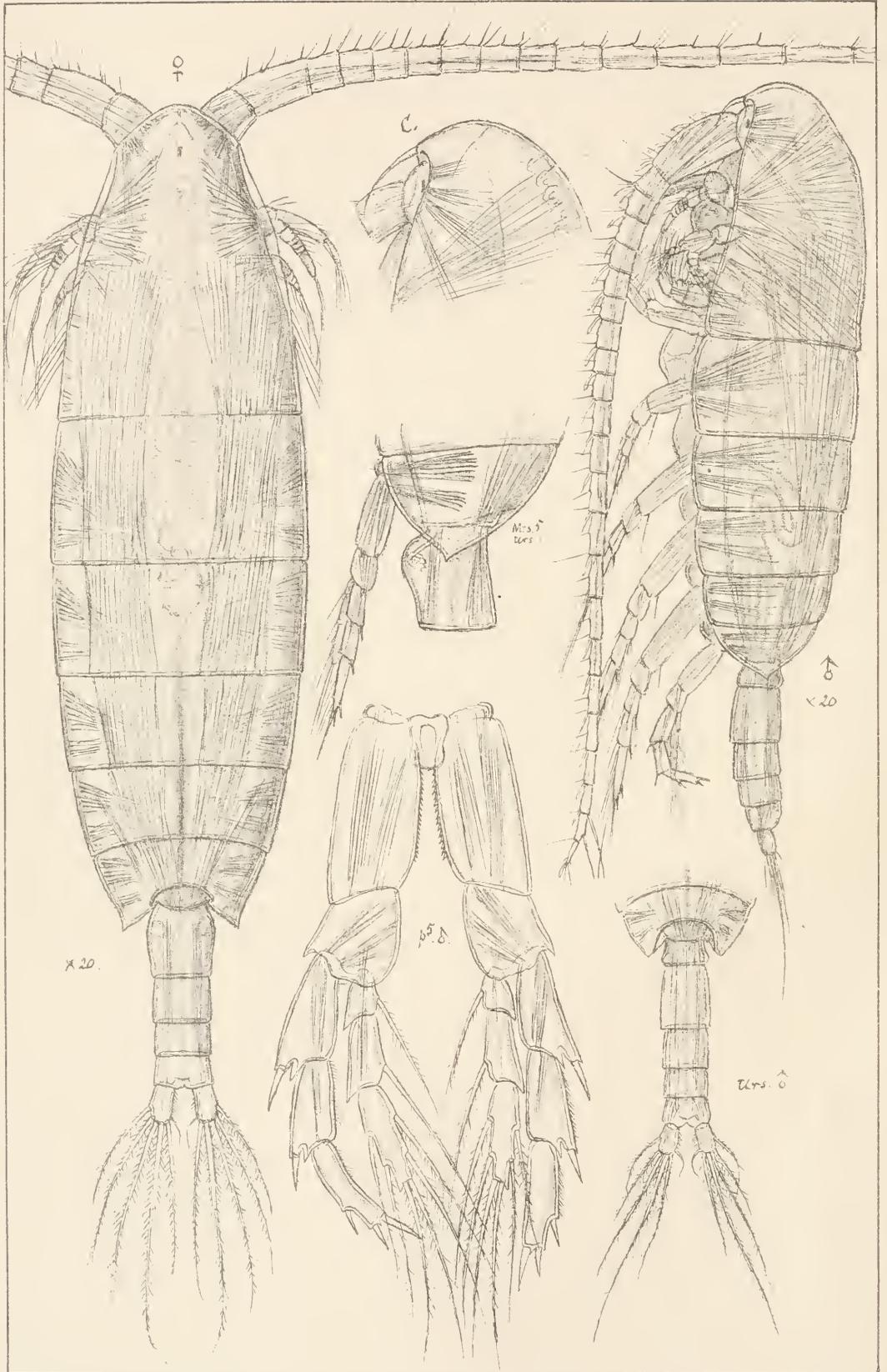
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# Copepoda

## Calanoida

Calanidæ.

Pl. V.



G.O. Sars autogr.

Trykt i den private Opmaaling Chra

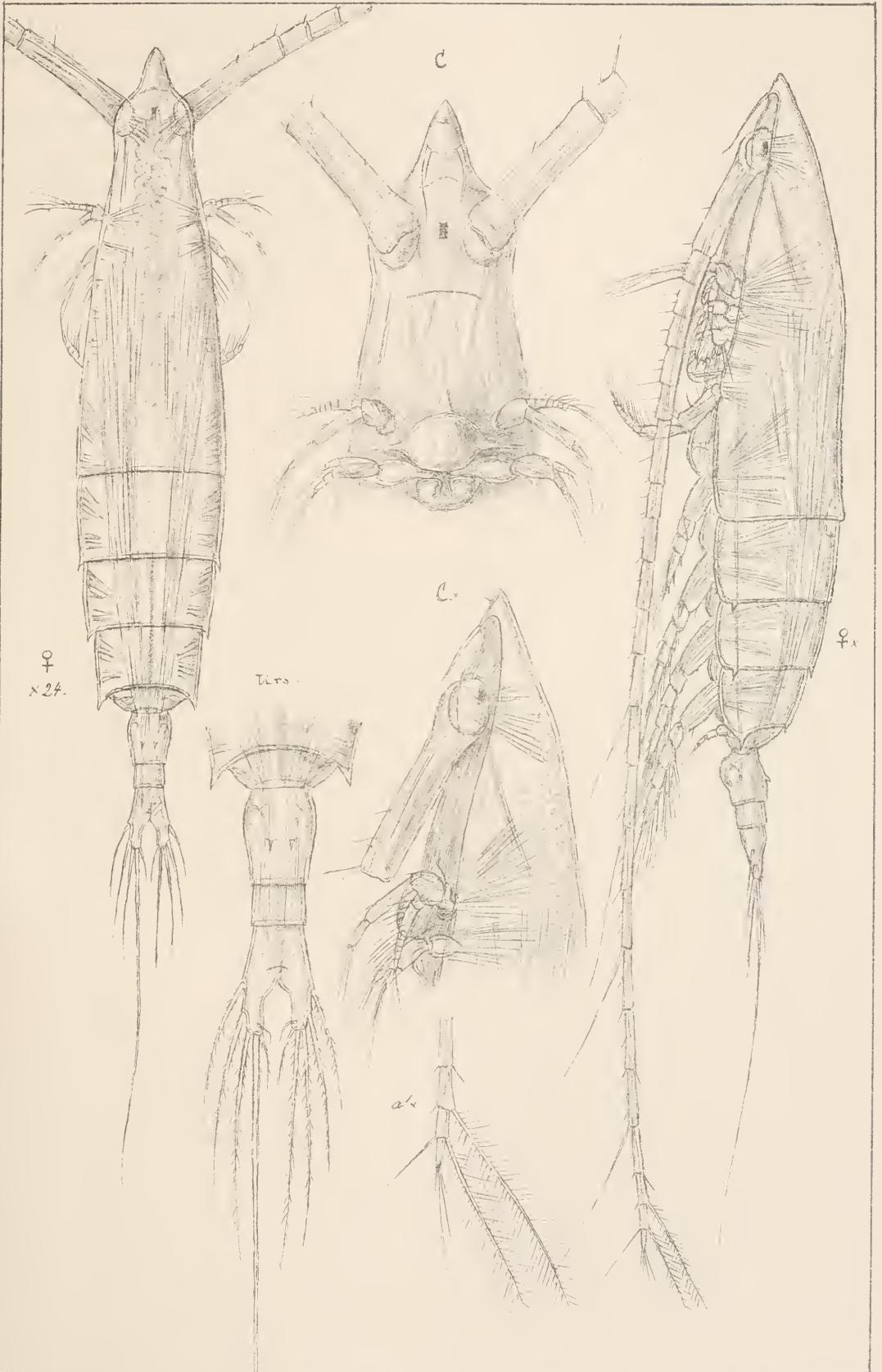
*Calanus hyperboreus*, Krøyer.

# Copepoda

## Calanoida

Eucalanidæ.

Pl. VI.



G.O. Sars autogr.

*Rhincalanus nasutus*, Giesbr.

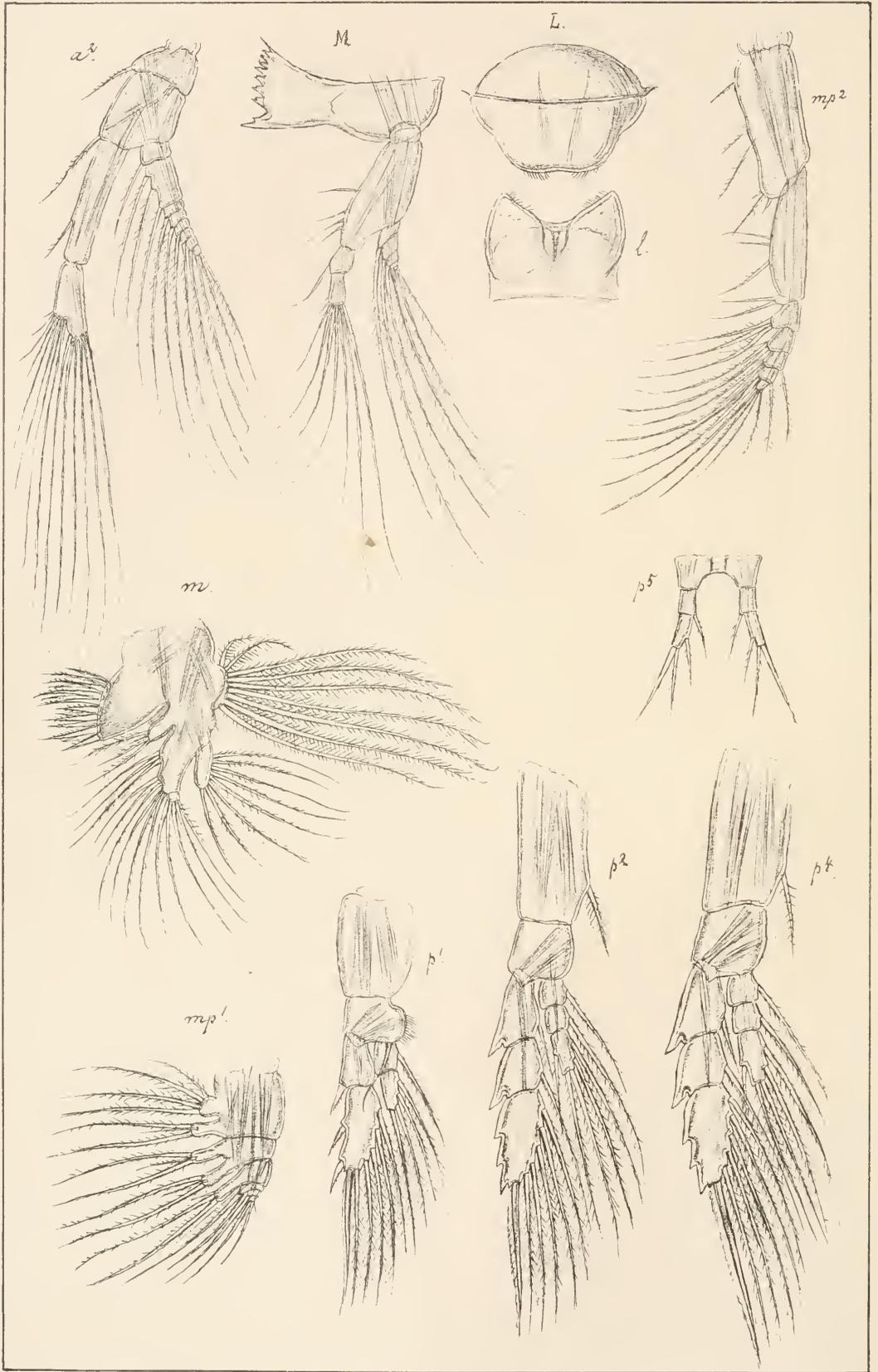
Trykt i den private Opmaaling, Chra

# Copepoda

## Calanoida

Eucalanidæ.

Pl. VII.



G.O. Sars autogr.

*Rhincalanus nasutus*, Giesbr.  
continued

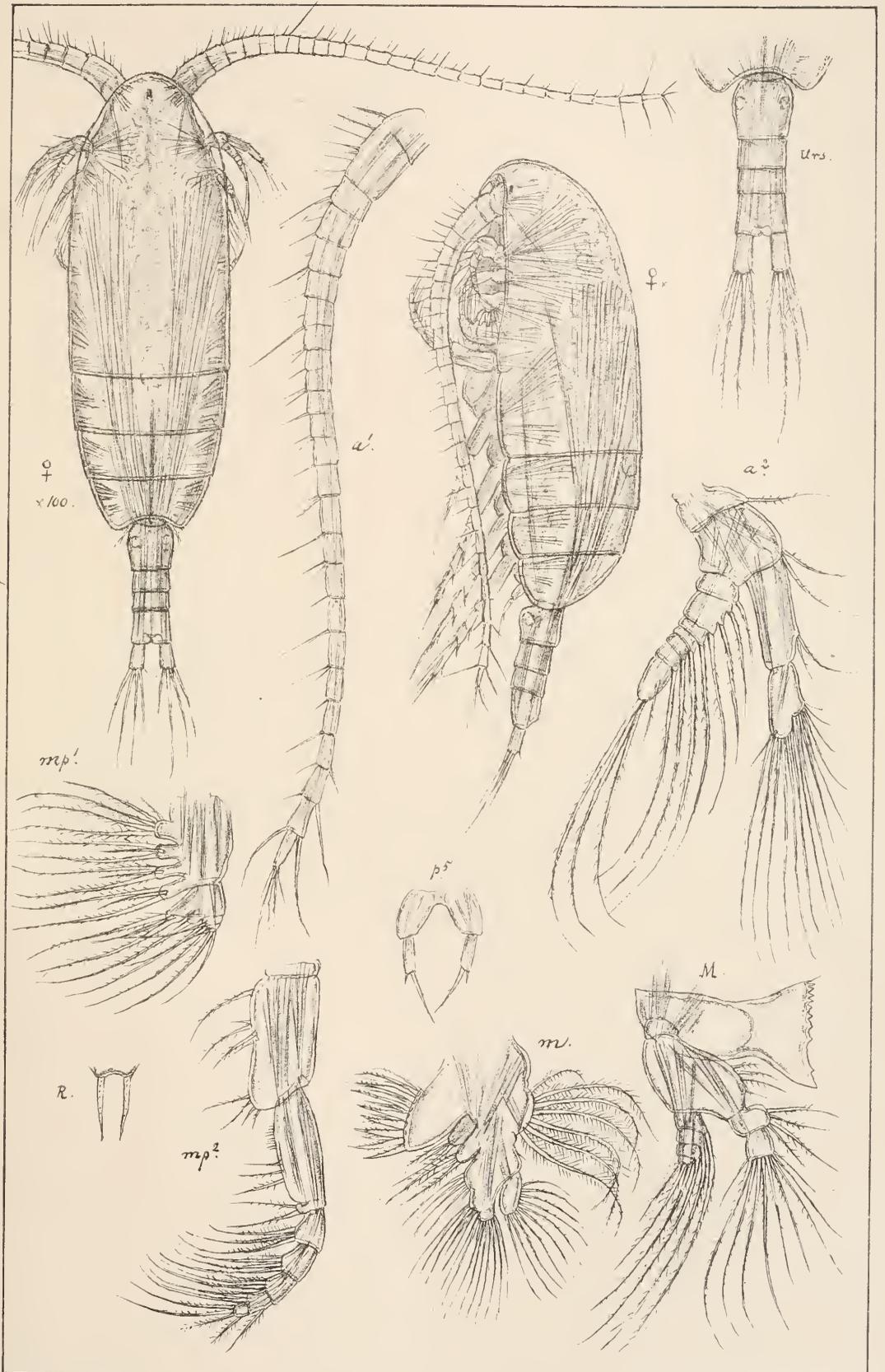
Trykt i den private Opmaaling, Chra

# Copepoda

## Calanoida

Paracalanidæ.

Pl. VIII.



G. O. Sars autogr.

*Paracalanus parvus* (Claus.)

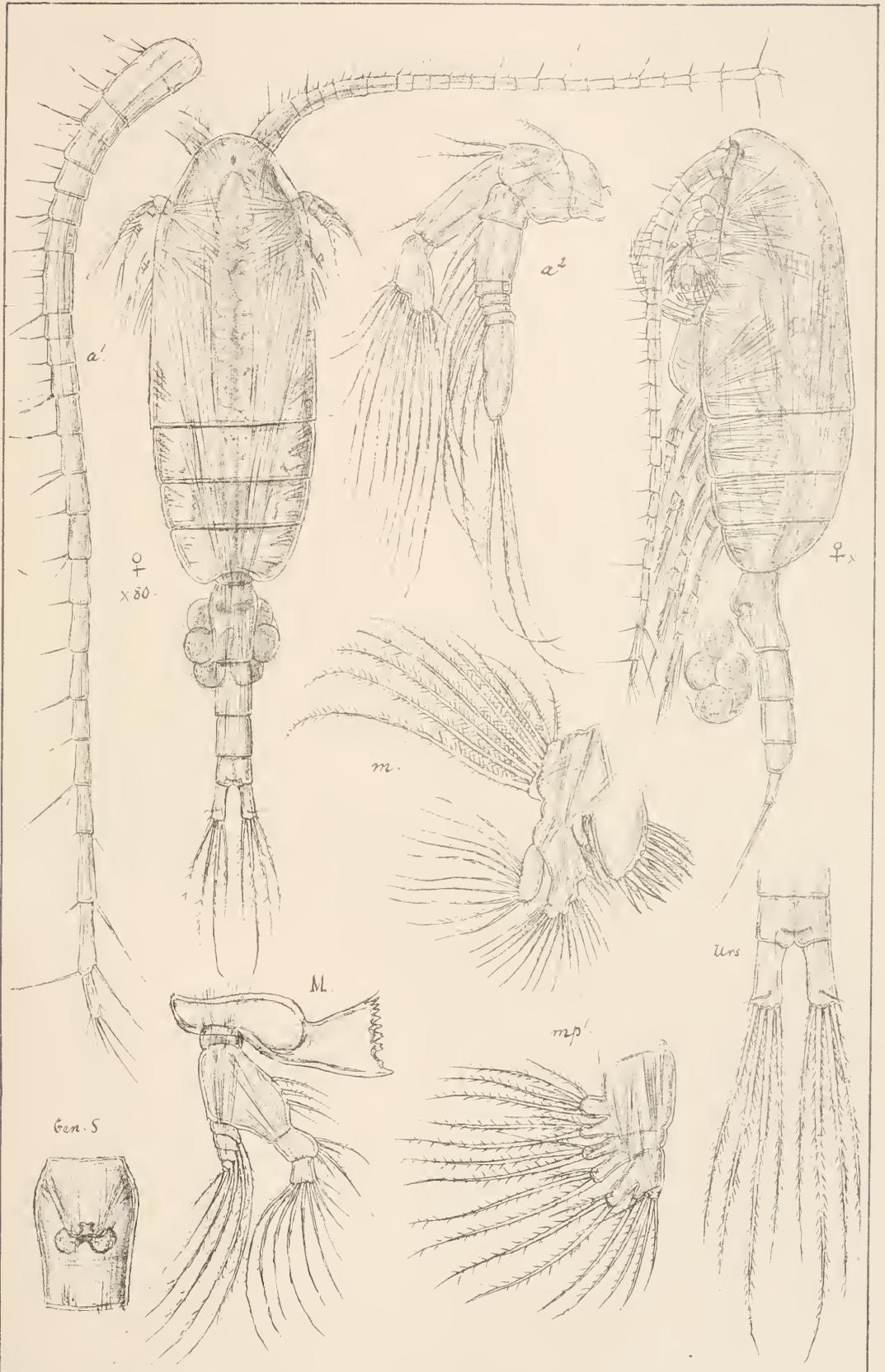
Trykt i den private Opmaaling, Chra

# Copepoda

## Calanoida.

Pseudocalanidæ.

Pl. X.



G.O Sars autogr.

Trykt i den private Opmaaling, Chtra

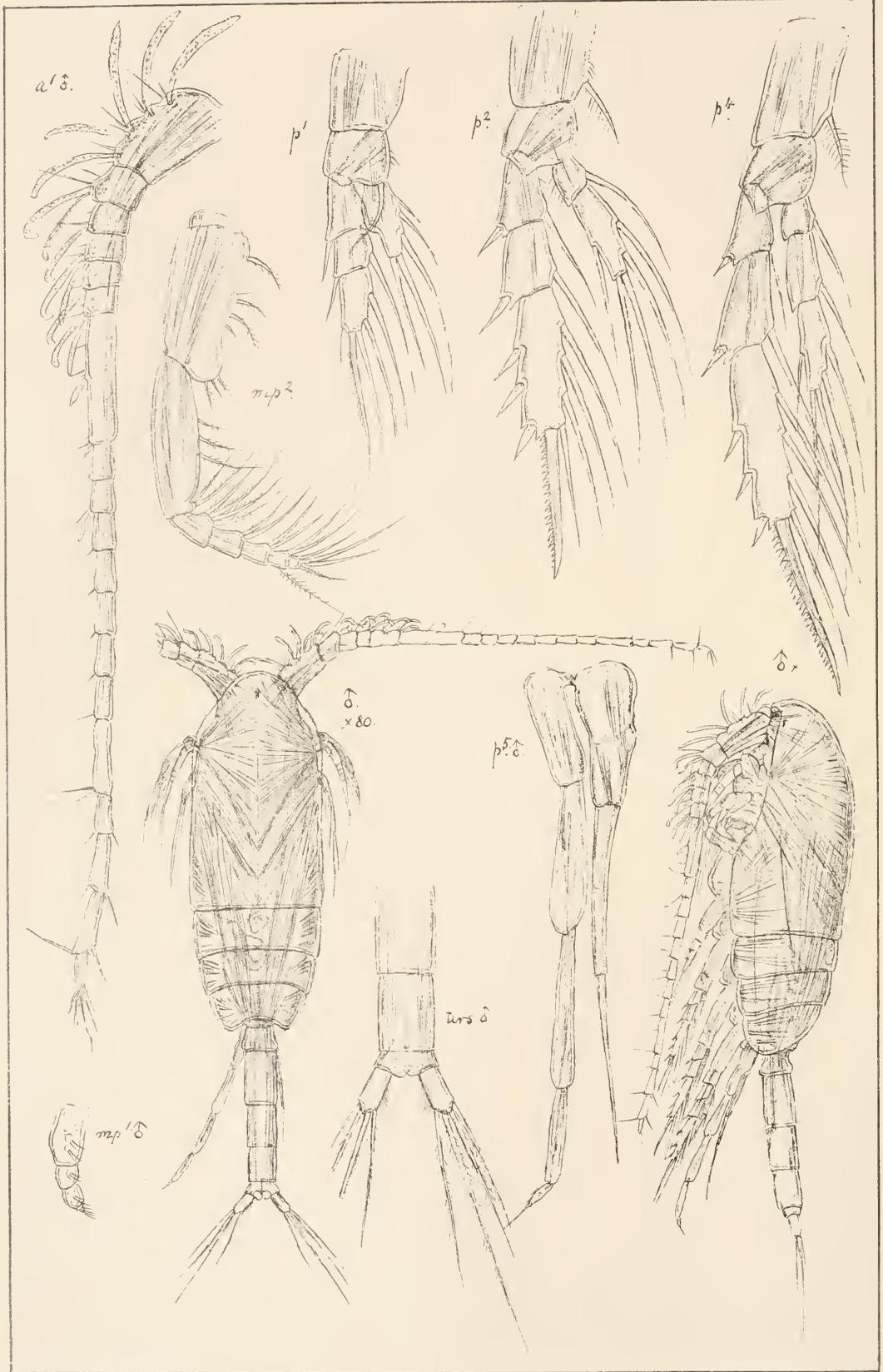
*Pseudocalanus elongatus*, Boeck.

# Copepoda

## Calanoida.

Pseudocalanidæ.

Pl. XI.



G.O. Sars autogr.

Trykt i den private Opmaaling Cnra

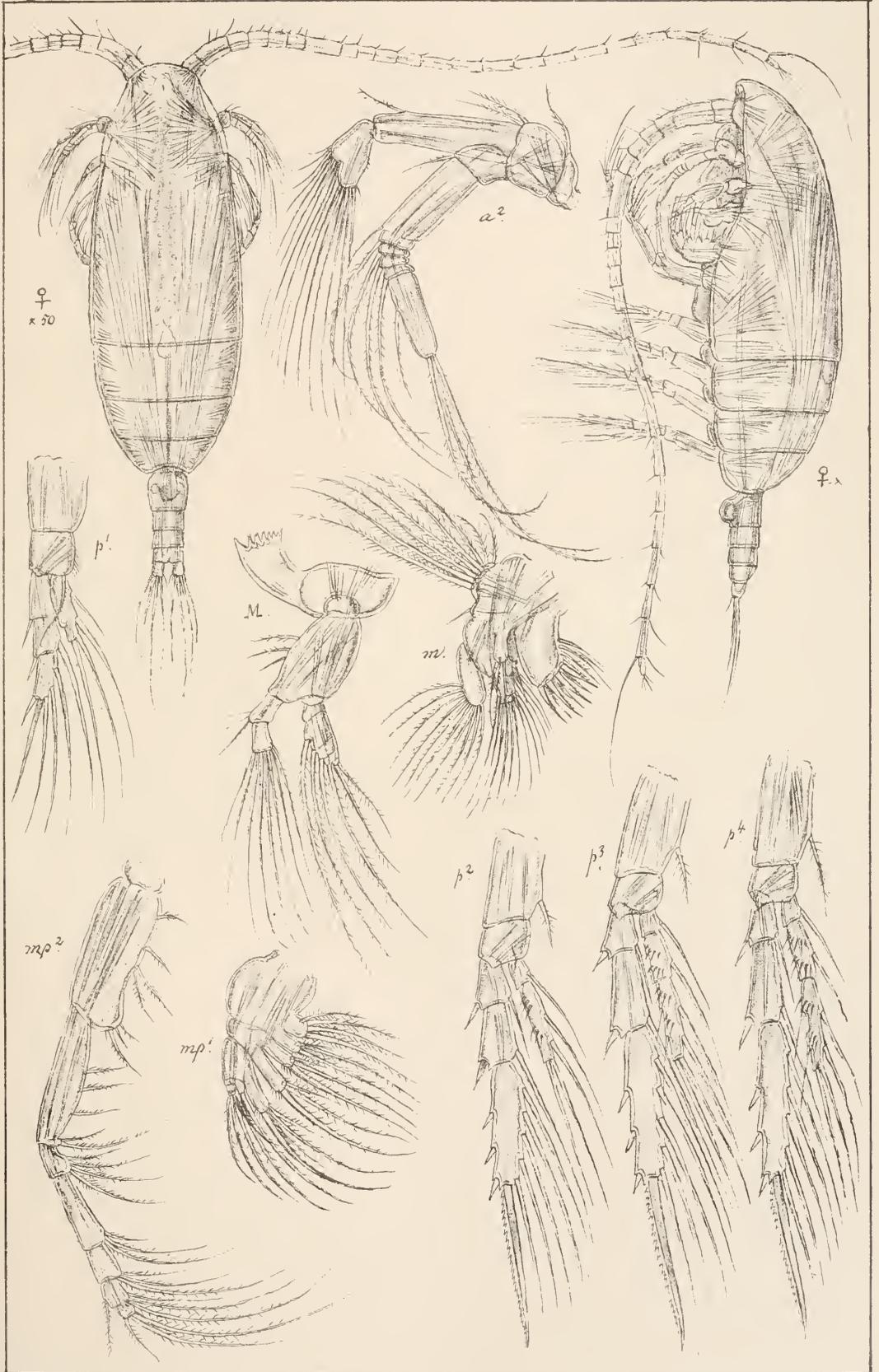
*Pseudocalanus elongatus*, Boeck.  
continued

# Copepoda

Pseudocalanidæ.

Calanoida.

Pl. XII.



G.O. Sars autogr.

Trykt i den private Opmaaling, Chra

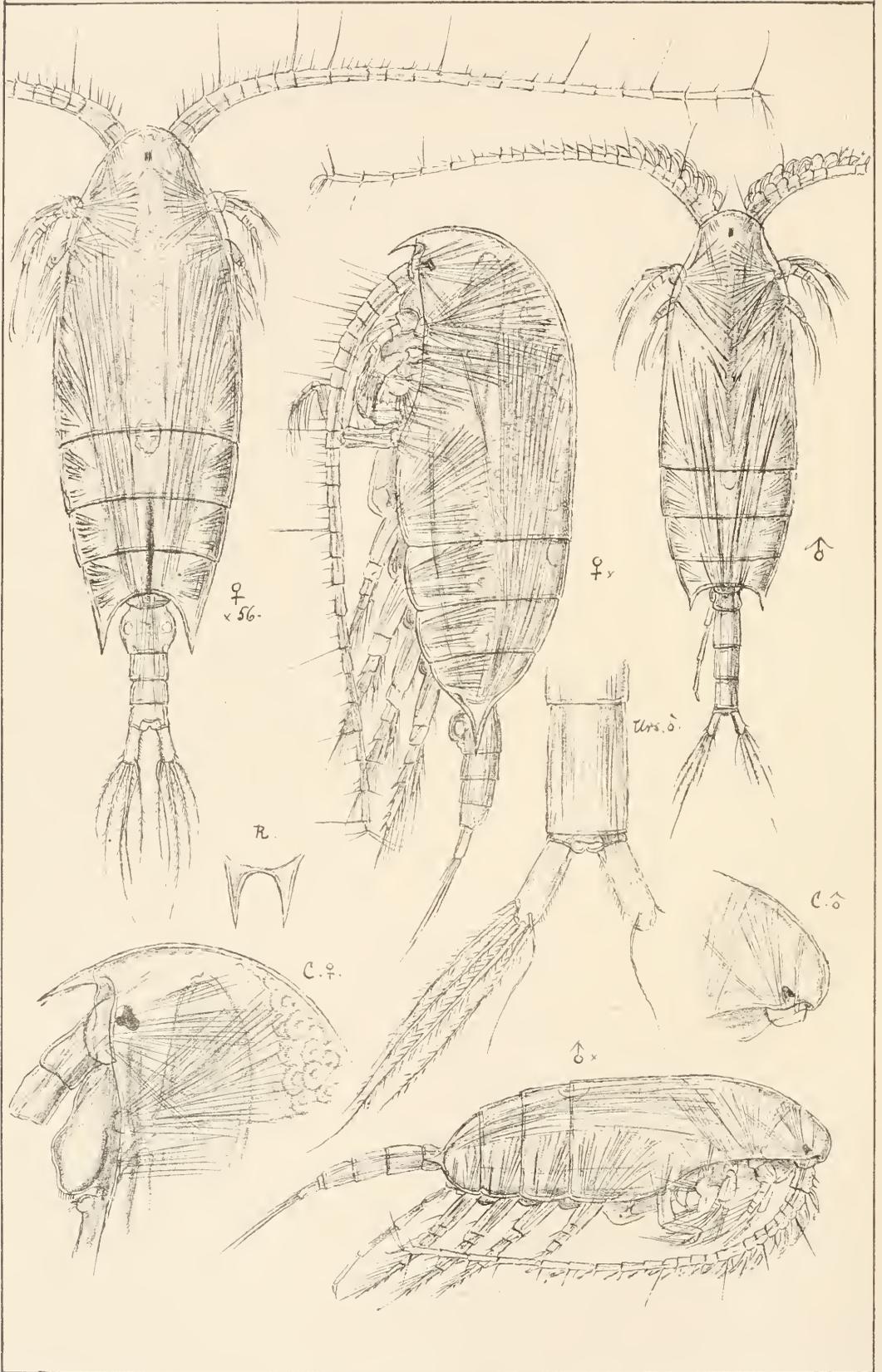
*Spinocalanus longicornis*, G.O. Sars.

# Copepoda

## Calanoida.

Ætidiidæ.

Pl. XIII.



G.O. Sars autogr.

Trykt i den private Opmaaling, Chra

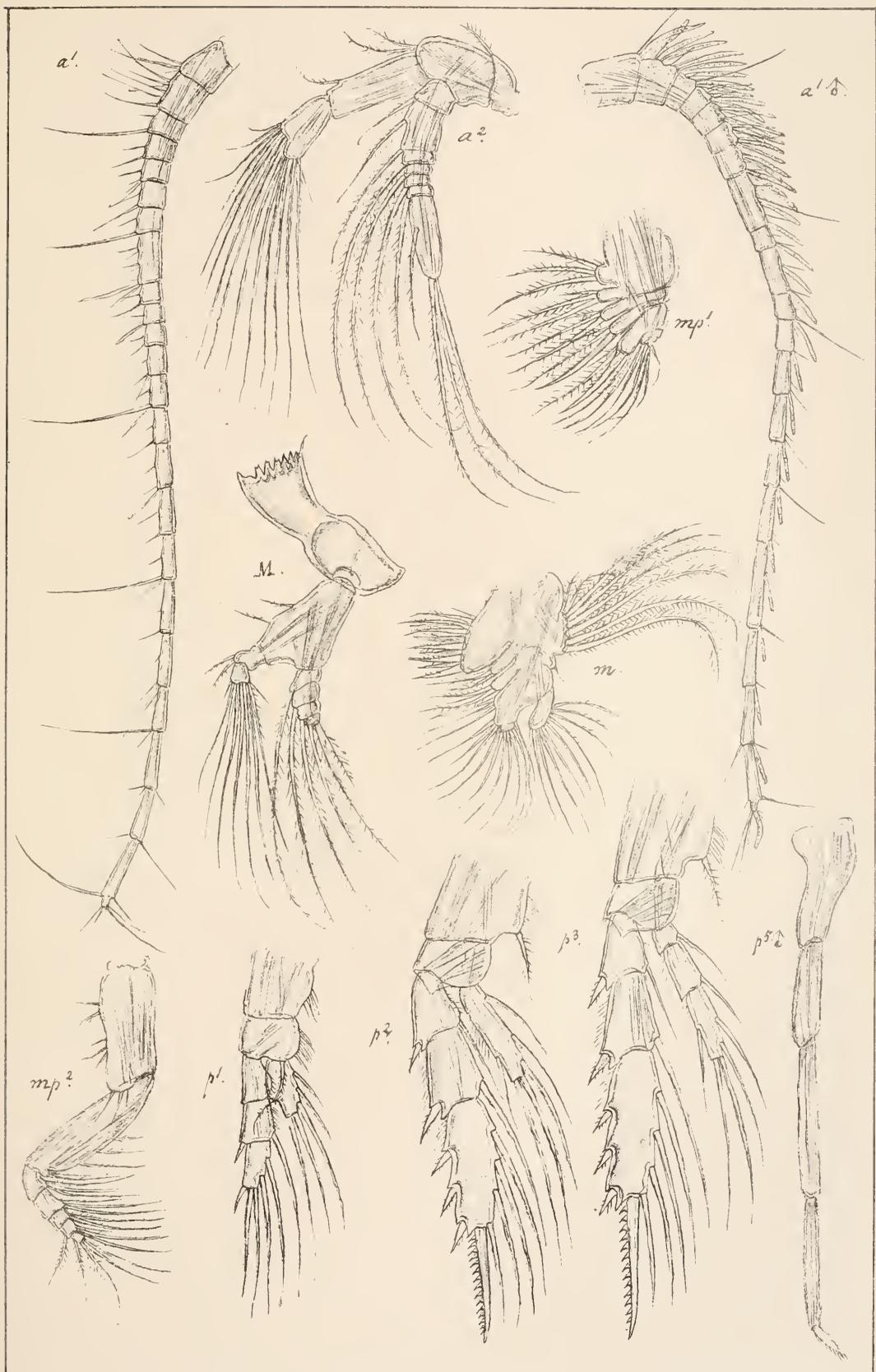
*Ætidius armatus*, (Boeck)

# Copepoda

## Calanoida.

Ætidiidæ.

Pl. XIV.



G.O. Sars autogr.

Trykt i den private Opmaaling, Chra

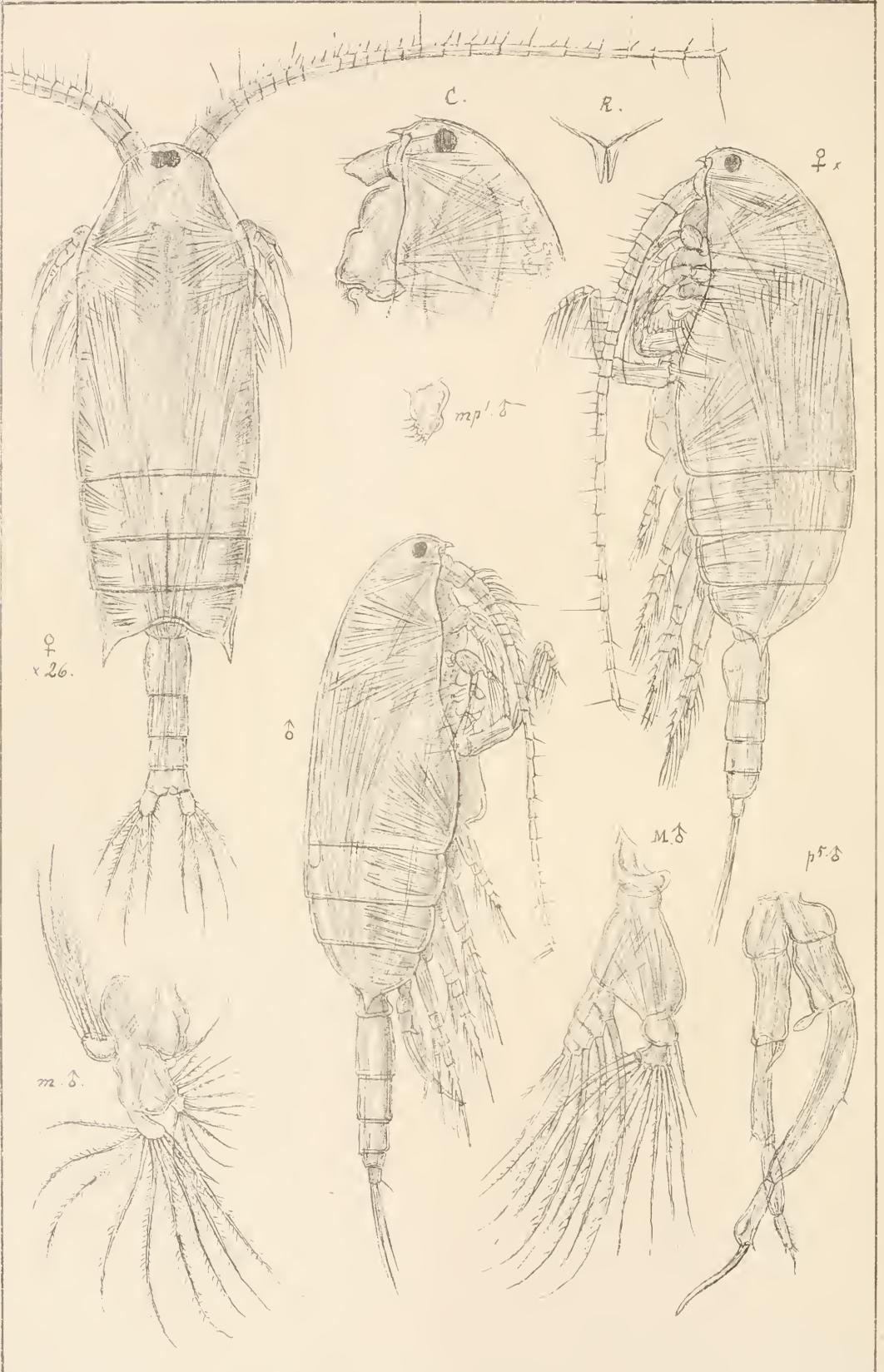
*Ætidius armatus*, (Boeck.)  
continued

# Copepoda

## Calanoida.

Ætidiidæ.

Pl. XV.



G.O. Sars autogr.

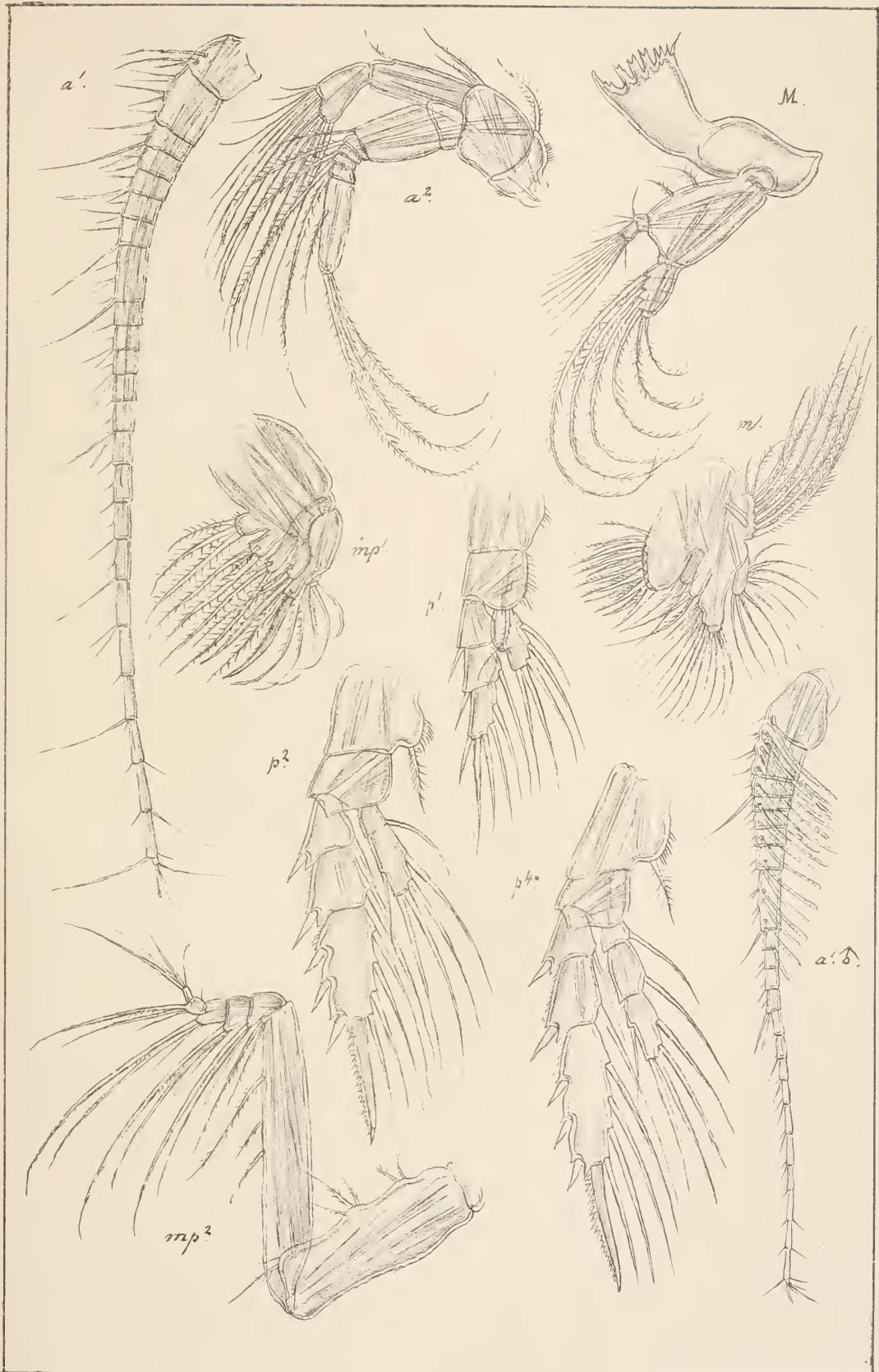
Trykt i den private Opmaaling, Chra

*Chiridius armatus*, (Boeck.)

# Copepoda Calanoida.

Ætidiidæ.

Pl. XVI.



G.O Sars autogr.

Chiridius. armatus, (Boeck.)  
continued

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