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Report on the Petrelae Copypoda collected at Plymouth  
in 1888-89.

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With Plates XI and XII.

The Copypoda not only form the greatest part of the petrelae life in temperate seas, but are also of the greatest importance to marine economy. Feeding on minute organisms and particles of animal and vegetable matter, they are themselves a prey to many other animals. Some fishes such as the herring, gull, and mackerel feed almost exclusively on Copypoda in certain seasons of the year, and export-ested fishermen are accustomed to look on the swarms of Copypoda which make their appearance in the spring and early summer as the sure sign of a large fishery. The Copypoda are also of great value to me in my particular investigations, and I have found it necessary to send them to various parts of the world.

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The following is a preliminary account of the species which I have hitherto met with in the surface net collections made during the past year. The systematic work necessarily precedes the more elaborate and thorough investigation of the life-history and habits of the group which I hope to be able to enter into as a later date. The present work therefore pretends to nothing more than a description of the species reported, and an indication of their distribution. The species taken in the surface net amount to sixteen, of which the majority, as might be expected, belong to the Calanidae. Of the sixteen, nine species belong to this family, two to the Cyclopidae, three to the Harpacticidae, and two to the Copepodidae. The majority are well known or hitherto known species which I have found in abundance, viz. *Paracalanus parvus* and *Calanus finmarchicus*, are generally considered rare in this country, and *Calanus finmarchicus* is a new English form which I have found hitherto. One species, *Calanus finmarchicus*, has not hitherto been known north of the Mediterranean. On the other hand, several well-known species of Calanidae are altogether absent from my collections, viz. *Calanus finmarchicus*, *Calanus finmarchicus*, and *Calanus finmarchicus*. The absence of *Calanus finmarchicus* and *Calanus finmarchicus* is a very important fact in the history of the life-history of the group.

## Report on the Pelagic Copepoda collected at Plymouth in 1888-89.

By

**Gilbert C. Bourne, M.A., F.L.S.,**

Fellow of New College, Oxford, and Resident Director of the Association.

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With Plates XI and XII.

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THE Copepoda not only form the greatest part of the pelagic life in temperate seas, but are also of the greatest importance in pelagic economy. Feeding on minute organisms and particles of animal and vegetable matter, they are themselves a prey to larger organisms. Some fishes such as the herring, pilchard, and mackerel feed almost exclusively on Copepoda at certain seasons of the year, and experienced fishermen are accustomed to look on the swarms of Copepods which make their appearance in the spring and early summer as the sure precursors of a shoal of fish. The important part played by these minute crustacea in the change of material in the sea has led me to pay particular attention to them amongst the other organisms found swimming free at the surface or at different depths in the open sea. The following is a preliminary account of the species which I have hitherto met with in the surface net collections made during the past year. The systematic work necessarily precedes the more laborious and thorough investigation of the life-history and bionomy of the group which I hope to be able to enter into at a later date, the present work, therefore, pretends to nothing more than an enumeration of the species captured, and an indication of their distribution. The species taken in the surface net amount to sixteen, of which the majority, as might be expected, belong to the Calanidæ. Of the sixteen, nine species belong to this family, two to the Cyclopidæ, three to the Harpactidæ, and two to the Corycæidæ. The majority are well known on British coasts, two species which I have found in abundance, viz. *Paracalanus parvus* and *Eutерpe gracilis*, are generally considered rare in this country, and *Pontella wollastoni* is a rare English form which I have found sparingly. One species, *Oncæa mediterranea*, has not hitherto been seen north of the Mediterranean. On the other hand, several well-known species of Calanidæ are altogether absent from my collections, viz. *Metridia armata*, *Isias clavipes*, and *Centropages hamatus*. The labour of looking through and sorting the large amount of material



collected by us during the past year has been very great, but I am satisfied that I have not allowed a species to escape my notice, and the above-mentioned forms must have been absent, during the past year at all events, from the open sea in this neighbourhood.

Having had access to only a limited number of systematic works on the Copepoda I am obliged to confine myself in the descriptive part of this paper to references to the following works. Brady's Monograph of the British Copepoda, three vols. Brady, Report on the Copepoda collected by H.M.S. Challenger, 1883. Claus, Die freilebenden Copepoden, 1863. Ibid, Neue Beitrage zur Kenntniss der Copepoden, Arbeit aus dem. zool. Inst. Wien, 1880-81. Giesbrecht, Die freilebenden Copepoden der Kiele Foeherde. Vierter Bericht der Commission zur wiss. Untersuchung der deutschen Meere in Kiel, 1882. Canu, Les Copepodes libres Marins du Boulonnais, 1888. Thompson, Proceedings of the Liverpool Biological Society, vols. i and ii, 1887 and 1888.

*Family*—CALANIDÆ.

1. CETOCHILUS SEPTENTRIONALIS, *Goodsir*.

CETOCHILUS HELGOLANDICUS, *Claus*. Die freilebenden Copepoden, p. 171, Taf. xxvi.

CALANUS FINMARCHICUS, *Brady*. Monogr., i, p. 38.

— — *Giesbrecht*. Copepod. Kieler Foeherde, p. 156.

— — *I. C. Thompson*. Proc. Liv. Biol. Soc., ii, p. 63.

This genus was found at all seasons of the year in the surface net, though seldom in considerable numbers, apparently it is more abundant towards the end of the autumn, but in the majority of gatherings it is altogether absent.

In adopting the generic name *Cetochilus* in preference to that of *Calanus* I am following the example of Claus, whose arguments in favour of retaining Roussel de Vauzeme's name for the genus appear to me to have more weight than the argument based on the uncertain identity of Müller's *Cyclops longicornis* with Gunner's *Monoculus finmarchicus*. For the discussion of the subject, *vide* Claus Neue Beitrage zur Kent. der Copep., Arb. Zool. Inst. Wien, iii, 3, and Brady, Challenger Reports, loc. cit.

2. PARACALANUS PARVUS, *Claus*. Pl. XI, figs. 1—3.

CALANUS PARVUS, *Claus*. Freilebenden Copepoden, p. 173, Taf. xxvi and xxvii.

PARACALANUS PARVUS, *Claus*. Neue Beitr. zur Kent. der Copep., Arb. Zool. Inst. Wien, iii, 3.

— — *Canu*. Copep. libres Marins du Boulonnais, Bull. Scient. de la France et de la Belg., iii sér., 1 ann., p. 81.



PARACALANUS PARVUS, I. C. Thompson. Copep. of Liverpool Bay, Proc. Liv. Biol. Soc., ii, p. 64.

This species appears to have been taken only once before in England, viz. by the Liverpool Marine Biology Committee in 1888. Canu found it in abundance at Wimereux. I cannot consider it as a rare species at Plymouth for I have found it in great abundance in several gatherings and less abundantly in many others. Apparently it is absent from these coasts in the winter, for I could not find a single specimen in gatherings made between September and March. I have not observed the disproportion in the numbers of males and females described by Canu. This species is easily recognised by the form of the first antennæ of the male, by the serration of the external edges of the outer branches of the swimming feet, and their simple spines in both sexes, and by the characteristic shape of the fifth feet in the male and female. The characteristic ensiform and plumose terminal setæ of the second maxillipedes of the male appear to have been overlooked by previous observers, *vide* Pl. XI, fig. 3.

### 3. CLAUSIA ELONGATA, Boeck.

- PSEUDOCALANUS ELONGATUS, Brady. Monogr., Brit. Copep., i, p. 45, pl. iii.  
 — — Giesbrecht. Freileb. Copep. der Kieler Foehrde, Nachtrag.  
 — — I. C. Thompson. Proc. Liv. Biol. Soc., ii, p. 63.  
 CLAUSIA ELONGATA, Claus. Neue Beitrage zur Kent. der Copep., Arb. Zool. Inst. Wien, iii, 3, p. 16, Taf. iii, figs. 11—15.  
 LUCULLUS ACUSPES, Giesbrecht. Freileb. Copep. der Kieler Foehrde, p. 160.

This is one of the commonest species in the Plymouth district. I have taken it in autumn, winter, and spring in immense numbers. The absence of the fifth pair of feet in the female, and the form of the fifth feet of the male are characteristic features of this species. Young males are frequently very abundant, and as Claus has pointed out (*loc. cit.*), they differ from the perfect males both in the form of the fifth feet and in other particulars, so that they might easily be mistaken for a distinct species. Giesbrecht in the body of his work, quoted above, refers *Clausia elongata* to a new genus and species, *Lucullus acuspes*, but withdraws this name in an appendix. It is difficult to understand how he can have overlooked the identity of his specimens with *Pseudocalanus elongatus*, Boeck; described by Brady, since the latter's figures of the fifth pair of feet of the male are readily recognisable, defective as his description may be in some particulars. I. C. Thompson in a report of Copepoda collected in the Maltese seas, refers to *Lucullus acuspes*, Giesbrecht; and *Pseudo-*



*calanus elongatus*, Boeck, as distinct genera! ('Proc. Liv. Biol. Soc.,' ii, pp. 140, 142.)

4. *DIAS LONGIREMIS*, Lilljeborg, Pl. XI, figs. 4—6.

- DIAS LONGIREMIS*, Brady. Monogr. Brit. Copep., i, p. 51, pl. v.  
 — — Claus. Freileb. Copepod., p. 193, Taf. xxxiii, figs. 6—14.  
 — — Giesbrecht. Freileb. Copep. der Kieler Foeherde, p. 148.  
 — — I. C. Thompson. Some Copepoda new to Britain, &c., Proc. Liv. Biol. Soc., i, p. 37.

This species is one of the most common near Plymouth. I have taken it in great quantities at all seasons of the year. Giesbrecht remarks that the genus *Dias* is found very sparingly at Kiel during the early spring months, but that it increases in numbers from July to the autumn. At Plymouth the contrary appears to be the case. On February 20th, 21st, and 22nd, 1889, the Calanidæ taken in the tow-net consisted almost exclusively of this species, and it was abundant in gatherings made both before and after these dates.

A close examination of these specimens leaves me in some doubt as to the distinctness of Giesbrecht's three species, *D. longiremis*, Lilljeborg; *D. bifilosus*, and *D. discaudatus*. According to him the remarkable differences (auffallende Merkmale) between *D. longiremis* and *D. bifilosus* are the presence of spines on the last thoracic segment of the former, and their absence in the latter species; the shape of the furca, which is much longer in *D. longiremis* than in *D. bifilosus*, and the presence of frontal setæ in the latter species. *D. discaudatus* is distinguished principally by the swollen furcal segments of the female and the spermatophores of the male, but in addition to these characteristics there are differences in the fifth pair of feet in the male (*vide* Giesbrecht, loc. cit., Taf. viii, figs. 30, 31, and 32). In my specimens the spines characteristic of *Dias longiremis* are present, but are not so long as those figured by Giesbrecht; there are no frontal setæ and the feet of the fifth pair are precisely those figured by Giesbrecht for *D. longiremis*. The difference lies in the furcal segments, the proportions of which are those of *D. bifilosus*, Giesbrecht and not of *D. longiremis*. From his drawing of the fifth pair of feet of the male I have no doubt that Brady's figures are taken from *D. longiremis*, Lilljeborg, though he has overlooked the spines of the last thoracic and abdominal segments. Claus' figure of the fifth pair of feet of the male is undoubtedly taken from *D. discaudatus*, Giesbrecht (cf. Claus, Freileb. Copepod., Taf. xxxiii, fig. 14, and Giesbrecht, loc. cit., Taf. viii, fig. 32). At the same time Claus speaks of the frontal setæ characteristic of *D. bifilosus*. Giesbrecht considers that the varieties in the fifth pairs of feet of the



males taken by Claus in Heligoland and the Mediterranean point to their being in fact two distinct species, but the facts given above support the conclusion that the characters taken by Giesbrecht as specific are liable to great variation, and that his three species, *D. longiremis*, *D. bifilosus*, and *D. discandatus* are, in fact, varieties of one species, viz. *Dias longiremis*, Lilljeborg.

5. TEMORA LONGICORNIS, O. F. Müller.

- TEMORA FINMARCHICA, Claus. Freileb. Copepod., p. 195.  
 — LONGICORNIS, Brady. Monogr. Brit. Copep., i, p. 54.  
 — — Canu. Les Copep. libres marins du Boulonnais, Bull. Sci. de la France et Belg., iii sér., 1 ann., p. 89.  
 — — Giesbrecht. Freileb. Copep. der Kieler Foehrde, Nachtrag.  
 HALITEMORA LONGICORNIS, Giesbrecht. Ibid., p. 149.  
 — — I. C. Thompson. Proc. Liv. Biol. Soc., vol. i, p. 35.

This very common species was found sparingly during the winter months at Plymouth; its numbers increase greatly in April, and appear to reach a maximum in August and September. Thompson, in adopting the generic name *Halitemora*, overlooks Giesbrecht's appendix in which the latter gives way to the priority of Claus' name *Temora* (Claus, Sitz. der Kais. Akad. Wien, lxxiii, 1881.)

6. CENTROPAGES TYPICUS, Kroyer.

- ICTHYOPHORBA DENTICORNIS, Claus. Freileb. Copepod., p. 199, Taf. xxxv, figs. 1, 3—9.  
 CENTROPAGES TYPICUS, Brady. Monogr. Brit. Copep., i, p. 65, pl. viii.  
 — — Canu. Les Copepodes libres, &c., Bull. Sci. de la France et de la Belg., iii sér., 1 ann., p. 96.

Taken in great abundance in summer, autumn, and spring, but it appears to be less abundant in the winter months.

7. PARAPONTELLA BREVICORNIS, Lubbock.

- PARAPONTELLA BREVICORNIS, Brady. Monogr. Brit. Copep., i, p. 69, pl. ix, figs. 1—6.  
 — — I. C. Thompson. Copep. Liv. Bay, Proc. Liv. Biol. Soc., ii, p. 65.

I have only found this species on two occasions, and then in small numbers, viz. on August 31st, 1888, near the Eddystone Lighthouse, and on March 21st, 1889, in the Cattewater.

8. PONTELLA WOLLASTONI, *Lubbock*.

- PONTELLA HELGOLANDICA, *Claus*. Freileb. Copepod., p. 208, Taf. iii, figs. 5—7; xxxvi, figs. 1—15; xxxvii, fig. 7.  
 — WOLLASTONI, *Brady*. Monogr. Brit. Copep., i, p. 73, pl. x  $\alpha$ .  
 — — *Canu*. Copep. libr. mar. du Boulonnais, Bull. Sci. de la France et de la Belg., iii sér., 1 ann., p. 100.  
 — — *J. C. Thompson*. Some Copep. new to Great Brit., Proc. Liv. Biol. Soc., i, p. 37.

I have only found this species twice, on August 31st, 1888, and on October 23rd, 1888, near the Eddystone Lighthouse, in small numbers in each instance. According to Thompson it is not uncommon in Liverpool Bay, and it is one of the commonest species at Wimereux (*Canu*).

9. ANOMALOCERA PATERSONII, *Templeton*.

- IRENEUS PATERSONII, *Claus*. Freileb. Copep., p. 206, Taf. ii, fig. 1; Taf. xxxvii, figs. 1—6.  
 ANOMALOCERA PATERSONII, *Brady*. Monogr. Brit. Copep., i, p. 75, pl. xi, figs. 1—14; pl. x, figs. 13, 14.

This species was abundant at Plymouth in the autumn and late summer but was absent from winter gatherings. I found a few specimens in the contents of the surface net on May 19th, 1889. Sometimes it occurs in immense profusion in the Channel. Mr. Matthias Dunn has sent me a large number of Copepods, dipped with a bucket from Mevagissey Harbour. They consisted almost exclusively of *A. Patersonii*. In the specimens taken on May 19th I noticed that the upaired eye of the male was nearly half as large again as that of the female.

## Family—CYCLOPIDÆ.

1. OITHONA SPINIROSTRIS, *Claus*. Pl. XI, figs. 7 and 8.

- OITHONA HELGOLANDICA, *Claus*. Freileb. Copep., p. 105, Taf. xi, figs. 4—9.  
 — SPINIROSTRIS, *Claus*. Ibid., p. 105, Taf. xi, figs. 10—12.  
 — SPINIFRONS, *Brady*. Monogr. Brit. Copep., i, p. 91, pl. xiv, fig. 19; pl. xxiv  $\alpha$ .  
 — SPINIROSTRIS, *Giesbrecht*. Freileb. Copep. der Kieler Foehrd, p. 139.  
 — — *I. C. Thompson*. Proc. Liv. Biol. Soc., ii, pp. 1, 2.

This species is so rare as to be practically absent from Plymouth seas in the late summer and autumn, but it appears in great profusion in February, March, and April. Giesbrecht states that the same is the case at Kiel. According to the same author the different



European species of *Oithona* are to be considered as varieties of *O. spirostris*, Claus. The figures of *Oithona* in Brady's Monograph are very unsatisfactory, but those of *O. Challengeri* in the Challenger Report are much better. The only accurate drawings of *Oithona* that I have seen are those of Giesbrecht, whose illustrations never leave anything to be desired. As his work is not always accessible to English naturalists, I give, in Plate XI, figs. 7 and 8, drawings of the mandibles and maxillæ of this species.

## 2. CYCLOPINA LITTORALIS, Brady.

- CYCLOPINA LITTORALIS, Brady. Monogr. Brit. Copep., i, p. 92, pl. xv, figs. 1-9.  
 — — I. C. Thompson. Copep. Liv. Bay, Proc. Liv. Biol. Soc.,  
 ii, p. 65.

A few specimens of this well-marked species were taken in the tow-net in the early days of April, 1889.

## Family—HARPACTIDÆ.

### 1. LONGIPEDIA CORONATA, Claus.

- LONGIPEDIA CORONATA, Claus. Freileb. Copep., p. 111, Taf. xiv, figs. 14-24.  
 — — Brady. Monogr. Brit. Copep., ii, p. 6, pls. xxxiv, xxxv.  
 — — Giesbrecht. Freileb. Copep. der Kieler Foeherde, p. 99.  
 — — I. C. Thompson. Cop. Liv. Bay, Proc. Liv. Biol. Soc.,  
 ii, p. 67.

A few specimens were taken in the surface net in March and April, 1889.

### 2. EUTERPE GRACILIS, Claus.

- EUTERPE GRACILIS, Claus. Freileb. Copep., p. 109, Taf. xiv, figs. 1-13.  
 — — Brady. Monogr. Brit. Copep., ii, p. 22, pl. xl, figs. 1-16.  
 — — I. C. Thompson. Copep. Liv. Bay, Proc. Liv. Biol. Soc., ii,  
 p. 67.

This species, rare in most localities, is very abundant near Plymouth in late winter and spring. I first found it on February 20th, 1889, when the tow-net taken near the Eddystone Lighthouse contained a profusion of females, nearly all carrying ovisacs. Since that date I have taken both males and females, sometimes sparingly, sometimes abundantly, in nearly every gathering up to May 20th.

### 3. THALESTRIS MYSIS, Claus.

- THALESTRIS MYSIS, Claus. Freileb. Copep., p. 130, Taf. xviii, figs. 12-16.  
 — — Brady. Monogr. Brit. Copep., ii, p. 121, pl. lviii, figs. 1-13.



Three or four specimens were taken in the surface net in the Cattewater on March 21st, 1889.

Family—CORYCÆIDÆ.

1. CORYCÆUS ANGLICUS, *Lubbock*.

CORYCÆUS GERMANUS, *Claus*. Freileb. Copep., p. 156, Taf. ix, figs. 1—4; Taf. xxiv, figs. 5, 6; Taf. xxviii, figs. 1—4.

— ANGLICUS, *Brady*. Monogr. Brit. Copep., iii, p. 34, pl. lxxxi, figs. 16—19; lxxxiii, figs. 11—15; lxxxiv, figs. 10—14.

This species appears to be somewhat rare and locally distributed on British coasts. I first found a few in the tow-net of February 20th, near the Eddystone Lighthouse, and from that date up to May I obtained numerous specimens, scarcely any gathering being without them. It is recorded in my note-book that of the specimens taken February 21st, 22nd, and 23rd, 1889, all the females had ovi-sacs attached.

2. ONCÆA MEDITERRANEA, *Claus*. Pl. XII, figs. 1—7.

ANTARIA MEDITERRANEA, *Claus*. Freileb. Copep., p. 158, Taf. xxx, figs. 1—7.

ONCÆA OBTUSA (?), *Brady*. Challenger Reports, Zoology, vol. viii, p. 120, pl. li.

— — *I. C. Thompson*. Copep. collected in Maltese Seas, Proc. Liv. Biol. Soc., ii, p. 148.

I have much pleasure in recording this species, which has not before been found north of the Mediterranean. It is very rare at Plymouth. I have only had two specimens, one taken on the 31st August, 1888, the other on April 15th, 1889; both are females.

I am satisfied that my specimens are identical with *Claus*' *Antaria mediterranea*, but am not quite sure of their identity with *Oncæa obtusa*, *Dana*. Comparing my specimens with *Claus*' and *Brady*'s figures, the second joint of the second antenna agrees in my specimens with *Claus*' drawing and description (zweite Glied der Klammerantennen aufgetrieben, dreieckig, so gross als die dritte), but in *Brady*'s drawing it has not the characteristic swollen three-cornered shape. The furca in *Brady*'s drawing is as long as the three preceding abdominal segments; in *Claus*' *Antaria mediterranea* and in my specimens it is but little longer than the last abdominal segment. The spines on the first abdominal segment of the male are longer in *Claus*' figures than in *Brady*'s. From want of specimens I am unable to give an opinion on the specific distinctness of these two forms, but I have preferred to use *Claus*' specific name for my specimens because of their full agreement with his drawings and description.

## PLATES XI AND XII.

Illustrating Mr. G. C. Bourne's paper on *The Pelagic Copepoda collected at Plymouth in 1888-89.*

## PLATE XI.

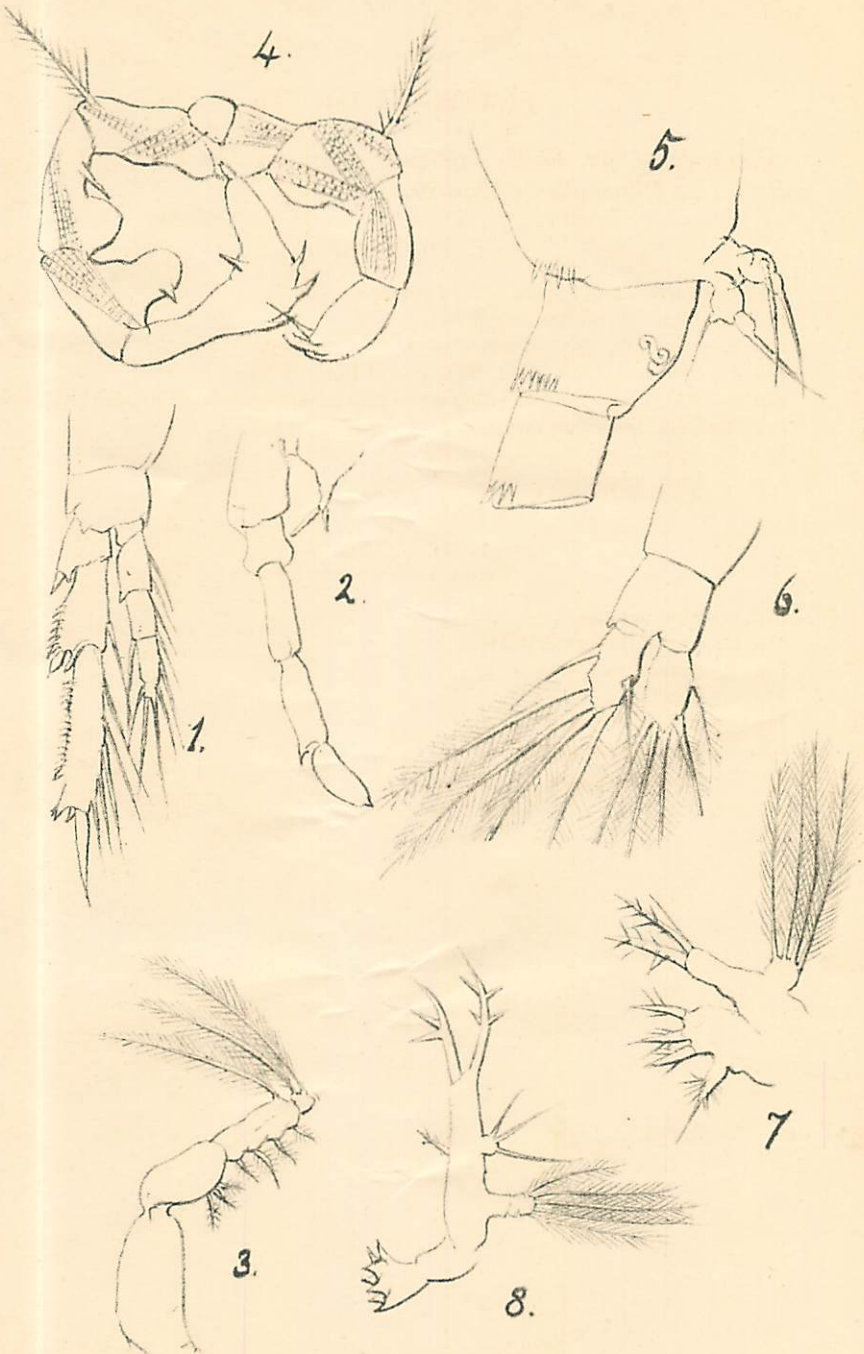
- FIG. 1.—*Paracalanus parvus*. Third swimming foot.  
 FIG. 2.—Ibid. ♂. Fifth pair of feet.  
 FIG. 3.—Ibid. ♂. Second maxillipedes.  
 FIG. 4.—*Dias longiremis*. ♂. Fifth pair of feet.  
 FIG. 5.—Ibid. Last thoracic and first two abdominal segments of ♀ showing the spines.  
 FIG. 6.—Ibid. Furcal segments of ♂.  
 FIG. 7.—*Oithona spirostris*. Maxilla.  
 FIG. 8.—Ibid. Mandible.

## PLATE XII.

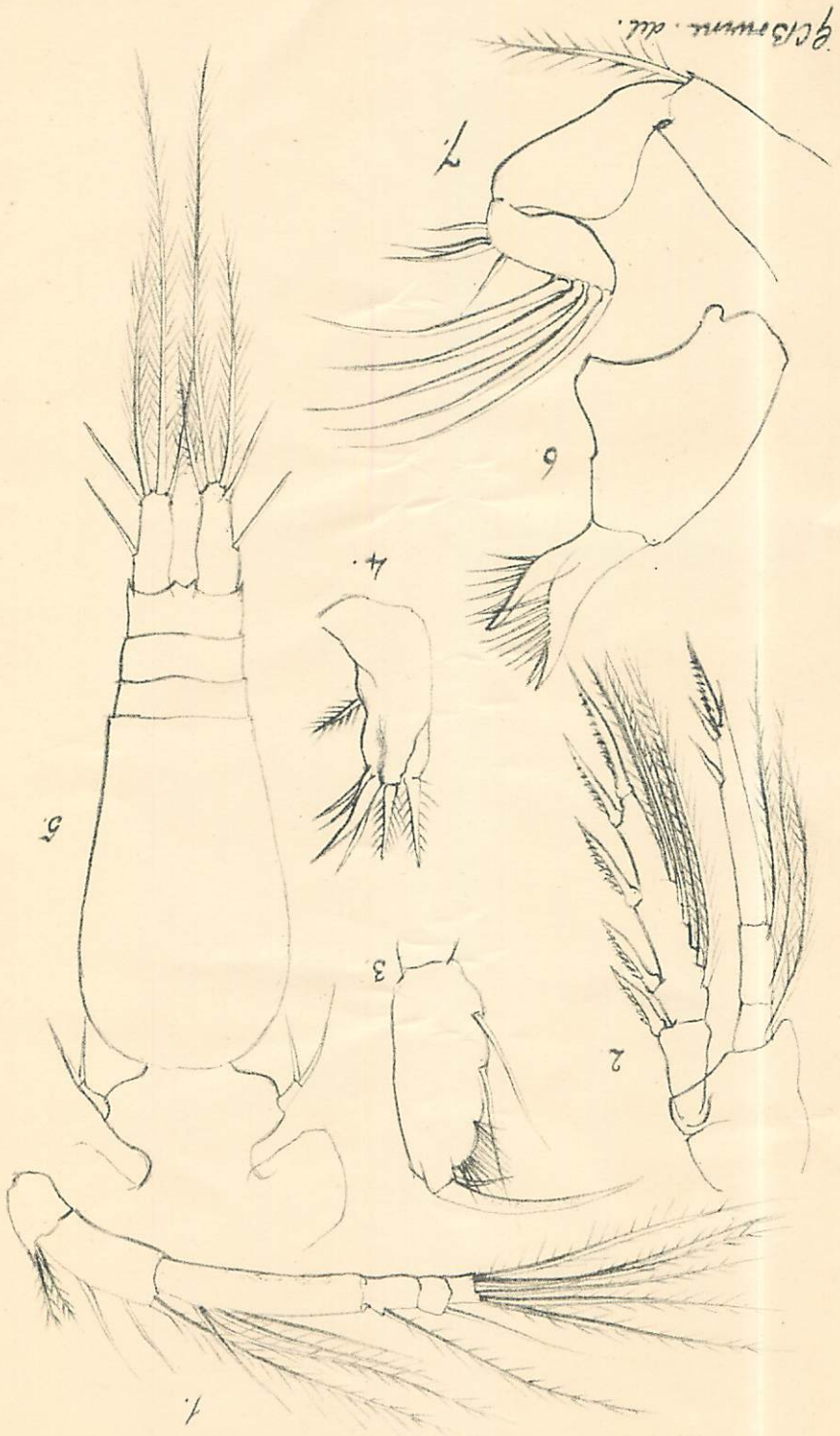
*Oncœa Mediterranea*. ♀.

- FIG. 1.—First antenna.  
 FIG. 2.—One of the swimming feet.  
 FIG. 3.—Second maxillipede.  
 FIG. 4.—Maxilla.  
 FIG. 5.—Abdominal segments.  
 FIG. 6.—First maxillipede.  
 FIG. 7.—Second antenna.





*G. Bourne del.*



*grobmann. det.*