A REVISION

OF THE

BRITISH SPECIES OF FRESH-WATER CYCLOPIDÆ AND CALANIDÆ.

BY

GEORGE STEWARDSON BRADY, M.D., LL.D., F.R.S.,

PROFESSOR OF NATURAL HISTORY IN THE DURHAM COLLEGE OF SCIENCE, NEWCASTLE-ON-TYNE.

WITH FOURTEEN PLATES.

(From the Natural History Transactions of Northumberland, Durham, and Newcastle-upon-Tyne, Vol. XI., Part 1).

LONDON:
WILLIAMS & NORGATE, 14, HENRIETTA ST., COVENT GARDEN
AND 20, SOUTH FREDERICK STREET, EDINBURGH.
NEWCASTLE-ON-TYNE: F. & W. DODSWORTH.

—

1891.

A Revision of the British Species of Fresh-water Cyclopidæ and Calanidæ.

Nowhere amongst the Entomostraca is there a group whose members offer greater difficulties as to specific discrimination than the genus *Cyclops*. In the first place, the changes undergone by each animal in the course of individual development are very extensive and have been as yet only imperfectly investigated. There can be no doubt that many so-called species have been founded upon forms which represent only transitory evolutionary phases, and as, not only amongst Crustacea but in many other groups of animals, the function of reproduction is certainly by no means confined to fully-developed adults, it is certain that we cannot entirely rely on the presence of ovisacs or other reproductive organs as conclusive evidence of the morphological maturity of the animals in which they occur. Nor is there in most cases any salient feature, such as an easily distinguished peculiarity of colour or form, which can enable one at a glance, by the help of an ordinary hand lens, to distinguish between nearly related species. It therefore becomes a necessity to dissect and examine under high microscopic powers very large numbers of specimens; and even when this is done, variations dependent upon race, habitat and other circumstances are so abundant that it often becomes a work of the greatest difficulty to decide as to the species to which any particular specimen may belong.

No wonder then that much confusion prevails in the nomenclature of these species: it is, indeed, rather wonderful that the confusion is not still greater, more especially when it is remembered that many copious authors have furnished only written descriptions of their species—drawings being absolutely essential to a proper understanding of minute points of specific difference. I cannot pretend to have cleared up all the doubtful points even amongst the small number of species noticed in this paper, nor do I suppose that no new or unrecorded species have been missed

amongst the numerous collections which I have had to examine. There will certainly, for many a year, be plenty of scope for the energy of collectors even if they limit their researches only to the discovery of new species. The two counties of Northumberland and Durham present probably as good an area as can anywhere be found for the prosecution of this kind of work, their numerous salt-marshes, moorland tarns and pools offering a fine field for research. Several of the most interesting species noticed in the following pages have been found within the confines of the two counties which we have been used to consider as the proper hunting ground of the Tyneside Field Club; but in these days of rapid and easy railway communication there seems no reason to restrict the survey of the Club within what are frequently mere arbitrary boundaries resting upon no important physical characters.

In the preparation of this paper I have had the very valuable help of many friends, to whom my best thanks are due:—to the Rev. Canon Norman, D.C.L., F.R.S., for a fine collection of tow-net and hand-net captures from almost all parts of England and Scotland, and from Lough Neagh and other localities in Ireland; to Mr. Thomas Scott, F.L.S., of the Scottish Fishery Board, for many very interesting species from various districts of Scotland; to Mr. D. J. Scourfield, for numerous gatherings from the neighbourhood of London. To Professors G. O. Sars of Christiania, B. W. Thomas of Chicago, M. Richard of Paris, and Herr S. A. Poppe of Vegesack, Hanover, I am also much indebted for the communication of specimens and other valuable information.

As regards the illustrative drawings now given, it may be explained that I have not thought it necessary to figure over again such species as were fairly well done in my Ray Society Monograph, except that in the genus *Cyclops* I have given in each case a single new figure of the entire animal. These, I think, will be useful as affording a ready means of comparison as to the external characters of the species. I regret that *Cyclops Ewarti* forms an unavoidable exception to this statement, no specimens of that species being attainable.

The reference numbers given in the lists of synonyms indicate the memoirs to which similar numbers are attached in the appended "Bibliographical Index."

Family CYCLOPIDÆ.

Genus CYCLOPS, Müller.

A. *Anterior antennæ eighteen-jointed.*

1. **Cyclops elongatus**, Claus, (Pl. I., figs. 1–5).

1863. *Cyclops elongatus*, Claus (**18**), p. 97, pl. XI., figs. 1, 2.
1871. ,, ,, Heller (**23**), p. 4.
1880. ,, ,, Rehberg (**33**), p. 538.
1883. ,, ,, Cragin (**40**), p. 2, pl. I., figs. 1, 19-23.
1885. ,, ,, Daday. (**44**), p. 207.

Body gradually tapering from before backwards; none of the segments much produced laterally, posterior angles of the first three rounded off or obtuse, those of the much smaller fourth and fifth segments somewhat produced backwards and acutely angulated; abdomen about half as long as the cephalothorax, margins not denticulated; caudal rami rather stout, about as long as the last two abdominal segments; principal caudal setæ half as long as the body of the animal. Anterior antennæ eighteen-jointed, scarcely as long as the first body-segment. The last joint of the outer branch in the second, third, and fourth pairs of feet has three spines on the outer and three setæ on the inner margin, the first of the three spines being smaller than the other two. The fifth foot is two-jointed, the basal joint rather short and wide and bearing a single long seta, the second joint elongated, narrow, and having at the extremity a short, awl-shaped spine and a long seta. Length 1·4 mm.

This species seems to be very uncommon, and has been noticed only by Professor Claus and Rehberg in Germany, by Heller in the Tyrol, and by Cragin in America, where it occurred "sparingly in a rain-pool near the Cambridge Museum of Comparative Zoology." The chief characteristic of the species is the division of the seventh joint (as it would be counted in the seventeen-jointed species) into two, thus giving eighteen joints

to the antennæ. The measurement given by continental authors is about twice that of British specimens.

C. elongatus was found plentifully in a gathering sent to me by the Rev. Dr. Norman, F.R.S., from "pools near Broomley Lough, Northumberland." This is the only British habitat known to me.

B. *Anterior antennæ seventeen-jointed,*

a. Reaching, when reflexed, beyond the posterior margin of the first somite.

2. **Cyclops signatus**, Koch (Pl. II., fig. 5).

Antenna with serrated ridge.

1820. *Monoculus quadricornis albidus*, Jurine (3), p. 44, pl. II., figs. 10, 11.
1841. *Cyclops signatus*, Koch (4), H. 21, tab. VIII.
1850. ,, *quadricornis* var. *c.*, Baird (7), p. 203, pl. XXIV., fig. 5.
1857. ,, *coronatus*, Claus (13), p. 29, pl. II., figs. 1–11.
1863. ,, ,, Claus (18), p. 97, pl. II., fig. 16; pl. X., fig. 1.
1863. ,, *signatus*, G. O. Sars (20), p. 33.
1863. ,, *coronatus*, Lubbock (19), p. 199.
1872. ,, ,, Fric (24), p. 218, fig. 11.
1874. ,, *Clausii*, Poggenpol (26), p. 70, pl. XV., figs. 4–14.
1875. ,, *signatus*, Uljanin (28), p. 29, pl. IX., figs. 6–11, pl. XI., fig. 8.
1876. ,, *coronatus*, Hoek (29), p. 12, pl. III., figs. 1–11.
1878. ,, *signatus*, Brady (32), p. 100, pl. XVII., figs. 4–12.
1883. ,, ,, var. *fasciacornis*, Cragin (40), p. 3, pl. II., figs. 1–14.
1885. ,, ,, Daday. (44), p. 208.
1886. ,, ,, Vosseler (46A), p. 189, pl. IV., figs. 1–5.

Antenna with simple ridge.

1820. *Monoculus quadricornis fuscus*, Jurine (3), p. 47, pl. III., figs. 2–4.
1850. *Cyclops quadricornis*, var. *b.* Baird (7) p. 202, pl. XXIV., fig. 4.
1857. ,, *tenuicornis*, Claus (13), p. 31, pl. III., figs. 1–11.
1863. ,, ,, Claus (18), p. 99, pl. I., fig. 3; pl. II., fig. 17; pl. IV., fig. 5.
1863. ,, *annulicornis*, G. O. Sars (20), p. 34.
1863. ,, *tenuicornis*, G. O. Sars (20), p. 33.

1863. *Cyclops tenuicornis*, Lubbock 19), p. 202.
1872. ,, ,, Fric. (24), p. 219, fig. 12.
1875. ,, *Clausii*, Poggenpol (26), p. 70, pl. XV., figs. 4–11.
1875. ,, *tenuicornis*, Uljanin (28), p. 30, pl. IX., figs. 12, 13.
1876. ,, ,, Hoek (29), p. 12, pl. III., figs. 1–11.
1878. ,, ,, Brady (32), p. 102, pl. XVIII., figs. 1–10.
1883. ,, ,, Cragin (40), p. 3, pl. II., figs. 1–14.
1884. ,, ,, Herrick (41), p. 153, pl. R., fig. 16.
1885. ,, ,, Daday (44), p. 211.
1886. ,, ,, Vosseler (46A), p. 189, pl. IV., figs. 6–10.

Herrick, in his "Final Report on the Crustacea of Minnesota," expresses the opinion that the two forms known under the names *signatus* or *coronatus* and *tenuicornis* represent but different stages of development of the same species. In this opinion, after an examination of all the material at my disposal, I am disposed to agree, though until the actual course of development has been watched in artificially bred specimens, one cannot be quite certain. The serrated edges of some of the joints, and the serrated rib on the last joint of the antenna, in the *signatus* form, seem to represent the ultimate, as the smooth joints and rib represent the penultimate (*tenuicornis*) stage of growth. The pectinate armature of the second joint of the antenna, which I have figured in the Ray Society Monograph as a character of *C. signatus*, I find to occur also in *C. tenuicornis*. Nor can the frequent presence of ovisacs in *C. tenuicornis* be held certainly to indicate the maturity of the individual, parthenogenesis being so frequent a phenomenon amongst the Entomostraca.

This species, in both its forms, is widely distributed: it is in fact one of the commonest species, not only in the British Islands but on the Continent of Europe and in North America, having been recorded as occurring in Scandinavia (Sars), Germany (Claus, Rehberg, &c.), Bohemia (Fric), Tyrol (Heller), France (Richard), Holland (Hoek), America (Herrick). In Great Britain, both forms of the species are very common and constantly occur together, as indeed they must necessarily do if the view of their relationship here adopted be correct.

3. Cyclops strenuus, Fischer (Pl. II., figs. 1-4).

1820. *Monoculus quadricornis rubens*, Jurine (3), p. 1, pl. I.; pl. II., fig. 1–9.
1841. *Cyclops pictus*, Koch (4), H. 21, pl. I.
1851. ,, *strenuus*, Fischer (8), p. 419, pl. IX., figs. 12–21.
1853. ,, *quadricornis*, Lilljeborg (9), p. 150, pl. XIV., figs. 5, 6; pl. XV., figs. 1–12; pl. XXVI., fig. 19.
1857. ,, *brevicaudatus*, Claus (13), p. 34, pl. II., fig. 12.
1863. ,, ,, Lubbock (19), p. 200.
1863. ,, *Clausii*, Lubbock (19), pl. XXXI., figs. 12–14.
1863. ,, *strenuus*, G. O. Sars (20), p. 27.
1872. ,, *brevicaudatus*, Fric (24), p. 221, fig. 15.
1878. ,, *strenuus*, Brady (32), p. 104, pl. XIX., figs. 1–7.
1885. ,, ,, Daday (44), p. 216.
1886. ,, ,, Vosseler (46A), p. 195, pl. IV., figs. 18–22.

Though not nearly so common a species as the foregoing, *C. strenuus* seems to be pretty generally distributed, having been found in Russia by Fischer, in Norway by G. O. Sars, in Germany (Claus), Hungary (Fric), Holland (Hoek). It has not, however, as yet been noticed in America.

I have notes of its occurrence in the following British localities: Belsay and Plessey, Northumberland; Seaton Marsh, county Durham; Staithes, Yorkshire; Llanfairfechan, North Wales; (*G.S.B.*); Loch Leven, Kinross (*Mr. T. Scott*); Lambton Park, county Durham; Loch Rutton and Carlingwark Loch, Kirkcudbrightshire; Grasmere and Lough Neagh (*Rev. Dr. Norman*).

4. Cyclops abyssorum, G. O. Sars (Pl. III.).

1863. *Cyclops abyssorum*, G. O. Sars (20), p. 29.

Female.—Body subtruncate in front, gradually tapering backwards, first segment forming at least half the length of the cephalothorax; the second, third, and fourth segments are not greatly produced laterally, but are abruptly narrowed in front and the posterior margins form acute angles laterally; the fifth segment is short, narrow, and much constricted in front: the abdomen is more than half as long as the cephalothorax, its first segment not greatly narrower than the last thoracic, wider in front and equal in length to the following three segments;

caudal rami slightly divergent, nearly as long as the preceding three segments, each marked by a longitudinal ridge, which is continued faintly over the last abdominal segment; the two principal setæ are of nearly equal length, the inner somewhat the larger, but shorter than the abdomen, and more than twice as long as the neighbouring lateral seta; outer lateral more than half as long as the inner; marginal seta situated near the extremity of the furca: the posterior margins of the abdominal segments are obscurely dentated except the last, which bears a series of minute hairs. Anterior antennæ slender, reaching backwards to the third segment of the body, and provided plentifully with setæ, especially towards the base. Posterior antennæ long and slender, the posterior margins of all the joints bearing patches of short hairs arranged in a pectinate manner; while the third joint has its anterior margin armed with a series of six moderately long, equal setæ, besides the usual apical hairs. Branches of the swimming feet all three-jointed and nearly equal in length, except in the fourth pair, where the inner branch is distinctly the longer: in the first and second pairs the marginal spines of the last joint of the outer branch are three in number, in the third and fourth pairs only two: the inner branch of the fourth pair has the last joint prolonged externally, forming a process about half as long as the terminal spine. Fifth foot composed of two nearly equal joints, first joint with one seta of moderate length, second with one long and one short seta. The animal is almost colourless. Length about 2 mm.

Taken in gatherings made by the deep net in Windermere and Coniston Water, but by no means plentiful: August, 1883. Prof. G. O. Sars has kindly examined specimens from one of these localities and identifies them as belonging to *C. abyssorum*. It occurs also in gatherings from Loch Awe, Loch Ness, Loch Achray, and Loch Lomond, Scotland; and in Broomley Lough, Northumberland (*Rev. Dr. Norman*). The foot-jaws do not present any characteristic features. This species has hitherto been recorded only by Prof. Sars, who found it at a depth of 40–50 fathoms in Maridals-water near Christiania.

I am rather disposed to look upon *C. abyssorum* as a deep-water variety of *C. vicinus*, the differences between the two forms being merely matters of degree; the most important point is, perhaps, the length of the anterior antennæ, which are decidedly shorter and thicker in *C. vicinus:* the peculiar setose armature of the antennæ is seen, though more feebly, in *C. vicinus:* the characters of the fifth feet, the abdomen, and caudal rami are alike in both forms.

5. Cyclops Scourfieldi, G. S. Brady (Pl. IV.).

1863. *Cyclops Leuckartii*, G. O. Sars (**20**), pl. VI., figs. 6–8, p. 30 (not *C. Leuckarti*, Claus).

Female.—Body slender, subtruncate in front and tapering gradually backwards; thoracic segments rounded off behind and not produced into angles laterally; the last segment smaller than the rest, from which it is separated in front by a deep constriction: first abdominal segment nearly as wide as the last thoracic, slightly wider in front than behind, and longer than the three following segments combined: caudal rami as long as the two preceding segments, the innermost of the two median tail-setæ is the longest and equal to the length of the abdomen, the other only slightly shorter; the two lateral setæ short and subequal; between the principal seta and the inner lateral there is a fifth seta of intermediate length; marginal setæ short and situated not far from the middle of the furca. Anterior antennæ slender, reaching a little beyond the second cephalo-thoracic segment, the last two joints elongated and slender; the fourth, seventh, and fifteenth joints are of medium length, all the rest short, except the first and the last two, which are the longest of all. The anterior maxilliped has the posterior margin of the second joint minutely crenulated near the middle. All four pairs of swimming feet have their branches three-jointed, the last joint of the outer branch bearing only one lateral spine; spines long and slender, with ciliated margins: the terminal joints of the inner branches are elongated and of peculiar shape, being dilated at the apex, with produced, spine-like angles; the first three pairs have a single terminal spine, the fourth pair

two such spines, the outermost of which is slightly the larger. Fifth foot small, two-jointed, the basal joint short, wide, and bearing one long apical seta; second joint narrower, with two long, almost equal setæ. Length 1·4 mm.

I am indebted to Mr. D. J. Scourfield (after whom I have pleasure in naming it) for specimens of this species taken at Wanstead Park and in a pond at the Botanic Gardens, Regent's Park. My first knowledge of the species was, however, derived from specimens which I took myself by moonlight in the surface-net at Coniston, in August, 1883; in this gathering it occurred in considerable numbers, as also in a subsequent daylight surface-gathering from the same lake. It occurs also in gatherings made by the Rev. Dr. Norman in Kirk Loch and Castle Loch, Lochmaben, Dumfriesshire, and at Mallow, county Cork. Mr. Scourfield has sent me the following additional list of localities in which he has taken it: Victoria Regia Tank, Royal Botanic Gardens, Regent's Park; Wroxham, Filby and Rollesby Broads, and Heigham Sounds, Norfolk; Higham Park, Woodford.

There can, I think, be little doubt that this is the species referred to by Sars as *Cyclops Leuckartii*,—the peculiar build and armature of the swimming feet agreeing with the descriptions of that author. Claus, however, does not mention these characters, and as he states that the fifth foot is similar to that of *C. brevicornis*, it seems impossible that his *C. Leuckartii* can be identical with the species now under consideration; the fifth foot of *C. Scourfieldi* bears three long and nearly equal setæ, while that of *C. bicuspidatus* has two such setæ and a short dilated seta or spine.

The Coniston specimens of *C. Scourfieldi* are very much less robust than others, more slender in all their parts, and perfectly pellucid except for masses of ingested material in the alimentary tract. An interesting form which must, I think, be looked upon as a variety, has been found by Mr. Scourfield at Higham Park, Essex. Its chief peculiarities are the more nodose anterior antennæ,—the joints of these appendages being more constricted at their proximal ends,—a slightly different arrangement of the setæ of the fifth foot, the two terminal setæ of which spring

from the same plane or nearly so, and the presence on the internal margins of the protopodite in the second, third, and fourth pairs of feet, of rounded laminar projections, which have spinulose margins. I have myself found the same variety in a collection from Lough Fadda, Connemara. Figures of this remarkable form are given in Plate VI.

The character which, so far as I know, distinguishes at once *C. Scourfieldi* from all other species is the presence, on the second joint of the posterior maxilliped, of a series of short marginal setæ. The crenulation of the posterior margin of the anterior maxilliped is a less constant character, but perhaps also diagnostic when it occurs. The apical dilatations of the inner branches of the swimming feet—more especially of the fourth pair—is another, and perhaps more important, character, which, however, is wanting in the Higham Park specimens.

β. Anterior antennæ, when reflexed, not distinctly longer than the first somite.

6. Cyclops vicinus, Uljanin (Pl. I., figs. 6-9).

1875. *Cyclops vicinus*, Uljanin (**28**), p. 30, pl. X., figs. 1–7; pl. XII., figs. 7–9.

1878. *Cyclops pulchellus*, Brady (**32**), p. 107, pl. XVII., figs. 1–3.

Professor G. O. Sars has kindly examined specimens of the species ascribed by me in my Ray Society Monograph to *Cyclops pulchellus*, Koch, and believes them to be quite distinct from the form described by himself as *C. pulchellus*, and likewise from the very nearly related *C. lucidulus*, Koch. He suggests that they come nearer to *C. strenuus*, Fischer, and I have, in fact, sometimes found it difficult to distinguish between the two species, but the shorter antennæ, the comparatively small size of the cephalic segment in the present species, the very marked and prominently angular outlines of the following three segments, and the different character of the caudal rami and setæ, forbid its being ascribed to *C. strenuus*. On the other hand, the very beautiful drawings of *C. vicinus* given by Uljanin, in his memoir on the Crustacea of Turkestan, agree most accurately with this species. I therefore adopt the name proposed by that author.

The most noteworthy characters of *C. vicinus* are to be found in the shape of the thoracic segments, the short anterior antennæ, the serrated margins of the abdominal segments, the proportions of the caudal rami and setæ, and the form of the fifth foot.

The British localities already published are Bolam Lake and Paston Tarn (Northumberland), and Tresco (Scilly Islands). I have now to add the following localities, where it has been found by Mr. D. J. Scourfield: Wanstead Park, Essex; Tottenham; Dulwich; Leytonstones; Eagle Pond, Snaresbook; Royal Botanic Gardens, Regent's Park; Pinner, Middlesex; Higham Park, Woodford. In Dr. Norman's gatherings it occurs as follows:—Loch Achray; Loch Katrine, Loch Leven, Kinross; pools near Sprinkling Tarn, and Ennerdale Water, Cumberland; Broomley Lough and Fallowlees Lough, Northumberland.

7. **Cyclops bicuspidatus**, Claus (Pl. V., figs. 1-5).

1857. *Cyclops bicuspidatus*, Claus (**14**), p. 209, pl. XI., figs. 6,7.
1863. ,, ,, Claus (**18**), p. 101.
1863. ? ,, ,, G. O. Sars (**20**), p. 38.
1876. ,, ,, Hoek (**29**), p. 17, pl. I., figs. 7–11.
1880. ,, *bisetosus*, Rehberg (**33**), p. 543.

Female.—The body is long and slender, gradually tapering from the front backwards, and without any distinct constriction between thorax and abdomen. The first body-segment is about equal in length to the three following segments and has its posterior angles rounded off; second segment produced laterally, its posterior angles forming sharp angular projections; third segment narrower and also having sharply produced posterior angles; lateral margins of the fourth segment rounded and showing no posterior angles; last thoracic segment very short, scarcely more than one-half the length of the preceding segment, its posterior angles sharp; all the segments are sharply separated one from another, being much constricted in front. The first abdominal segment is large, tumid in front and narrowed behind, nearly equal in length to the following three segments. Caudal rami long, closely approximated and parallel, about five times as long as broad, their inner margins destitute of hairs: the two median terminal setæ are long and very feebly ciliated, the innermost

the longer of the two, being equal in length to the whole abdomen; of the lateral setæ the outer is the longer; the inner one is so closely appressed to the long seta as to be almost invisible; the outer margins of the rami bear near the extremity a single short seta. The anterior antennæ are rather stout, only slightly tapered towards tho apex, and do not exceed in length the first body-segment. The posterior border of the posterior maxilliped is irregular, having near the base a slight abrupt prominence, each end of which forms an obscure tooth: this structure is variable in development but is usually more or less distinctly visible. Both branches of all the swimming feet are three-jointed, and the terminal joint of the outer branch bears on its outer margin two spines, on the inner margin three long setæ. and at the apex a single spine and a seta; but in the case of the first pair of feet, the last joint of the outer branch has two lateral spines only, the usual apical spine being absent. The feet of the fifth pair are extremely small (·027 mm., exclusive of setæ), two-jointed, the first bearing only one long apical seta, the second one long seta and a much shorter, stout spine. Length 1·3 mm. Colour (of spirit specimens) very deep, opaque brown (Windermere); bluish, semi-opaque (Wanstead Park).

I have specimens of this species which were taken several years ago in Windermere amongst weeds at the surface of the lake, and one (probably this species) from a deep-net gathering taken in Ellesmere Lake, Shropshire. It occurs also in gatherings from Lambton Park, county Durham (*Rev. Dr. Norman*); and from Duddingston Loch, near Edinburgh (*Mr. T. Scott*). I am indebted to Mr. D. J. Scourfield for others taken in 1890 and 1891 at Wanstead Park, Essex: more recently Mr. Scourfield has sent me the following supplementary list of stations:—Hackney Marsh; Leytonstone; Royal Botanic Gardens, Regent's Park; Cuckoo Pits, Chingford; Southend, Essex; Higham Park and Warner's Pond, Woodford; Pavenham, Bedfordshire.

The specimens generally agree very exactly with the description of Professor G. O. Sars, except as to the spines of the fourth pair of feet. Respecting these Sars says, "aculeorum

apicalium rami interioris pedum quarti paris interior altero duplo longior," and in the synopsis* he states with reference to the external branch, "intus setis 3, extus aculeis 3 instructus." I give drawings of the fourth foot of a Wanstead Park specimen, from which it will be seen that the last joint of the outer branch possesses only two marginal spines. Dr. Claus gives the length of his species as 2 millimetres—a discrepancy perhaps of no great moment: in other respects his description is applicable to the specimens here described. Mr. Herrick, in his elaborate memoir on the Crustacea of Minnesota, includes under the term *Cyclops pulchellus*, Koch, several forms which have been described by various authors as distinct species: these are *C. bicuspidatus*, Claus; *C. Thomasi*, Forbes; *C. navus*, Herrick; *C. bisetosus*, Rehberg; *C. bicuspidatus*, Sars, and (?) *C. insectus*, Forbes. The species appears to be generally distributed, though by no means very common,—having been noted by Sars in Norway, Rehberg and Claus in Germany, Dr Anton Fric in Bohemia, and Forbes and Herrick in the United States of America. It appears to differ in certain minor characters from all of the forms described by Forbes and Herrick, while agreeing with Sars' description of *C. bicuspidatus* in the more important points, excepting the spinous armature of the swimming feet. It would seem impossible, without actual comparison of authentic specimens of these various forms, to come to any certain conclusion as to their specific distinctness.

8. Cyclops Thomasi, Forbes (Pl. VI., figs. 1-4).

1882. *Cyclops Thomasi*, Forbes (**38**), p. 640, pl. IX, figs. 10, 11, 16.
1883. ,, ,, Cragin (**40**), p. 3, pl. III., figs. 1-13.
1884. ,, ,, Herrick (**41**), p. 151, pl. U, figs. 4, 5, 7, 8.

Female.—Body obtusely rounded in front, abdomen much narrower than the cephalothorax; none of the segments are very prominent laterally, but the posterior angles are much produced backwards, forming sharp cusps, the segments rapidly decreasing

* The specific name appears in the synopsis as *bispinosus*, but the reference is apparently to *bicuspidatus*.

in size from the first to the fifth, which last is scarcely wider than the first abdominal segment. First abdominal segment rather tumid in front, nearly as long as the following three segments, and bearing on each lateral margin in front of the middle a stout seta: borders of the abdominal segments smooth, except the last, which is finely pectinated; caudal rami slender, elongated, parallel, or slightly divergent, about five times as long as broad, lateral setæ short, considerably removed from the apex; at the anterior third, on the outer aspect of the ramus, is a transverse row of several short setæ, and the inner margins are minutely ciliated; the outer and inner tail-setæ are very short, the outer rather the shorter of the two; of the two median setæ the innermost is the longer, equalling in length the entire abdomen; both are minutely ciliated. Anterior antennæ shorter than the first body-segment. All the swimming feet have both branches three-jointed; the outer branch of the first foot has at the apex of the last joint a single spine and a seta, and on the outer margin one spine; the remaining feet have the same apical armature, but have two lateral spines. The feet of the fifth pair are two-jointed, the basal joint rather wide and bearing at the distal angle one long seta, second joint long and narrow and bearing two apical setæ, one as long as the joint itself, the other more than twice as long. Length 1·55 mm.

The only British locality known to me for this species is Duddingston Loch, Edinburgh, where it was found by Mr. Thomas Scott, F.L.S., of the Scottish Fishery Board. On comparing these British specimens with American ones, kindly sent to me by Mr. B. W. Thomas, I cannot find any great difference. The antennæ in the latter are perhaps somewhat longer.

It is with considerable doubt that I have admitted *C. Thomasi* as a distinct species. Probably Herrick may be right in looking upon it as a mere variety of the preceding. Hoek, in his figure of the caudal rami of *C. bisetosus*, gives the characteristic basal row of setæ, though very feebly developed.

9. Cyclops viridis, Jurine (Pl. V., figs. 6-10).

1820. *Monoculus quadricornis viridis*, Jurine (**3**), p. 46, pl. III., fig. 1.
1851. *Cyclops viridis*, Fischer (**8**), p. 412, pl. IX.. figs. 1–11.
1857. ,, *brevicornis*, Claus (**13**), pl. III., figs. 12–17.
,, *gigas*, idem, ibidem, p. 207, pl. XI., figs. 1–5.
1863. ,, *viridis* and *C. gigas*, G. O. Sars (**20**), p. 35.
1863. ,, *brevicornis*, Lubbock (**19**), p. 200.
1871. ,, *Clausii* (junr.), Heller (**23**), p. 7.
1871. ,, *brevicornis*, Heller (**23**), p. 5.
1872. ,, ,, Fric (**24**), p. 220, fig. 13.
,, *gigas*, idem, ibidem, p. 220, fig. 14.
1875. ,, *brevicornis*, Hoek (**29**), p. 13, pl. I.. figs. 5, 6.
1878. ,, *gigas*, Brady (**32**), p. 105, pl. XX.
1880. ,, *viridis*, Rehberg (**33**), p. 540, and *C. gigas*, p. 541.
1882. ,, *ingens*, Herrick (**38A**), p. 228, pl. IV., figs. 1–8.
1883. ,, *viridis*, Cragin (**40**), p. 3, pl. IV., figs. 8–16.
1884. ,, ,, Herrick (**41**), p. 145.
1885. ,, ,, Daday (**44**), p. 214.

When engaged upon my Ray Society Monograph I was much puzzled to know whether the bulk of my seventeen-jointed "short-horned" specimens—evidently all belonging to the same species—ought to be referred to *C. brevicornis*, Claus, or to *C. gigas*, Claus. It did not occur to me that perhaps the two so-called species might not after all be distinct, as they were both admitted, though apparently with some hesitation, by G. O. Sars. But a further acquaintance with the animals, together with the figures and descriptions of various authors, convinces me that there is no sufficient ground for the separation of the two forms. *C. gigas* appears to be simply a very large variety of *C. viridis* (*brevicornis*). This opinion is held also by Herrick.

This species is common and widely distributed, being noted as occurring in Norway (G. O. Sars); Germany (Fischer, Claus, &c.); Holland (Hoek); Switzerland (Jurine); Hungary (Fric), Tyrol (Heller); North America (Herrick). In the British Islands it is very common, occurring chiefly in small sheets of water, such as ponds and ditches, but also amongst the vegetation of the margins of lakes. It occurs sometimes also in slightly brackish water—as at Lymington, Hampshire; and I have taken specimens which I cannot distinguish from it by the deep-net in Windermere.

c. *Anterior antennæ fourteen-jointed.*

10. **Cyclops insignis**, Claus (Pl. VI., fig. 5).

1857. *Cyclops insignis*, Claus (**13**), p. 209, pl. XI., figs. 8–12.
1868. ,, *Lubbockii*, Brady (**22A**), p. 127, pl. IV., figs. 1–8.
1863. ,, *insignis*, G. O. Sars (**20**), p. 38.
1863. ,, ,, Claus (**18**), p. 101.
1878. ,, ,, Brady (**32**), p. 108, pl. XXI., figs. 1–9.
1884. ,, ,, Herrick (**41**), p. 155, pl. T, figs. 11–14.
1891. ,, ,, Schmeil (**66**), p. 25.

This is one of the less common species of *Cyclops*. I have only to add to the two localities given in the Ray Society Monograph, one other,—Salt-marsh at Poole, Dorset, where it was found by the Rev. Dr. Norman, F.R.S. Herrick notices the species in his report on the Crustacea of Minnesota, but his remarks appear to refer only to specimens taken at Leipzig. It has been found by G. O. Sars in Norway, by Claus, Rehberg, and Schmeil in Germany, and by Fric in Bohemia.

d. *Anterior antennæ twelve-jointed.*

11. **Cyclops serrulatus**, Fischer (Pl. VII., fig. 1).

1838.? *Cyclops agilis*, Koch (**4**), H. 21, pl. III.
1851. ,, *serrulatus*, Fischer (**8**), p. 423, pl X., figs. 22, 23, 26–31.
1853. ,, ,, Lilljeborg (**9**), p. 158, pl. XV., fig. 12.
1857. ,, ,, Claus (**13**), p. 36, figs. 1–3.
1863. ,, ,, G. O. Sars (**20**), p. 45.
1863. ,, ,, Claus (**18**), p. 101, pl. I., figs. 1,2; pl. IV., fig. 12; pl. XI., fig. 3.
1863. ,, ,, Lubbock (**19**), p. 197.
1871. ,, ,, Fric (**24**), p. 222, fig. 18.
1871. ,, ,, Heller (**23**), p. 6.
1875. ,, ,, Uljanin (**28**), p. 34, pl. VIII., figs. 1–8.
1878. ,, ,, Brady (**32**), p. 109, pl. XXII., figs. 1-14.
1880. ,, *agilis*, Rehberg (**33**), p. 545.
1883. ,, *pectinifer*, Cragin (**40**), p. 6, pl. IV., figs. 1–7.
1884. ,, *serrulatus*, Herrick (**41**), p. 157, pl. O., figs. 17–19.
1886. ,, *agilis*, Vosseler (**46A**), p. 190, pl. V., figs. 29–31.
1891. ,, *serrulatus*, Schmeil (**66**), p. 29.

C. serrulatus is, in the British Islands, certainly the commonest representative of the genus, few gatherings of Copepoda, from whatever elevation, whether from lakes, ponds, or smaller collections of water, being entirely without it. It is, moreover, remarkably constant in its characters and can scarcely be confounded with any other species. The American *C. pectinifer*, Cragin, seems to be only a variety and scarcely a well-marked one. Rehberg identifies this species with *C. agilis*, Koch, chiefly on account of the shape of the egg-sacs. Koch's figures may very probably be meant to refer to *C. serrulatus*, but it seems scarcely wise to discard Fischer's well-known specific name for one of only speculative propriety.

C. serrulatus is recorded by almost all continental authors:—Norway (G. O. Sars); Sweden (Lilljeborg); Germany (Fischer, Koch, Claus); Tyrol (Heller); Bohemia (Fric); Holland (Hoek); Turkestan (Uljanin), North America (Herrick).

12. Cyclops macrurus, G. O. Sars (Pl. VII., fig. 2).

1863. *Cyclops macrurus*, G. O. Sars (**20**), p. 45.
1878. ,, ,, Brady (**32**), p. 111, pl. XXIV., figs. 1–5.

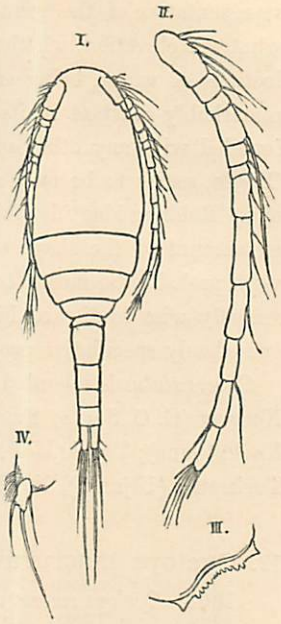
Crag Lake, Northumberland, was until recently the only known British locality for this species. But it occurs also very plentifully in collections made by the Rev. Dr. Norman in the Castle Loch, Lochmaben, Dumfriesshire, and in Loch Achray, Perthshire. It is recorded by G. O. Sars from Norway and by Rehberg from Germany. The last-named author identifies it with *C. spinulosus*, Claus, but as that species is described as having antennæ longer than those of *C. serrulatus* it is impossible to accept the identification.

13. Cyclops magnoctavus, Cragin.

1883. *Cyclops magnoctavus*, Cragin (**40**), p. 5, pl. III., figs. 14–23.

Cephalothorax subelliptical, widest in the middle, none of its segments angulated nor prominent laterally, the last segment

slightly constricted in front and not wider than the abdomen; first segment very large, occupying about two-thirds of the entire length of the cephalothorax. Abdomen only very slightly tapering backwards, its first segment much the longest. Caudal rami about thrice as long as broad, closely approximated and not at all divergent; outermost seta short, spine-like, nearly as long as the furca, innermost about twice as long, very slender and inconspicuous; of the two median setæ, the inner is the longer, being more than equal in length to the whole abdomen; the outer is about two-thirds as long; the plumose character so delicate as to be scarcely discernible; the lateral setæ are short, and arise a little behind the middle of the furca. Anterior antennæ slender, of nearly equal thickness throughout, and reaching, when reflexed, almost to the anterior margin of the abdomen, rather sparingly clothed with setæ, though the fourth joint bears one of remarkable length: the length of the joints may be formulated thus:



Cyclops magnoctavus, *Cragin*.
I. Female, seen from above × 60.
II. Anterior antenna of same.
III. Labrum.
IV. Foot of fifth pair.

1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.
16	5	4	10	6	3	12	18	14	11	12	12

The rami of the first four pairs of feet are all three-jointed, the spines of the external rami very delicately pectinated. The fifth foot is one-jointed and bears three setæ, the apical seta more than twice as long as the others: the side of the last thoracic ring near the margin of the fifth foot bears a fringe of fine hairs. Length ·85 mm.

For this interesting species I am indebted to my friend the Rev. Dr. Norman, F.R.S., by whom it was taken "in a ditch at the end of Lochaber Loch, Kirkcudbrightshire," in 1885. The

only previous record of it is by Mr. Cragin, who found it at Cambridge, U.S.A., very abundantly "in the dirty water of the blind ditches connected with the artificial pond known as "Glacialis." It is curious that in both cases the animal was found in ditches immediately connected with large sheets of water.

I have had no opportunity of examining any but the spirit-specimens of Dr. Norman's collection, but the following characters may be added as having been noticed by Mr. Cragin in living specimens: "eye large, dark red; divided deeply by a median constriction posteriorly. Ovisacs small, sub-oval, nearly or quite meeting above the abdomen, and usually containing from five to eight eggs. Animal dirty blue-green; antennæ lighter. Dark green pigment masses are scattered beneath the integument in various places, particularly along the anterior side of the first antennæ."

Herrick, in his "Final Report on the Crustacea of Minnesota," identifies this species with *C. fluviatilis*, Herrick, but there are several characters which prevent my accepting this view; notably that in *C. fluviatilis*, "the terminal segment of the antennæ is slightly but evidently hinged, and together with the pair preceding, somewhat curved," and that the feet have the "terminal spines strongly toothed." "The antennæ," Herrick says, "are long and much modified so as to resemble superficially the antennæ of Diaptomus." This can scarcely be said of the British specimens which I ascribe to *C. magnoctavus*, and which agree in every respect with the figures and description given by Cragin.

E. *Anterior antennæ eleven-jointed.*

14. Cyclops affinis, G. O. Sars (Pl. VIII., figs. 1–6).

1863. *Cyclops affinis*, G. O. Sars (**20**), p. 47.
1875. ,, ,, Uljanin (**28**), p. 36, pl. XI., figs. 3–7.
1878. ,, ,, Brady (**32**), p. 112, pl. XV., figs. 11–14; pl. XXIVB., figs. 10–15.
1880. ,, *pygmæus*, Rehberg (**33**), p. 546, pl. VI., figs. 3–6.
1886. ,, *affinis*, Vosseler (**46A**), p. 192, pl. VI., figs. 1–3.
1891. ,, ,, Schmeil (**66**), p. 34.

This species occurs in a gathering made by the Rev. Dr. Norman in the River Till at Etal, Northumberland, and Mr. Scourfield records it from Wanstead Park, Essex, and from the River Lea at Tottenham. Mr. Thomas Scott has also recently sent me specimens from Raith Lake, Kirkcaldy, Fifeshire, and Dr. Norman others from Yetholm Loch, Roxburghshire; the previously recorded British localities being Peterhead, N.B., and Pwllheli, North Wales. Professor G. O. Sars found it near Christiania.

15. Cyclops Ewarti, G. S. Brady (Pl. VII., figs. 4–7).

1888. *Cyclops Ewarti*, Brady (58), pl. VIII., figs. 1–6.

Female.—Anterior antennæ about as long as the cephalothorax, eleven-jointed; the first, seventh, and eleventh joints nearly equal and longer than any of the rest; second and fifth joints very short The four pairs of swimming feet have both branches three-jointed; fifth pair of feet two-jointed, the basal joint bearing a single long seta at the inner angle, the last joint one long and one very short seta at the apex. Last thoracic segment narrower than the preceding one, dilated behind, and equal in width to the first abdominal segment, from which it is not separated by any distinct constriction. The first abdominal segment has at each side two small lateral setæ, one of which is spine-like. Caudal rami not divergent, in length rather more than equal to the two preceding segments; the longest tail-seta equal in length to the entire abdomen. Length 1·4 mm.

A considerable number of specimens of this species were taken by Mr. T. Scott, in November, 1887, in the tow-net in a small bay west of Charleston, about five miles above Queensferry, Firth of Forth. It is interesting as being the only undoubted member of the genus which has been found living in the sea. But the Forth at this point is subject to considerable admixture of fresh water, and it is possible that this *Cyclops* may have its real habitat in some of the streams or ponds whose contents find their way into the Forth. This is a matter to be decided by future investigation.

One is liable to look with suspicion on the validity of small

species of *Cyclops* with eleven-jointed antennæ, seeing that the possession of that number of joints is characteristic of one stage in the development of the seventeen-jointed forms. But we have, in this case, the swimming feet all perfectly developed and three-jointed, and no examples of any seventeen-jointed forms were found in the gathering. For the present, therefore, I must look upon *C. Ewarti* as being a good species. The figure of the entire animal, given in the Fishery Board Report, is not quite satisfactory, and I regret that I am unable here to give a better one, no specimens having been preserved in a fit condition for that purpose.

16. **Cyclops longicaudatus**, Poggenpol (Pl. X., figs. 5–7).
1874. *Cyclops longicaudatus*, Poggenpol (**26**), p. 72, pl. XV., figs. 19–21; pl. XVI., figs. 5–6.

Female.—Body widest in front; tapering gradually and evenly to the furca; no distinct separation between thorax and abdomen. First cephalothoracic segment almost circular; a distinct constriction between it and the following segment, the sides of which are somewhat produced backwards, forming angular cusps; third segment constricted in front, lateral margins protuberant, rounded, not at all angulated; fourth segment somewhat narrower, constricted in front, but produced behind so as to form angulated, alæform lateral processes; last thoracic scarcely wider than the first abdominal segment, constricted in front, lateral margins rounded; first abdominal segment quite as long as the following three, tapering backwards, constricted in front; caudal rami about four times as long as broad; equal in length to the two preceding segments; caudal setæ short, delicately plumose; innermost of the two median setæ more than half as long as the abdomen, and only slightly longer than the next (outer) seta; bases of these two setæ dilated; the two secondary apical setæ are very short, the outer, however, distinctly longer than the inner; the lateral setæ are situated at about the middle of the outer margins of the rami and reach nearly to the apices. The abdomen, altogether, including the furca, is more than half as long as the cephalothorax. Anterior antennæ eleven-

jointed, slender, much shorter than the first cephalothoracic segment, the first, seventh, and eighth joints being the longest; the second, fourth, and sixth the shortest. All the pairs of swimming feet have both branches two-jointed, and the last joint of the outer branch bears three lateral spines. The fifth foot is quite rudimentary, consisting, on each side, of two simple spine-like setæ with slightly dilated bases. Length 1·1 mm.

This very interesting form, which seems not to have been previously noticed except by Poggenpol (environs of Moscow), I have seen only in very small numbers, in a gathering made by Mrs. Tupper Carey, at Ebbesburne, near Salisbury, and communicated to me by my friend the Rev. Canon Norman. Poggenpol's measurement of length is rather greater than mine (1·39 mm.), but apart from this there does not seem to be the slightest discrepancy. The description of the Russian specimens, however, does not refer at all to the number of joints in the rami of the swimming feet: this is an important point, the two-jointed forms being of extremely rare occurrence. *C. bicolor*, G. O. Sars, is a very much smaller species, but, judging from the description, agrees very closely with *C. longicaudatus*, and has, moreover, the two-jointed feet: it disagrees, however, in some minor points, such as the arrangement and size of the caudal setæ, on which Professor Sars is very explicit. It may be added that, though I have seen no specimens with ovisacs, the Salisbury specimens have every appearance of perfect development, and I have no doubt at all that they are quite mature.

E. *Anterior antennæ ten-jointed.*

17. Cyclops Kaufmanni, Uljanin (Pl. VII., fig. 3).

1875. *Cyclops Kaufmanni*, Uljanin (**28**), p. 38, pl. XII., figs. 2–4.

1878. ,, ,, Brady (**32**), p. 113, pl. XXIV., figs. 6–12.

This is a very well-marked species, characterised chiefly by the ten-jointed antennæ and the strongly pectinated margins of the abdominal and posterior thoracic segments. The only British locality for it known to me, at the time of publishing the Ray Society Monograph, was Lambton Park, county Durham,

where it was taken by the Rev. Dr. Norman; but I have recently (1890) found it in Minstead Mill Dam, Hants. It has not been noticed, so far as I know, by any other author since its publication by Uljanin.

18. **Cyclops phaleratus**, Koch (Pl. IX., fig. 2).

1841. *Cyclops phaleratus*, Koch (4), H. 21, tab. IX.
1851. ,, *canthocarpoides*, Fischer (8), p. 426, pl. X., figs. 24, 25, 32–38.
1853. ,, ,, Lilljeborg (9), p. 208.
1857. ,, ,, Claus (13), p. 37, pl. I., figs. 6–10.
1863. ,, ,, Claus (18), p. 102, pl. IV., figs. 1–4.
1863. ,, ,, Lubbock (19), p. 202.
1863. ,, *phaleratus*, G. O. Sars (20), p. 46.
1872. ,, *canthocarpoides*, Fric (24), p. 223, fig. 19.
1874. ,, *lascivus*, Poggenpol (26), p. 72, pl. XV., figs. 22–24; pl. XVI., figs. 7, 8.
1875. ,, *phaleratus*, Uljanin (28), p. 38, pl. IX., figs. 1–5.
1878. ,, ,, Brady (32), p. 116, pl. XXIII., figs. 7-13.
1882. ,, *adolescens*, Herrick (38A), p. 231, pl. VI., figs. 16–20.
1883. ,, ?*perarmatus*, Cragin (40), p. 7, pl. I., figs. 9–18.
1884. ,, *phaleratus*, Herrick (41), p. 161, pl. R., figs. 6–10.
1891. ,, ,, Schmeil (66), p. 36.

Mr. Thomas Scott has sent me specimens of this species from Raith Loch, Kirkcaldy, N.B.; and Mr. Scourfield notes it from Wanstead Park; Cuckoo Pits, Chingford; and the Royal Botanic Gardens, Regent's Park. These are the only localities which I have to add to the list given in the Ray Society Monograph. Though widely distributed it seems to be a scarce species. It has been recorded from Norway (G. O. Sars); Sweden (Lilljeborg); Germany (Koch, Fischer, Claus); Bohemia (Fric); Turkestan (Uljanin); North America (Herrick).

F. *Anterior antennæ eight-jointed.*

19. **Cyclops fimbriatus**, Fischer (Pl. IX., fig. 1).

1785. ? *Cyclops crassicornis*, Müller (1), p. 113, pl. XVIII., figs 15-17.

1853. *Cyclops fimbriatus*, Fischer (**8**), p. 94, pl. III., figs. 19–28, 30.
1863. ,, *crassicornis*, G. O. Sars (**20**), p. 47.
1871. ? ,, *Gredleri*, Heller (**23**), p. 8, pl. I., figs. 3, 4.
1871. ,, *pauper*, Fric (**24**), p. 223, fig. 20.
1875. ,, *crassicornis*, Uljanin (**28**), p. 39, pl. VIII., figs. 9–16; pl. XII., fig. 1.
1878. ,, ,, Brady (**32**), p. 118, pl. XXIII., figs. 1–6.
1880. ,, *Poppei*, Rehberg (**33**), p. 550, pl. VI., figs. 9–11.
1882. ,, *crassicornis*, Herrick (**38A**), p. 232, pl. IV., figs. 9–14.
1884. ,, *fimbriatus*, Herrick (**41**), p. 162, pl. R., fig. 11.
1886. ,, ,, Vosseler (**46A**), p. 192, pl. VI., figs. 4–8.
1891. ,, ,, Schmeil (**66**), p. 35.

The localities for this species given in the Ray Society Monograph are Bolam Lake, Northumberland, and Tresco, Scilly Islands. I have, however, recently (1891) found it in a ferruginous ditch by the side of the road between Haydon Bridge and Stawarď, Northumberland; in Balmer Lawn Pond, and at Castle Malwood, both in the New Forest; in pools near high water mark, Penmaenmawr, North Wales; also in gatherings by the Rev. Dr. Norman from Rainton Meadows, county Durham, and Loch Achray, Perthshire, and from Raith Lake, Kirkcaldy (*Mr. T. Scott*). Mr. Scourfield informs me that he has found it at Hackney Marsh; Hampstead; River Lea at Tottenham; Stanstead, Herts; Wanstead Park, Essex; and Higham Park, Woodford.

The specific name *crassicornis* is scarcely tenable. Müller's description is extremely vague, and his figures seem to indicate a much more robust species with very short furca. Fischer's figures, however, are quite sufficiently characteristic; I therefore adopt his name, *fimbriatus*, which has priority over all except that of Müller.

G. *Anterior antennæ six-jointed.*

20. Cyclops æquoreus, Fischer (Pl. X., fig. 1).
1860. *Cyclops æquoreus*, Fischer (**16**), p. 654, pl XX., figs. 26–29.

1878. *Cyclops æquoreus*, Brady (**32**), p. 119, pl. XIX., figs. 8–10; pl. XXI., figs. 10–17.

Cyclops æquoreus occurs not uncommonly in the brackish pools of salt-marshes in many parts of the British Islands. The only localities which I have to add to those already recorded, are Lymington, Hants (*G.S.B.*); Poole, Dorset (*Rev. Dr. Norman*); Loch Stennis, Orkney (*Mr. T. Scott*).

[*Cyclops Helleri*, Brady.

In the many collections which I have examined during the preparation of this memoir, I have found no specimens which I could certainly refer to *C. Helleri*, while those upon which the species was originally founded have been lost by evaporation of the spirit in which they were preserved. It is perhaps more than probable that the types represented one of the stages of development of a seventeen-jointed species, and under this impression it seems best for the present to regard the species as one of doubtful validity.]

Family CALANIDÆ.

Genus DIAPTOMUS, Westwood.

(*Cyclopsine*, Fischer.)

1. **Diaptomus Castor** (Jurine), (Pl. XI., figs. 1–6).

1785. *Cyclops cæruleus*, Müller (**1**), p. 102, pl. XV., figs. 1–9.
,, *lacinulatus* (♀), idem, ibidem, p. 105, pl. XVI., figs. 4–6.
,, *rubens* (♂), idem, ibidem, p. 104, pl. XVI., figs. 1–3.
1820. *Monoculus Castor*, Jurine (**3**), p. 50, pl. IV.–VI.
1850. *Diaptomus Castor*, Baird (**7**), p. 219, pl. XXVI., figs. 1, 2, 2a–j.
1863. ,, ,, Lilljeborg (**9**), pl. XII., figs. 1–10; pl. XIV., figs. 1–4.
1863. ,, ,, Lubbock (**19**), p. 205, pl. 31, figs. 7–11.
1872. ,, ,, Fric (**24**), p. 225, figs. 22a, b.
1878. ,, ,, Brady, in part (**32**), p. 59, pl. VI., figs. 6, 8, 11.
1889. ,, ,, De Guerne and Richard (**62**), p. 11, fig. 1, and pl. II., fig. 1.

This, the first described, and for long the only known species

of *Diaptomus*, needs no description further than to refer to a few salient characters which distinguish it from the rest of the genus.

The animal is stout and robust in build,—the female considerably larger and heavier than the male. The posterior extremity of the thorax is truncated, and in the *female* the lateral angles are strongly produced, and form mucronate cusps; in the *male* the thorax is more tapered posteriorly, and the angles are only slightly produced. The abdomen in the *male* is five-jointed, slender, and of nearly equal width throughout; in the *female* the segments are reduced to three, the first occupying half the length of the abdomen, and having its margins produced laterally so as to form two large truncated processes; the second segment is extremely small, and the last somewhat larger. The anterior antennæ are composed of twenty-five joints, and, in the *female*, reach, when reflexed, as far as about the middle of the first abdominal segment; in the *male* they are very nearly as long as the entire body of the animal. The right anterior antenna of the *male* is, of course, geniculated, but the antepenultimate joint is destitute of any special appendage or process. The basal joint of the posterior maxilliped has the anterior distal angle much produced, rounded, minutely crenulated, and bearing a series of very minute cilia, below which are three or four larger hairs, and, at the very extremity, one very long and stout seta. The fifth pair of feet in the *female* are alike on both sides, and composed of a two-jointed basal portion (protopodite) and two branches, each consisting of two joints. The first joint of the outer branch (exopodite) is simple, the second forms a stout, slightly curved claw, with dilated base, from which spring one long spine-like seta and two very much shorter ones: the inner branch (endopodite) is equal in length to the first joint of the exopodite, and is composed of two distinct joints, the second of which bears at its apex three setæ, one as long as the entire branch, another extremely short (almost imperceptible), and a third of intermediate length. In the *male* the inner branch of the right side is very small, slender, composed of two simple joints, and reaches scarcely to the middle of the penultimate

joint of the outer branch: just above the origin of this branch, the margin of the protopodite is produced in the form of a hyaline lamina: the outer branch consists of three joints, the penultimate strongly angulated near the middle, to which is attached a rather long and stout seta; last joint simple, slender, and forming a long, falcate claw: inner branch of the left side simple, two-jointed, and about as long as the outer branch; terminal joint of the outer branch subglobose, ending in two short, sharp processes, between which there is a crenulated, disc-like surface; inner margin of the joint setiferous. Length of the female, 2·5 mm. (*circa*); of the male, 2 mm. (*circa*).

Diaptomus Castor is recorded by almost all European writers on the Copepoda, and though it is mentioned by Herrick in his memoir on the Crustacea of Minnesota, it does not appear that the genus has been examined by American authors with sufficient precision, so that it is uncertain as yet whether this species occurs on the American continent. In Scandinavia its occurrence is noted by Müller and Lilljeborg, in Germany by Poppe and others; in France by De Guerne and Richard, in Bohemia by Fric, in Switzerland by Jurine. In our own country it seems to be generally distributed, though by no means a very common species; very rarely occurring in lakes or large sheets of water, but generally in ponds or ditches where there is much vegetation. My notes embrace the following localities:—Ponds at Chester Road, Sunderland; Shotton, and Wardley, county Durham (*G. S. B.*); Broomley Lough, Northumberland (*Rev. Dr. Norman*); ponds in Wanstead Park and at Pavenham, Bedfordshire (*Mr. D. J. Scourfield*). Dr. Baird records it as being "common in the neighbourhood of London."

2. Diaptomus gracilis, G. O. Sars (Pl. XI., figs. 7–9; pl. XII., figs. 1–8).

1863. *Diaptomus gracilis*, Sars (**20**), p. 9.
1863. ,, *Westwoodii*, Lubbock (**19**), p. 203, pl. XXXI., figs. 1–6.
1888. ,, ,, Nordquist (**51**), p. 71, pl. IX., figs. 1–7.
1888. ,, *graciloides*, Lilljeborg (**53**), p. 156.

1889. *Diaptomus graciloides*, De Guerne & Richard (**62**), p. 36, pl. I., figs. 26, 27.
1889. ,, *gracilis*, De Guerne & Richard (**62**), p. 14, pl. II., figs. 12, 16, 20.
(? *Glaucia hyalina*, *G. cæsia*, *G. ovata*, Koch.)

Female.—Body slender; cephalothorax widest in the middle, and only slightly tapered towards either extremity; angles of the last segment much produced and mucronate; the first abdominal segment bearing near the middle of each side a similar but more slender spine: caudal laminæ short, setæ very divergent. Anterior antennæ very long and slender, when reflexed reaching considerably beyond the extremity of the caudal lamellæ. Outer branch of the posterior antennæ much longer than the inner, its last joint equal to half the length of the branch. Outer branch of the fifth pair of feet three-jointed, terminal process of the second joint stout, more or less bent; last joint small, rather indistinct, quadrate, bearing two apical setæ, the inner and larger of which nearly reaches the extremity of the claw of the preceding joint, while the outer forms only a minute spine: inner branch two-jointed, nearly as long as the first joint of the outer branch, bearing at the apex two or three delicate, translucent setæ. Colour variable; whitish, bluish-grey, or brown. Length 1·3 mm.

Male.—Angles of the last thoracic segments mucronate, slightly produced backwards but not at all laterally; caudal setæ adpressed. Antepenultimate joint of the right anterior antenna usually produced externally at the apex into a blunt hatchet-like process. Inner branch of the *right* fifth foot, one-jointed, stout, reaching nearly to the extremity of the last joint of the outer branch; terminal claw of the outer branch strongly curved, falcate or S-shaped: last joint of the outer branch of the *left* side bearing at the apex a rather long sub-acute process and a lesser spine-like appendage, and at the middle of its inner margin a papilliform process, which has an apical brush of hairs. (Pl. XI., fig. 9a.) Inner branch one-jointed. The second joint of the basal portion of the limb has its inner margin produced into a keel-like flange, which ends abruptly in a rectangular prominence beyond the middle of the joint.

This species seems to be universally distributed through the British Islands, but is not found in waters smaller in extent than lakes or very large ponds, frequently in such situations occurring in vast numbers. By the deep-water net in depths of 50–80 fathoms it is often taken in abundance, and in one instance, at least (Talkin Tarn, Cumberland), I have seen the net come up from a depth of six or eight feet below the surface with a dense mass consisting almost entirely of *D. gracilis*. It is also taken quite commonly at the surface, but scarcely ever, in my experience, among weeds, though it occurs quite close to the shore on the stony margins of lakes and tarns. *D. gracilis* has been recorded as occurring in Norway (G. O. Sars), Sweden (Lilljeborg), Finland (Nordquist), and by various authors in Germany, Switzerland, and Italy.

That a species so widely distributed, and occurring often in numbers so enormous, should show a marked tendency to variation, is only what one would expect; and while hesitating to express an opinion different from that which has been arrived at by observers so careful and accurate as Sars, Lilljeborg, De Guerne & Richard, and Poppe, I cannot help believing that *D. gracilis* and *D. graciloides* certainly, and some other so-called species, very possibly, ought to be considered as referable to one only. I will briefly state my reasons for this view. The characters which are chiefly relied on to distinguish *D. graciloides*, Lilljeborg, from *D. gracilis*, Sars, may be stated as follows:—

	D. gracilis, Sars.	*D. graciloides*, Lilljeborg.
Inner branch of the fifth foot of the *female*	very short	long
Inner branch of the fifth foot in the *male* (right side)	long	short
Terminal claw of *fifth* foot in the *male*	simply falcate	sigmoid
Last joint of external branch of the *left* fifth foot of *male*	bearing on its internal margin a process with an apical bunch of hairs	bearing a simple ciliated seta
Antepenultimate joint of *right male* antenna	having an apical hook-like prolongation	simple—not produced

But, so far as my observation extends, these characters are by no means constant, individuals being frequently seen which present in some points the characters of *D. gracilis* and in others those of *D. graciloides*. One of the most remarkable characters of *D. gracilis* in its typical form is the brush-bearing lateral process of the outer branch of the left fifth foot in the male, but specimens from Floutern Tarn, Lough Nascrahoge, and Wanstead Park do not possess this appendage. Again, the males from Wanstead Park and Lough Neagh have the antepenultimate joint of the right anterior antenna destitute of any lateral prolongation (in this respect agreeing with *D. graciloides*), but those from Lough Neagh do possess the lateral brush of the fifth foot,—agreeing here with *D. gracilis*. The inner branch of the female fifth foot in *D. gracilis* is one-jointed, but in specimens from Talkin Tarn and other places we find it two-jointed. Lastly, as regards the terminal claw of the male fifth foot: this organ, in Talkin Tarn specimens and others, is S-shaped (a typical *graciloides* character), while the external branch of the foot possesses the characteristic setose brush of *D. gracilis*. Some of the more interesting of these variations I here figure. The character which seems to me most distinctive of *D. gracilis*, as I understand it, is the angulated projection on the inner side of the second joint of the protopodite of the left male fifth foot: this prominence occurs in all specimens, so far as I know, whether of *gracilis* or *graciloides* type, and I do not find that it occurs in any other species, though a more extreme form of a similar structure is figured by De Guerne and Richard from *D. Eiseni*, Lilljeborg. But, although not uniformly present, I should set down as *D. gracilis* any specimen possessing the minute setose papilla of the left male fifth foot or the short hatchet-shaped process of the right male antenna.

The localities from which I have notes of *D. gracilis* are as follows:—Ponds at Wanstead Park and Wandsworth Common, Surrey (*Mr. D. J. Scourfield*); Chartners Lough and Crag Lough, Northumberland, and most of the Lochs of the Scottish Highlands (*Rev. Dr. Norman*); Loch Leven, Kinross (*Mr. T. Scott*); Nostell Lake, Yorkshire; Ellesmere Lake, Shropshire;

most of the lakes and tarns of the English Lake District; Talkin Tarn and Tindale Tarn, Cumberland; Ormesby Broad, Norfolk; Loch at Rockcliff, Kirkcudbrightshire; Clearburn Loch, Selkirkshire; Phœnix Park Lake, Dublin; and several Loughs about Roundstone, Connemara (*G.S.B*).

There can, I think, be no doubt whatever that the species described by Sir John Lubbock as *Diaptomus Westwoodii* is identical with *D. gracilis*, G. O. Sars. Both names date from 1863, but as Sars' paper was "read" in 1862 it seems right to give the preference to his specific name.

3. **Diaptomus bacillifer**, Koelbel (Pl. XIV., figs. 9–13).

1882. *Diaptomus gracilis*, var. β, Wierzejski (**38B**), p. 20, pl. III., fig. 5.
1884. ,, *bacillifer*, Koelbel (**42A**), p. 312, pl. I., figs. 1–5.
1887. ,, *montanus*, Wierzejski (**50A**), p. 6, (*fide* De Guerne & Richard).
1889. ,, ,, De Guerne & Richard (**62**), p. 25, pl. IV., figs. 17, 23.

Body slender, widest in front; last thoracic segment not produced laterally, its angles rounded and bearing two small spines. First abdominal segment having a similar spine on each side. Anterior antennæ reaching about as far backward as the furca. Inner branch of the fifth pair of feet in the *female* indistinctly two-jointed, about half as long as the first joint of the outer branch; last joint of the outer branch very small, bearing two apical spines, the outermost of which is about half as long as the inner; spine of the second joint very stout, almost straight, finely pectinated towards the apex. "Antepenultimate joint of the right anterior antenna in the *male* bearing a slender styliform process, which is about equal in length to the following joint. Inner branch of the left fifth foot in the *male* coalescent with the basal joint, the internal margin of which is produced into a long spine: last joint forcipate. Inner branch of the fifth foot of the right side much exceeding in length the penultimate joint of the outer branch." Length of the *female* 1·4 mm.

Not having seen the adult male of this species, I have had to depend for that part of the description on De Guerne and Richard,

from whose memoir the figures 10 and 13 in Pl. XIV. are likewise copied.

Females, and a few immature males, of *D. bacillifer* occurred somewhat sparingly in a gathering made by the Rev. Dr. Norman at Loch Earn Head, Perthshire, near the middle of the lake. In the same collection occurs also *D. gracilis* in great numbers, and it is by no means easy in the younger forms to separate the two species; but in the adult condition, *D. bacillifer* is easily recognized by its somewhat stouter build and by the shorter antennæ. *D. bacillifer* was described by Wierzejski in 1882 as a variety of *D. gracilis*, but in 1887 was re-named by that author as *D. montanus;* the term *bacillifer*, however, previously proposed by Koelbel having the claim of priority.

D. bacillifer is noted by Prof. Lilljeborg as having been taken in Siberia during the Nordenskiöld Polar Expedition; amongst the Tatras (Carpathian) Mountains (*Wierzejski*); in the Balaton Lake, Hungary (*Koelbel*); in Finmark (*G. O. Sars*); and in the lakes of Gimont and Cristol, near Briançon, at a height of about 2,400 mètres (*Dr. R. Blanchard*).

There is so little, on a cursory glance, to distinguish this species from *D. gracilis*, that it is very likely it may have been often overlooked amongst lake gatherings from mountainous regions. I can scarcely doubt that I have done so myself, and that it will be found to occur not unfrequently in such localities.

4. Diaptomus Sancti Patricii, n. sp. (Pl. XIV., figs. 5–8).

Posterior angles of the last thoracic segment very much produced so as to form attenuated spines. Anterior antennæ reaching about as far as apex of furca: penultimate joint of the anterior antenna of the *male* entirely destitute of marginal process. Inner branch of the fifth pair of feet in the *female* indistinctly biarticulate, nearly as long as the first joint of the outer branch, and bearing three minute apical setæ. Last joint of the outer branch small, the larger apical seta not reaching as far as the extremity of the claw of the penultimate joint. Inner branch of the right fifth foot in the *male* simple, mucronate at the apex, and reaching beyond the middle of the last joint of the outer

branch; terminal claw of the outer branch strongly falcate, and delicately ciliated on the inner edge; lateral spine attached near the middle of the last joint, long, slender, and finely ciliated. Fifth foot of the left side (*male*) terminating in a sub-crescentiform hyaline lamina, the inner edge of which is delicately crenulated. Length of male and female about 1·55 mm.

I regret that I am unable, owing to the small number of specimens obtained, and their imperfect preservation, to give a more copious account of this species. My specimens were taken in the year 1865, in two of the small peaty tarns of Connemara (Lough Doon and Lough Nawheelan), nearly on the sea-level. Amongst described species that to which they bear most resemblance is *D. laciniatus*, Lilljeborg. They come very near, indeed, to this, but scarcely close enough to allow of my identifying them with it. The species, however, requires further investigation with the help of better specimens than those at present available.

5. Diaptomus hircus, n. sp. (Pl. X., figs. 2–4).

Female.—Seen from above the body is widest across the front, thence tapering backwards to the hinder end of the thorax, which is but little wider than the abdomen. The posterior thoracic angles are mucronate but not very strongly produced. The anterior antennæ reach backwards as far as the posterior end of the thorax. Inner branch of the fifth foot two-jointed, more than half as long as the first joint of the outer branch, its apex clothed with a fringe of minute cilia: second joint of the outer branch ending in a stout, slightly curved claw, which is finely ciliated on the concave margin; last joint bearing at its apex a long, finely ciliated spine and one much smaller seta.

Male.—Antepenultimate joint of the right anterior antenna armed with a ploughshare-shaped process, which is nearly half as long as the following joint, and has an obscurely fimbriated free margin. Inner branch of the fifth foot of the left side very small; outer branch slender, ending in two subequal finely pectinated setæ: the last joint of the protopodite has a finger-like hyaline appendage on the inner margin, and there is a

similar but smaller organ in the same position on the right foot. Inner branch of the right fifth foot very small, pyriform, one-jointed, acuminate: terminal claw of the outer branch long, slender, subsigmoid. Length 1·1 mm.

I took a few specimens only of this, which appears to be a quite distinct species, in Goat Water, a tarn lying at a considerable elevation on the side of Coniston Old Man. More recently (1891), Mr. Scott has sent me specimens from Loch Harray, Orkney, where he found it abundantly.

6. Diaptomus serricornis, Lilljeborg (Pl. IX., figs. 3–10).

1888. *Diaptomus serricornis*, Lilljeborg (**53**), p. 157.
1888. ,, *Wierzejskii*, Richard (**52**), p. 45.
1889. ,, ,, De Guerne & Richard (**62**), p. 35, pl. II., figs. 10, 22; pl. III., fig. 5.
1889. ,, *serricornis*, De Guerne & Richard (**62**), p. 37, pl. I., figs. 20, 21, 30.

Smaller and more slender than *D. Castor*, but larger than *D. gracilis*.

Female.—The posterior thoracic angles, seen from above, are rounded, moderately prominent, and furnished with (usually two) small mucrones. The first abdominal segment is broad at the base, and expanded laterally into more or less acuminate triangular processes. Anterior antennæ twenty-five-jointed, and reaching as far back as beyond the middle of the abdomen. Mouth-organs and first four pairs of feet as usual in the genus. Angle of the basal joint of the posterior maxilliped rounded, slightly crenulated, and bearing about six small marginal hairs but no long seta. Inner branch of the fifth foot small, one-jointed, simple, cylindrical, about half as long as the basal joint of the outer branch, bearing at its apex two very minute cilia; outer branch three-jointed; first joint simple, cylindrical; second, large at the base, but contracted distally, forming a stout curved claw, which is minutely ciliated on its concave margin; last joint extremely small, and having two apical setæ, one large and one small, neither of which reaches nearly as far as the apex of the second joint.

Male.—The right (geniculating) anterior antennæ is twenty-two-jointed, the antepenultimate joint bearing a large serrated lateral appendage, which reaches as far as the middle of the following joint, the number of serratures varying from seven to about twelve. Left antenna twenty-five-jointed, and reaching nearly to the extremity of the abdomen. Inner branch of the right fifth foot of moderate size, simple, one-jointed, truncated at the apex, and reaching as far as the apex of the second joint of the outer branch: first joint of the outer branch produced externally into a large acuminate process: terminal claw long, slender, somewhat flexuous or subsigmoid, and having part of the margin very finely (almost imperceptibly) pectinated. Inner branch of the fifth foot of the left side very small; outer branch about twice as long, slender, and terminating in two very slender, subequal, and very finely pectinated setæ. The second joint of the protopodite of the right fifth foot possesses a curious marginal hyaline lamina, communicating, apparently, with the interior of the organ; and the same joint of the left limb has a similar structure of an elongated pyriform shape. Length of the male, 1·6 mm.; female, 1·75 mm.

The description here given differs in some important particulars from that of Prof. Lilljeborg. The anterior antennæ in the Scottish specimens have, in the female, on both sides 25 joints, whereas Lilljeborg states the number of joints at 23: in the male the right attennæ has 22, the left 25 joints; the Russian specimens having respectively 23 and 24 joints. Again, in the male fifth foot of the left side I am unable to find the ciliated nodule described by Lilljeborg, while in the same organ of the female I find the inner branch to be composed of a single joint—not of two, as stated by Lilljeborg: he, however, adds that in imperfectly developed specimens there is only one joint. But notwithstanding these discrepancies I think there can be no doubt that the species referred to are the same.

D. serricornis was taken by Mr. T. Scott, F.L.S., of the Scottish Fishery Board, in Loch Mulloch Corrie, Sutherlandshire, where it occurred in considerable numbers. To his kindness I am indebted for specimens, and for the opportunity of describing

the species. It was also taken many years ago (1867) by my friend Mr. David Robertson, F.L.S., in a pond near the North Loch at Lerwick, N.B., but the capture has remained until now unnoticed in print. Lilljeborg's specimens (*D. serricornis*) were taken in fresh-water lakes at Lumbowski, in Russian Lapland,—peninsula of Kola—on the 11th of August, 1877. The type-specimens of *D. Wierzejskii* were from the neighbourhood of Madrid and Valladolid; and it has more recently been taken abundantly at Zorbig, near Halle, in Saxony, by M. O. Schmeil.

I am quite unable to recognize any valid specific distinction between *D. serricornis*, Lilljeborg, and *D. Wierzejskii*, Richard. The number of serratures on the male antennal appendage is stated to be seven or eight in one form and about twelve in the other, but in the Scottish gatherings the number is very variable. As regards the fifth pair of feet of the male, I find that my drawing made from a Sutherlandshire specimen (Pl. IX., fig. 5) agrees almost exactly, even down to the peculiar shape of the hyaline laminæ, with De Guerne and Richard's figure of the same organ in *D. Wierzejskii*; but the Sutherland specimens have in almost every case only about seven or eight antennal serratures, in this respect agreeing with the typical *D. serricornis*. I have only in one or two cases been able to make out the ciliated bosses described and figured by De Guerne and Richard, as well as in this paper (Pl. IX., figs. 9, 10), but it is extremely difficult to get a good view of these minute structures, the parts of the limb being very apt to become mixed and to overlap one another.

Genus EURYTEMORA, Giesbrecht.

(= *Temorella*, Claus.)

A subdivision of the old genus *Temora*, Baird, was proposed almost simultaneously in 1881 by two authors, Drs. Claus and Giesbrecht, the latter having apparently a slight advantage of priority. Giesbrecht, however, made his divisions sub-generic only, while Claus, retaining the name *Temora* for one group, assigned to his second group the generic name *Temorella*. In

this way the genera *Temora* and *Temorella* of Claus coincide exactly with the sub-genera *Halitemora* and *Eurytemora* of Giesbrecht. The salient characters of the two divisions are expressed in the following table:—

	Halitemora, Giesbrecht. *Temora*, Claus.	*Eurytemora*, Giesbrecht. *Temorella*, Claus.
Right anterior antenna of male	destitute of spines	armed with spines
Distal portion of posterior maxilliped	five-jointed, elongated	four-jointed, feeble
Inner branch of first pair of feet	two-jointed	one-jointed
Fifth pair of feet of female	three-jointed, without a hooked process	four-jointed, having a hooked process
Fifth pair of feet of male	clawed; unlike on the two sides; foot of left side dilated, forcipate	unlike on the two sides; both sides having two-jointed prehensile claws
Serrations of terminal spines of swimming feet	large	small
Fifth thoracic ring	coalescent	free
Habitat	marine only	marine, brackish, and fresh-water

To the first group belong *T. longicornis* (Müller) and *T. armata*, Claus; to the second, *T. velox*, Lilljeborg; *T. inermis*, Boeck; *T. Clausii*, Hoek; *T. affinis*, Poppe; and *T. lacustris*, Poppe.

Quoting from the "Index Bibliographique" of Messrs. De Guerne and Richard, the paper of Dr. Giesbrecht in which he proposes the name *Eurytemora* was published on the 16th of May, 1881. I do not know not precisely the date of publication of Dr. Claus's memoir on "*Temora* and *Temorella*," but inasmuch as it was "read" on the 12th of May, 1881, the date of its publication must necessarily be later than that of Giesbrecht. By virtue of priority, therefore, the generic name *Temorella* must give way to *Eurytemora*; and as it seems to me much better to divide the old genus *Temora* than to adopt Giesbrecht's plan of forming under it two new subgenera, I prefer (with Dr. Claus) to retain for the "*Halitemora*" group the old name *Temora*, adopting *Eurytemora* as the generic name of the remaining species.

The genus *Eurytemora* may be defined as follows:—Head distinct from thorax, conical in front and having a bifid rostrum; fourth and fifth body-segments distinct; the fifth segment in the female produced into pointed alæform processes. Abdomen of the male five-, of the female three-jointed. Anterior antennæ twenty-four-jointed, and bearing a well developed terminal papilla; eighth and ninth joints incompletely separated, in the male hinged between the eighteenth and nineteenth joints. Posterior antennæ and mandibles as usual in the Calanidæ: maxilla and maxillipeds relatively small. Distal portion of the posterior maxilliped four-jointed, short and slender. Inner branch of the first pair of swimming feet one-jointed, of the following pairs two-jointed. Outer branches of the swimming feet in both sexes three-jointed; terminal spines slender and finely serrated. Fifth pair composed of one branch only, in the female four-jointed, in the male unlike on the two sides and ending in two-jointed hooked claws.

1. Eurytemora Clausii, (Hoek) (Pl. XIII., figs. 1–5).

1853. *Cyclopsina lacinulata*, Fischer (**8**), p. 86, pl. II., figs. 4–17, 34.
1853. *Temora velox*, ♀ Lilljeborg (**9**), p. , pl. XX., figs. 2, 7.
1865. ,, ,, Boeck (**21A**), p. 17.
1865. ,, ,, Brady (**22**), p. 38, pl. I., fig. 16; pl. III., figs. 1–11.
1876. ,, *Clausii*, Hoek (**29**), p. 23, pls. IV., V.
1878. ,, *velox*, Brady (**32**), p. 56, pl. VI., figs. 1–5.
1881. ,, *Clausii*, Claus (**36**), p. 9, pl. II., figs. 1–7.
1885. *Temorella Clausii*, Poppe (**43**), p. 180, pl. IV., figs. 1–9.
1888. ,, ,, Nordquist (**51**), p. 59, pl. V., fig. 8; pl. VI., figs. 6–8.
1889. *Eurytemora lacinulata*, De Guerne & Richard (**62**), p. 82, figs. 44, 45.

Last segment of the thorax produced at the posterior angles into hook-shaped alæform processes; caudal rami about four times as long as broad, setæ short, not exceeding the length of the furca. Caudal rami and last abdominal segment densely clothed with short rigid hairs. Anterior antennæ reaching to the posterior extremity of the cephalothorax. Terminal claw

of the right fifth foot in the male not dilated at the base. Penultimate joint of the fifth foot in the female twice as long as the preceding joint, armed with one spine only on its outer margin, its inner margin produced towards the apex so as to form a large dagger-like spine, the base of this spine extending over less than one half of the margin of the joint. Length of the female 1·8 mm.

This species occurs commonly in salt-marsh pools and estuaries, and sometimes in fresh water. It has been recorded from the Neva, near Peterhof (*Fischer*); the Baltic (*Lilljeborg*); Finland, in brackish and fresh water (*Nordquist*); Bremen (*Rehberg*); Leyden (*Hoek*); N.W. Germany, frequent in fresh-water (*Poppe*); Abbeville, fresh-water, and Croisic, brackish (*De Guerne and Richard*).

In Britain I have notes of its occurrences as follows:—In salt-marshes at Hylton (county Durham), Seaton Sluice and Alnmouth (Northumberland), Cumbrae (Firth of Clyde), Pensarn (Merionethshire), in several of the broads of Norfolk and Suffolk; Whittlesea Dyke, Cambridgeshire; and in pools near the river Stour at Manningtree (*G.S.B.*); Higham Park, Essex, fresh-water (*Mr. D. J. Scourfield!*). In brackish pools fully exposed to the rays of the sun it seems to luxuriate, often fairly swarming in such places. The few specimens which I have recorded as being taken in the sea at Sunderland, must, I think, be looked upon as waifs and strays.

It seems to be taken for certain by some authors (Poppe, De Guerne & Richard) that Prof. Lilljeborg's original description of *Temora velox* must have been drawn up from the male of *T. affinis* and the female of *T. Clausii*; and no doubt the drawings given by him of the fifth pair of feet in the two sexes go to support this view. But the characters of these organs seem to be, to a certain extent, inconstant. In a gathering, for instance, of *T. affinis*, from Falmouth, there occur many examples of males which are without the characteristic dilatation of the claw of the fifth foot, while the fifth feet of the females from the same place have the characters of typical *T. affinis*. And, again, the drawing with which I myself illustrated *T. velox* in the North-

umberland and Durham Deep Sea Dredging Report (1865), represents the male fifth pair of feet as in *T. affinis*. These figures were drawn from Hylton specimens, and there are, so far as I can make out, no examples of *T. affinis* in the gathering; nor have I been able, on further search, to find any specimens showing the characters of my drawing. I take it, therefore, that the specimen from which the drawing was made was an exceptional one, and had I at the time recognized its abnormal character it would not have been used; but the same thing may have happened to Prof. Lilljeborg. Further, amongst the Whittlesea specimens are some which have *two* external lateral spines on the female fifth foot—a character usually found only in *T. affinis*. The only unfailing distinctions between the two species seem to be (1) the relative size of the penultimate joint of the female fifth foot and its internal tooth; (2) the length of the anterior antennæ, and (3) the length and proportions of the caudal rami and their setæ. Frequently *T. Clausii* is tinged of a deep vinous red: this I have never seen in *T. affinis*.

2. **Eurytemora affinis**, (S. A. Poppe) (Pl. XIII., figs. 6–9).

1853. *Temora velox*, ♂ Lilljeborg (**9**), p. 177, pl. XIX., figs. 9, 10; pl. XX., fig. 1.
1865. ? ,, *inernis*, Boeck (**21A**), p. 16.
1881. ,, *affinis*, Poppe (**34**), p. 55, pl. III., figs. 1–14.
1881. *Eurytemora hirundo*, Giesbrecht (**35**), p. 4.
1881. *Temorella affinis*, Claus (**36**), p. 10, pl. II., figs. 8–14.
1881. *Eurytemora hirundo*, Giesbrecht (**37**), p. 152, pl. II., figs. 1, 7, 12, 19; pl. III., figs. 3, 10; pl. V., fig. 17; pl. VI., figs. 8, 20; pl. VII., figs. 5, 22; pl. VIII., figs. 21, 39, 40, 43; pl. IX., figs. 1, 31; pl. X., figs. 5, 38; pl. XI., fig. 3.
1884. *Temora affinis*, Herrick (**41**), p. 132, 182, pl. H., figs. 8–16.
1885. *Temorella affinis*, Poppe (**43**), p. 184, pl. VI., figs. 22–28.
1888. ,, ,, var. *hirundoides*, Nordquist (**51**), p. 48, pl. IV., figs. 5, 11; pl. V., fig. 5; pl. VI., fig. 3.
1888. ,, ,, var. *hispida*, Nordquist (**51**), p. 53, pl. V., figs. 1, 6, 7, 10; pl. VI., figs. 4, 5.
1888. ,, ,, Canu (**59A**), p. 13, pl. VII., figs. 1–4.
1889. *Eurytemora affinis*, De Guerne & Richard (**62**), p. 84, figs. 46, 47.

Posterior margin of the last thoracic segment produced backwards, and forming two large acutely angulated cusps. Caudal rami and last abdominal segment densely hispid; rami about seven times as long as broad; principal caudal setæ more than half as long as the abdomen, very flaccid and finely plumose; attachment of the lateral setæ distant from the apex about one third the length of the ramus; anterior antennæ reaching to the penultimate thoracic segment. Penultimate joint of the fifth pair of feet in the *female* scarcely longer than the preceding joint, produced inwardly and forming a large dagger-like spine which occupies the whole internal margin of the joint; external margin supporting two slender spines, and sometimes a third much smaller one. The fifth pair of feet in the *male* is not much unlike that of *T. Clausii*, but the terminal claw of the right side is dilated and bulbous at the base. Length 1·3 mm.

Eurytemora affinis appears to be a very widely distributed species, and sometimes occurs in immense profusion, constituting, it is said, at some seasons the almost exclusive food of certain fishes, as of the Shad in the Rhine and the Herring in the Baltic. Poppe has found it in many places in North Germany, both in fresh and brackish water. Nordquist records either the type or the varieties described by him under the names *hirundoides* and *hispida* from Helsingsfors in the Gulf of Finland, and from near Abo, at the entrance of the Gulf of Bothnia. M. Gadeau de Kerville has taken it in the Estuary of the Seine, and Herrick records a form either identical with or closely allied to *E. affinis* from the coast of Alabama.

In England *E. affinis* seems to be less common than the preceding species *E. Clausii*, but occurs in precisely similar localities. I have taken it in pools near Hartlepool Slake, county Durham; at Burgh Marsh, near Carlisle; and Beaulieu Lake, Hants. The Rev. Dr. Norman has sent me specimens from Swan Pool, Falmouth; and Mr. Thomas Scott has taken it in the surface-net in the Firth of Forth, near Alloa. My friend Mr. Isaac C. Thompson, F.L.S., of Liverpool, tells me that he found it plentifully in tow-net gatherings from the river Mersey in 1886, but has not taken it again until the present season

(1891), when he found the filter-beds of the marine baths at Bootle—close to the first-mentioned locality—swarming with it.

Genus ACARTIA, Dana.

1. Acartia longiremis, Lilljeborg (Pl. XIV., figs. 1–4).

1853. *Dias longiremis*, Lilljeborg (**9**), p. 181, pl. XXIV., figs. 1–13.
1863. ,, ,, Claus (**18**), p. 193, pl. XXXIII., figs. 6–14.
1878. ,, ,, Brady (**32**), p. 51, pl. V.
1881. ,, ,, Giesbrecht (**37**), p. 146; *idem* (**35**), p. 3.
1881. ,, *bifilosus*, Giesbrecht (**37**), p. 147; *idem* (**35**), p. 3.
1881. ,, ? *discaudatus*, Giesbrecht (**37**), p. 148; *idem* (**35**), p. 3.
1887. ,, ? ,, I. C. Thompson (**50B**), p. 36, pl. V., figs. 1–6.
1890. ,, *longiremis*, Bourne (**64**), p. 147, pl. XI., figs. 4–6.

It has been proposed by Dr. W. Giesbrecht to break up the forms hitherto considered as belonging to *Dias longiremis*, Lilljeborg, into two, or perhaps three, distinct species:—*D. longiremis* (restricted form), *D. bifilosus*, Giesbrecht, and *D. discaudatus*, Giesbrecht. The last-named may or may not be considered as having been previously included under the old term *longiremis*. The characters relied upon by Giesbrecht to uphold this separation are as follows:—

	longiremis.	*bifilosus.*	*discaudatus.*
Frontal filaments	absent	two	absent
Last thoracic segment	armed with two large & several smaller spines	unarmed	unarmed
Furca	long	short	short and (in the female) dilated
Fifth pair of feet (male)	small	large	very large
Fifth pair of feet (female)	large	small	very small

To me it appears that these characters—trivial even when displayed to the best advantage on paper—are of even less account when put to a practical test, their inconstancy even more than their intrinsic triviality being fatal to their acceptance as

good specific marks. *First*, as regards the frontal filaments, which are relied upon as furnishing an important character, and even a name, to *D. bifilosus*. These organs are apparently merely the segments of a bifid, very finely divided rostrum: they are so extremely slender as to be (in spirit specimens, at any rate) often very difficult to see, and though in some few of the Burgh Marsh specimens I have succeeded in finding them, in most cases I quite failed to do so, and believe that they are usually absent, though in other respects the specimens from that locality entirely agree with *D. bifilosus*. Claus and Boeck, however, notice the occurrence of frontal filaments in "*D. longiremis*, Lilljeborg." *Secondly*, The spines of the last thoracic segment of (the restricted) *longiremis* are rarely (never, in my experience) developed so largely as represented by Giesbrecht; usually they are so small as to be very easily overlooked. *Thirdly*, The proportions of the furca are certainly very variable, and even in extreme forms (except in *discaudatus*) are not well enough marked to be of much diagnostic service. *Fourthly*, The diversity of size in the fifth feet of the two sexes cannot be looked upon as of much moment, and the differences of form of those organs in the three species are certainly by no means well marked. I therefore think that the two forms *bifilosus* and *discaudatus*, though presenting characters of very great interest, should be looked upon as races or varieties of the original type and not as separate species. And a nomenclature which retains such forms as varieties in direct connection with a central type, so preserving the idea of relationship and evolution, is not only truer to the actual facts, but adds a distinct and vivifying interest to the mere dry bones of classification.

I have no note of the occurrence of any species of *Acartia* in fresh or brackish water except in one locality, Burgh Marsh, Cumberland, where I took the *bifilosus* form abundantly many years ago. *Eurytemora affinis* occurred in the same pools and in equal abundance.

The generic name *Acartia* was proposed by Dana in 1846, and was undoubtedly meant to cover the forms more lately assigned by Prof. Lilljeborg to the genus *Dias*. Having the claim of

priority, the term *Acartia* ought to be adopted in place of *Dias*.

The drawings in Plate XIV. were made from specimens taken at Burgh Marsh.

Bibliographical Index.

The following list comprises most of the more important published works dealing with the subjects of this memoir:—

1. 1785. Muller, O. F., Entomostraca seu insecta testacea, quae in aquis Daniæ et Norvegiæ reperit, descripsit et iconibus illustravit.
2. 1806. Ferussac, Daudebert de, Mémoire sur deux nouvelles Espèces d' Entomostracés et d' Hydrachnes (*Cyclops Mülleri* et *Cypris reniformis*). (*Ann. Mus. Hist. Nat., VII.*)
3. 1820. Jurine, L., Histoire des Monocles qui se trouvent aux environs de Genève.
4. 1835-41. Koch, C. L., Deutschlands Crustaceen, Myriapoden, und Arachniden, etc.
5. 1846. Loven, S., Fyra ruga Arter af Sötvattens-Crustacéer från södra Afrika. (*Kong. Vet. Akad. Handling.* 1846.)
6. 1848-49. Nicolet, Crustaceos in Gay, C. Historia fisica y politica de Chile, etc. (*Zoologia, III.*)
7. 1850. Baird, W., Natural History of the British Entomostraca. (*Ray Society.*)
8. 1851-53. Fischer, S., Beiträge zur Kenntniss der in der Umgegend von St. Petersburg sich findenden Cyclopiden (und Fortsetzung). (*Bull. Soc. imp. Moscou.* 1851. 1853.)
9. 1853. Lilljeborg, W., De Crustaceis ex ordinibus tribus; Cladocera, Ostracoda, ét Copepoda in Scaniá occurrentibus.
10. 1855. Dana, J., Crustacea of the United States Exploring Expedition.
11. 1855. King, R. L., On Australian Entomostraca. (*Papers and Proceedings of the Royal Society of Van Diemen's Land, III.*)
12. 1856. Fischer, S., Branchiopoden und Entomostraceen, *in Middendorff*, Reise in den aussersten Norden und osten Siberiens Während der Jahre 1843 und 1844, etc.
13. 1857. Claus, C., Das Genus *Cyclops*, u.s. einheimische Arten. (*Weigmanns Archiv.*, 1857.)
14. 1857. Claus, C., Weitere Mittheil. über d. einh. Cyclopiden. (*Ibid.*)

15. 1858. Claus, C., Beiträge zur Anat. u. Entw. d. Cyclopiden. (*Ibid.*, 1858.)

16. 1859. Baird, W., Description of several species of Entomostracous Crustacea from Jerusalem. (*Ann. and Mag. Nat. Hist., IV.*)

16a. 1860. Fischer, S., Beiträge zur Kenntniss der Entomostracen. (*Abhandl. der Konig. Bayer. Akad. der Wissenschaft, VIII.*)

17. 1862. Lilljeborg, W., Beskrifning öfver twa arter Crustaceen of ordnigarna Ostracoda och Copepoda. (*Ofvers. af K. Vet. Akad. Forhandl., XIX.*)

18. 1863. Claus, C., Die frei lebenden Copepoden mit besonderer Berücksichtigung der Fauna deutschlands, der Nordsee und des Mittelmeeres.

19. 1863. Lubbock, J., Notes on some new or little-known species of Freshwater Entomostraca. (*Trans. Linn. Soc., Lond., XXIV.*)

20. 1863. Sars, G. O., Oversigt af de indenlandske Ferskvandscopepoder. (*Videnskabsselsk. Forhandl.*, 1862.)

21. 1864. Sars, G. O., Indberetning om en i Pommeren 1862–1863 foretagen Zoologisk Reise in Christianias og Throndhjems Stifter. (*Nye. Magaz. for Naturvidensk, XII.*)

21a. 1865. Boeck, A., Oversigt over de ved Norges Kyster iagttagne Copepoder, henhorende til Calanidernes, Cyclopidernes, og Harpactidernes familier. (*Forhandl. Videns. Selsk., Christiania*, 1864.)

22. 1865. Brady, G. S., Reports of Deep-Sea Dredging on the Coasts of Northumberland and Durham. Pelagic Entomostraca. (*Nat. Hist. Trans. Northumberland and Durham, I.*)

22a. 1868. Brady, G. S., On the Crustacean Fauna of the Salt Marshes of Northumberland and Durham. (*Nat. Hist. Trans Northumberland and Durham, Vol. III.*)

23. 1871. Heller, C., Untersuchungen über die Crustaceen Tirols. (*Bericht. des Med-naturwissensch. Ver. in Innsbruck*)

24. 1872. Fric, A., Die Krustenthiere Böhmens.

25. 1873. Marenzeller, E., von, — Ueber *Diaptomus amblyodon*. (*Verhandl. K. K. Zool. bot. Gesellsch. Wien.* XXII.)

26. 1874. Poggenpol, M. J., List of the Copepoda, Cladocera, and Ostracoda of the Environs of Moscow.† (In Russian.)

† A translation of the descriptions of species of *Cyclops* contained in this Memoir was given by Mr. Cragin in the Transactions of the Kansas Academy of Science Vol. VIII. 1883.

27. 1874. Uljanin, W. N., Cladocera and Copepoda of some Lakes of Central Russia. (In Russian.)

28. 1875. Uljanin, W. N., Crustacea of Turkestan. Part I. (*Reise in Turkestan von Alexis Fedtschenko.*) (In Russian.)

29. 1876. Hoek, P. P. C., De Vrijlevende Zoetwater-Copepoden der Nederlandsche Fauna. (*Tijdsch. d. Nederl. Dierkund., Vereenig III.*)

30. 1876. Forbes, S. A., List of Illinois Crustacea. (*Bull. Illinois Mus. Nat. Hist., No.* 1.)

31. 1878. Gruber, A., Über Zwei Süsswasser-Calaniden. (*Promotionsschrift, Leipzig.*)

32. 1878. Brady, G. S., A Monograph of the free and semi-parasitic Copepoda of the British Islands. Vol. I. (*Ray Society.*)

33. 1880. Rehberg, H., Beitrag zur Kenntniss der freilebenden Süsswasser-Copepoden. (*Abhandl. Naturw. Ver. Bremen, VI.*)

34. 1881. Poppe, S. A., Ueber Eine neue Art der Calaniden-Gattung *Temora*, Baird. (*Abhandl. des Naturw. Ver. Bremen, VII.*)

35. 1881. Giesbrecht, W., Vorläufige Mittheilung ans einer Arbeit über die freilebenden Copepoden des Kieler Hafens. (*Zool. Anzéiger, No.* 83.)

36. 1881. Claus, C., Über die Gattungen *Temora* und *Temorella* nebst den zugehörigen Arten. (*Sitz. der K. Akad. der Wissensch. LXXXVIII.*)

37. 1881. Giesbrecht, W., Die freilebenden Copepoden der Kieler Foehrde. (*Bericht der Commission der untersuch. der deutsch. Meere in Kiel. VII.*)

38. 1882. Forbes, S. A., On some Entomostraca of Lake Michigan and adjacent waters. (*American Naturalist. XVI.*)

38A. 1882. Herrick, C. L., Cyclopidæ of Minnesota, with Notes on other Copepoda. (*Tenth Annual Report of the Geological and Natural History Survey of Minnesota.*)

38B. 1882. Wierzejski, A., Materyjaly do fauny jesior tatrzanskich. (*Spraw. Komis. fizyjogr. Krakowie, XVI.*, 1881.)

39. 1883. Thomson, G. M., On New Zealand Copepoda. (*Trans. and Proc. New Zealand Instit., XV.*)

40. 1883. Cragin, F. W., A Contribution to the History of the Freshwater Copepoda. (*Trans. Kansas Acad. Sci., Vol. VIII.*)

41. 1884. Herrick, C. L., A Final Report on the Crustacea of Minnesota included in the orders Cladocera and Copepoda. (*Twelfth Annual Report of the Geological and Natural History Survey of Minnesota.*)

42. 1884. HARTOG, M. M., The Morphology of *Cyclops* and the relations of the *Copepoda*. (*Trans. Linn. Soc., Lond., Series 2, Zoology, Vol. V.*)

42A. 1885. KOELBEL, C., Carcinologische, Sitz. d. k. k. Akad. Wissensch. Wien, XIX.

43. 1885. POPPE, S. A., Die freilebenden Copepoden des Jadebusens. (*Abhandl. Naturwissch. Ver. Zu Bremen, IX.*)

44. 1885. DADAY, JENO, Monographia Eucopepodorum liberorum in Hungaria hucusque repertorum. (*A. M. tud. Akadémia altal a Vitéz-alapból*, 1882.)

45. 1886. POPPE, S. A., Ein neuer *Diaptomus* aus dem Hirschberger Thal. (*Ergebnisse einer rool. Exkurs. in das Glatzer-Iser und Reisengebirge.*)

46. 1886. BRADY, G. S., Notes on Entomostraca collected by Mr. A. Haly in Ceylon. (*Journ. Linn. Soc., Lond., Zool, XIX.*)

46A. 1886. VOSSELER, J., Die freilebenden Copepoden Württembergs und angrenzender Gegenden. (*Inaugural-Dissertation der hohen Naturwissenschaftlichen Fakultät der Universität Tübingen.*)

47. 1886. NORDQUIST, O., Bidrag till Kännedomen om Crustacéfaunan i nägra af mellersta Finlands sjöar. (*Acta Societatis pro fauna et flora feunica, t. III., No. 2.*)

48. 1887. POPPE, S. A., Beschreibung einiger neuer Entomostraken aus norddeutschen Seen. (*Zeitschr. fur Wissensch., Zool, XLV.*)

49. 1887. RICHARD, J., Liste des Cladocères et des Copépodes d'eau douce observés en France. (*Bull. de la Soc. Zool. de France, XII.*)

50. 1887. LILLJEBORG, W., On the Entomostraca collected by Mr. Leonhard Stejneger on Bering Island, 1882-83. (*Proc. U.S. National Museum.*)

50A. 1887. WIERZEJSKI, A. O., Krajowych skorupiaksach zrodziny Calanidæ. (*Nozgrawn i Spraw. Wydz. matem. przyr. Akad. Unnej., XVI.*)

50B. 1887. THOMPSON, I. C., On some Copepoda new to Britain. (*Proceedings of the Liverpool Biological Society, Vol. I.*)

51. 1888. NORDQUIST, O., Die Calaniden Finlands. (*Bidr. till Känned. af Finlands Natur och Folk, heft 47. Finks. Vet. Soc., Helsingfors.*)

52. 1888. RICHARD, J., Entomostracés nouveaux ou peu connus (*Bull. de la Soc. Zool. de France, XIII.*)

53. 1888. Liljeborg, W., Description de deux espèces nouvelles de *Diaptomus* du Nord de l'Europe. (*Bull. Soc. Zool. de France, XIII.*)

54. 1888. Poppe, S. A., Diagnoses de deux espèces nouvelles du genre *Diaptomus*, Westwood. (*Ibid., XIII.*)

55. 1888. De Guerne, J., et Richard, J., Diagnoses de deux *Diaptomus* nouveaux d' Algerie. (*Ibid., XIII.*)

56. 1888. De Guerne, J., et Richard, J., Sur la distribution géographique du genre *Diaptomus*. (*Compt. rend. Acad. Sc., Paris.*)

57. 1888. Richard, J., Cladocères et Copépodes non marins de la faune française. (*Reveu scientifiques du Bourbonnais*).

58. 1888. Brady, G. S., Description of a new species of *Cyclops*. (*Sixth Annual Report of the Fishery Board for Scotland.*)

59. 1888. Scott, T., A Revised List of the Crustacea of the Firth of Forth. (*Sixth Annual Report of the Fishery Board for Scotland.*)

59A. 1888. Canu, E., Les copépodes libres marins du Boulonnais. (*Bullet. scient. de la France et de la Belgique, No.* 1.)

60. 1889. De Guerne, J., et Richard, J., Note sur les Entomostracés d'eau douce recueillis par M. Charles Rabot dans la province de Nordland Norvège septentrionale. (*Bull. Soc. Zool. de France, XIV.*)

60A. 1889. Vosseler, J., Die Copepodenfauna der Eifelmaare (*Archiv.* f. Naturgesch. 1889).

61. 1890. Poppe, S. A., Notizen zur Fauna der Süsswasser-Becken des Nordwestlichen Deutschland mit besonderer Berücksichtigung der Crustaceen. (*Abh. Natur. Ver. Bremen, X.*)

62. 1889. De Guerne, J., et Richard, J., Revision des Calanides d'eau douce. (*Mémoires de la Société Zoologique de France, Vol. II.*)

63. 1890. Richard, J., Sur les Entomostracés et quelques autres animaux inférieures des lacs de l'Auvergne. (*Revue des Sciences naturelles appliquées.*)

64. 1890. Bourne, G. C., Report on the Pelagic Copepoda collected at Plymouth in 1888-89. (*Journal of the Marine Biological Association, Vol. I.*)

65. 1891. Poppe, S. A., Ein neue Diaptomus aus Brasilien. (*Zoologischen Anzeigers, No.* 368.)

66. 1891. Schmeil, O., Beiträge zur Kenntniss der Süsswasser-Copepoden Deutschlands mit besonderer Berücksichtigung der Cyclopiden. (*Inaugural-dissertation der hoh. phil. facult. der Univ. Leipzig.*)

EXPLANATION OF PLATES.

PLATE I.

CYCLOPS ELONGATUS.

Fig. 1. Female seen from above × 60.
2. Anterior antenna.
3. Labrum.
4. Maxilliped of second pair.
5. Foot of fifth pair.

CYCLOPS VICINUS.

6. Male seen from above × 40.
7. Labrum.
8. Foot of fifth pair.
9. Vulvar openings.

PLATE II.

CYCLOPS STRENUUS.

Fig. 1. Female seen from above × 80.
2. Posterior antenna.
3. Maxilliped of second pair.
4. Foot of fifth pair.

CYCLOPS SIGNATUS.

5. Female seen from above × 40.

PLATE III.

CYCLOPS ABYSSORUM.

Fig. 1. Female seen from above × 50.
2. Anterior antenna.
3. Posterior antenna.
4. Labrum.
5. Foot of first pair.
6. ,, second pair—outer branch.
7. ,, third pair.
8. ,, fourth pair.
9. ,, fifth pair.

PLATE IV.

CYCLOPS SCOURFIELDI.

Fig. 1. Female seen from above × 80.
2. Posterior antenna.
3. Maxilliped of first pair.
4. ,, second pair.

5. Foot of first pair.
6. Second and third feet—last joint of inner branch.
7. Foot of fourth pair.
8. ,, fifth pair.

Plate V.

Cyclops bicuspidatus.

Fig. 1. Female seen from above × 80.
2. Maxilliped of first pair.
3. Foot of first pair.
4. ,, fourth pair.
5. ,, fifth pair.

Cyclops viridis.

6. Female seen from above × 38.
7. Labrum.
8. Foot of first pair (male).
9. ,, fifth pair.
10. Appendage of first abdominal segment (male).

Plate VI.

Cyclops Thomasi.

Fig. 1. Female seen from above × 80.
2. Foot of first pair.
3. ,, fourth pair.
4. ,, fifth pair.

Cyclops insignis.

5. Female seen from above × 95.

Cyclops Scourfieldi, var.

6. Anterior antenna of female.
7. Foot of fourth pair.
8. ,, fifth pair.

Plate VII.

Cyclops serrulatus.

Fig. 1. Female seen from above × 53.

Cyclops macrurus.

2. Female seen from above × 53.

Cyclops Kaufmanni.

3. Female seen from above × 53.

CYCLOPS EWARTI.

4. Male seen from side × 54.
5. Anterior antenna of female.
6. Foot of fifth pair.
7. Abdomen of female.

PLATE VIII.

CYCLOPS AFFINIS.

Fig. 1. Female seen from above × 105 (Duddingston Loch.)
2. ,, ,, × 100 (Yetholm Loch).
3. Anterior antenna.
4. Foot of first pair.
5. ,, third pair.
6. ,, fourth pair.

PLATE IX.

CYCLOPS FIMBRIATUS (= CRASSICORNIS).

Fig. 1. Female seen from above × 80.

CYCLOPS PHALERATUS.

2. Female seen from above × 80.

DIAPTOMUS SERRICORNIS.

3. Last three joints of anterior antenna of male.
4. Distal angle of basal joint of posterior maxilliped.
5. Fifth pair of feet of male.
6. ,, ,, of female.
7. Posterior thoracic lobules and first abdominal segment (female).
(Figs. 3–7 drawn from Loch Mulloch Corrie specimens.)
8. Right antennal appendage of male.
9. Inner branch, right fifth foot of male.
10. ,, ,, ciliated appendages, more highly magnified.
(Figs. 8–10 drawn from Lerwick specimens.)

PLATE X.

CYCLOPS ŒQUOREUS.

Fig. 1. Female seen from above × 136.

DIAPTOMUS HIRCUS.

2. Foot of fifth pair of female.
3. ,, ,, of male.
4. Right antennal appendage of male.

CYCLOPS LONGICAUDATUS.

5. Female seen from above × 80.
6. Anterior antenna of female.
7. One of the swimming feet.

Plate XI.

Diaptomus Castor.

Fig. 1. Female seen from above × 40.
2. Last three joints of right anterior antenna of male.
3. Distal end of basal joint of posterior maxilliped.
4. Foot of fifth pair of female.
5. ,, ,, of male.
6. ,, ,, extremity of left outer branch, more highly magnified.

Diaptomus gracilis.

7. Abdomen and posterior thoracic angles (Wanstead Park).
8. Basal joint of posterior maxilliped.
9. Fifth pair of feet of male (Talkin Tarn).
   a. Setiferous papilla.

Plate XII.

Diaptomus gracilis.

Fig. 1. Female seen from above × 80 (Coniston).
2. Last three joints of right anterior antenna of male (Floutern Tarn).
3. ,, ,, ,, (Talkin Tarn).
4. ,, ,, ,, (Lough Neagh & Wanstead Park).
5. Fifth pair of feet of female (Wanstead Park).
6. ,, ,, of female (Talkin Tarn).
7. ,, ,, of male (Wanstead Park).
8. Last thoracic segment and abdomen of male.

Plate XIII.

Eurytemora Clausii.

Fig. 1. Female seen from above × 55.
2. Apical joints of right anterior antenna of male
3. Foot of fifth pair of male—left.
4. ,, ,, ,, —right.
5. ,, ,, of female.

Eurytemora affinis.

6. Female seen from left side × 55.
7. Abdomen and last thoracic segment of female.
8. Fifth pair of feet of male.
9. Foot of fifth pair of female.

PLATE XIV.

ACARTIA LONGIREMIS, var. *bifilosus*.

Fig. 1. Abdomen of male.
2. Foot of fifth pair—female.
3. Fifth pair of feet—male.
4. Frontal tentacle.

DIAPTOMUS SANCTI-PATRICII.

5. Fifth foot of female.
6. ,, of right side—male.
7. ,, of left ,, ,,
8. Apical joints of the same—more highly magnified.

DIAPTOMUS BACILLIFER.

9. Female seen from above × 40.
10. Last three joints of right antenna of male.
11. Angle of last thoracic, and side of first abdominal, segment.
12. Fifth foot of female.
13. Fifth pair of feet of male.

(Figs. 10 and 13 are after De Guerne and Richard.)

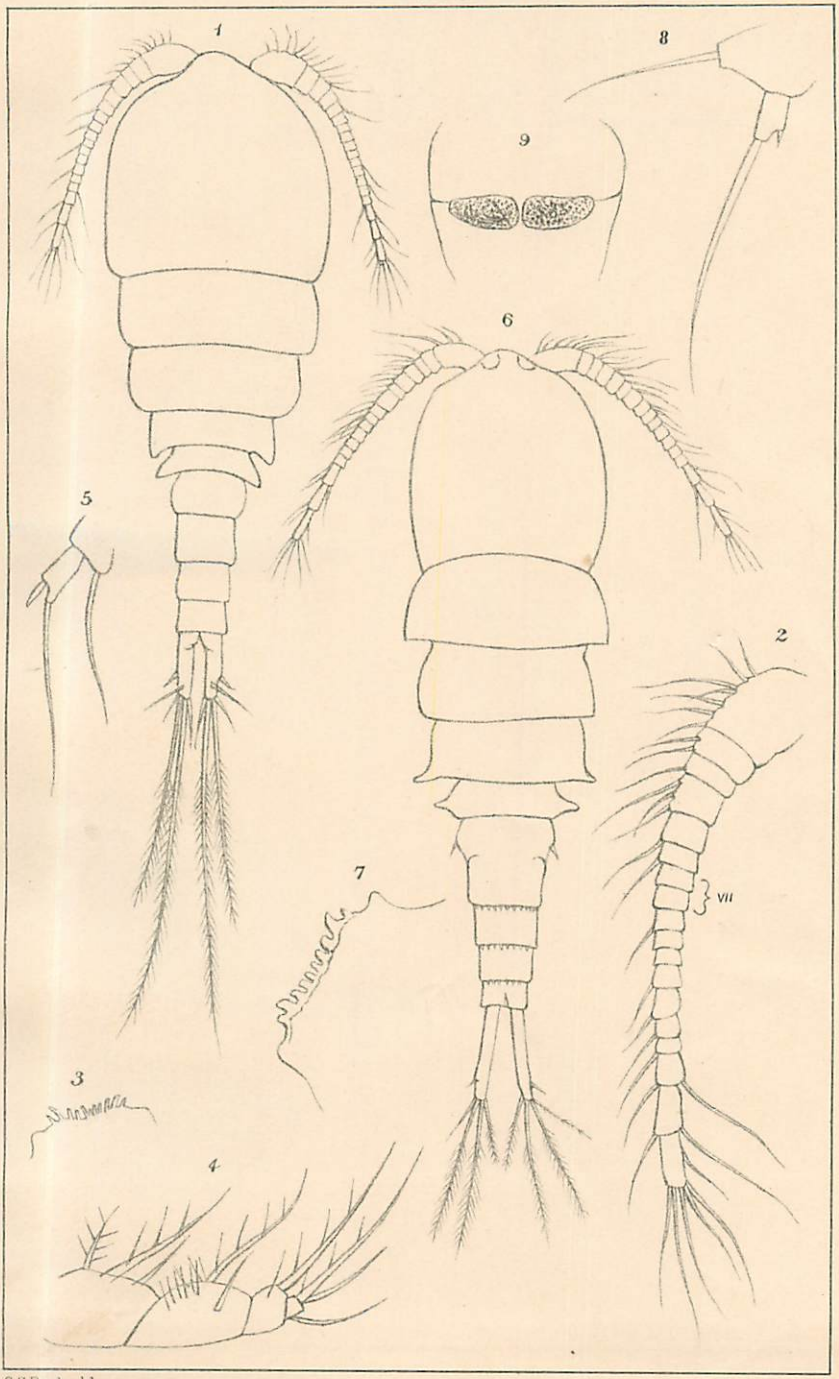
ERRATA.

p. 10, line 9, read Cyclops Scourfieldi, G. S. Brady (Pl. IV; Pl. VI., figs. 6–8).

p. 10, line 10, read *Cyclops Luckartii* (20) p. 30 (not *C. Luckarti* Claus).

Plate IX., fig. 1. C. for CRASSICORNIS read C. FIMBRIATUS.

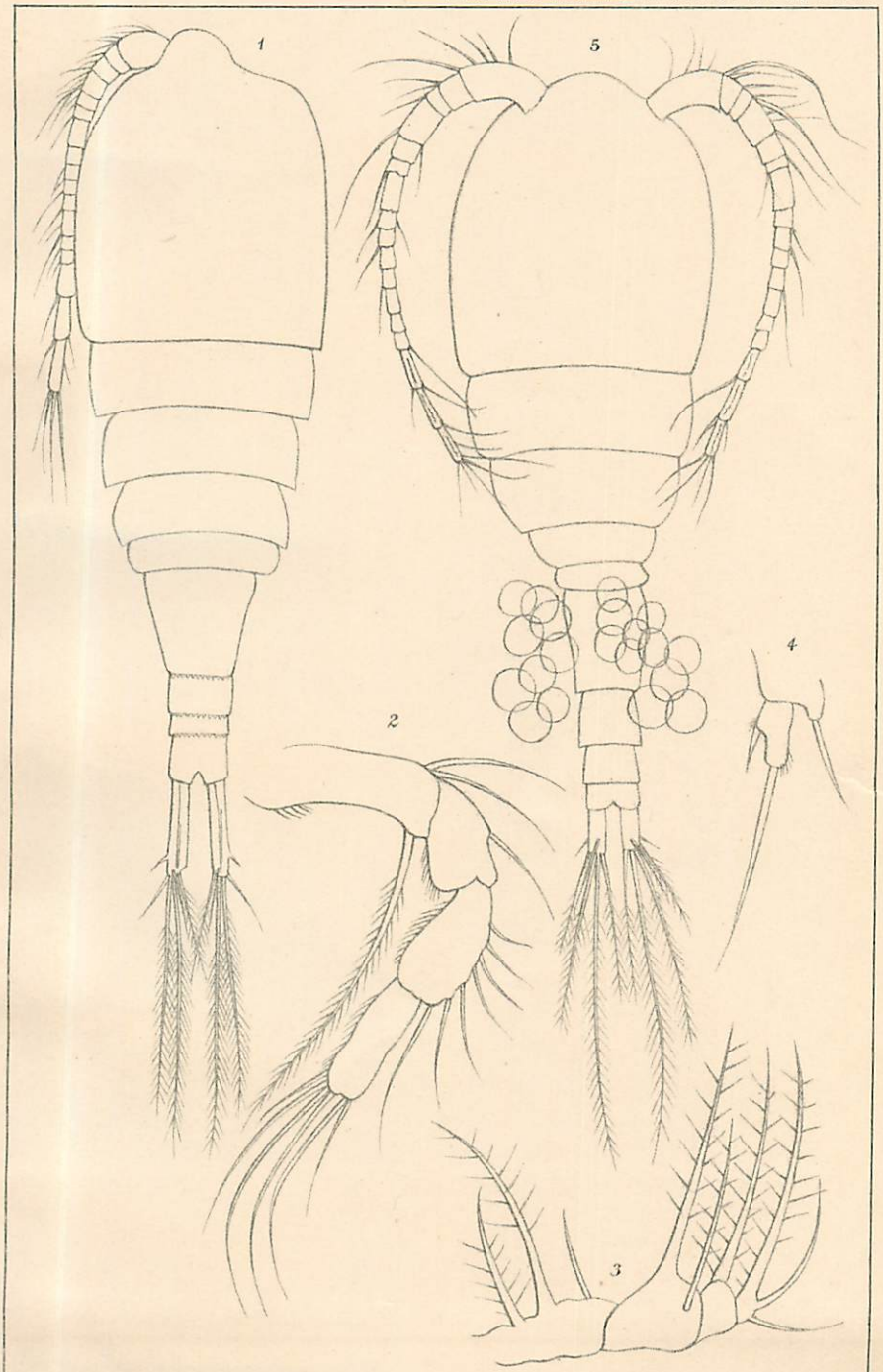
PRINTED BY J. BELL AND CO., RAILWAY LANE, PILGRIM STREET, NEWCASTLE-ON-TYNE.



G.S.Brady del.

Geo West & Sons lith et imp.

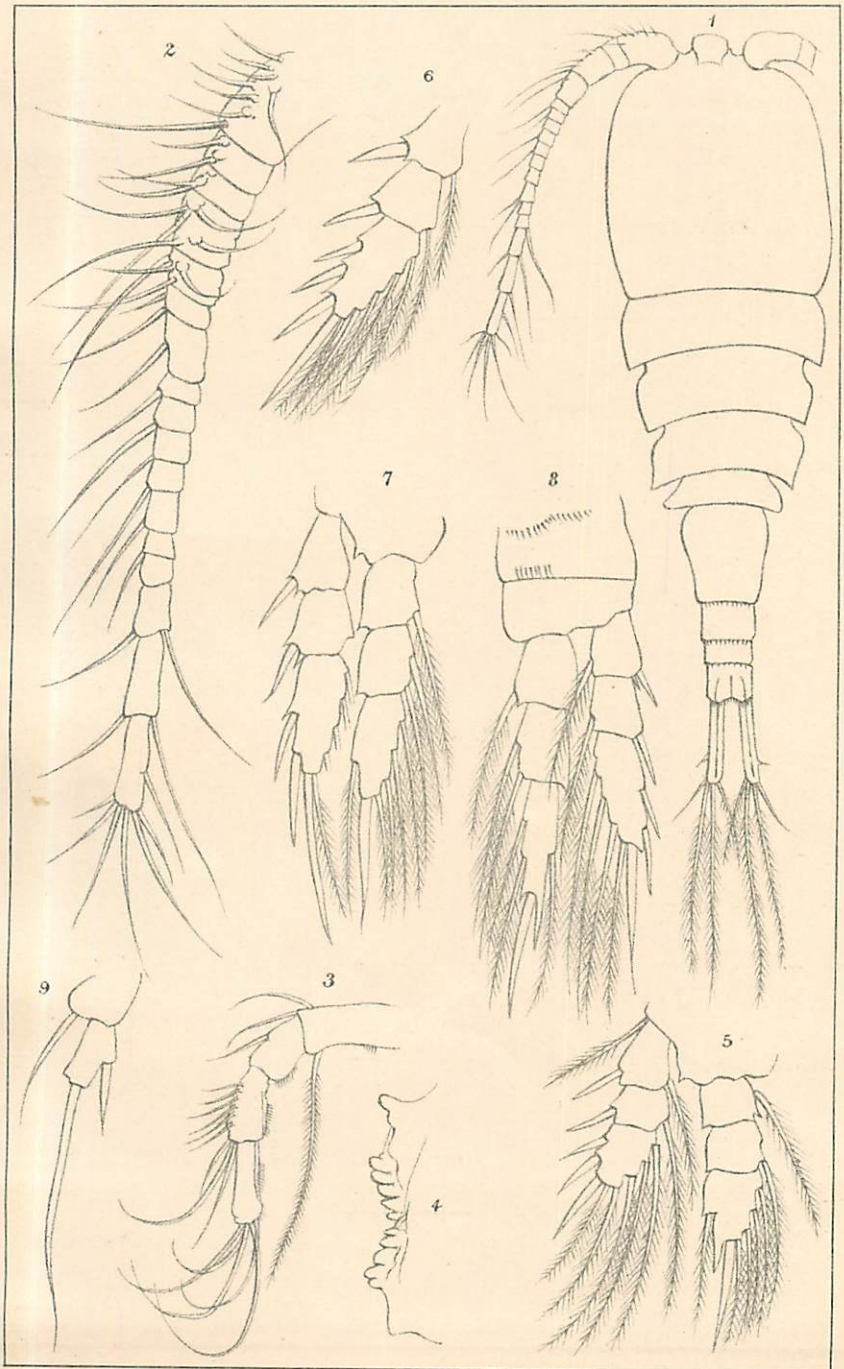
Figs 1–5. CYCLOPS ELONGATUS
6–9. " VICINUS.



G.S.Brady del.

Geo. West & Sons lith et imp.

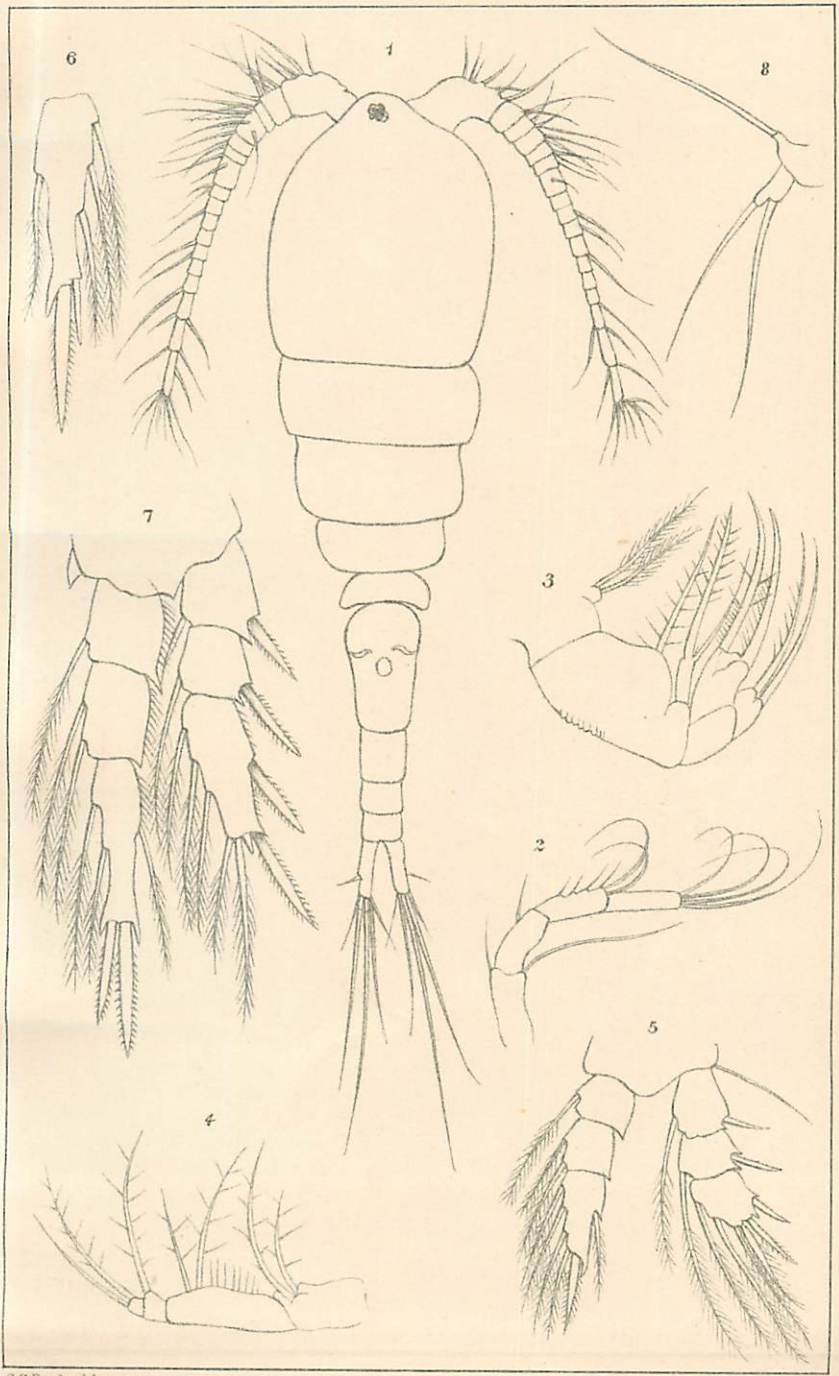
Figs 1-4. CYCLOPS STRENUUS



G.S.Brady del.

Geo West & Sons lith et imp.

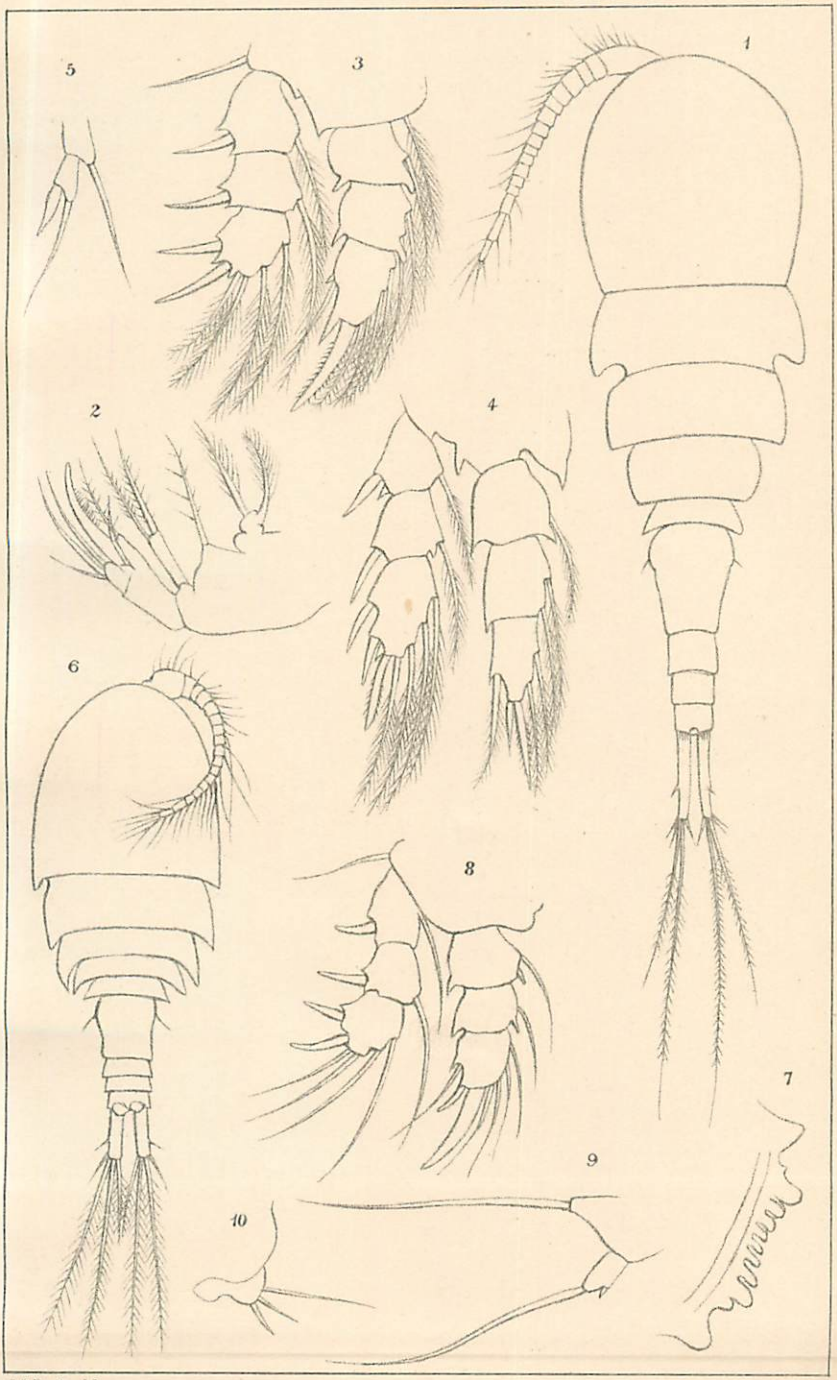
CYCLOPS ABYSSORUM.



G.S.Brady del.

Geo West & Sons lith.et imp.

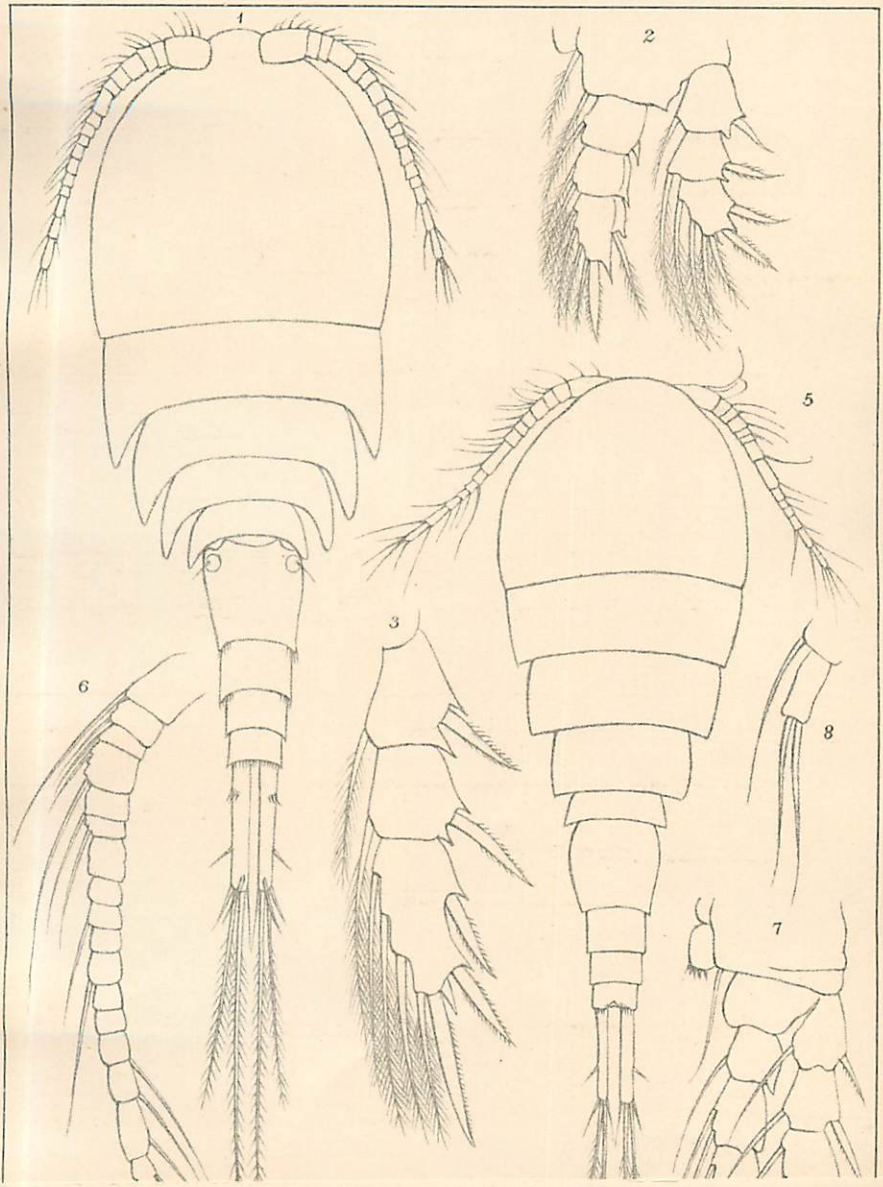
CYCLOPS SCOURFIELDI.

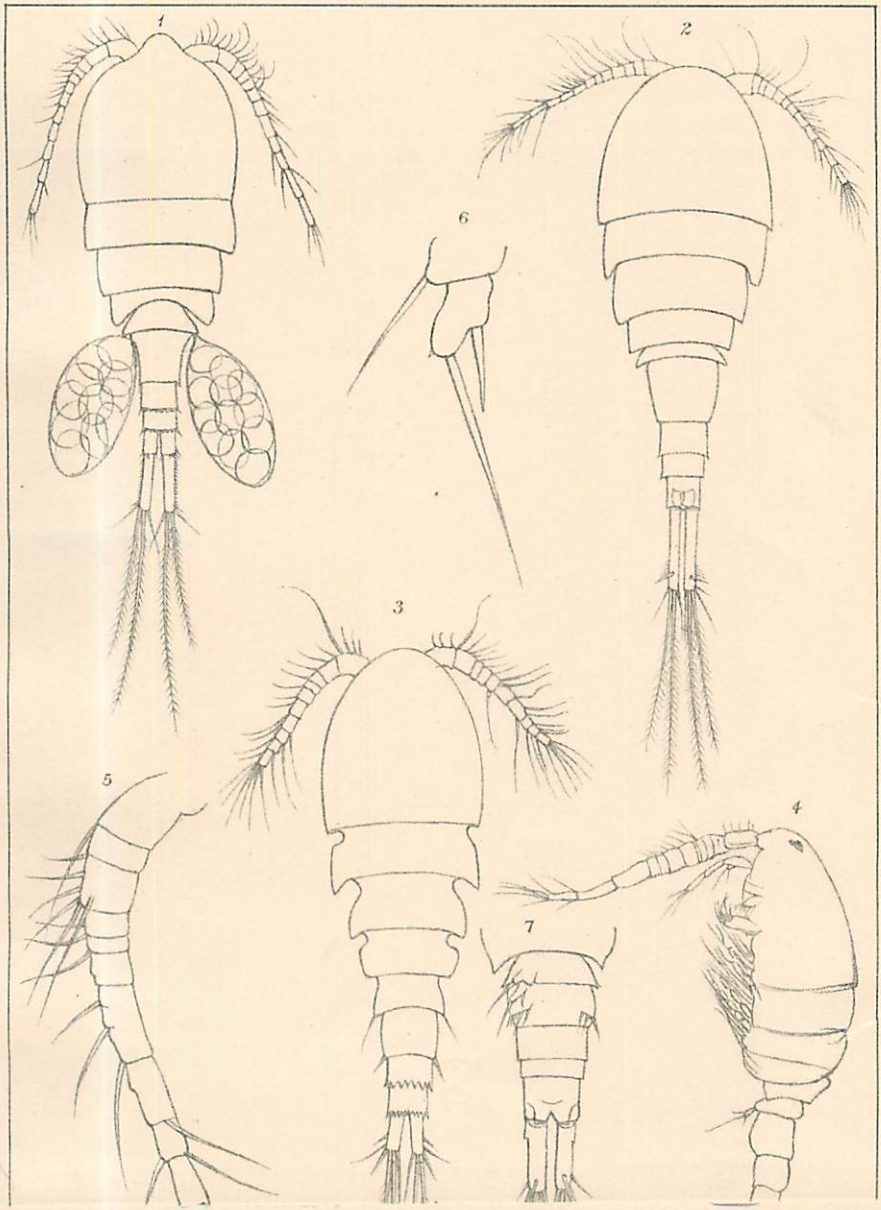


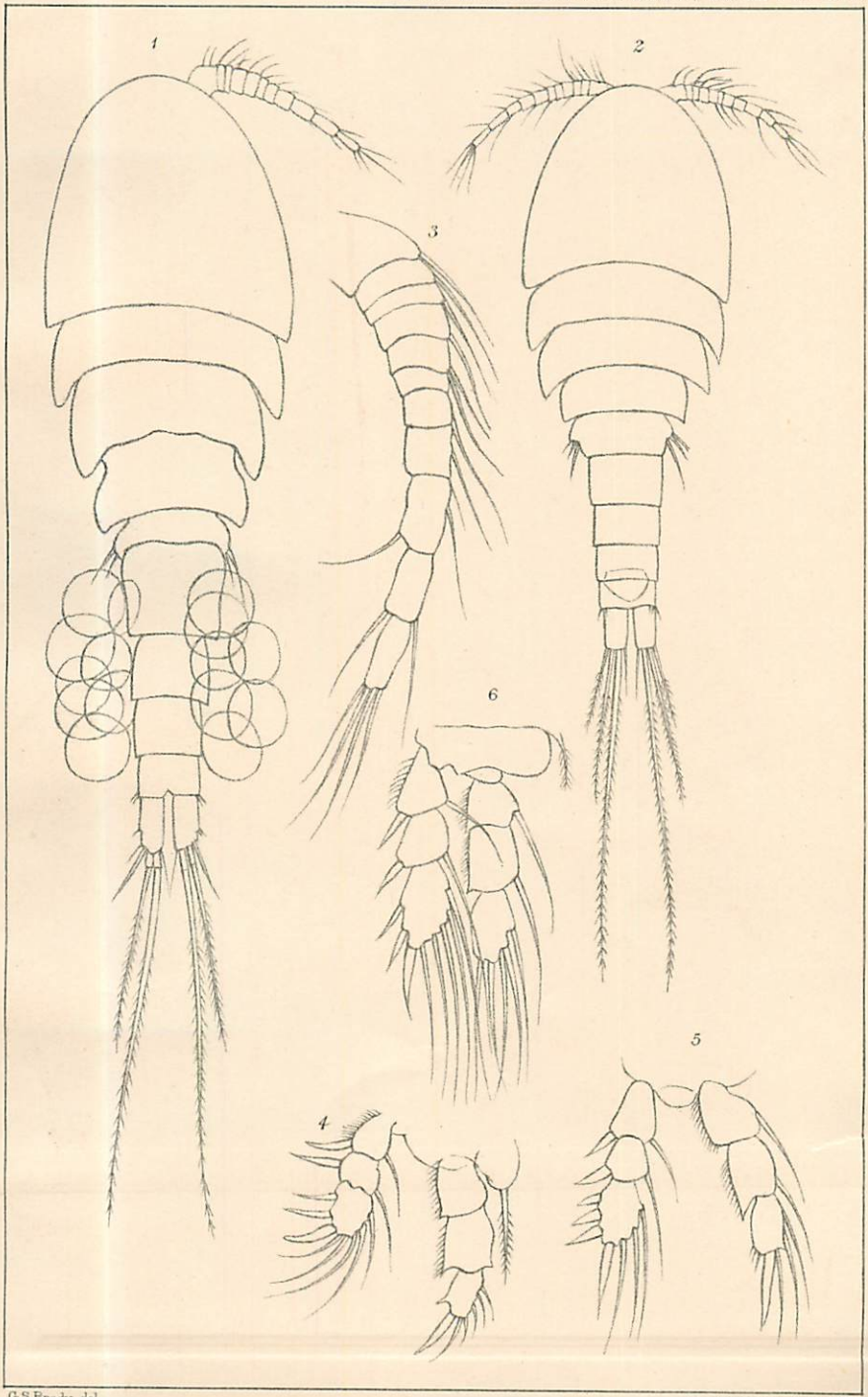
G.S.Brady del.

Geo West & Sons, lith et imp.

Figs 1–5. CYCLOPS BICUSPIDATUS
6–10. " VIRIDIS.


1
2
5
3
6
8
7

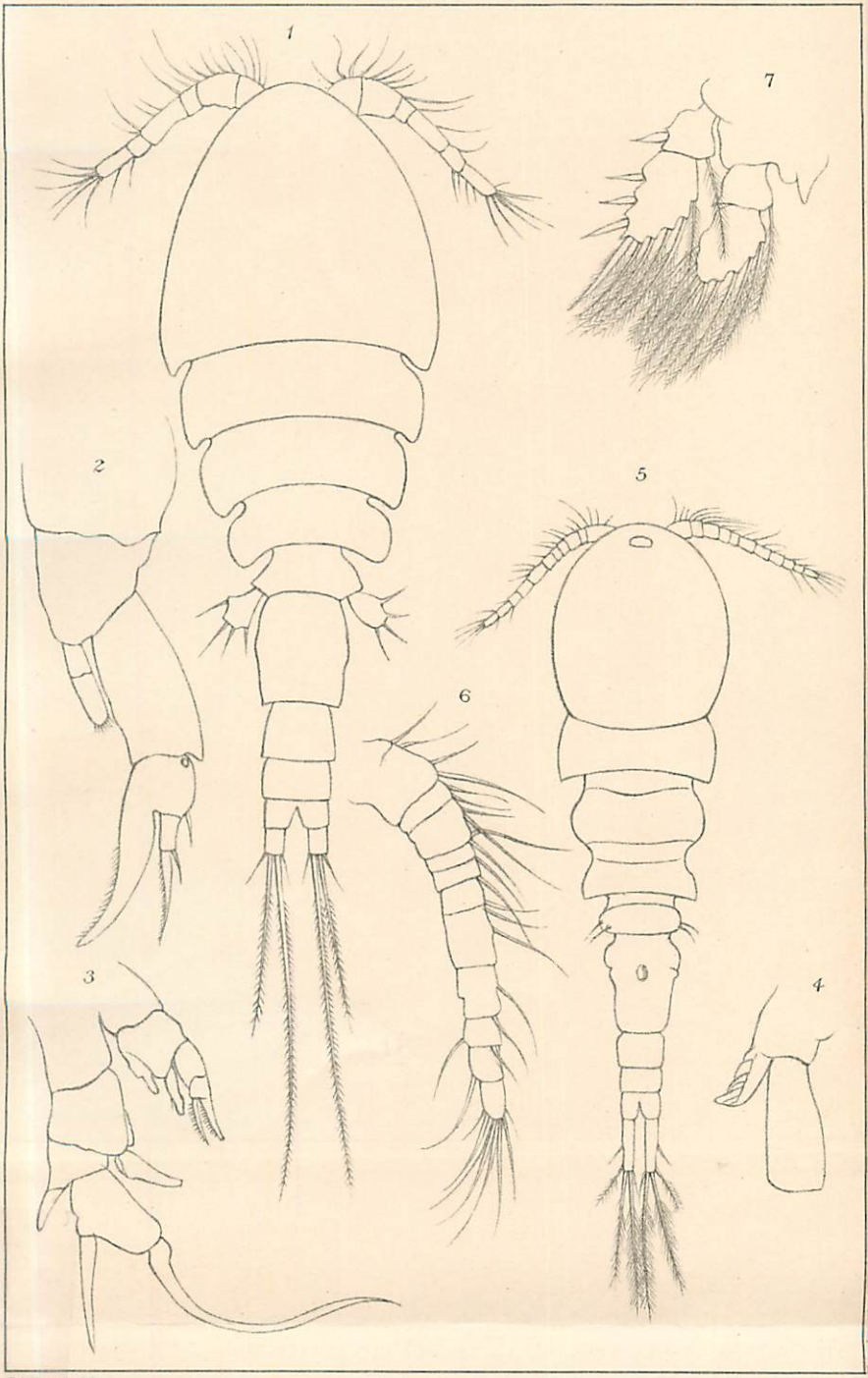

1
2
6
3
5
4
7



G.S.Brady del.

Geo West & Sons lith et imp

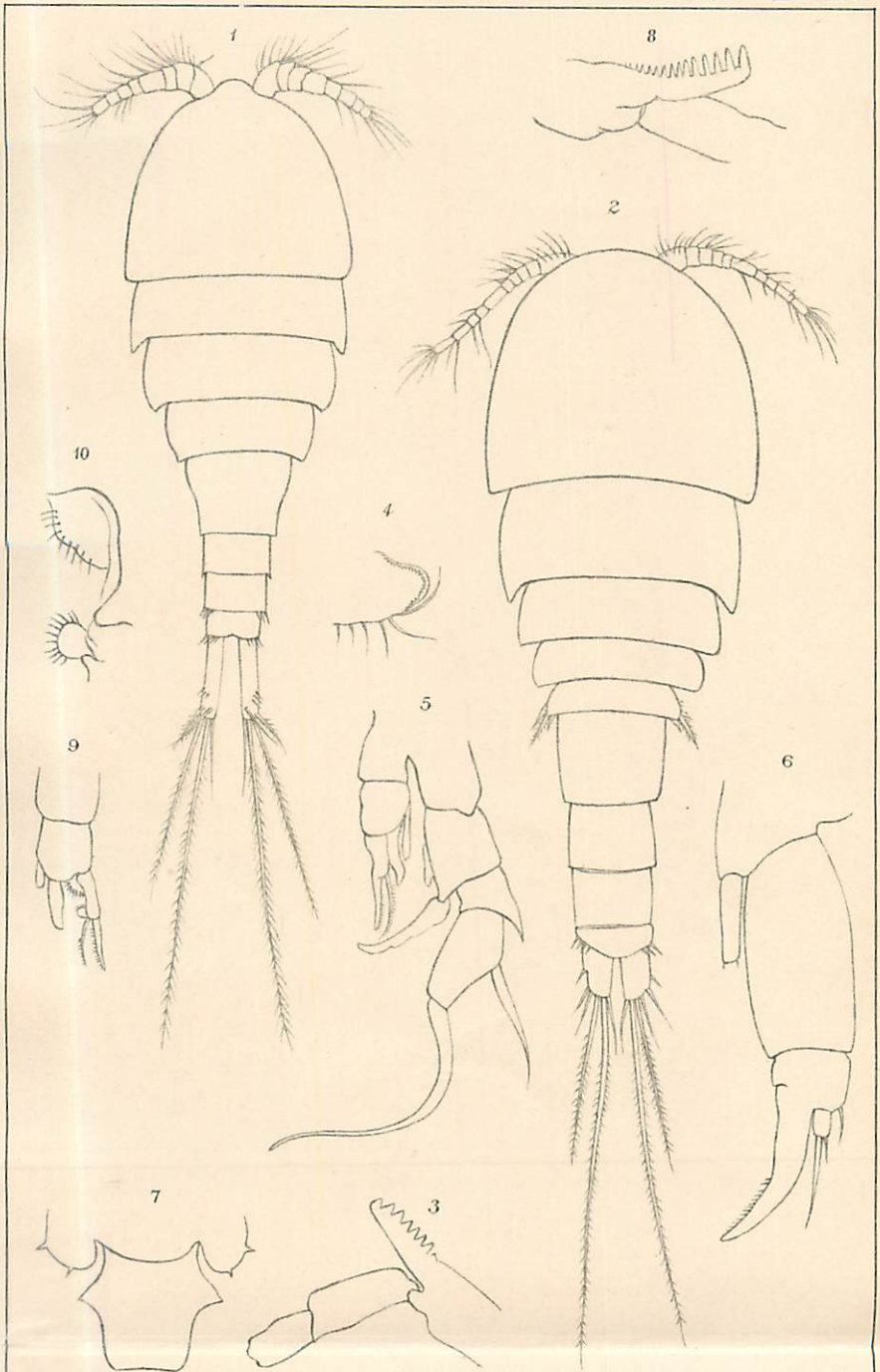
CYCLOPS AFFINIS.



G.S.Brady del.

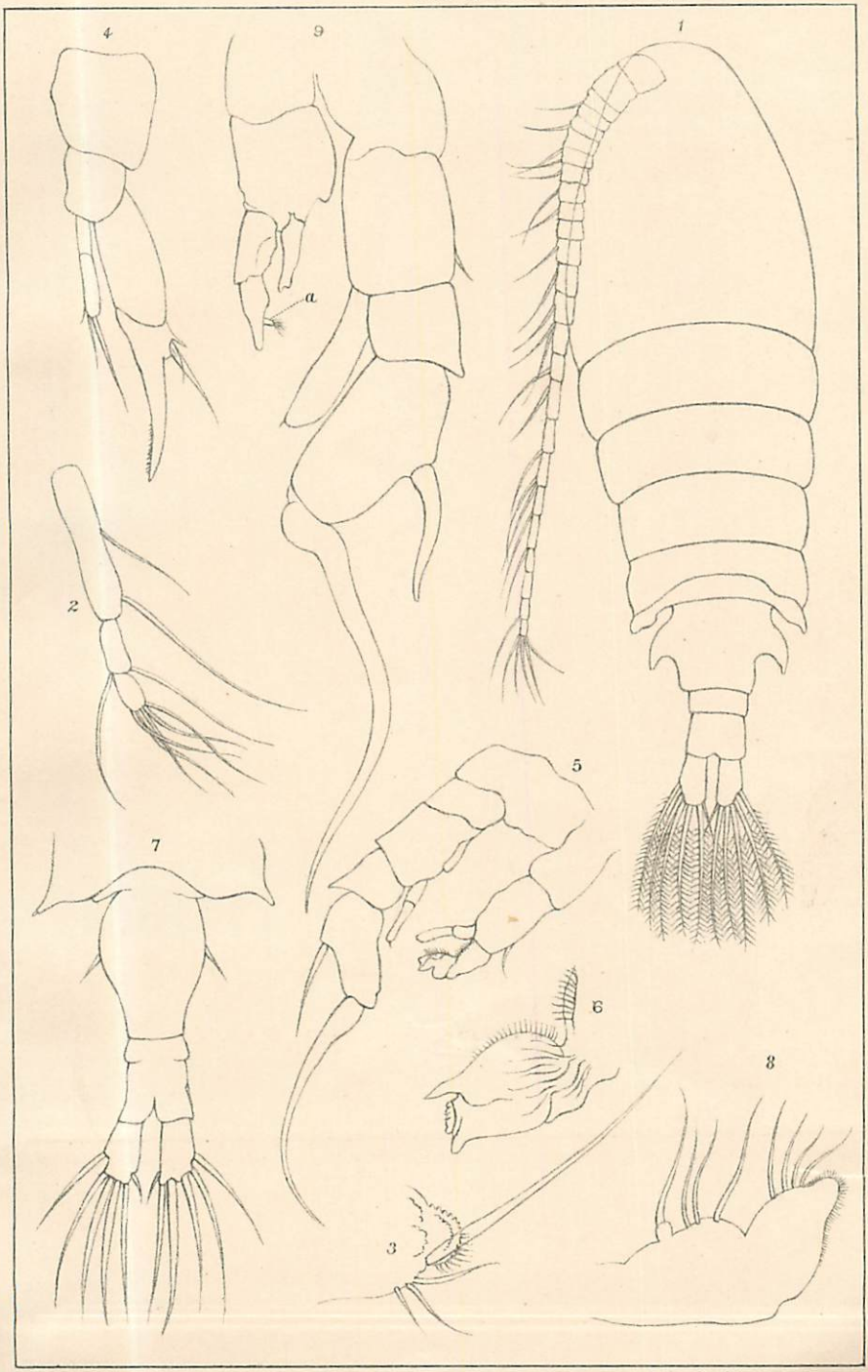
Geo West & Sons lith et imp

Figs 1. CYCLOPS ÆQUOREUS
2–4. DIAPTOMUS HIRCUS
5–7. CYCLOPS LONGICAUDATUS.



G.S.Brady del. Geo West & Sons lith et imp

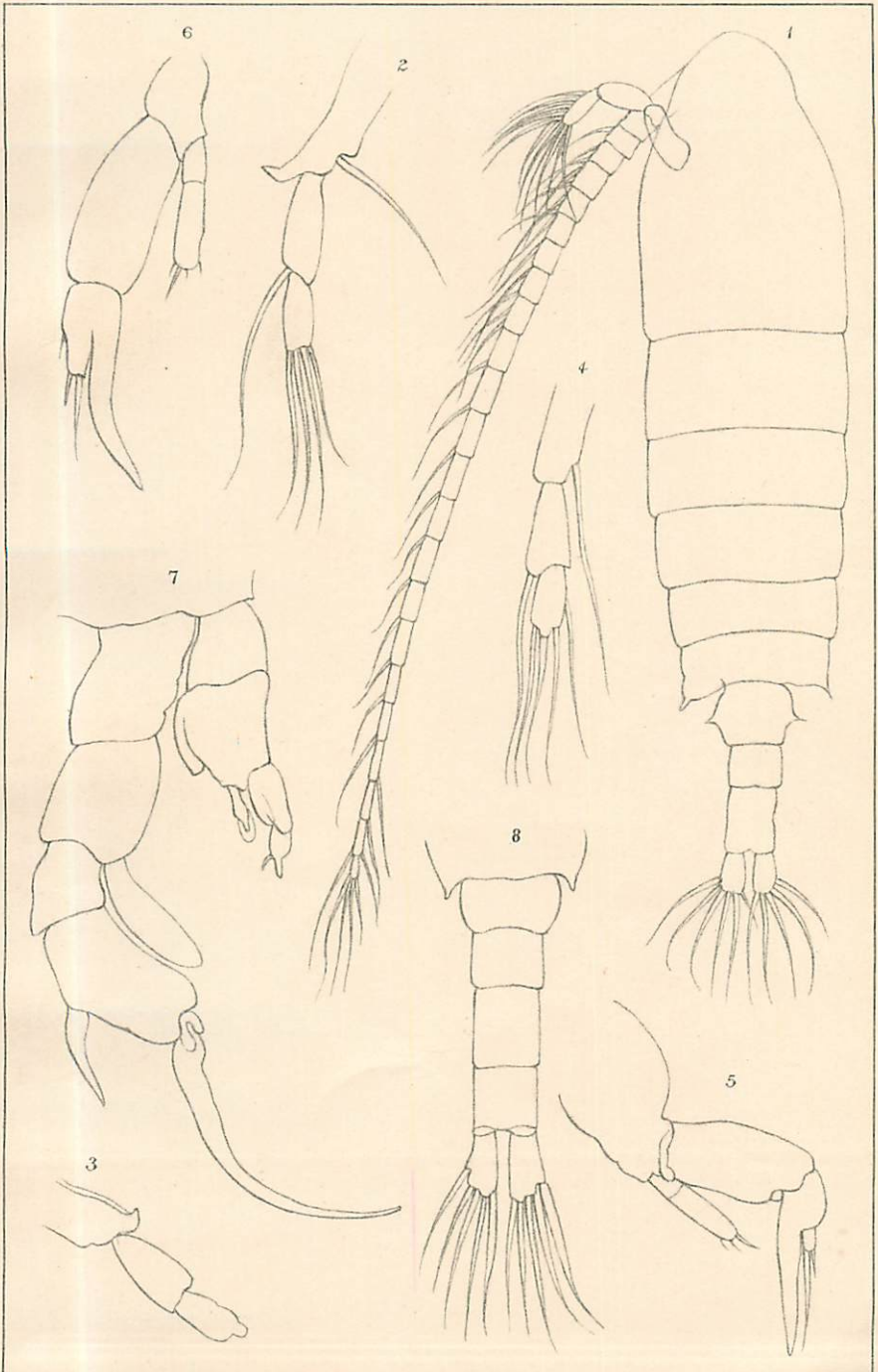
Figs 1. CYCLOPS CRASSICORNIS
2. " PHALERATUS
3-10. DIAPTOMUS SERRICORNIS.



G.S.Brady del.

Geo. West & Sons lith et imp.

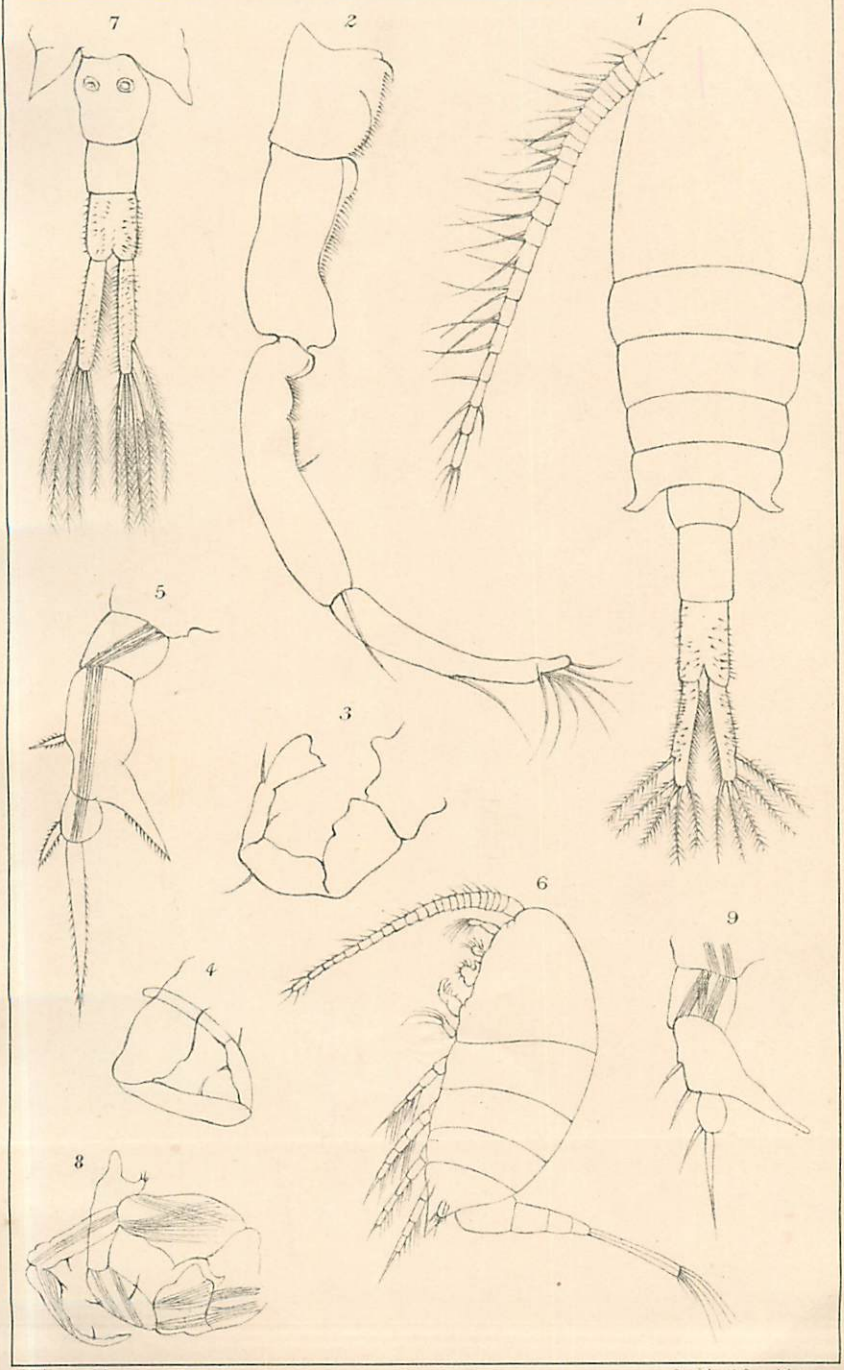
Figs 1–6. DIAPTOMUS CASTOR
7–9 " GRACILIS



G.S.Brady del.

Geo West & Sons lith et imp

DIAPTOMUS GRACILIS.



G.S.Brady del.

Geo. West & Sons lith. et imp.

Figs 1–5. EURYTEMORA CLAUSII
6–9. " AFFINIS.

G.S.Brady del.

Geo. West & Sons lith et imp.

Figs 1–4. ACARTIA LONGIREMIS
5–8. DIAPTOMUS SANCTI-PATRICII
9–13. " BACILLIFER.