

AN ACCOUNT
OF THE
CRUSTACEA
OF
NORWAY

WITH SHORT DESCRIPTIONS AND FIGURES OF ALL THE SPECIES

BY
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VOL. VI
COPEPODA
CYCLOPOIDA

PARTS I & II
OITHONIDÆ, CYCLOPINIDÆ, CYCLOPIDÆ (part).

WITH 16 AUTOTYPIC PLATES



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INTRODUCTION.

Under the head *Cyclopoida* I comprise a number of Copepoda, which on the whole may be said to be built upon the type of our common fresh-water fleas (*Cyclops*), though exhibiting many modifications, both as to their general appearance and to their habits, the latter affecting chiefly the structure of the oral parts. The present group, or sub-order, exhibits some relations both to the *Calanoida* and to the *Harpacticoida*, and also shows a certain approach to some of the other sub-orders distinguished by the present author, especially to the *Notodelphyoida* and the *Caligoida*, though the Cyclopoid type may always be easily recognisable. Whereas the extensive group *Harpacticoida* by earlier authors has generally been comprised within a single family, the *Harpacticidæ*, several families referable to the present sub-order were established very early, though their real connexion under a common type has not been recognised.

According to the system proposed by Dr. Giesbrecht, the *Cyclopoida*, like the *Harpacticoida*, should be included in the 2nd of his 2 primary divisions, the so-called *Podoplea*. This very extensive and heterogeneous group has been divided by that author into 2 sections, *Isokerandria* and *Ampharthrandria*, according to the non-prehensile or prehensile character of the anterior antennæ in the male, each section comprising several families, which have been enumerated in his recent work on the family *Asterocheridae*, p. 57. I am, however, by no means prepared to adopt this classification, which appears to me quite artificial, like the primary grouping of the Copepoda into *Gymnoplea* and *Podoplea*. In the sense here adopted, the sub-order *Cyclopoida* comprises families referred by Dr. Giesbrecht partly to the *Isokerandria* and partly to the *Ampharthrandria*, whereas other families included by that author in the latter section are wholly removed as types of distinct sub-orders. One of these, the *Harpacticoida*, has been treated of in the preceding volume, the 4 remaining sub-orders, *Notodelphyoida*, *Monstriloida*, *Caligoida* and *Lernæoida*, being reserved for the succeeding volumes of the present work.

As mentioned above, the habits of the *Cyclopoida* are much more varied than is the case with the *Calanoida* and *Harpacticoida*. Some of them, for instance the species of the genus *Oithona*, are true pelagic animals, constituting a chief part of the plankton in almost all regions of the Oceans. Several other forms, like the *Harpacticoida*, live near the shores among algæ or on a muddy bottom at different depths, and a great number of forms lead a more or less pronounced parasitic existence, attacking different invertebrate animals, in some instances also fishes. In most cases, however, the parasitism may be said to be merely temporary, though there are also a few examples of a more permanent parasitism, for instance in the case of *Ergasilus* and *Nicothoe*. The different mode and degree of parasitism has a great influence on the structure of the oral parts, and indeed we have in this feature a good guide for an exact subdivision of this group of Copepoda. The parasitic forms exhibit, as regards the structure of the oral parts, 2 well-marked types, both again differing conspicuously from the non-parasitic forms. We may accordingly divide the Cyclopoida into 3 natural sections, for which I propose to retain the well-known names: *gnathostoma*, *siphonostoma* and *poecilostoma*. These names were first proposed by Thorell, but were taken in a much wider sense, viz., to divide the entire order Copepoda. I here restrict them to the group of Copepoda which will be treated of in the present volume.

As to the general characters distinguishing this group, the external appearance of the body, as a rule, looks rather different from that found in the typical *Harpacticoida* by the very sharp demarcation of the 2 chief divisions of the body, the anterior one being more or less tumefied, the posterior very narrow. So far the Cyclopoida more resemble the *Calanoida* than the *Harpacticoida*, though they are easily distinguished from them by the very moveable articulation between the last 2 trunk-segments, the posterior of which, as a rule, is very small and firmly connected with the genital segment, so that, at first sight, it has the appearance of belonging more properly to the posterior than to the anterior division of the body.

The anterior antennæ are, as a rule, more elongated than in the *Harpacticoida* and are composed of a greater number of articulations. There are, however, also some instances of a more or less great reduction of these limbs, both in size and in the number of joints.

The posterior antennæ are generally simple, without any outer ramus or exopodite. Only in a few of the parasitic forms is there a slight rudiment of such a ramus. In several of the poecilostomous Cyclopoida these antennæ are transformed into powerful prehensile organs.

The oral parts, as mentioned above, are of very different structure in the 3 sections of Cyclopoida.

The natatory legs are, as a rule, shorter and stouter than in the Harpacticoida, with the basal part broad and flattened and the rami generally well developed and subequal in size. The 1st pair are smaller than the succeeding ones and never prehensile. In a few of the parasitic forms, for instance *Cancerilla*, a considerable reduction of the natatory legs is found to have taken place, at least in the female.

The last pair of legs are always very small and simple in structure, being in most cases exactly alike in the two sexes.

The ova are carried in 2 ovisacs, which are lateral or even subdorsal, never, as in the Harpacticoida, ventral. Only in one instance, viz., in our indigenous species of *Corycaeus*, have I found only a single ovisac, which, however, is attached quite dorsally.

The Cyclopoida are well represented also in fresh water by numerous species of the genus *Cyclops* and allied forms, and some of the parasitic forms, for instance *Ergasilus*, are also true fresh-water animals.

Section 1. Gnathostoma.

General Characters.—Anterior antennæ in male distinctly hinged. Posterior antennæ without any outer ramus, and carrying on the tip a number of curved setæ. Oral parts adapted for mastication. Masticatory parts of mandibles and maxillæ strongly dentate. Maxillipeds not subchelate; the posterior ones smaller than the anterior, and of the same appearance in the two sexes. Natatory legs well developed, with both rami generally 3-articulate.

Remarks.—The several forms belonging to this section have generally been combined within a single family, the *Cyclopidae*. It is, however, very easy to distinguish at least 3 well-defined families of gnathostomous Cyclopoida. All these 3 families are represented in the fauna of Norway, and will be shortly characterised below.

Fam. 1. Oithonidæ.

Characters.—Body slender and of a very delicate structure, with thin and pellucid integuments. Anterior antennæ in female very slender and provided with long diverging setæ; those in male much more robust and distinctly geniculate. Posterior antennæ comparatively small, with the number of joints reduced. Oral parts well developed, and rather different in structure from those in other Cyclopoida, being partly armed with claw-like spines. Natatory legs with comparatively slender 3-articulate rami edged with unusually long setæ. Last pair of legs rudimentary and partly confluent with the corresponding segment. Caudal rami differing in shape and armature in the two sexes.

Remarks.—This family is founded upon the genus *Oithona* Baird, which in several respects differs rather conspicuously from the other genera included in the present section, and may accordingly be entitled to constitute the type of a distinct group. We do not know as yet any other genus referable to this family. The genus *Mormonilla* of Giesbrecht, it is true, exhibits some resemblance to *Oithona* in the general appearance of the body as also in the structure of the anterior antennæ; but the posterior antennæ are very different and built wholly on the type of the *Calanoida*. The systematic position of this genus is still very doubtful, though it perhaps may be found to be nearest related to the Cyclopoida. In this case it must be regarded as the type of a very anomalous family of the gnathostomous Cyclopoida.

Gen. 1. *Oithona*, Baird, 1843.

Syn: *Scribella*, Dana.

Generic Characters.—Body slender and attenuated, with the anterior division only slightly dilated, the posterior very narrow, linear in form. Head defined from the 1st pedigerous segment by a well-marked suture, and generally produced in front to a sharply-pointed rostrum, wanting, however, in male. Anterior antennæ long and slender, scarcely tapered distally, and composed of a limited number of joints, some of which are imperfectly defined. Posterior antennæ abruptly bent in the middle, and apparently only consisting of 2 joints, the 1st carrying about in the middle behind a short seta arising from a knob-like prominence. Mandibular palp with the basal part greatly produced, pediform, terminating in 2 claw-like spines, inner ramus represented by a very small seti-

ferous appendage attached outside the basal part at some distance from its end, outer ramus well developed and abruptly reflexed, being composed of 3—4 joints carrying long plumose setæ. Maxillæ with the masticatory lobe well defined and carrying a number of sharp claw-like spines accompanied inside by a thick setiform appendage, palp lamellar, with the outer distal lobe very small, proximal lobe well developed, recurved, and provided at the tip with long plumose setæ¹). Both pairs of maxillipeds slender and elongated, the anterior ones 5-articulate, the posterior ones 4-articulate, both carrying long anteriorly-curving spines. Natatory legs with no distinctly developed seta inside the 1st joint of the outer ramus, apical spine of this ramus very slender and serrate outside, spines of outer edge more perfectly developed in male than in female. Last pair of legs represented by a small conical joint terminating in a long seta; another similar seta issuing from a knob-like prominence on each side of the segment itself, seems to answer to that arising from the basal joint of these legs in other Cyclopoida. Caudal rami in female strongly divergent, with the 2 middle apical setæ much elongated and crossing each other at the base; those in male of quite normal appearance.

Remarks.—The present genus was established in the year 1843 by Baird, to include a species, *O. plumifera*, taken in the tropical part of the Atlantic. Another genus with the same name has been established by Alder and Hancock for a nudibranchiate Mollusc; but as this genus is of younger date than that of Baird, its name must be changed. The genus *Scribella* of Dana is identical with that of Baird, and likewise of later date. Several species of this genus have in recent times been described from different parts of the Oceans. Thus Dr. Giesbrecht records no less than 8 species, and some additional species have been named by other authors. There is, however, still considerable confusion about the right identification of some of these species, partly owing to their close relation and partly to the difficulty which is connected with an exact anatomical examination of such delicate and fragile animals. One of the species described by Dr. Giesbrecht, *O. nana*, seems in some respects to differ more conspicuously from the others, and may perhaps be regarded as the type of a separate, though nearly allied genus, for which the name *Oithonina* may be proposed. To the fauna of Norway belong 2 well-defined species, to be described below.

¹) I have formerly described these 2 lobes as the *exopodal* and *epipodal* lobes, but find that these names cannot properly be retained, since they unquestionably, as is clearly seen in the present genus, answer to the inner and outer rami of the mandibular palp. As, however, both these lobes are always attached outside the palp, I find it more appropriate to give them the indifferent names of *proximal* and *distal* outer lobes.

1. *Oithona spinirostris*, Claus.

(Pl. I & II).

Oithona spinirostris, Claus, Die freilebenden Copepoden, p. 105, Pl. XI, figs. 4—9.Syn: *Oithona challenger*i, Thompson.„ *plumifera*, Scott, (not Baird).„ *atlantica*, Farran.

Specific Characters.—*Female.* Body exceedingly slender, with the anterior division narrow fusiform in shape, the greatest width scarcely exceeding $\frac{1}{3}$ of the length and occurring somewhat in front of the middle. No conspicuous plumes present laterally. Rostrum strong, spiniform, and only very slightly curved, so as to be visible in the dorsal aspect of the animal. Tail not much shorter than the anterior division and very narrow; genital segment about the length of the 2 succeeding segments combined, and conspicuously dilated in its anterior part. Caudal rami nearly as long as the anal segment and rather divergent, seta of outer edge attached close to the base, the 2 middle apical setæ almost twice the length of the tail. Eye narrow linear in form and of a deep red colour. Anterior antennæ very slender and elongated, reaching, when reflexed, to the end of the 2nd caudal segment, and composed of about 12 more or less distinctly defined joints of rather unequal length and carrying scattered exceedingly long setæ pointing in different directions. 1st pair of natatory legs with the inner ramus distinctly 3-articulate, all joints of outer ramus spiniferous outside. 2nd and 3rd pair with no spine outside the middle joint of the outer ramus, terminal joint of this ramus, as in the 1st pair, with 2 spines outside. 4th pair with no spines outside the first 2 joints of the outer ramus and with only a single setiform spine outside the terminal joint. Ovisacs narrow oblong in form and greatly divergent, in some cases extending nearly at right angles to the axis of the body, each sac containing only a limited number of very pellucid ova, generally arranged in a double row.

Male much smaller than female and of a rather different appearance, the body being comparatively less slender, with the front obtusely truncate and wanting any trace of a rostrum. Tail distinctly 5-articulate, with the 1st or genital segment greatly swollen, to receive the 2 spermatophores. Caudal rami shorter than the anal segment and not at all divergent, apical setæ much shorter than in female and of quite normal appearance. Anterior antennæ scarcely longer than the anterior division of the body and exhibiting the usual geniculation; middle section only slightly tumefied, terminal one biarticulate. Natatory legs with all the joints of the outer ramus spiniferous outside, 3 such spines being

present on the terminal joint in the 2nd and 3rd pairs. Setæ of last pair of legs much shorter than in female.

Body in both sexes highly pellucid and nearly colourless, though in adult females generally a light orange pigment is seen clothing the oral area and partly also the sides of the head. A large oil-bubble is often found within the posterior part of the trunk, and 2 smaller ones at the limit between the head and the 1st pedigerous segment.

Length of adult female 1.35 mm., of male 0.82 mm.

Remarks.—I regard it as beyond all doubt that the above-described form is that originally recorded by Claus under the name *Oithona spinirostris*. It has generally been confounded with the very nearly allied species described by Baird as *O. plumifera*, from which, however, it is at once distinguished by the absence of the very conspicuous brightly-coloured plumes projecting in the latter at each side of the trunk, and from which indeed the specific name *plumifera* has been derived. These plumes in reality belong to the natatory legs, and are formed by the setæ attached outside the 2nd basal joint of the legs, which in the said species are richly plumose, whereas in the form here under consideration they are simple and do not even project laterally. In addition to this distinguishing character, Mr. Farran has recently pointed out some minute differences in the structure of the oral parts between these two forms, which accordingly must be regarded as distinct, though closely-allied species. Mr. Farran has proposed a new specific name for the present species, viz., *atlantica*, but I think that his doubt about the identity of Claus' species with the one here under question cannot properly be approved.

Occurrence.—I have observed this form in many different places on the Norwegian coast, at least up to the Trondhjem Fjord. It is, however, not nearly so common as the next species, and seems more properly to be an inhabitant of the open sea, from which it is only occasionally brought in by the currents to the shores and fjords.

When kept living in a vessel with fresh sea-water, the specimens are always found freely suspended in the water, more generally in an erect attitude, with the anterior antennæ and the caudal setæ spread to each side, these parts apparently serving as a very effective balancing apparatus. In this attitude the animal often rests for long time nearly immobile, only now and then, by the action of the natatory legs, making a short bound to change its place. To judge from the structure of the oral parts, the animal must be of a very rapacious nature, probably feeding upon other small pelagic animals. These may at first be seized by the slender maxillipeds and by them thrown in against the

other oral parts, the structure of which indeed seems to be more adapted for killing than for masticating the prey.

Distribution.—As this form has generally been confounded with *O. plumifera*, its true distribution is as yet rather difficult to determine. In all probability it has a similar wide range in the Oceans to that of the next species. With full certainty it may be said to be distributed all over the North Atlantic, as also in the Mediterranean.

2. *Oithona helgolandica*, Claus.

(Pl. III).

Oithona helgolandica, Claus, Die freilebenden Copepoden, p. 105, Pl. XI, figs. 10—12.

Syn: *Oithona spinifrons*, Boeck.

" *pygmaea*, Boeck.

" *similis*, Claus.

" *spinirostris*, Giesbrecht (not Claus).

Specific Characters.—*Female*. Body of the usual slender form, though somewhat less so than in the preceding species. Rostrum, as in that species, acutely pointed, but abruptly bent downwards at a right angle to the axis of the body, so as not to be visible in the dorsal aspect of the animal. Genital segment somewhat less dilated in its anterior part. Caudal rami not nearly attaining the length of the anal segment, and less divergent than in *O. spinirostris*, seta of outer edge shorter. Anterior antennæ, when reflexed, extending scarcely beyond the anterior division of the body, and composed of about 10 joints, some of which, however, are only faintly defined. Posterior antennæ and oral parts agreeing in structure with those in the preceding species. Natatory legs, however, exhibiting some characteristic differences: 1st pair with the outer ramus armed in a manner similar to that in *O. spinirostris*, except that the apical spine is less strong and almost setiform; inner ramus apparently only biarticulate, the 2 outer joints being confluent. 2nd and 3rd pairs with no spine outside the middle joint of the outer ramus, though exhibiting at the end of the joint a small dentiform projection of the margin. 4th pair without any spines either on the 1st or 2nd joints. Terminal joint of this ramus in all 3 pairs with only a single small spine outside, attached close to the end, and exhibiting moreover in the 2nd and 3rd pairs a very small dentiform prominence of the margin at about the middle of the joint. Ovisacs narrow oblong and closely appressed to the sides of the tail, each sac containing only a single series of very large and pellucid ova.

Male closely resembling that of the preceding species, but of smaller size, and moreover differing somewhat in the armature of the natatory legs, the terminal joint of the outer ramus having only 2 spines outside.

Body in both sexes extremely pellucid, without any obvious pigment.

Length of adult female 0.70—0.90 mm.; of male 0.50—0.60 mm.

Remarks.—There cannot in my opinion be any doubt, that the form at first recorded by Claus as *O. helgolandica* is the present species. It has subsequently been redescribed by the same author from Mediterranean specimens, but under another specific name, viz., *similis*, and this name has been applied to the present species by most authors. According to the rules of priority, however, the first name under which a species has been recorded should in every case be retained. The 2 forms named by Boeck *O. spinifrons* and *O. pygmæa* are undoubtedly both referable to the present species, and this is also the case with the form described by Dr. Giesbrecht from the bay of Kiel as *O. spinirostris*. The present species is easily distinguishable from the preceding one by the rather different form of the rostrum, the less elongated anterior antennæ, and the very different manner in which the ovisacs are borne by the female. Also in the structure of the natatory legs some well-marked differences are found to exist, as shown in the above diagnosis.

Occurrence.—This form occurs very abundantly along the whole coast of Norway, both on the outer shores and in the fjords. In the Christiania Fjord I have often taken it in great numbers even close to the beach of the innermost shallow creeks. As with the preceding species, male specimens are much scarcer than females, and seem only to appear in certain seasons.

Distribution.—The distribution of this species seems to be very extensive. It has been noted as far north as in Mosel Bay, Spitsbergen, and southwards in the Mediterranean, off the Canary Islands, and even in the Indian Ocean. I have myself examined specimens taken off the coast of New Zealand, and have carefully compared them with northern specimens, without having been able to detect any difference whatever.

Fam. 2. Cyclopinidæ.

Characters.—Body of somewhat varying shape, but never so slender as in the *Oithonidæ*, the anterior division being, as a rule, considerably dilated. Head in most cases confluent with the 1st trunk-segment; rostral projection short and generally bent in against the ventral face. Anterior antennæ less elongated than in the *Oithonidæ*, tapered, and clothed with moderately long setæ; those in male strongly hinged. Posterior antennæ generally composed of 4 joints. Oral

parts well developed and on the whole built on the same type as in the *Calanoida*. Natatory legs comparatively short and stout, with both rami 3-articulate and subequal in length. Last pair of legs generally extended laterally and composed of 1—3 joints.

Remarks.—The type of this family is the genus *Cyclopina* of Claus, which has generally been considered as closely allied to *Cyclops*, but which in reality differs very essentially in the structure of the oral parts, which much more resembles that found in the *Calanoida*. 4 different genera referable to this family will be described in the sequel.

Gen. 2. *Cyclopina*, Claus 1863.

Generic Characters.—General form of body much resembling that in the genus *Cyclops*. Anterior antennæ more or less elongated and composed of a somewhat varying number of articulations; posterior antennæ distinctly 4-articulate. Mandibles with the cutting edge divided into a number of sharp claw-like denticles, palp comparatively large, biramous, inner ramus well developed, biarticulate, outer generally multiarticulate. Maxillæ with the masticatory lobe well defined and armed with several claw-like spines, palp lamellar, with both outer appendages sharply defined and carrying long plumose setæ. Anterior maxillipeds rather stout, with the 2nd basal joint clawed, and the terminal part well developed, consisting of 3 joints. Posterior maxillipeds more slender, with the terminal part generally divided into 3 or 4 setiferous joints. Natatory legs of normal structure. Last pair of legs extended laterally, and composed of 2 or 3 joints, none of which are lamellar.

Remarks.—This genus was established in the year 1863 by Claus, to include a species, *C. gracilis*, found by him at Messina. The genus is chiefly characterised by the *Cyclops*-like form of the body, and by the very full development of the mandibular and maxillary palps, which strongly recalls that in the *Calanoida*. Several species have been recorded by different authors; but some of these have turned out to be referable to other genera, not even belonging to the present family. In the succeeding pages 4 different species of this genus, belonging to the fauna of Norway, will be described, and I am much disposed to believe that their number will be considerably increased by a closer study of our Copepod-fauna. For instance, many years ago, off the Lofoten islands, I observed 2 peculiar forms, the one distinguished by the excessive prolongation of the

caudal rami, the other by the strong development of the spines on the legs. The specimens of these 2 forms, which I had noted with the provisory names, *C. longifurca* and *C. euacantha*, have, however, unfortunately been lost, and I am thus unable to give any closer description of them here. A small species of this genus has also been described by me from the Chatham Islands under the name of *C. pusilla*, and another species has recently been recorded by Th. Scott as *C. longicaudata*.

3. *Cyclopina gracilis*, Claus.

(Pl. IV).

Cyclopina gracilis, Claus, Die freilebenden Copepoden, p. 104, Pl. X, figs. 9—15.

Syn: *Cyclopina norvegica*, Boeck.

Cyclops salinus, Brady.

Specific Characters.—*Female.* Body moderately slender, with the anterior division oval in form, greatest width exceeding half the length and occurring about in the middle. Tail rather slender, with the genital segment about the length of the other 3 combined and gradually narrowed behind. Caudal rami of somewhat varying length, though scarcely longer than the last 2 segments combined, sub-linear in form and only slightly diverging, seta of outer edge placed in front of the middle; apical setæ of moderate length, the inner medial one being, as usual, the longest and about equal to the tail in length; seta of inner corner scarcely longer than that of the outer. Anterior antennæ not much elongated, being considerably shorter than the cephalic segment, and composed of 10 joints, the 6th of which is much the longest and about equal in length to the 4 succeeding ones combined. Posterior antennæ with the last joint scarcely as long as the 2nd. Natatory legs with the spines outside the outer ramus of moderate size, 3 such spines being present on the terminal joint, except in 4th pair, where only 2 spines occur outside the apical spine. Last pair of legs biarticulate, proximal joint comparatively broad and finely ciliated inside, carrying outside the usual slender bristle, distal joint shorter and narrower than the proximal one, sub-quadrangular in form, and armed on the obtusely truncated extremity with 2 somewhat unequal lanceolate spines, between which a slender bristle is attached. Ovisacs of moderate size, oval in form, and carried closely appressed to the sides of the tail.

Male of much smaller size than female, and easily distinguished by the strongly hinged anterior antennæ and the distinctly 5-articulate tail, the 1st (genital) segment of which is considerably dilated. Last pair of legs of exactly the same appearance as in the female.

Body in both sexes of a whitish grey colour, with a faint yellow tinge. Length of adult female 0.43—0.57 mm.

Remarks.—This form was rather imperfectly described by Claus from Mediterranean specimens, and has subsequently been observed by other authors in different places of the northern Ocean. The form recorded by Boeck as *C. norvegica* can scarcely be regarded as specifically distinct, though it represents a strictly littoral variety, with the caudal rami comparatively shorter than in the typical form. Dr. Giesbrecht has also called attention to the variation in this respect both in the present and next species. The *Cyclops salinus* of Brady is unquestionably the present species, and belongs to its variety *norvegica*, Boeck. The specific name *gracilis* proposed by Claus for the present species, is somewhat inappropriate, since in reality this species is of less slender form of body than most of the other known species.

Occurrence.—I have taken this form in several places on the Norwegian coast, from the Christiania Fjord at least up to the Trondhjem Fjord. It is a strictly littoral form, being found close to the shore among algæ and scarcely ever, like the next species, at any considerable depth. The variety *norvegica* occurs rather frequently in shallow creeks and in pools left by the tide, both on the southern and western coasts.

Distribution.—British Isles (Brady), coast of France (Cann), bay of Kiel (Giesbrecht), Franz Josef Land (Scott), Polar Islands north of Grinnel Land (2nd Fram Expedition), Mediterranean (Claus), Black Sea (Czerniawsky).

4. *Cyclopina longicornis*, Boeck.

(Pl. V).

Cyclopina longicornis, Boeck, Nye Slægter og Arter af Saltvandscopepoder. Chr. Vid. Selsk. Forhandl. 1872, p. 41.

Syn: *Cyclopina littoralis*, Brady.

Specific Characters.—*Female.* Body comparatively more slender than in the preceding species, with the anterior division oblong oval in form, greatest width about equalling half the length and occurring in the middle, cephalic segment gradually tapered anteriorly, with the front narrowly rounded. Tail very slender, almost equalling in length the anterior division, genital segment slightly dilated in front and shorter than the 3 succeeding segments combined. Caudal rami long and narrow, being generally longer than the 2 preceding segments combined, seta of outer edge rather slender and attached a little in front of the middle; apical setæ very unequal, the inner medial one equal to the whole tail in length and fully twice as long as the outer, seta of outer corner scarcely half as long

as the inner. Anterior antennæ much more elongated than in the preceding species, about equalling in length the cephalic segment, and composed of 18 well defined joints, 3rd joint much the largest, 6th joint exhibiting a slight indication to be subdivided into 3 joints. Posterior antennæ with the terminal joint fully as long as the 2 preceding joints combined. Natatory legs with the seta attached inside the 1st joint of the inner ramus remarkably strong, especially in the 2 posterior pairs; terminal joint of outer ramus in 4th pair with only a single spine outside, the distal spine being replaced by a thin bristle abruptly bent inwards. Last pair of legs of comparatively feeble structure, and composed each of 3 joints, the first 2 somewhat lamellar and finely ciliated inside, middle joint carrying outside the usual bristle, last joint comparatively small, and provided with 4 slender ciliated setæ, the innermost of which is the shortest. Ovisacs of moderate size and slightly divergent.

Male, as usual, smaller than female, and easily recognizable by the strongly hinged anterior antennæ. Last pair of legs differing from those in female in being 4-articulate, the last joint being subdivided into 2 well defined joints, the proximal of which carries on each side a seta, whereas the distal joint has 4 setæ on the tip.

Body semipellucid, with scattered opaque patches of a whitish or yellow colour, in some cases, moreover, exhibiting a fine rosy tinge on several parts of the body, as also partly on the anterior antennæ.

Length of adult female 0.70—0.90 mm.

Remarks.—This form has generally been recorded under the specific name *littoralis* proposed by Brady. As, however, the name *longicornis*, assigned to this species by Boeck, dates from the very same year, and is a much more adequate name, I have found it suitable to prefer that name to the one proposed by Brady. For the present species cannot in reality be said to be, like the preceding one, a strictly littoral form, as it more generally occurs in greater depths and is only quite occasionally met with in the littoral region. I have found that such specimens are of smaller size and have the caudal rami less elongated than in the typical form, thus more properly constituting a particular variety, for which the name *littoralis* may be retained.

The present species is easily distinguished from the preceding one by the more slender form of the body, the much more elongated anterior antennæ, and the somewhat different shape of the caudal rami. In the structural details also some well-marked differences are found, especially as regards the structure of the last pair of legs.

Occurrence.—I have found this form rather frequently in many places of

the Norwegian coast, from the Christiania Fjord at least up to the Trondhjem Fjord. It is generally met with in depths ranging from 10 to 60 fathoms, especially where the bottom consists of coarse sand; much more seldom it is found in shallower water among algæ. Like the other species of the present genus, it is a true bottom-form, keeping constantly close to the ground. When disturbed, it darts away with great rapidity, to settle again very soon in another place. I have never seen it moving freely for any length of time in the water.

Distribution.—British Isles (Brady), Cuxhaven (Timm), Mediterranean (Giesbrecht), Polar Islands north of Grinnel Land (2nd Fram Exped.).

5. *Cyclopina brevifurca*, G. O. Sars, n. sp.

(Pl. VI).

Specific Characters.—*Female*. Body moderately slender, with the anterior division oblong oval in form, greatest width scarcely exceeding half the length, front evenly rounded. Tail not attaining half the length of the anterior division, genital segment comparatively large, being fully as long as the 3 succeeding segments combined, anal segment shorter than the preceding one. Caudal rami very small, being scarcely longer than they are broad, seta of outer edge slender and attached about in the middle, apical setæ rather elongated, the inner medial one considerably exceeding the length of the tail and, like the outer, clothed in its proximal part with coarse distant hairs, seta of outer corner unusually slender, being fully as long as that of the inner corner. Anterior antennæ comparatively longer and more slender than in *C. gracilis*, though not quite attaining the length of the cephalic segment, and composed of 12 well-defined joints, the 6th of which is much the largest, the 6 outer joints short and all of equal size. Posterior antennæ with the terminal joint about the length of the antipenultimate one. Natatory legs about as in *C. gracilis*. Last pair of legs, as in that species, bi-articulate, distal joint, however, comparatively larger, exceeding in length the proximal one, and narrow oblong in form, inner edge finely ciliated, tip armed with 2 slender and somewhat unequal spines, having between them a slender bristle. Ovisacs of moderate size, oval in form, and borne closely appressed to the sides of the tail.

Body rather pellucid, of a whitish gray colour, with light bluish transparent ovaria.

Length of adult female 0.60—0.70 mm.

Remarks.—This form is closely allied to *C. gracilis* Claus, but differs conspicuously in the shape of the anterior division of the body, the more slender

and distinctly 12-articulate anterior antennæ, and the remarkably short caudal rami, which latter character has given rise to the specific name here proposed.

Occurrence.—I have met with this form in several distant places on the Norwegian coast, for instance at Risør on the southern coast, at Skutesnæs on the south-western coast, and at Bejan outside the Trondhjem Fjord. A single well-marked ovigerous specimen was found, moreover, in a sample taken by Mr. Nordgaard in the Porsanger Fjord, Finmark. The specimens observed by me were taken in depths ranging from 10 to 30 fathoms, muddy bottom.

6. *Cyclopina elegans*, Scott.

(Pl. VII).

Cyclopina elegans, Th. Scott. Addition to the Fauna of the Firth of Forth. 12th Ann. Report of the Fishery Board of Scotland. Part. III, p. 237, Pl. V, figs. 9—19.

Specific Characters.—*Female*. Body very slender, with the anterior division narrow oblong in form, greatest width not attaining half the length and occurring in its anterior part, front evenly rounded. Tail almost as long as the anterior division and having the genital segment unusually large and tumid, clothed on each side with small spikes; anal segment fully as long as the preceding one. Caudal rami long and slender, equalling in length the last 2 segments combined; outer edge with 2 successive bristles, the smaller one occurring at a short distance from the base, the other attached nearer to the end and somewhat dorsally; apical setæ of moderate length, that of the outer corner shorter than that of the inner. Anterior antennæ moderately slender, though not attaining the length of the cephalic segment, and composed of 18 joints, the 4th and 5th joints exhibiting, however, a more or less distinct sub-division, so that the number of joints may be increased to 20—21. Posterior antennæ with the terminal joint scarcely longer than the antipenultimate one. Mandibular palp comparatively more slender than in the other species, with the outer ramus shorter. Posterior maxillipeds with the terminal part composed of 5 well-defined joints. 1st pair of legs, like the 3 succeeding ones, provided with 2 setæ inside the middle joint of the inner ramus, these setæ being in 4th pair very coarse, almost spiniform. Last pair of legs distinctly 3-articulate, 1st joint with a coarse ciliated seta inside, middle joint rather dilated and carrying outside the usual slender bristle; terminal joint narrow oblong in form, exceeding in length the other 2 combined, and provided outside with 2 setæ, at the tip with another very slender seta and a stout spine. Ovisacs of moderate size and somewhat divergent.

Colour whitish grey, with a slight yellow tinge.

Length of adult female about 0.80 mm.

Remarks.—This is a very distinct species, easily recognisable both by the general form of the body and by the structure of some of the appendages.

Occurrence.—The only place where I have observed this species, is at Farsund, south coast of Norway. It occurred here occasionally together with *C. longicornis* in a depth of about 20 fathoms, sandy bottom.

Distribution.—Firth of Forth (Scott), Gulf of Naples (Giesbrecht).

Gen. 3 **Cyclopinella**, G. O. Sars, n.

Generic Characters.—General appearance resembling that in the genus *Cyclopina*, the anterior division of the body being considerably dilated, the posterior narrow and attenuated. Head defined from the 1st pedigerous segment by a well-marked suture. Anterior antennæ comparatively short and composed of a limited number of articulations. Posterior antennæ with the first joint simple and quite smooth. Mandibles short and stout, with the palp less fully developed than in *Cyclopina*, being simple, without any outer ramus. Maxillæ likewise rather short, palp with the 2 outer appendages well developed and of about equal size, one of the apical spines, as also those of the masticatory lobe, unusually thick, almost digitiform. Anterior maxillipeds rather compact, with the claw of the 2nd basal joint scarcely different from the spines of the terminal part. Posterior maxillipeds much smaller, and of the usual structure. Natatory legs well developed differing somewhat in structure from those in *Cyclopina*. Last pair of legs less rudimentary than usual, being distinctly 3-articulate, with the terminal joint comparatively large and armed with strong lanceolate spines.

Remarks.—This new genus is somewhat allied to *Cyclopina*, though distinguished by certain apparently fundamental differences, of which may be named the distinct separation of the head from the 1st pedigerous segment, and the simple structure of the mandibular palp. Only a single species of this genus has hitherto come under my notice.

7. *Cyclopinella tumidula*, G. O. Sars, n. sp.

(Pl. VIII).

Specific Characters.—*Female.* Body comparatively short, with the anterior division greatly tumefied and almost pyriform in shape, the greatest width occurring

far in front and considerably exceeding half the length. Tail very narrow and tapered, with the genital segment only slightly dilated, anal segment fully as long as the preceding one. Caudal rami somewhat exceeding in length the anal segment and narrow linear in form, seta of outer edge attached about in the middle, apical setæ rather unequal, the inner medial one, as usual much the longest and about equalling in length the tail; seta of outer corner quite rudimentary, that of inner attaining the length of the corresponding ramus and very thin. Eye wholly absent. Anterior antennæ much shorter than the head, and composed of 12 well-defined joints, the 9th of which is somewhat longer than the others and carries a slender sensory filament. Posterior antennæ with the terminal joint unusually short, not even attaining the length of the preceding one. Mandibular palp forming a simple bi-articulate stem, the distal joint of which is very small and provided with 3 curved setæ. Natatory legs with no seta inside the 1st joint of the outer ramus; 1st pair with a strong spine outside the terminal joint of the inner ramus, replacing the usual seta; spines of outer ramus in this and the succeeding pairs slender, and edged with hyaline rims, 4 such spines being present on the terminal joint in the 3 anterior pairs, 3 in that of the 4th pair, inner ramus of the latter pair unusually narrow and, like that of the 2 preceding pairs, armed at the tip with 2 spines. Last pair of legs with the 1st joint quite unarmed, 2nd carrying outside a slender bristle, terminal joint much longer than the other 2 combined, oblong quadrangular in form, and much constricted at the base, carrying outside, somewhat in front of the middle, a strong lanceolate spine and at the transversely truncated end 2 similar spines and a very small bristle between them, inner edge of the joint straight and finely ciliated. Ovisacs small, and borne closely appressed to the sides of the tail, each containing, as a rule, only 3 ova arranged in a single row.

Male exhibiting the usual sexual characters. Last pair of legs of exactly the same appearance as in female.

Body of the usual whitish grey colour, but appearing darker on account of the translucent, very capacious anterior part of the intestine, which is generally filled with dark brown contents. A peculiar opaque body of a whitish or pale orange hue, and transversely oval or semilunar in form, is constantly found immediately inside the dorsal wall of the head, in front of the intestine, and is very conspicuous in the living animal.¹⁾

Length of adult female 0.68—0.75 mm.

¹⁾ I am unable to say anything about the significance of this body. It cannot be the missing visual organ, as it does not occupy the usual place of the eye, being far remote from the front. As to structure, it seems to consist of a uniform granular matter.

Remarks.—In its general appearance this form is rather similar to certain species of the genus *Cyclopina*, and I was indeed at first inclined to refer it to that genus. The closer anatomical examination has, however, proved it to be in reality so different, that in my opinion it ought to be generically separated.

Occurrence.—I have met with this peculiar form in several distant places on the Norwegian coast, for instance at Risør and Lillesand on the southern coast, at Christiansund on the western coast, and in the Trondhjem Fjord. In all places it occurred on a muddy bottom, partly covered by decaying algæ, the depth ranging from 20 to 40 fathoms.

Gen. 4. *Cyclopetta*, G. O. Sars, n.

Generic Characters.—Body somewhat depressed, with the 2 chief divisions less sharply marked off from each other than in the 2 preceding genera. Head confluent with the 1st pedigerous segment, and conspicuously contracted in front. Tail comparatively short. Anterior antennæ of inconsiderable length, with the number of articulations reduced. Posterior antennæ likewise unusually short and stout, and clothed with strong plumose setæ. Mandibles with the palp distinctly biramous, outer ramus well developed, inner uniarticulate. Maxillæ and maxillipeds very small and difficult to examine, though apparently built on the same type as in the other *Cyclopinidæ*. Natatory legs well developed and of normal structure. Last pair of legs consisting each of a single lamellar joint edged with ciliated setæ.

Remarks.—This new genus in some respects differs rather conspicuously from the 2 preceding ones, and seems to exhibit a certain approach to the next anomalous genus, *Pterinopsyllus*, though it is distinguished also from this genus by several well-marked characters. The genus is only founded upon a single species, to be described below.

8. *Cyclopetta difficilis*, G. O. Sars, n. sp.

(Pl. IX).

Specific Characters.—*Female.* Body comparatively short and stout, and distinctly depressed, with the anterior division oblong fusiform in outline, greatest width scarcely exceeding half the length, and occurring about in the middle. Cephalic segment rather large and evenly contracted anteriorly, with

the front narrowly rounded. Tail not attaining half the length of the anterior division, and scarcely tapering behind; genital segment conspicuously constricted in the middle, anal segment equalling in length the 2 preceding ones combined. Caudal rami short, not nearly attaining the length of the anal segment, and quadrangular in shape, seta of outer edge attached about in the middle, apical setæ of moderate length, the inner medial one about twice as long as the outer, both coarsely ciliated, seta of outer corner much smaller than that of the inner. Anterior antennæ scarcely exceeding half the length of the cephalic segment, and each composed of only 9 joints clothed with strong partly ciliated setæ; 5th joint the longest, 6th about the length of the 3 outer joints combined. Posterior antennæ distinctly 4-articulate, 1st joint provided at the end on either side with a strong ciliated seta, 2nd joint with a similar seta in front, 3rd joint with 4 such setæ outside, last joint about the length of the 2 preceding ones combined, and carrying on the tip 6 anteriorly-curving and likewise densely ciliated setæ. Mandibular palp with the outer ramus composed of 4 well defined joints, inner ramus with 3 comparatively short apical setæ. Proximal outer lobe of the maxillary palp much larger than the distal one and carrying 4 unusually thick plumose setæ. Maxillipeds very small and densely crowded, the anterior ones apparently of normal structure, the posterior ones with the number of the terminal joints much reduced. Natatory legs not exhibiting any pronounced peculiarity in their structure. Last pair of legs consisting each of a rounded oval lamella attached outside the last trunk-segment and provided with 3 thick and curved ciliated setæ; just above this lamella a thin bristle is attached to a conical projection of the segment itself.

Colour not yet ascertained.

Length of adult female 0.60 mm.

Remarks.—The present form cannot be confounded with any of the other *Cyclopinidæ*, exhibiting, as it does, a most characteristic appearance, somewhat recalling that found in certain of the semi-parasitic forms, to which, indeed, I was at first inclined to refer it, before having made out its anatomy.

Occurrence.—Only 3 specimens of this remarkable form, all of the female sex, have hitherto come under my notice. They were picked up from a sample taken last summer at Risør, south coast of Norway, in a depth of about 40 fathoms, muddy sand. All 3 specimens have been sacrificed for dissection, in order to get a satisfactory conception of the structure of the very small and densely crowded oral parts. The specific name here proposed alludes to the difficulty experienced in the examination of these parts.

Gen. 5. **Pterinopsyllus**, Brady, 1880.Syn: *Lophophorus*, Brady (not Temminch).*Cyclopella*, Claus.

Generic Characters.—Body robust and somewhat depressed, with the anterior division moderately dilated, the posterior less narrow than usual. Head coalesced with the 1st pedigerous segment, and terminating in a blunt rostrum projecting downwards. Caudal rami short, with the 2 middle apical setæ very strong and densely ciliated. Anterior antennæ short and stout, with the number of articulations reduced, and clothed with unusually strong pennate setæ; those of male of much larger size and strongly hinged. Posterior antennæ likewise short, and only 3-articulate, the last 2 joints being united. Mandibles with the cutting part considerably expanded and coarsely dentate; palp comparatively slender, with the outer ramus small and undivided, inner ramus biarticulate. Maxillæ with all the constituting parts well developed. Anterior maxillipeds very stout, with 3 well-defined terminal joints armed with strong spines. Posterior maxillipeds with the terminal part very fully developed and composed of 5 joints, the 1st much larger than the others. Natatory legs strongly built, with short and blunt spines outside the outer ramus; inner ramus of 1st pair in male prehensile, that of 4th pair more or less reduced in female, normal in male. Last pair of legs comparatively small and not extended laterally, being composed of 3 more or less lamellar joints, somewhat different in the two sexes.

Remarks.—This genus was established in the year 1878 by Prof. Brady, to comprise a peculiar Copepod found by him off the British coast. As, however, the generic name he proposed, *Lophophorus*, had been preoccupied for a genus of birds, he changed it in the year 1880 to *Pterinopsyllus*. The name *Cyclopella* proposed by Claus is of later date, and must yield to that given to the genus by Brady.

The systematic position of the present genus has remained somewhat doubtful. In some respects it recalls certain genera among the *Harpacticoida*, and, indeed, it has been placed within that group in the list of Crustacea from Northumberland and Durham published by Norman and Brady. I think, however, that its place within the group *Cyclopoida* cannot at present be disputed. On the other hand, owing to the peculiarities observed in this genus, it might be thought necessary to establish for its reception a distinct family, *Pterinopsyllidæ*. Indeed, I was at first much inclined to do so; but after having become acquainted with the preceding genus, *Cyclopetta*, which in some respects exhibits an evident

approach to the one here under consideration, I find that, without any serious scruple, it may be included in the family *Cyclopinidæ*, as here defined.

In addition to the typical species described below, 2 closely-allied species, *P. egyptius* and *P. illustris*, have been recorded by Dr. Giesbrecht from the gulf of Naples.

9. *Pterinopsyllus insignis*, Brady.

(Pl. X & XI).

Lophophorus insignis, Brady, Monograph of British Copepoda, Vol. I, p. 122, Pl. XIII, figs. 1—10, Pl. XV, fig. 10.

Specific Characters.—*Female*. Body rather stout, with the anterior division ovate in outline, greatest width exceeding half the length and occurring about in the middle. Cephalic segment large and narrowly produced in front. Last trunk-segment sharply defined from the preceding one, and projecting laterally in a small dentiform process. Tail about half the length of the anterior division, and nearly of uniform width throughout; genital segment about as long as the 3 succeeding ones combined, and scarcely at all dilated in front; anal segment shorter than the preceding one. Caudal rami quadrangular in shape, being scarcely longer than they are broad, seta of outer edge obsolete, the 2 middle apical setæ very strong and divergent, with coarser and more scattered hairs on their proximal parts, seta of outer corner much smaller than that of the inner, both very thin and naked. Anterior antennæ scarcely more than half as long as the cephalic segment and rather broad at the base, being composed of 8 joints, the 2nd of which is the largest, 5th joint very small. Posterior antennæ clothed along the outer edge and at the tip with coarsely hairy setæ, inner edge without any setæ. 4th pair of natatory legs with the inner ramus much shorter than the outer, middle joint imperfectly defined from the terminal one and without any setæ inside, the latter joint having inside 2 short blunt spines replacing the usual setæ. Last pair of legs with the 1st joint imperfectly defined at the base, but carrying inside a well-developed ciliated seta, 2nd joint conically produced outside and carrying the usual thin bristle, last joint much larger than the other 2 combined, and forming a rounded oval lamella coarsely ciliated inside and provided with 4 slender setæ, 3 of which are ciliated, the 4th, issuing from the tip, very thin and smooth. Ovisacs, according to Brady, short pyriform, with a limited number of ova.

Male of smaller size than female, and easily recognisable by the very coarse structure of the anterior antennæ, which are powerful prehensile organs divided into 12 joints. Inner ramus of 1st pair of legs with the apical spine

peculiarly transformed, being abruptly bent, so as to form a claw-like prehensile appendage. Inner ramus of 4th pair of quite normal structure. Last pair of legs as in the female, 3-articulate; the 1st joint does not, however, answer to the 1st joint in the female, but to the 2nd, as is clearly shown by the bristle issuing from its outer side. Of the other 2 joints, which accordingly answer to the terminal joint in the female, the proximal one is much the larger and carries at the end on each side a seta, whereas the distal joint is quite short with 4 diverging setæ on the end.

Body in both sexes of a whitish grey colour, with a slight violaceous tinge. Eye in living specimens very conspicuous and of light red colour.

Remarks.—The present form may be easily recognised from any of our indigenous Cyclopoida, both by its characteristic outward appearance and by the rich ornament of coarsely-ciliated setæ, which clothes most of the appendages. Especially are these setæ very conspicuous on the anterior antennæ, where they partly assume a pennate or pectinate character, giving these appendages a peculiar shrubby appearance. It was indeed to this peculiarity that the generic name, *Lophophorus*, at first proposed by Brady, alluded. From the 2 Mediterranean species recorded by Dr. Giesbrecht the present form cannot be distinguished without a very close anatomical examination.

Occurrence.—I have met with this pretty form occasionally in 3 different places on the Norwegian coast, viz., in the inner part of the Christiania Fjord, at Risør, and at Flekkerø, outside Christiansand. The specimens were taken in depths ranging from 20 to 40 fathoms, muddy sand. Canon Norman has taken this form also in the Trondhjem Fjord, at Rødberget, where it occurred in the considerable depth of 150 fathoms.

Distribution.—Coast of England and Scotland (Brady, Scott), Gulf of Naples (Giesbrecht).

Fam. 3. Cyclopidae.

Characters.—General form of the body resembling that in the typical *Cyclopinidae*, the anterior division being more or less dilated, the posterior much narrower and attenuated. Head in all the known forms confluent with the 1st pedigerous segment, and having the rostrum bent in against the ventral face. Anterior antennæ more or less elongated and strongly hinged in male. Posterior antennæ generally 4-articulate, with an elongated seta at the end of the 1st joint

posteriorly. Anterior lip with the terminal edge finely denticulate. Mandibles with the palp quite rudimentary, being reduced to a small knob-like process carrying 2 or 3 ciliated setæ. Maxillæ with the palp likewise imperfectly developed and without any distinctly-defined outer appendages. Maxillipeds built on the same type as in the *Cyclopinidæ*, but of comparatively simpler structure. Natatory legs, as a rule, well developed, with subequal triarticulate rami, though in some instances the number of joints in the rami may be reduced. Last pair of legs generally small and of the same appearance in the two sexes.

Remarks.—This family, in the restriction here adopted, is chiefly distinguished from the 2 preceding ones by the rudimentary condition of both the mandibular and the maxillary palps. This character is invariably found in all the forms, and must be regarded as of fundamental significance. In other respects this family exhibits a close resemblance to the *Cyclopinidæ*.

Only a limited number of species, belonging to 2 genera, are strictly marine, whereas in fresh water we find a great number of forms, all generally referred to a single genus, viz., *Cyclops*. I have, however, found it appropriate to divide this extensive genus into a number of closely-allied genera (or subgenera), which will be characterised in the next parts of the present Volume.

Gen. 10. **Euryte**, Philippi, 1843.

Syn: *Thorellia*, Boeck.

Generic Characters.—Body, as a rule, rather robust, the anterior division being considerably tumefied, and sharply marked off from the slender and attenuated tail. Anterior antennæ in female divided into a great number of short, but well-defined joints; those in male much more strongly built, and hinged in the usual manner. Posterior antennæ rather stout, 4-articulate, with the last 2 joints comparatively short. Mandibles with the cutting edge divided into several sharp claw-like teeth, setæ on the rudimentary palp not much elongated. Maxillæ with the masticatory lobe well developed and armed with strong dentiform spines, palp forming an oblong lamella projecting beyond the masticatory lobe and terminating in a serrated edge, being moreover provided on each side with 2 juxtaposed setæ. Anterior maxillipeds rather stout, with the digitiform lobe, issuing from the end of the 1st basal joint anteriorly, comparatively strong and, like the 2nd basal joint, projecting in a claw-like spine accompanied by a much

thinner seta; terminal part composed of only a single joint armed with short curved spines. Posterior maxillipeds of a somewhat unusual appearance and apparently sub-prehensile, the terminal part being abruptly bent and terminating in 2 short claw-like spines. Natatory legs powerfully developed with broad flattened basal part and the joints of the rami partly conspicuously expanded; spines of outer ramus lanceolate, bordered by broad hyaline rims finely serrated at the edges; several of the setæ, both of this and the inner ramus, transformed to similar, though more delicate spines. Last pair of legs less rudimentary than usual, and resembling in structure those in the genus *Cyclopinella*.

Remarks.—This genus was established by Philippi as early as in the year 1843, but was not recognised by Boeck, who records it under another name, viz., *Thorellia*. The genus is especially characterised by the peculiar structure of the maxillary palp and that of the posterior maxillipeds, as also by the transformation of several of the natatory setæ on the legs to lanceolate spines. Two species of this genus have hitherto been described, both occurring off the Norwegian coast, and a 3rd new species is here added. All 3 species are exclusively marine.

10. *Euryte longicauda*, Philippi.

(Pl. XII).

Euryte longicauda, Philippi, *Fernere Beobachtungen über die Copepoden des Mittelmeeres*. Arch. f. Naturg. 1843, p. 63, Pl. 3, fig. a—d.

Syn: *Thorellia brunnea*, Boeck.

Cyclops, nigricauda, Norman.

Cyclopina Clausi, Czerniawsky.

Specific Characters.—*Female*. Anterior division of body rounded oval in outline, greatest width almost equalling $\frac{2}{3}$ of the length, and occurring somewhat behind the middle. Cephalic segment very large, considerably longer than all the free trunk-segments combined, and evenly rounded in front. Last trunk-segment somewhat produced on each side. Tail very slender, almost attaining the length of the anterior division; genital segment imperfectly subdivided in the middle, and exhibiting on each side a dentiform posteriorly-pointing projection; anal segment longer than the preceding one. Caudal rami very slender and elongated, equalling in length the last 3 segments combined, and sublinear in form, diverging a little in their distal parts, which appear slightly thickened; seta of outer edge attached near the extremity; apical setæ not much elongated, the inner medial one not nearly attaining the length of the tail, that of the outer corner shorter than that of the inner. Anterior antennæ rather slender, though

not quite attaining the length of the cephalic segment, and composed of 21 joints, the 1st of which is much the largest; 2nd joint faintly subdivided in the middle. Posterior antennæ rather strongly built, 2nd joint angularly produced at the end inside, and almost as long as the outer 2 joints combined, some of the apical setæ rather strong, almost spiniform. 1st pair of natatory legs with the inner corner of the 2nd basal joint considerably produced and carrying a strong deflexed spine; middle joint of inner ramus very broad and, like that of the succeeding pairs, provided inside with 2 setæ, terminal joint with all the setæ transformed to spines. Setæ of terminal joint of outer ramus in 2nd to 4th pairs likewise transformed. Last pair of legs with the 1st joint very small and imperfectly defined at the base, 2nd joint likewise rather small, and carrying outside the usual bristle, last joint comparatively large, oblong quadrangular in shape and somewhat curved at the narrowed base, being armed with 3 strong lanceolate spines, one of which issues a little beyond the middle of the outer edge, the other 2 from the transversely truncated extremity; between the latter, moreover, a thin bristle is attached. Ovisacs narrow oblong in form and greatly diverging.

Male, as usual, smaller than female and of somewhat more slender form of body, being moreover easily recognised by the strongly hinged anterior antennæ and the distinctly 5-articulate tail.

Colour yellowish brown, with scattered patches of a darker hue; proximal part of the caudal rami and the middle part of the anterior antennæ generally of a similar dark hue.

Length of adult female about 1.30 mm., that of male 0.90 mm.

Remarks.—The identity of the above-described form with Philippi's *Euryte longicauda* has been sufficiently proved by Dr. Giesbrecht, who observed the species in about the same place, that Philippi had made his investigations in. The name *Thorellia brunnea*, under which this species has been recorded by most authors, is of much later date than that given to this form by Philippi, and cannot therefore be retained. It is also beyond doubt that both *Cyclops nigricauda* Norman and *Cyclopina Clausi* Czerniawsky are referable to the same species. From the 2 next species the present one may be easily distinguished by the very long and slender caudal rami, as also by the manner in which the ovisacs are borne in the female.

Occurrence.—I have found this form rather plentifully along the whole Norwegian coast, from the Christiania Fjord to Vadsø in moderate depths among algæ. More particularly it seems to haunt places where the great Laminariæ grow, to the leaves of which it is often found clinging rather firmly, probably by the aid of the clawed posterior maxillipeds. It moves through the water

in the usual jumping manner, and has on the whole in its behaviour much the appearance of an ordinary Cyclops. Dr. Scott records a smaller form of this species, which he designates as *varietas minor*. I have also myself in the inner part of the Christiania Fjord observed such small, though fully adult specimens, but have failed to detect any other differences from the typical form.

Distribution.—British Isles (Brady), coast of France (Canu), Gulf of Naples (Philippi), Black Sea (Czerniawsky), eastern coast of Greenland (Buchholtz), Franz Josef Land (Scott), Polar Islands north of Grinnel Land (2nd Fram Expedition).

11. *Euryte robusta*, Giesbrecht.

(Pl. XIII).

Euryte robusta, Giesbrecht, Mittheilungen über Copepoden, 12—14, p. 58, Pl. 4, figs. 1—18.

Specific Characters.—*Female*. Body comparatively more robust than in the preceding species, with the anterior division more regularly oval in outline. Tail comparatively shorter and broader at the base; genital segment exhibiting in the middle quite similar dentiform projections to those in *E. longicauda*. Caudal rami rather shorter than in that species, scarcely exceeding in length the last 2 segments combined, and slightly diverging at the end; apical setæ more evenly ciliated. Anterior antennæ, as in that species, rather slender and composed of 20 joints. Posterior antennæ somewhat less robust, with the 2nd joint scarcely angular behind and the apical setæ thinner. Posterior maxillipeds with the apical claws more slender and accompanied by 2 thin bristles. Structure of the legs almost exactly as in *E. longicauda*, though having the spines comparatively shorter and stouter. Ovisacs small and of irregularly rounded form, each containing a very limited number of ova.

Male resembling that of the preceding species, but of somewhat more robust form.

Body of a dark ochraceous colour, the caudal rami being tinged with deep chestnut and the anterior antennæ with bands of a similar hue.

Length of adult female 1.20—1.40 mm., of male about 1.00 mm.

Remarks.—I cannot doubt that the above-described form is identical with that recorded by Dr. Giesbrecht from the gulf of Naples, though there are a few points of disagreement. Thus Dr. Giesbrecht counts 21 joints in the anterior antennæ, whereas I have never found more than 20 such joints, some of which even are imperfectly defined. The figure given by him of the posterior antennæ also differs somewhat, and more agrees with those antennæ in *E. longicauda*. Otherwise, however, the two forms seem to agree perfectly.

The present species is closely allied to *E. longicauda*, but is easily distinguished by the comparatively more robust form of the body, and more particularly by the considerably shorter caudal rami.

Occurrence.—I have found this form not unfrequently in several places of the Norwegian coast, for instance at Kleven and Korshavn on the southern coast, and at Aalesund and Christiansund on the western coast. It is a more pronounced deep-water form than the preceding one, being generally found in depths ranging from 20 to 60 fathoms, especially where the bottom consist of coarse sand intermingled with mud. It is very perplexing, that this form has not yet been observed off the British Isles, the Copepod-fauna of which has been so thoroughly studied, especially by Th. Scott.

Distribution.—Gulf of Naples (Giesbrecht).

12. *Euryte curticornis*, G. O. Sars, n. sp.

(Pl. XIV).

Specific Characters.—*Female*. Body somewhat less robust than in the preceding species, with the anterior division ovate in outline, the cephalic segment being somewhat contracted in front. Last trunk-segment less produced laterally than in the other 2 species. Tail exceeding somewhat half the length of the anterior division, genital segment with only a slight rudiment of the lateral denticles so conspicuous in the 2 preceding species. Caudal rami about equalling in length the last 2 segments combined, and not at all diverging, tapering slightly distally; apical setæ of moderate length, the 2 middle ones clothed in their proximal part with rather coarse and distant hairs. Anterior antennæ much shorter and thicker than in the 2 preceding species, though composed of a similar great number of joints (20), most of the setæ rather coarse and finely ciliated. Posterior antennæ of a similar structure to that in *E. robusta*. Posterior maxillipeds less abruptly curved and having the terminal part much shorter, with the apical claws extremely minute. Natatory legs built in the same manner as in the 2 preceding species, though having the rami somewhat less broad and the spines more slender. Last pair of legs likewise of a very similar structure, last joint, however, comparatively shorter. Ovisacs rather large, and borne closely appressed to the sides of the tail.

Colour not yet ascertained.

Length of adult female 1.30 mm.

Remarks.—This new species may be at once distinguished from the 2 preceding ones by the much shorter and stouter anterior antennæ, which character

indeed has given rise to the specific name here proposed. In the structural detail also some minor differences are found to be present, especially as regards the posterior maxillipeds and the caudal rami.

Occurrence.—Several specimens of this form were collected, many years ago, at Skraaven, Lofoten islands. They occurred in a depth of about 6 fathoms, on a sandy bottom partly overgrown with algæ.

Gen. 11. *Halicyclops*, Norman, 1903.

Syn: *Hemicyclops* Claus (not Boeck).

Generic Characters.—Body of the usual cyclopoid shape, and somewhat depressed in its anterior part. Head confluent with the 1st pedigerous segment, and having the rostrum bent in against the ventral face. Anterior antennæ short, with the number of joints greatly reduced; those in male strongly hinged. Posterior antennæ with the outer 2 joints confluent. Mandibles with one of the cutting teeth much larger than the others, setæ of rudimentary palp comparatively short. Maxillary palp forming a small lamella not extending beyond the masticatory lobe, and terminating in a short spine accompanied by one or two setæ. Anterior maxillipeds with the digitiform lobe, issuing from the end of the 1st basal joint anteriorly, rather small and terminating in 2 unequal setæ. Posterior maxillipeds imperfectly developed, being composed of 2 or 3 joints only. Natatory legs built upon the usual cyclopoid type, but having the rami not nearly so broad as in *Euryte*. Last pair of legs with the proximal joint more or less completely coalesced with the corresponding segment, distal joint broad lamelliform and edged with partly ciliated setæ.

Remarks.—This genus was established in the year 1893 by Claus, to include the form generally recorded as *Cyclops aegroveus* Fischer. As, however, the name he proposed, *Hemicyclops*, had been preoccupied by Boeck, to designate another very different genus, not even belonging to the same section, it has been changed by Norman to *Halicyclops*. The genus is nearly allied to *Cyclops*, but differs in the imperfect development of the posterior antennæ and of the posterior maxillipeds, as also in the peculiar structure of the last pair of legs. In addition to the typical form, to be described below, another nearly-allied species has been recorded by the present author from the Chatam islands as *H. propinquus*, and a 3rd species, not yet described, occurs, as a true planktonic form, in the Caspian

Sea. All the species are inhabitants of more or less brackish water, though they may be of marine origin, as they are never found in purely fresh water.

13. *Halicyclops magniceps* (Lilljeborg).

(Pl. XV).

Cyclops magniceps, Lilljeborg. De crustaceis ex ordinibus tribus, etc. p. 204, Pl. XXII, fig. 1.

Syn: *Cyclops æquoreus*, Fischer.

„ *christianiensis*, Boeck.

Specific Characters.—*Female.* Body moderately stout, with the anterior division oblong oval in outline, greatest width about equalling half the length and occurring somewhat in front of the middle. Cephalic segment very large and broadly rounded in front; last trunk-segment only slightly produced laterally. Tail scarcely more than half as long as the anterior division, genital segment nearly of equal width throughout, anal segment shorter than the preceding one, and deeply cleft at the end. Caudal rami about twice as long as they are broad and somewhat divergent; seta of outer edge attached about in the middle; apical setæ rather slender, the inner medial one attaining half the length of the body; seta of outer corner shorter than that of the inner. Anterior antennæ comparatively short and stout, being composed of only 6 distinctly defined joints, the first 2 rather dilated, the 3rd quite short, the 4th nearly as long as the outer 2 joints combined. Posterior antennæ with the terminal joint sub-fusiform in shape, and provided in the middle outside with a well-marked notch, indicating the place where the 2 outer joints have been coalesced. Posterior maxillipeds very small and only composed of 2 joints, the distal one much the smaller. Natatory legs with the terminal joint of the inner ramus not much larger than the middle one, and provided in the 1st pair with 2, in the other pairs with 3 spines in addition to the setæ; terminal joint of outer ramus having 3 spines outside in the 3 anterior pairs, 2 in the 4th pair. Last pair of legs with the proximal joint imperfectly defined from the segment, distal joint much expanded, spatulate in form, terminal edge obliquely truncated and carrying 4 comparatively short setæ, the innermost but one simple, the others ciliated. Ovisacs oblong oval in form and borne closely appressed to the sides of the tail, each containing only a limited number of ova.

Male much smaller than female, and having the anterior antennæ very strongly built, being composed of 11 more or less distinctly defined joints, the last constituting the terminal section and produced in a sharp point. Last pair of legs with the proximal joint more distinctly defined, distal joint only differing

from that in female by the presence of an additional seta attached inside the others.

Body semipellucid, of a whitish colour, with a very faint yellowish or greenish tinge. Ovaria and ova in the ovisacs generally of a dark blue colour.

Length of adult female 0.75 mm.

Remarks.—This form was first recorded by Lilljeborg under the name of *Cyclops magniceps*, but was rather imperfectly described, and, as moreover the number of joints in the anterior antennæ were erroneously indicated to 8, instead of 6, the species was not recognised by subsequent authors, who generally recorded it under the specific name *ægvoreus* proposed by Fischer several years afterwards. The form named by Boeck *Cyclop christianiensis* is also unquestionably the same species. It is distinguished from the nearly-allied form *H. propinquus* G. O. Sars by the more produced caudal rami, as also by its larger size.

Occurrence.—I have found this form not unfrequently in the uppermost part of the Christiania Fjord, where it occurs close to the border of the shallow creeks in the immediate neighbourhood of the town. It also occurs in other places, both of the south and west coasts of Norway, partly in more or less brackish water.

Distribution.—Kullaberg, coast of Sweden (Lilljeborg), British Isles (Brady), coast of France (Canu), Algeria (Richard), Madeira (Fischer).

Gen. 12. **Cyclops**, Müller, 1776 (ex parte).

Generic Characters.—Anterior division of body moderately tumid, and generally more tapered behind than in front; lateral parts of the 3 anterior trunk-segments well defined and sub-angular behind; last trunk-segment more or less produced laterally. Tail slender and attenuated, with the genital segment in female more or less dilated in front. Anterior antennæ of varying length, and more generally composed of 17 well defined joints, though in some cases, by concrescence, their number may be considerably reduced; those in male strongly hinged, with the terminal section distinctly biarticulate. Posterior antennæ with all 4 joints well defined, the 1st carrying at the end posteriorly a long ciliated seta. Rudimentary palp of the mandibles carrying 2 very long and densely plumose setæ accompanied by a short bristle. Maxillary palp scarcely extending beyond the masticatory lobe, and provided outside near the base with 4 ciliated setæ, 3 of which issue from a slight expansion of the margin. Anterior maxilli-

peds moderately strong, with the 1st basal joint generally subdivided in the middle, and provided anteriorly with a small rounded lobe carrying 2 plumose setæ; digitiform lobe issuing from the end of this joint anteriorly comparatively small, with none of the setæ unguiform. Posterior maxillipeds much more slender, and composed of 4 well-defined joints. Natatory legs with both rami generally 3-articulate, though in some cases, by an imperfect separation of the 2 outer joints, one or other of them, or all, may be only biarticulate; inner ramus of 4th pair with 2 apical spines. Last pair of legs very small and generally not extended laterally, being composed of 2 joints, the proximal of which in some cases may be coalesced with the corresponding segment, distal joint not expanded, and carrying a slender apical seta and a short lateral spine. Seminal receptacle in female of comparatively simple structure, being generally transversely oval in shape.

Remarks.—This genus is here taken in a much more restricted sense than done by other authors. Owing to the great number of species referred to this genus, it has long appeared very desirable to group them according to their mutual relationship, in order to get a clear survey on them. A such grouping of the European species has indeed been effected by Dr. Schmeil in his very valuable work on the fresh water Copepoda of Germany. I think, however that we may be justified to take a further step, and to subdivide the old genus *Cyclops* into a number of nearly-allied genera, each being designated by a particular name. In the present work I have attempted to do so, distinguishing 5 different genera, the name *Cyclops* being restricted to one of them, which comprises the greater bulk of the hitherto known species. In this genus I have included 4 of the 8 groups of Cyclopes distinguished by Dr. Schmeil, having not found sufficient reason for a generic separation of these groups; the 4 other genera answer to as many groups distinguished by Dr. Schmeil.

In the restriction here adopted, the present genus is, among other things, characterised by the well defined and angular epimeral parts of the segments composing the anterior division of the body, giving to the sides of that division a more or less jagged appearance. Of the structural details, it is especially the rudimentary last pair of legs which exhibits a very characteristic appearance, conspicuously differing from that in any of the other 4 genera.

A considerable number of species referable to the present genus will be described in the sequel, some of them being, however, so closely allied, that their specific distinctness has not generally been recognised. They all, like the species of the 4 succeeding genera, are exclusive inhabitants of fresh water.

The diagnoses here given of the several species have chiefly been drawn up from adult female specimens, the males affording, as a rule, no particular characters available for the specific distinction.

14. *Cyclops strenuus*, Fischer.

(Pl. XVI).

Cyclops strenuus, Fischer, Bulletin de la Société Impér. d. Nat. de Moscow, Vol. XXIV, p 419 Pl. IX, figs. 12—21.

Syn.¹⁾ ? *Monoculus quadricornis rubens*, Jurine.

? *Cyclops pictus*, Koch.

" *quadricornis*, Lilljeborg.

" *brevicaudatus*, Claus.

" *Clausi*, Lubbock.

Specific Characters.—*Female.* Body moderately slender, with the anterior division oblong oval in form, greatest width about equal to half the length and occurring in the middle. Cephalic segment only slightly longer than the 4 succeeding segments combined, and narrowly rounded in front. Lateral parts of penultimate trunk-segment terminating in a short tooth-like projection turned somewhat outwards. Last trunk-segment angularly produced laterally. Tail somewhat exceeding half the length of the anterior division; genital segment conspicuously dilated in front, though the width is somewhat less than the length. Caudal rami moderately slender, exceeding in length a little the last 2 segments combined, and slightly divergent, being linear in form, and each provided dorsally with a distinct longitudinal keel, inner edge finely ciliated; seta of outer edge rather small and not much remote from the end; apical setæ comparatively short, the inner medial one only very little longer than the outer and scarcely twice as long as the corresponding ramus, seta of inner corner not much longer than that of the outer. Anterior antennæ of moderate length, reaching, when reflexed, to the middle of the 2nd segment, and composed of 17 joints. Natatory legs with 3 spines outside the terminal joint of the outer ramus of 1st and 2nd pairs; inner edge of same joint carrying in 1st pair 3, in the succeeding pairs 4 setæ. Inner ramus of 4th pair moderately slender, with the outer apical spine somewhat exceeding half the length of the inner. Last pair of legs with the distal joint not twice as long as it is broad, lateral spine rather strong and attached about in the middle of the inner edge. Ovisacs comparatively large, oval in form, and borne closely appressed to the sides of the tail. Seminal receptacle transversely truncated in front.

¹⁾ Many other synonyms have been given in the work of Dr. Schneil. But as he evidently has combined several species under the name *strenuus*, only those synonymes are here quoted, which more strictly may refer to the species here under consideration.

Copepoda

Oithonidæ.

Cyclopoida.

Pl. I.

G. O. Sars, del.

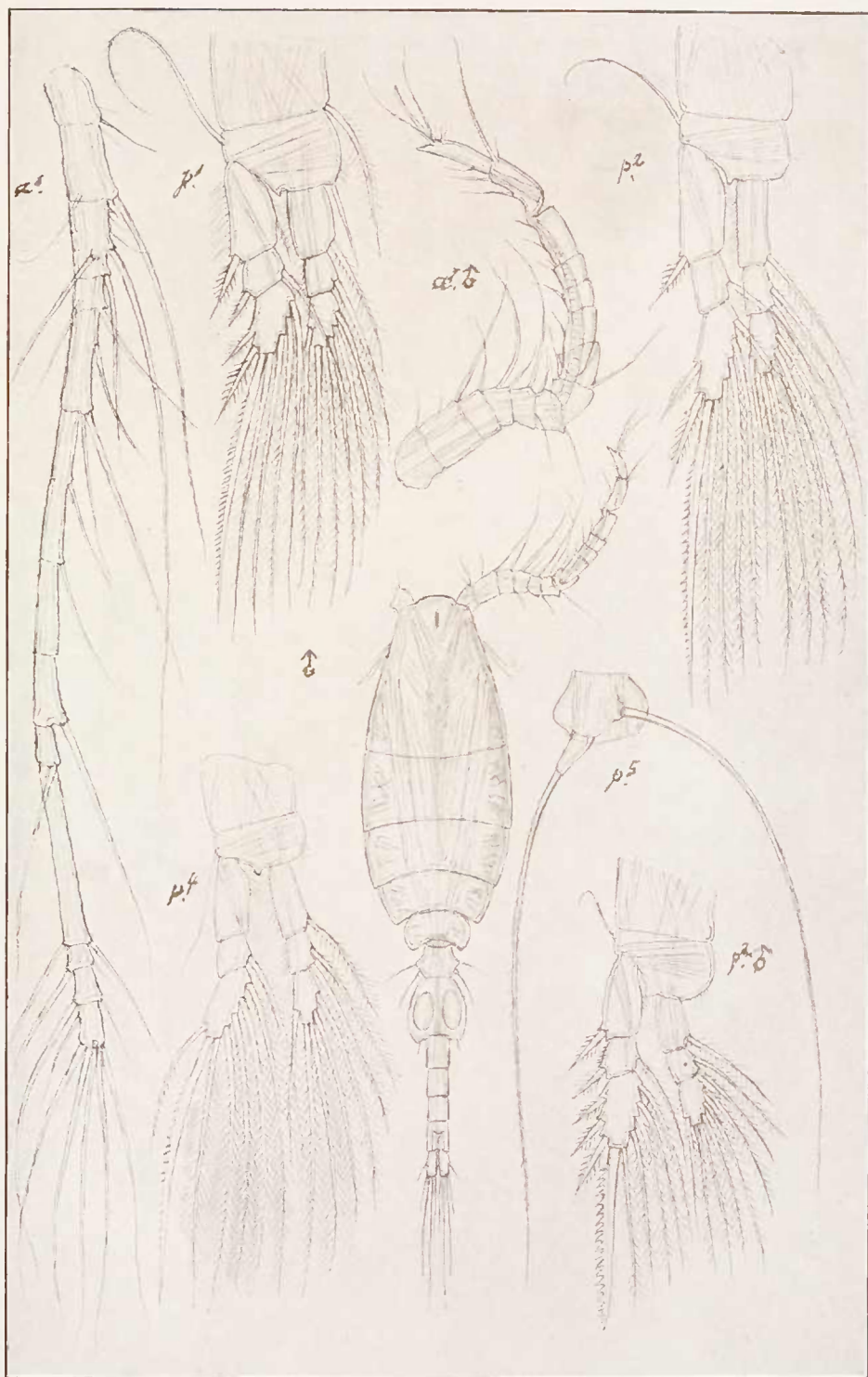
Oithona spinirostris, Claus.

Copepoda

Oithonidæ.

Cyclopoida.

Pl. II.



G. O. Sars, del.

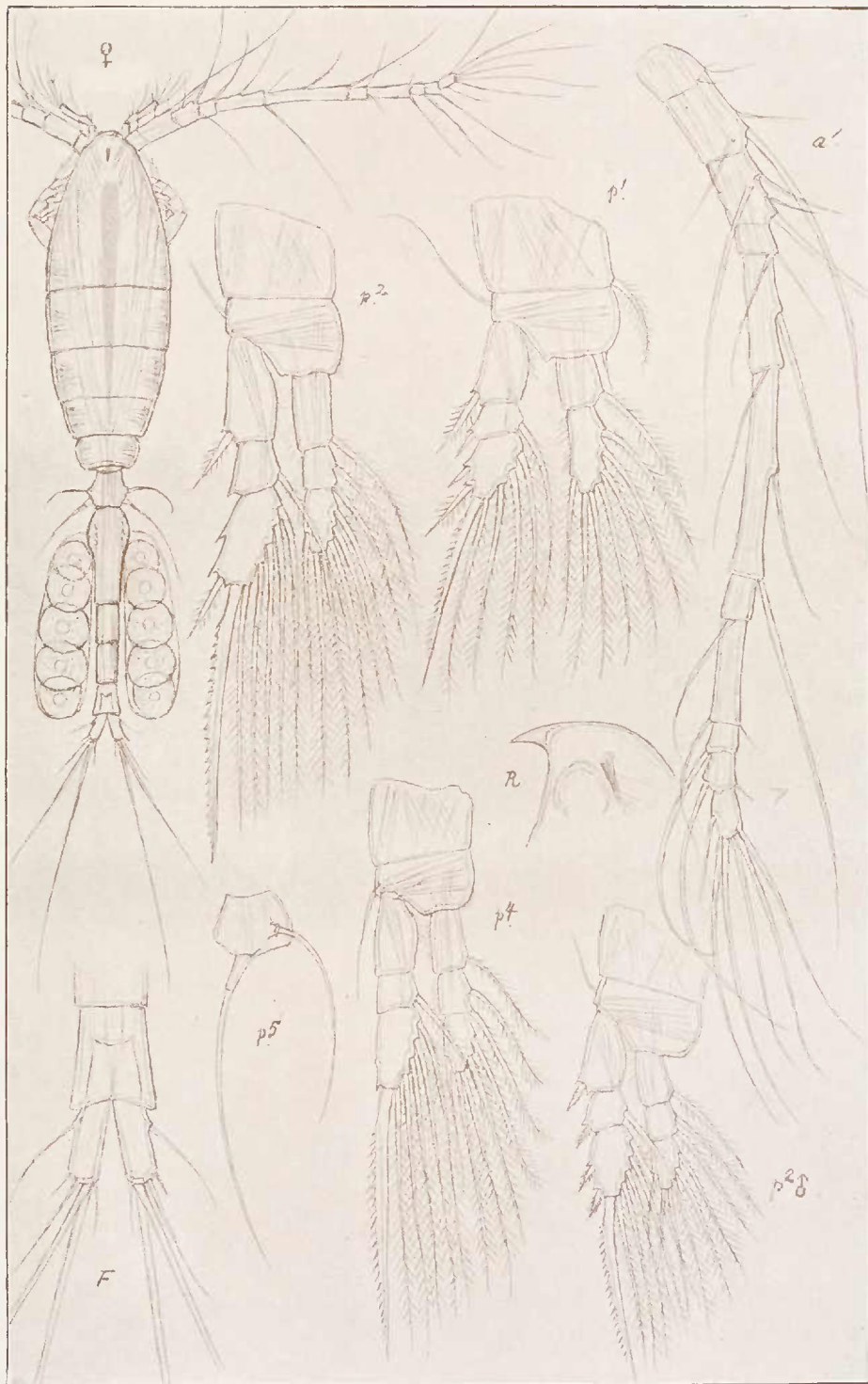
Oithona spirostris, Claus.
(Continued).

Copepoda

Oithonigæ.

Cyclopoida.

Pl. III.



G. O. Sars, del.

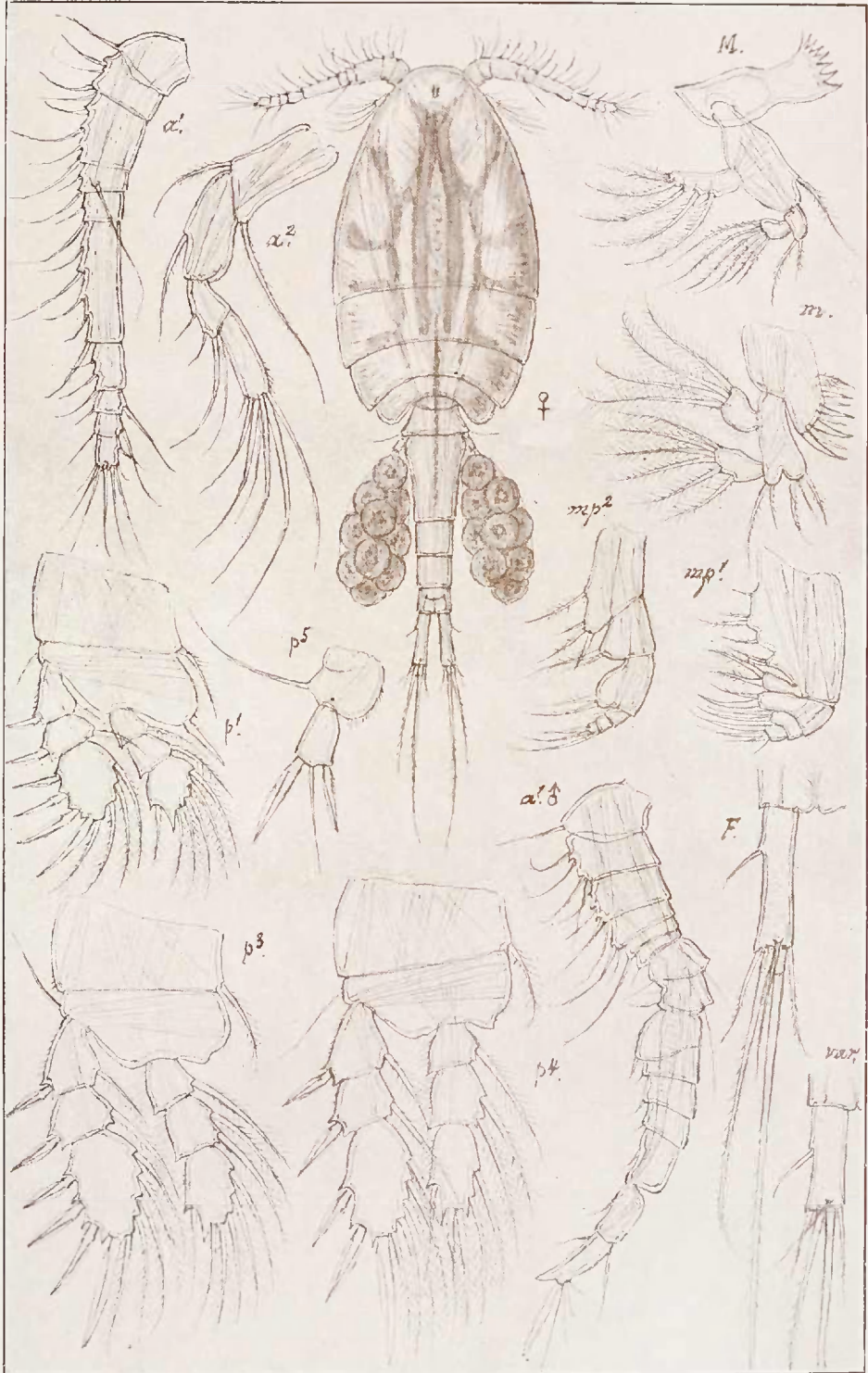
Oithona helgolandica, Claus.

Copepoda

Cyclopinidæ.

Cyclopoida.

Pl. IV.



G. O. Sars, del.

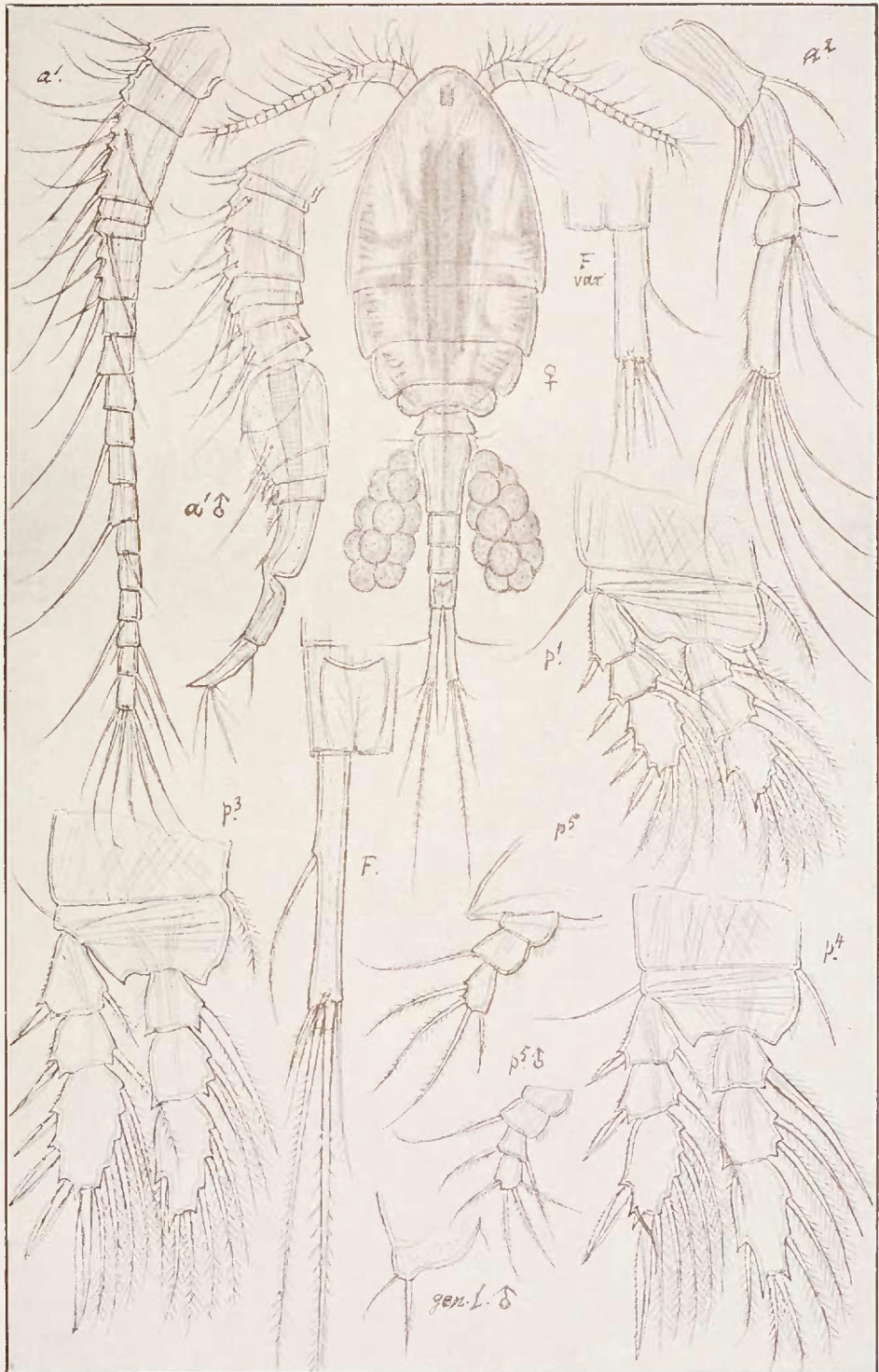
Cyclopina gracilis, Claus.

Copepoda

Cyclopinidæ.

Cyclopoida.

Pl. V.



G. O. Sars, del.

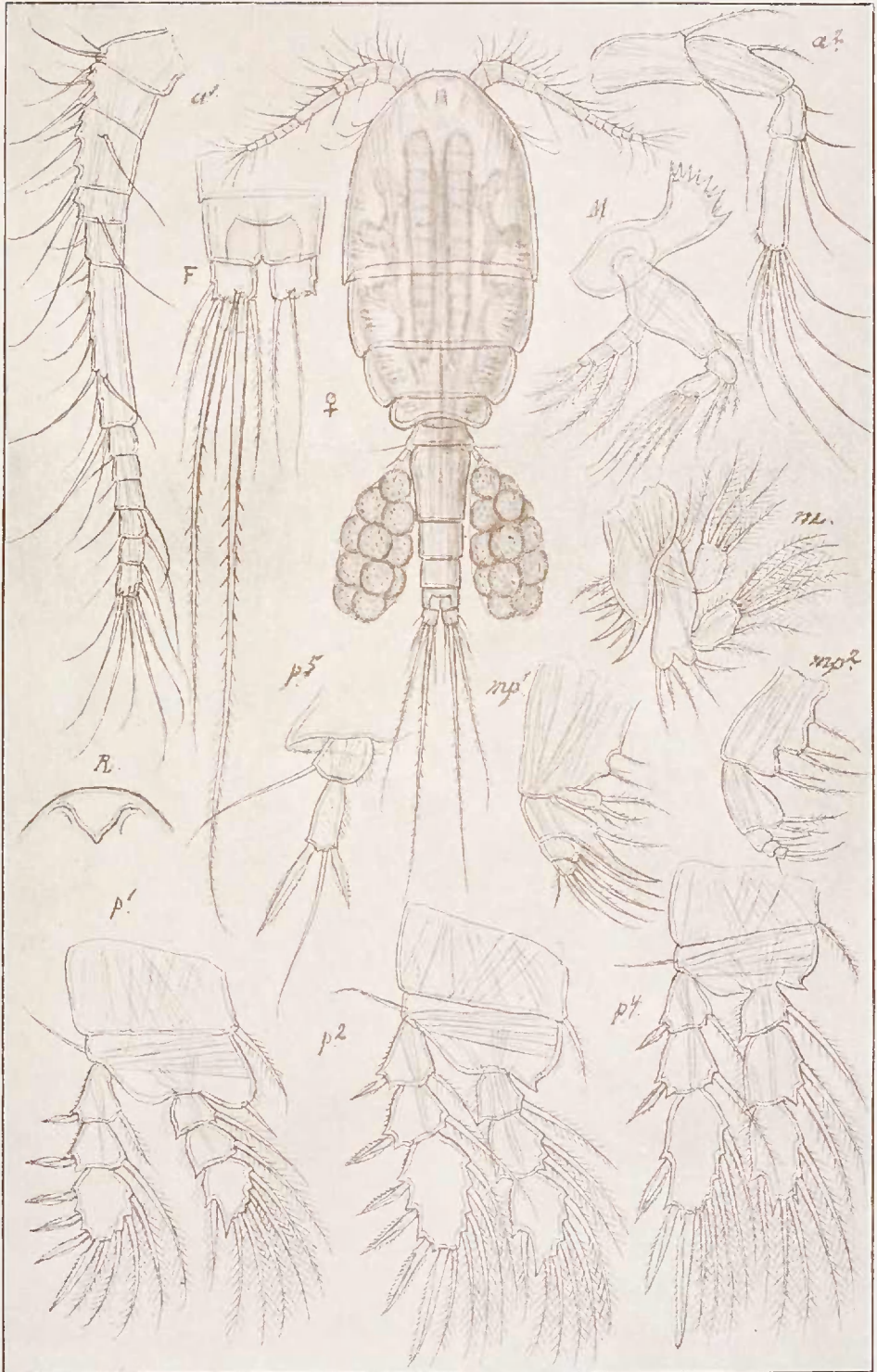
Cyclopina longicornis, Boeck.

Copepoda

Cyclopiniidæ.

Cyclopoida.

Pl. VI.



G. O. Sars, del.

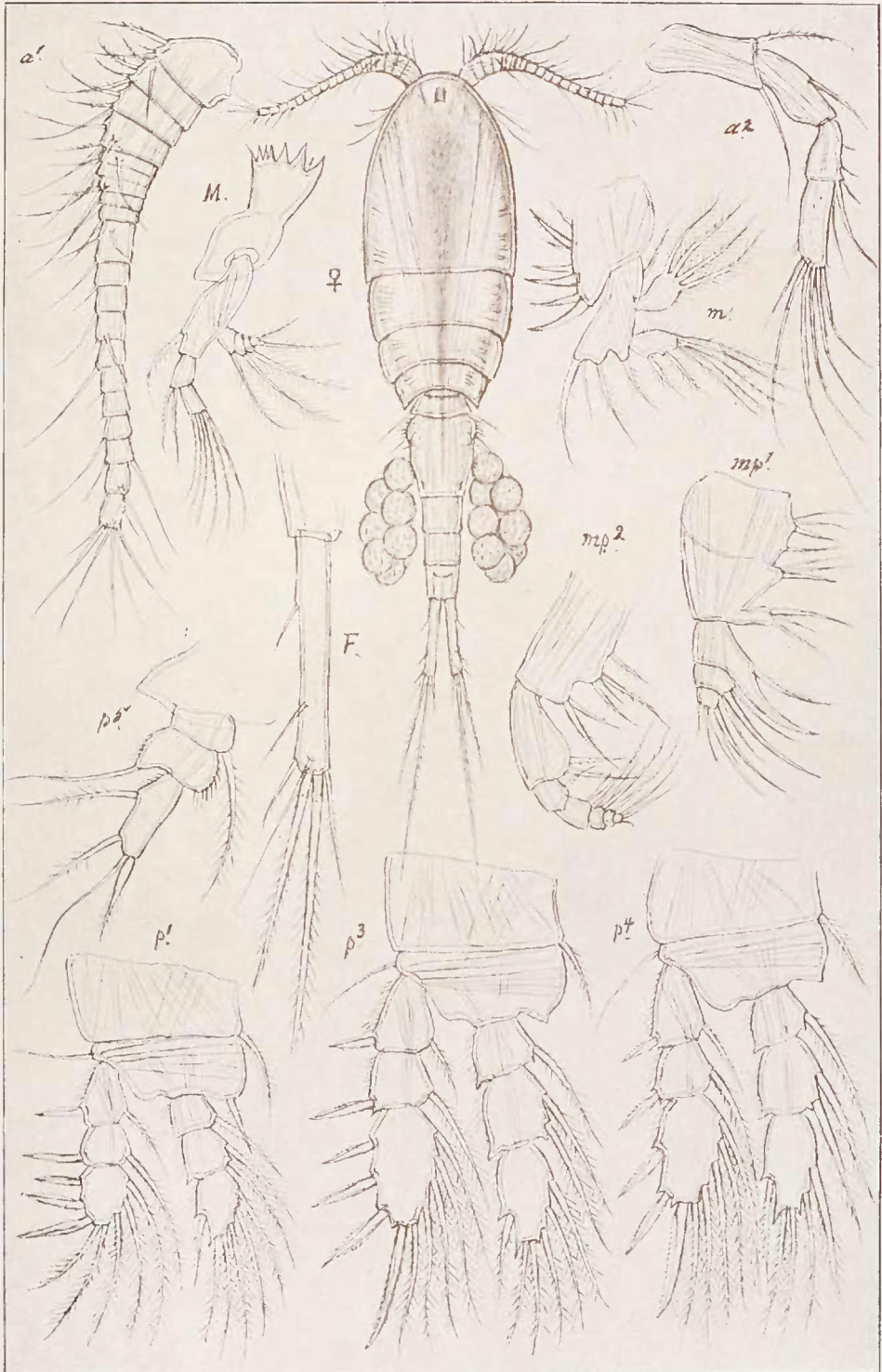
Cyclopina brevifurea, G. O. Sars.

Copepoda

Cyclopinidæ.

Cyclopoida.

Pl. VII.



G. O. Sars, del.

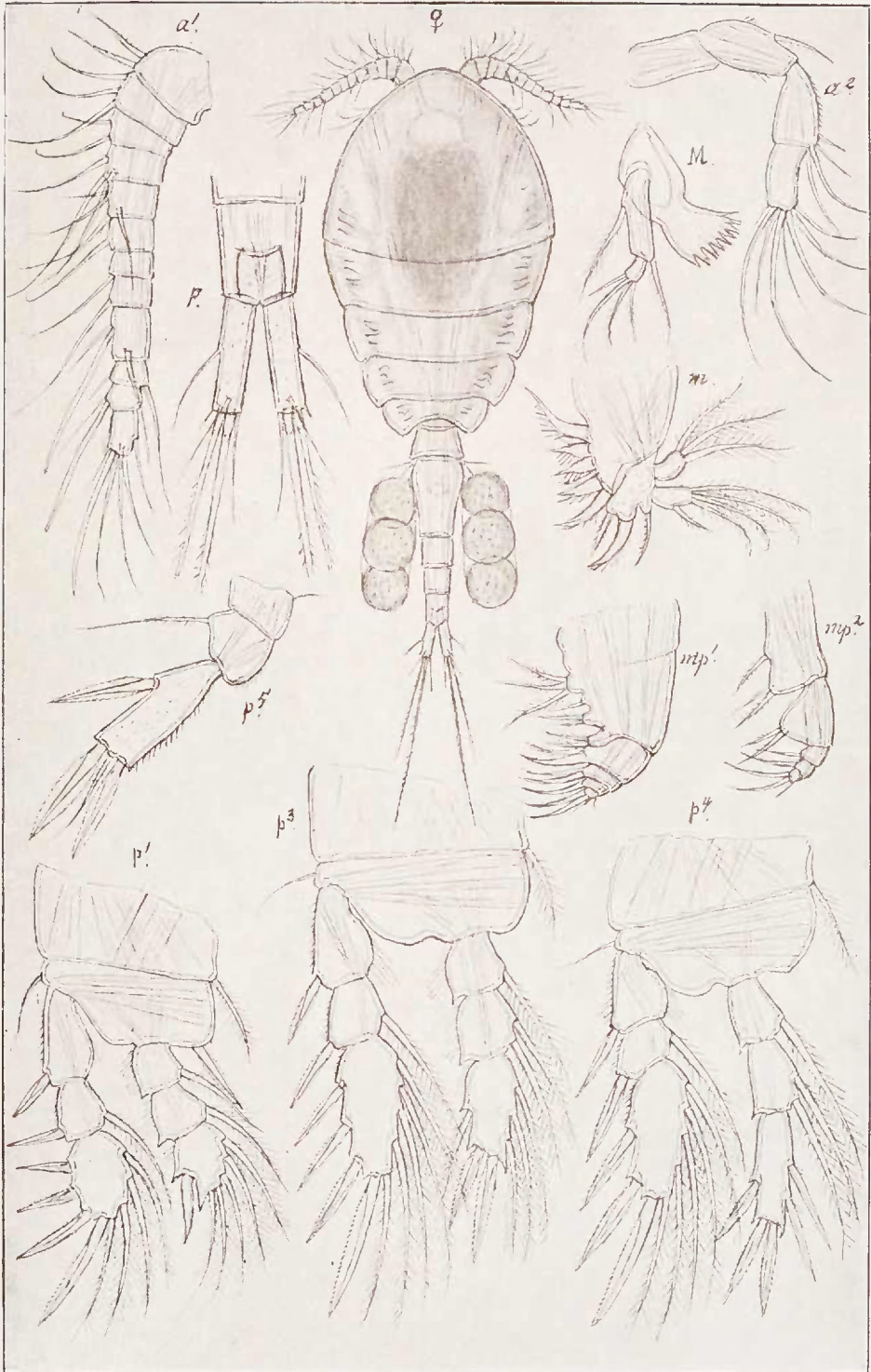
Cyclopina elegans, Scott.

Copepoda

Cyclopinidæ.

Cyclopoida.

Pl. VIII.



G. O. Sars, del.

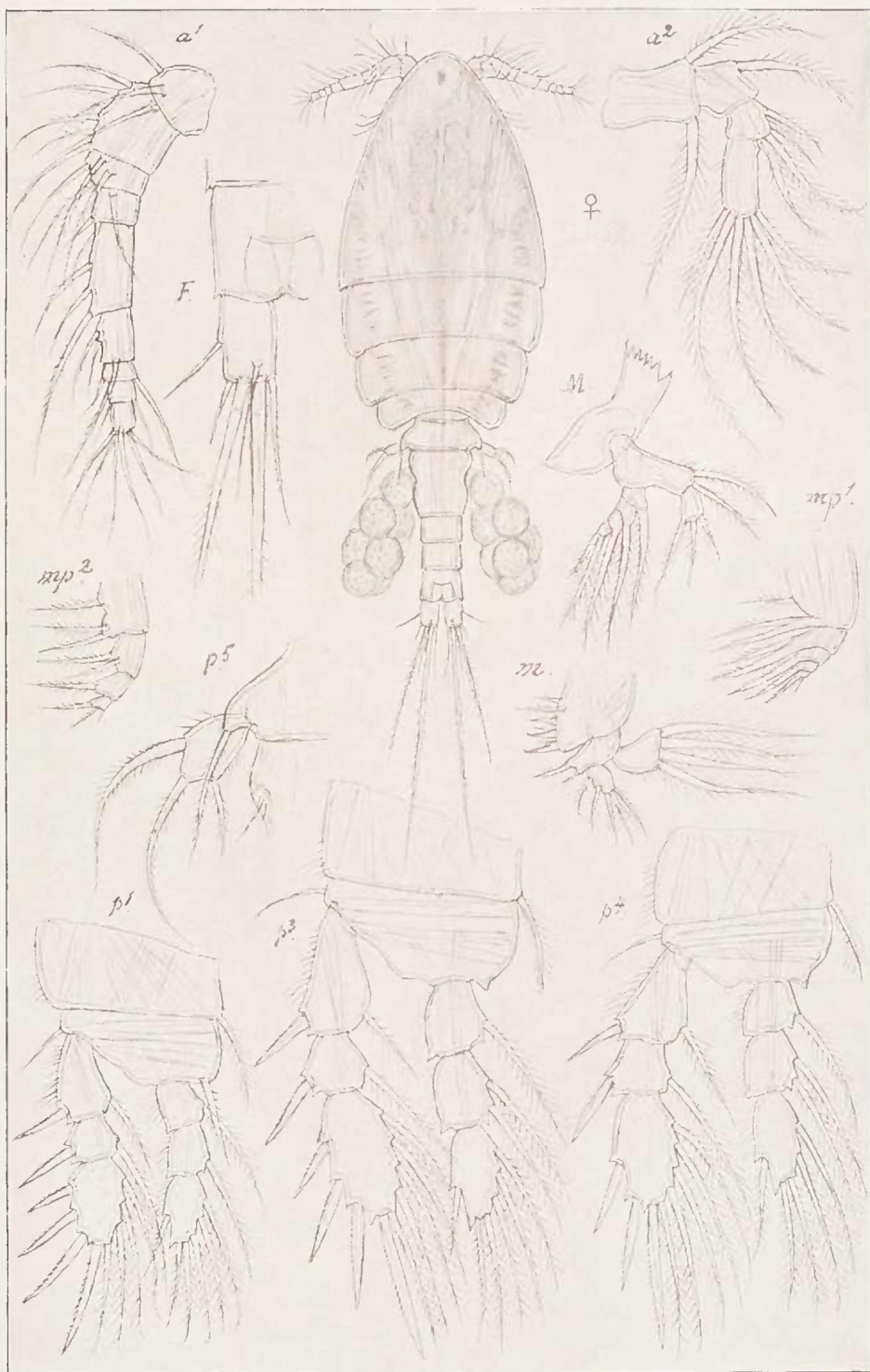
Cyclopinella tumidula, G. O. Sars.

Copepoda

Cyclopinidæ.

Cyclopoida.

Pl. IX.



G. O. Sars, del.

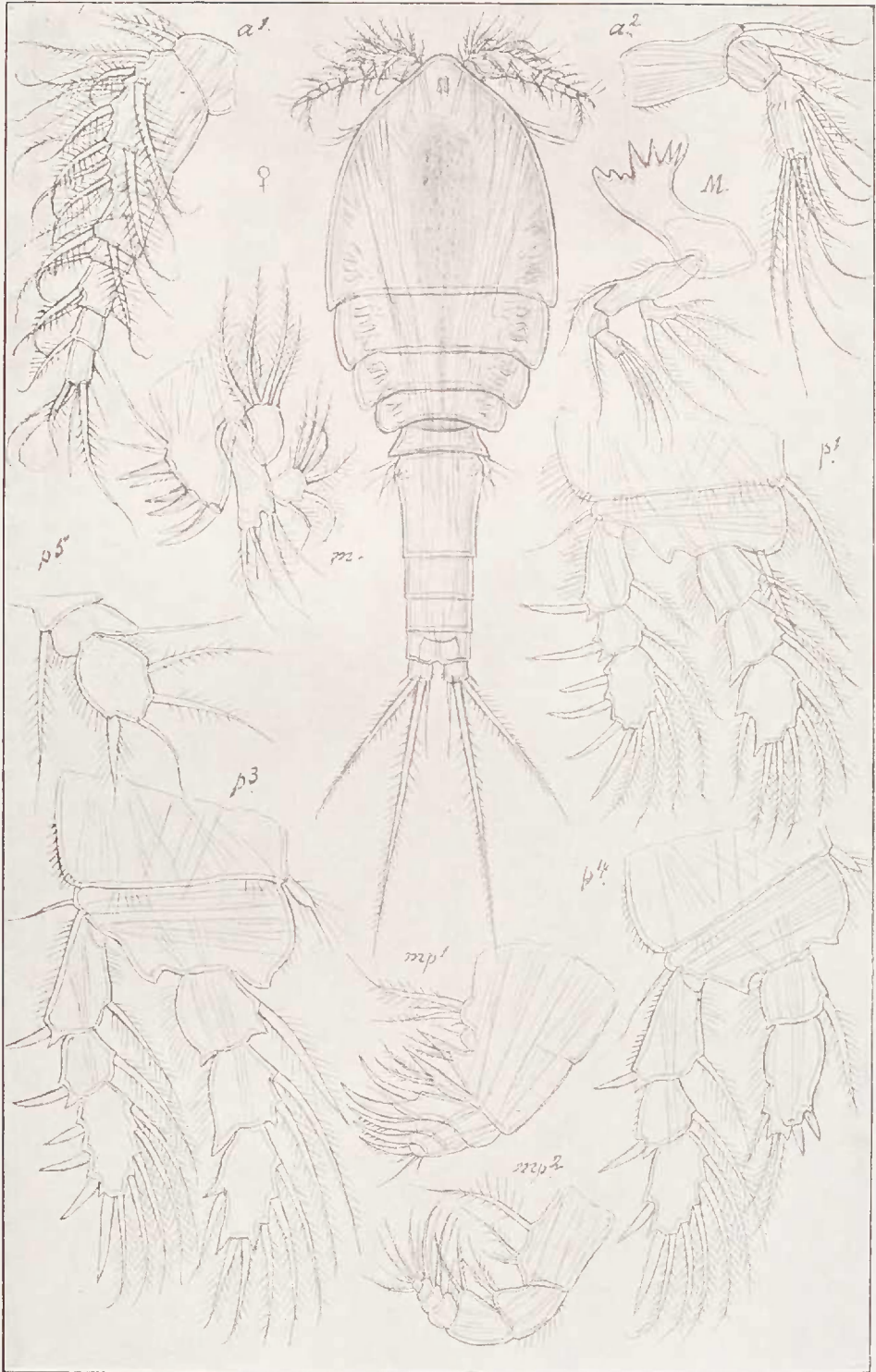
Cyclopetta difficilis, G. O. Sars.

Copepoda

Cyclopiniidæ.

Cyclopoida.

Pl. X.



G. O. Sars, del.

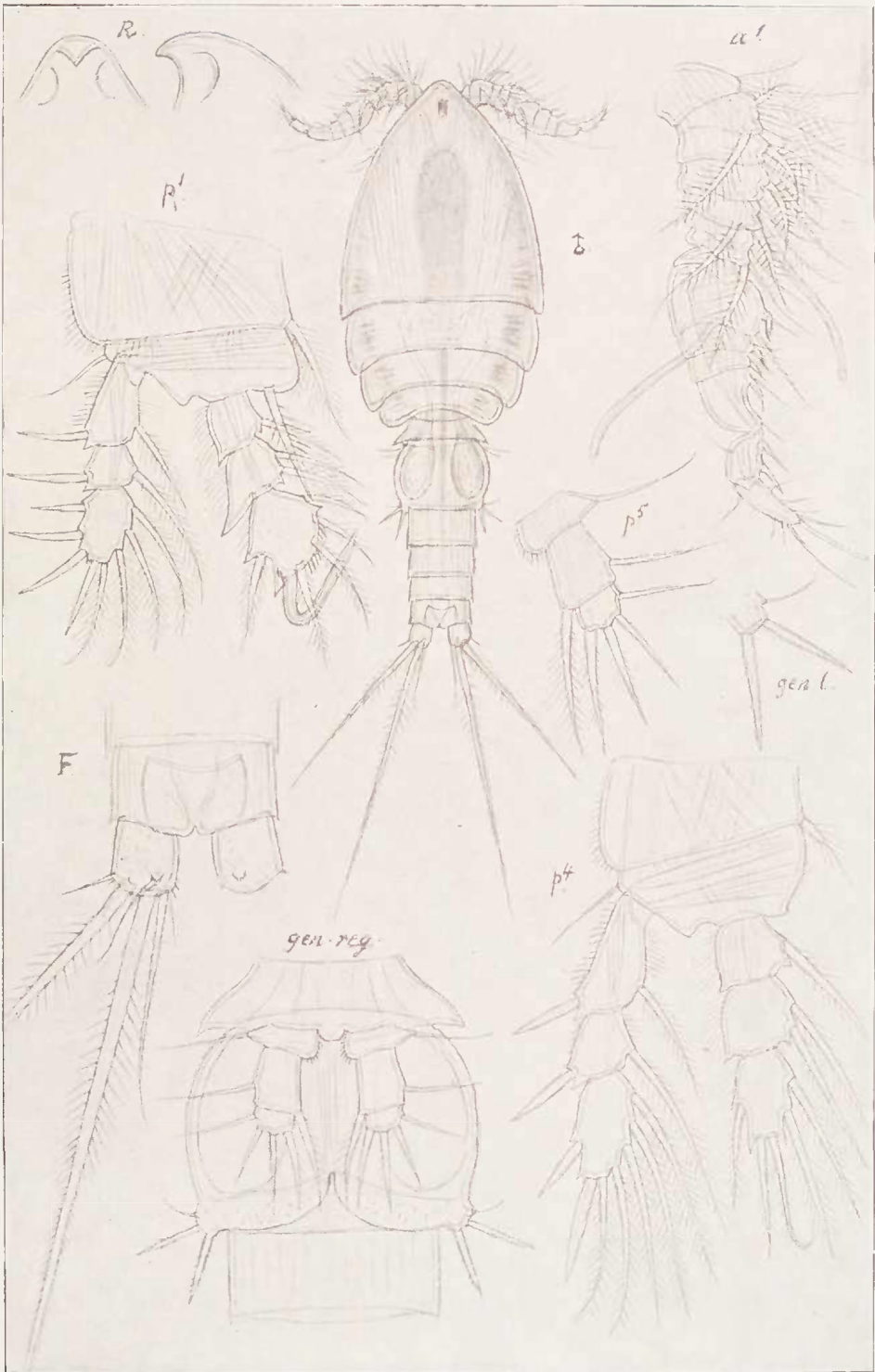
Pterinopsyllus insignis, Brady.

Copepoda

Cyclopinidæ.

Cyclopoida.

Pl. XI.



G. O. Sars, del.

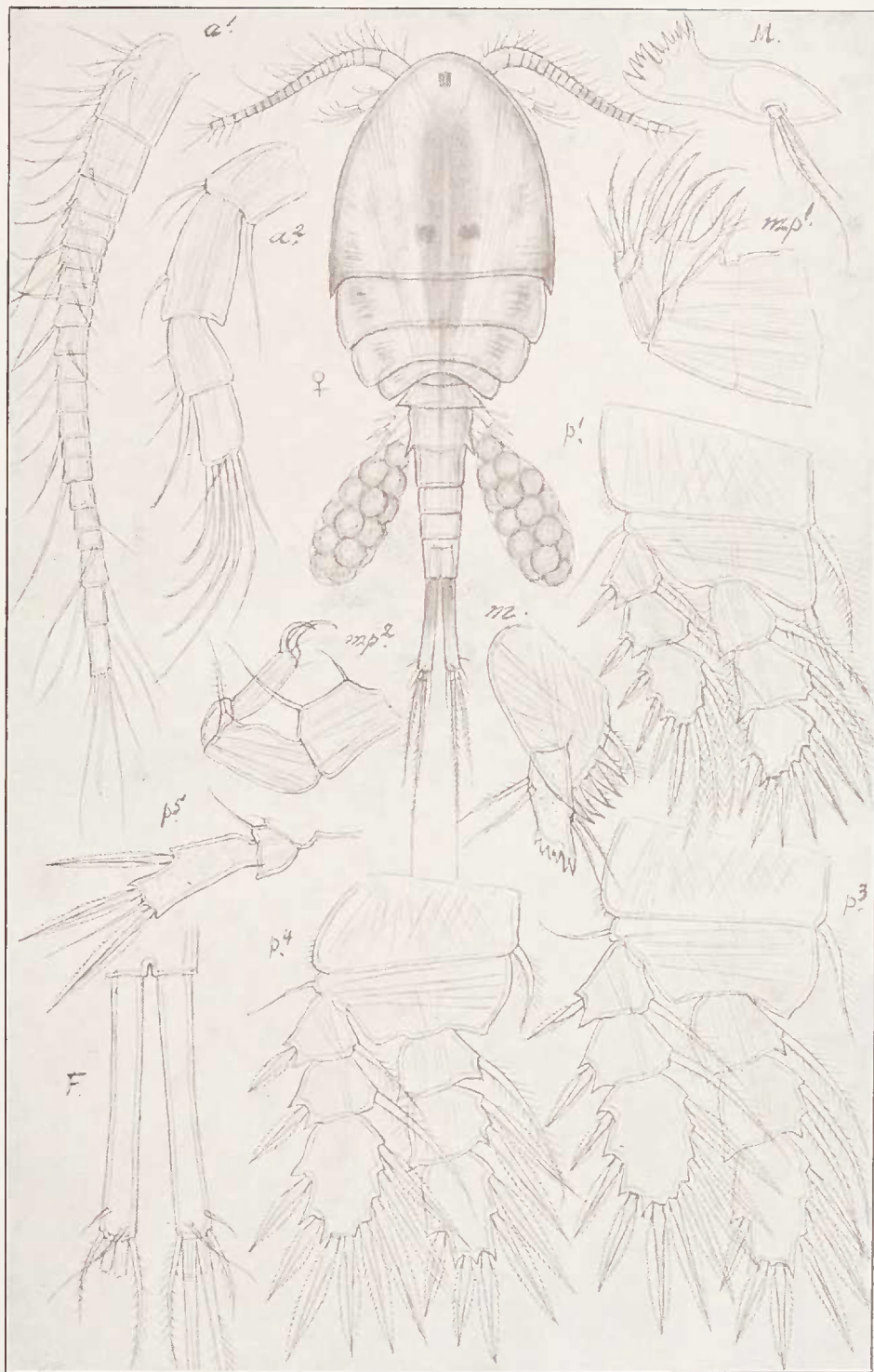
Pterinopsyllus insignis, Brady.
(Male)

Copepoda

Cyclopidae.

Cyclopoida.

Pl. XII.



G. O. Sars, del.

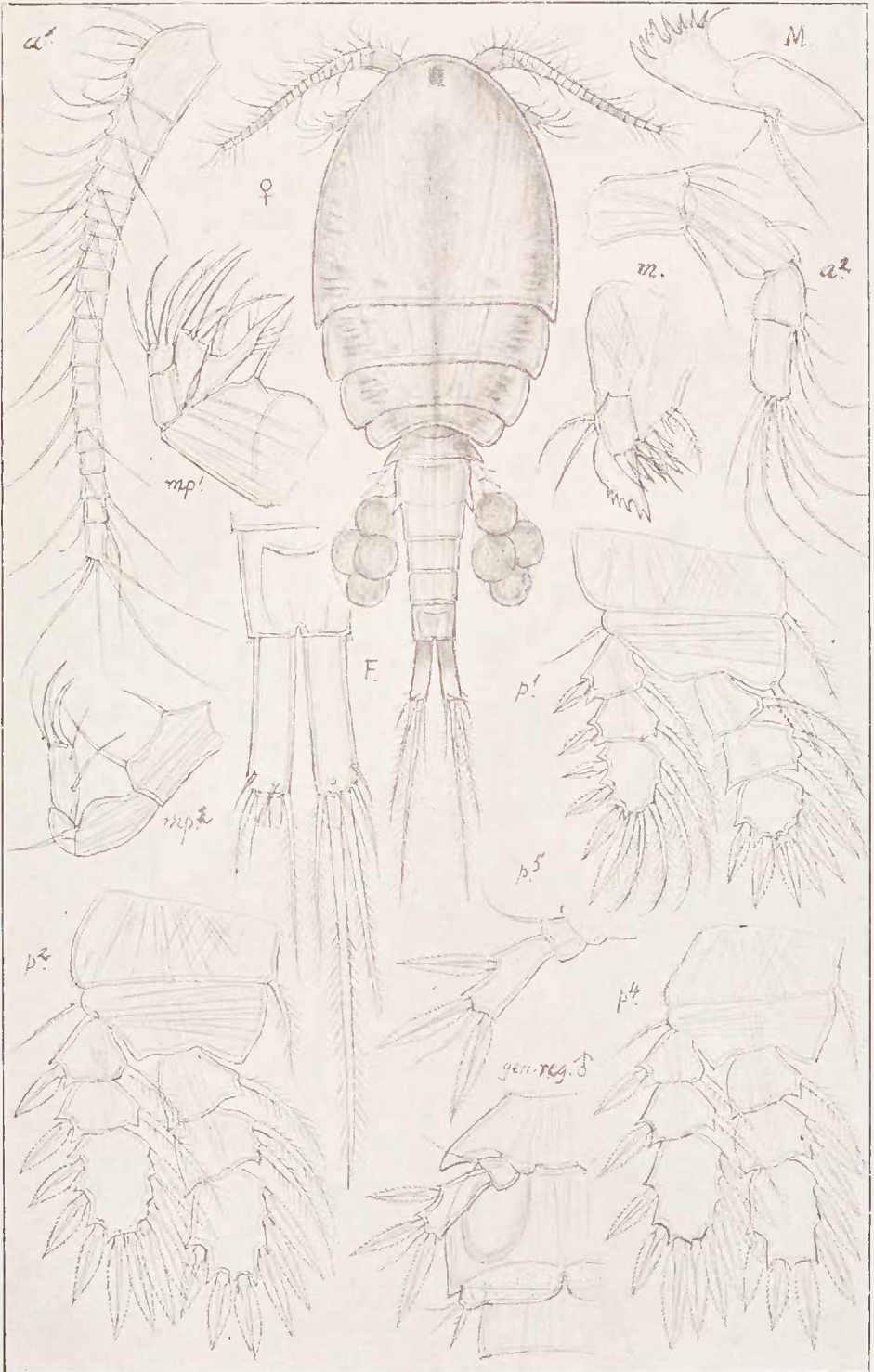
Euryte longicauda, Philippi.

Copepoda

Cyclopidae.

Cyclopoida.

Pl. XIII.



G. O. Sars, del.

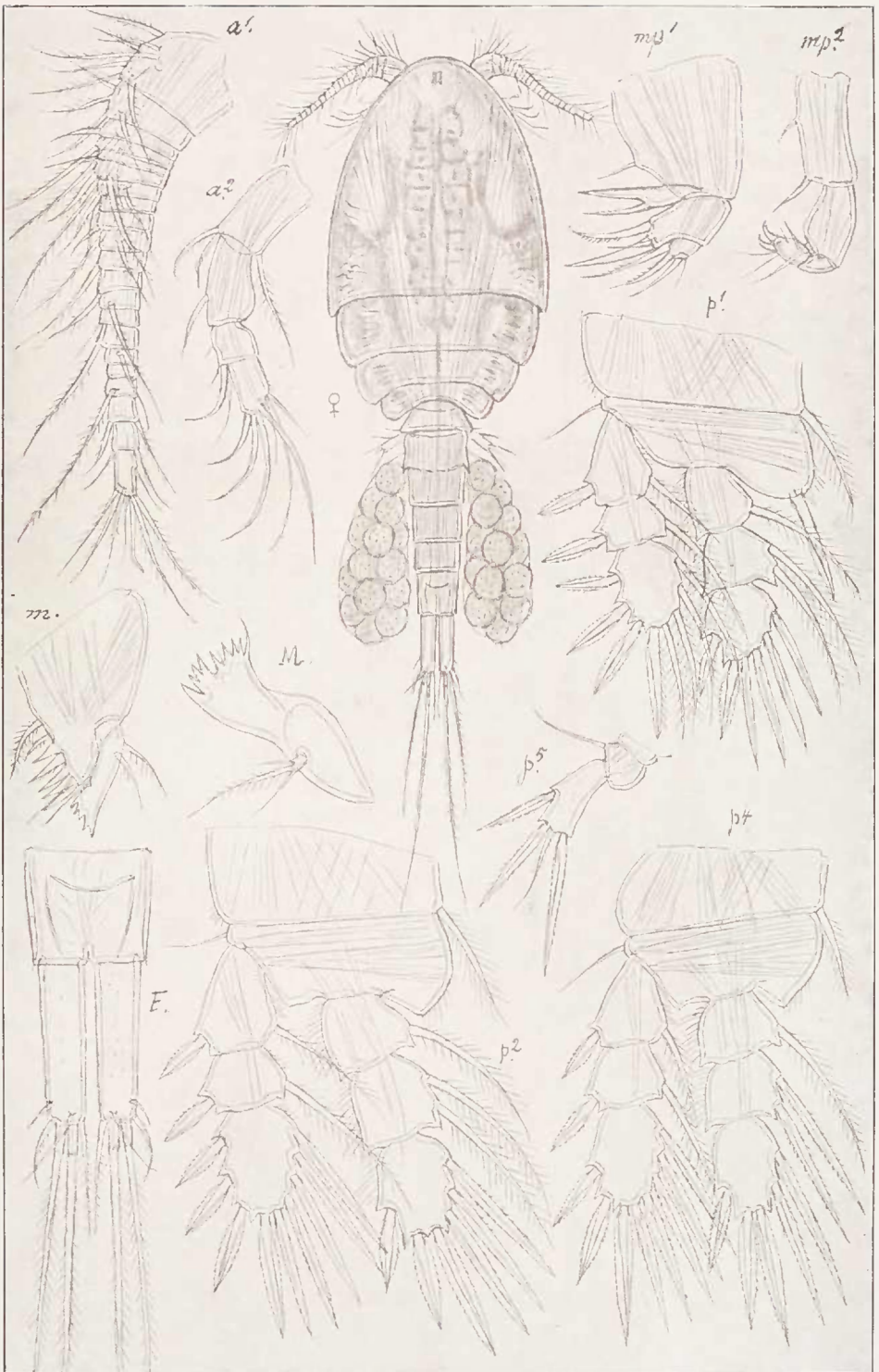
Euryte robusta, Giesbr.

Copepoda

Cyclopidae.

Cyclopoida.

Pl. XIV.



G. O. Sars, del.

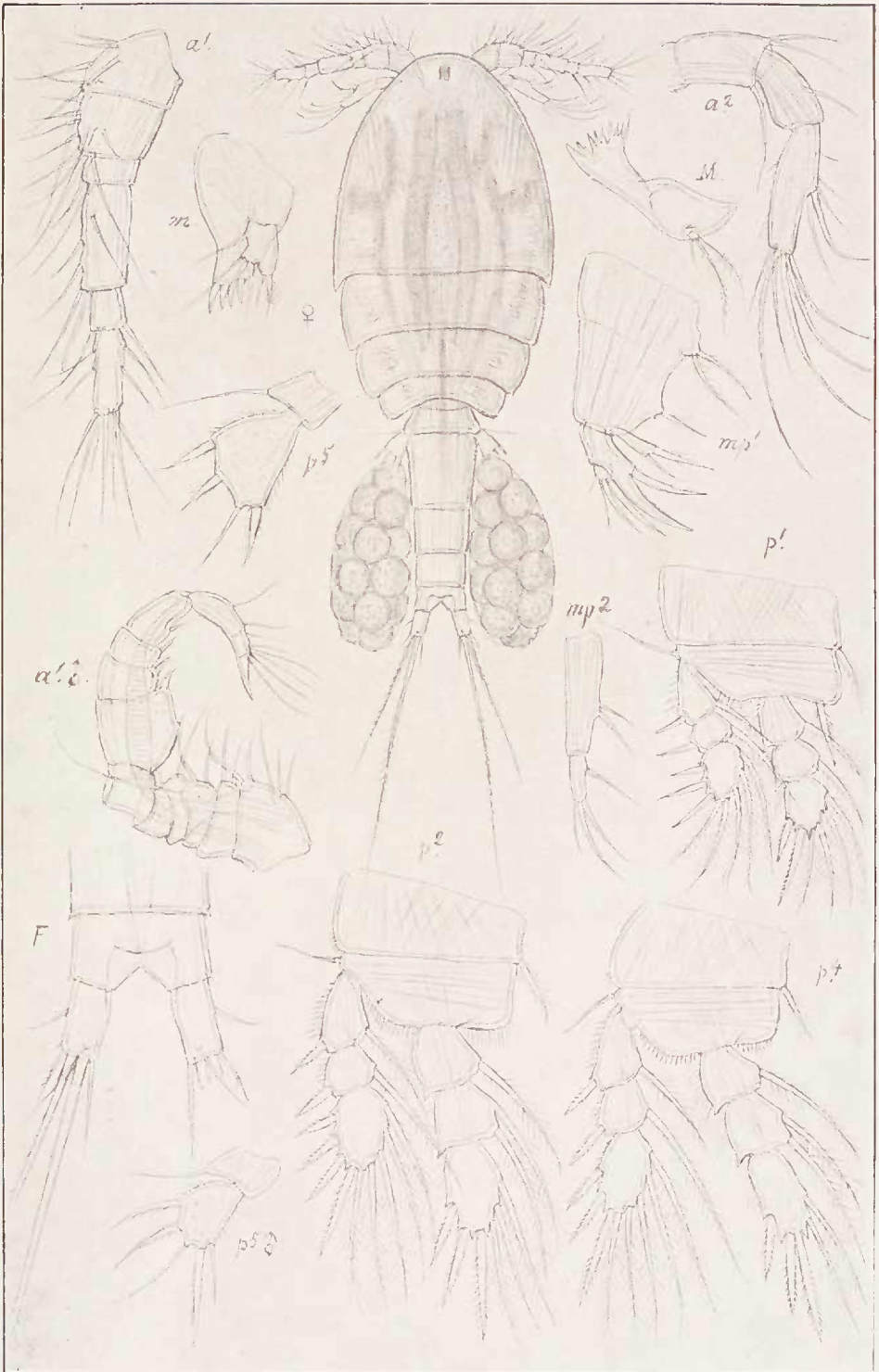
Euryte curticornis, G. O. Sars.

Copepoda

Cyclopidae.

Cyclopoida.

Pl. XV.



G. O. Sars, del.

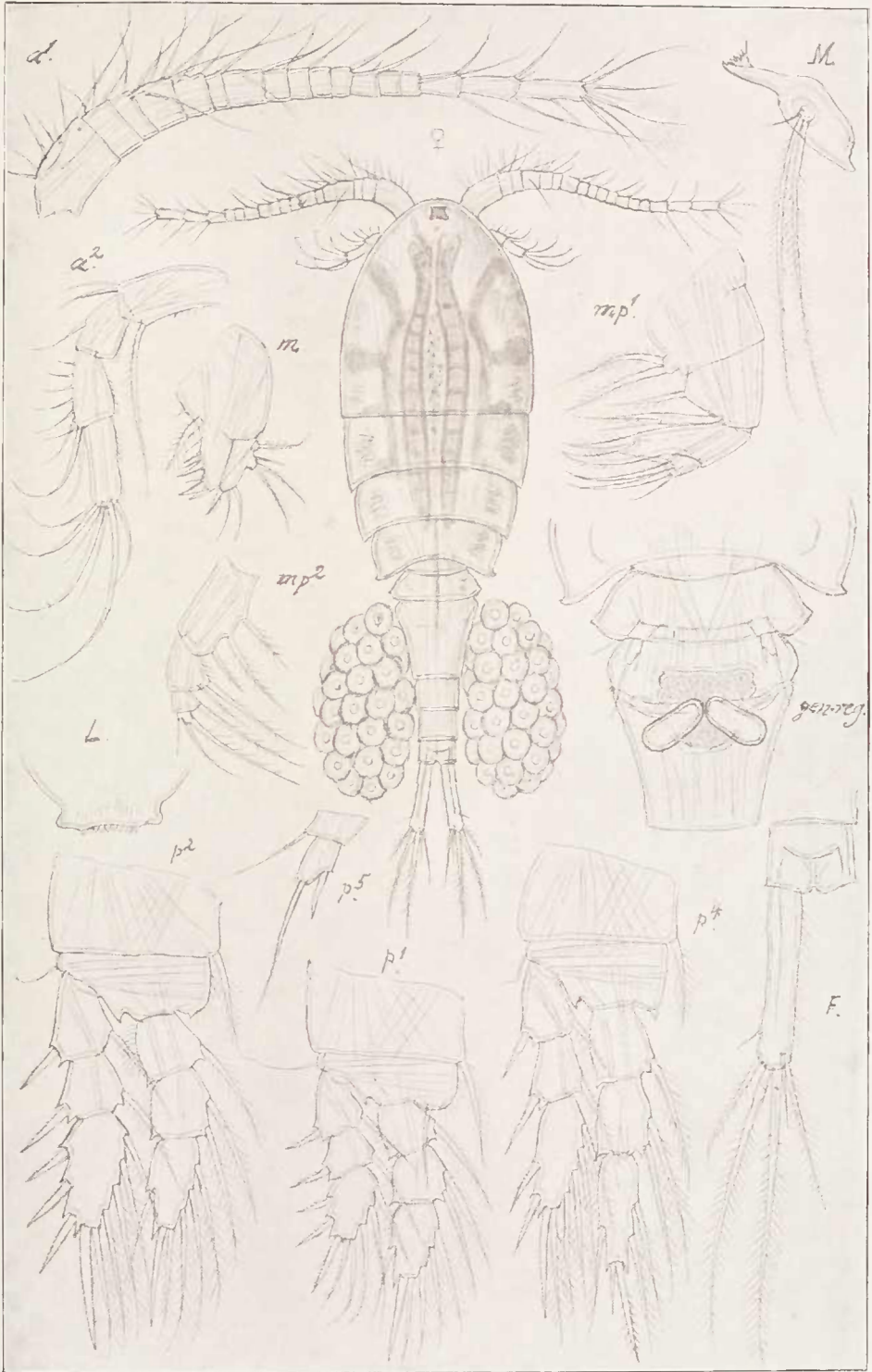
Halicyclops magniceps (Lilljeb.).

Copepoda

Cyclopidae.

Cyclopoida.

Pl. XVI.



G. O. Sars, del.

Cyclops strenuus, Fischer.

