

II.—ON SOME NEW AND RARE CRUSTACEA COLLECTED AT VARIOUS TIMES IN CONNECTION WITH THE INVESTIGATIONS OF THE FISHERY BOARD FOR SCOTLAND.

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(Plates II.—VI.)

Though the larger, or, as they are sometimes called, the higher Crustacea of the British seas are now fairly well known, our knowledge of the smaller forms is still very defective; and as these smaller species constitute an important part of the food of small and young fishes, their study becomes important from a fisheries' point of view as well as from the point of view of the naturalist.

A large number of gatherings of small crustaceans has been examined during the past year. These gatherings have been collected at various times, and some of them several years ago; some of the earlier gatherings were not examined or only partially examined at the time they were collected, as other work requiring more immediate attention had to be done. The re-examination of these collections has yielded several new forms, besides a number of rare and interesting species already described. The new species all belong to the Copepoda—a group which from their great abundance, their wide distribution in all our seas and estuaries, and their nutritive qualities, is of immense value as food for fishes.

In a recent paper on the food of fishes* it is shown that the young of almost all the food-fishes live very largely on small crustaceans, and a considerable proportion of them belong to the Copepoda.

Among the species recorded in the present paper the following appear to be undescribed:—

- Ameira pusilla*, T. Scott (sp. nov.).
- ” *ambigua*, T. Scott (sp. nov.).
- Delavalia minutissima*, T. Scott, (sp. nov.).
- Tetragoniceps pygmaeus*, T. Scott (sp. nov.).
- Laophonte gracilis*, T. Scott (sp. nov.).
- Cletodes neglecta*, T. Scott (sp. nov.).
- Enhydrosoma gracile*, T. Scott (sp. nov.).
- Enhydrosoma minutum*, T. Scott (sp. nov.).
- Dactylopus littoralis*, T. Scott (sp. nov.).
- Dactylopus vararensis*, T. Scott (sp. nov.).
- Dactylopus mixtus*, T. Scott (sp. nov.).
- Paranthesius dubius*, T. Scott (gen. et sp. nov.).

While among the other species recorded in the sequel there are several that are of special interest. For example, *Parastephos pallidus* (G. O. Sars) is a copepod new to the British fauna.

Eucalanus crassus, Giesbrecht, is a copepod which was added to the British fauna a few years ago, and is now recorded from a new station.

Stephos scotti, G. O. Sars, is also recorded from a new station, and the male is described for the first time from Scottish specimens.

* *Twentieth Annual Report Fishery Board for Scotland*, Part III., pp. 486-538 (1902).

The number of Crustacea described in the present paper is scarcely so large as in some of those previously published.

I am, as formerly, indebted to my son Mr. Andrew Scott, A.L.S., for the drawings required to illustrate the new and rare species described here; and the arrangement of the species is similar to that adopted in previous papers.

CRUSTACEA.

Sub-Class ENTOMOSTRACA.

Order I.—COPEPODA.

CALANOIDA.

Genus *Eucalanus*.

Eucalanus crassus, Giesbrecht.

1881. *Eucalanus crassus*, Giesb., Atti. Acc. Lincei Rend., ser. 4, vol. 4, lem. 2, p. 333. See also Pelagisch. Copep. Golfes von Neapel, pp. 131-152, t. 11 and 35.

Several specimens of this species were captured about 10 miles off Aberdeen on November 6th, 1901. This is the first time that *Eucalanus crassus* has been taken so far south on the east side of Scotland. The species has been several times captured in the Moray Firth,* and it has also been collected along with *Eucalanus elongatus* about fifty miles south-east of Fair Island.† Dr. R. Norris Wolfenden records it from the Farøe Channel, where he has also taken several other interesting species.‡

Genus *Stephos*, T. Scott (1892).

Stephos scotti, G. O. Sars. Pl. ii., figs. 1-4.

1897. *Stephos gyrans*, T. Scott (not Giesbrecht), 15th Ann. Rept. Fishery Board for Scotland, pt. iii., p. 146, pl. iv., fig. 9; pl. iii., figs. 17-18.

1892. *Stephos scotti*, G. O. Sars. An Account of the Crustacea of Norway, vol. iv., p. 63, pl. xliii.

This species was first observed in some material dredged in 1896 in Loch Gair—a small lagoon opening into Loch Fyne. Only a single female was obtained on this occasion, and, as it had a somewhat close resemblance to *Stephos gyrans*, Giesbrecht, it was ascribed to that species. Additional female specimens were subsequently obtained not only in other parts of the Clyde area but also in the Firth of Forth, but till quite recently no males had been observed among Scottish specimens. Prof. G. O. Sars, however, had already obtained both sexes of the species in Norwegian waters, and had found that the males especially differed considerably from the males of *Stephos gyrans*, and, therefore, in vol. iv. of his great work on the Crustacea of Norway described it under the name given above.

It happened that I had a gathering of small Crustacea which had been collected in 1894 in an old quarry near Granton to which the tide has access during high water. This gathering, which was examined during

* Eighteenth Annual Report of the Fishery Board for Scotland, Part III., p. 382 (1900).
 † Nineteenth Annual Report of the Fishery Board for Scotland, Part III., p. 237 (1901).
 ‡ Journ. Marine Biol. Assoc., vol. vi., No. 3 (January, 1902), p. 361.

the past summer, was found to contain many copepods, some of them being rare forms; several specimens of *Stephos scotti* were obtained in this gathering, and they included both males and females. The dissections of both species corresponded exactly with Prof. G. O. Sars' description and figures in the work referred to.

The two drawings (pl. ii., figs. 1 and 2) represent an adult female and male from the Granton quarry gathering; the only obvious external difference between them is in the structure of the fifth pair of feet, separate drawings of which are represented by figures 3 and 4. A full description of the species, with drawings, is given by Prof. Sars in the work already mentioned.

Genus *Parastephos*, G. O. Sars (1902).

Parastephos pallidus, G. O. Sars. Pl. ii., figs. 5-10.

1892. *Parastephos pallidus*, G. O. Sars, Crustacea of Norway, vol. iv., p. 65, pl. xlv.

The genus *Parastephos* was recently instituted by Prof. G. O. Sars for a single male specimen of a copepod found many years before at Sjerjehavn, west coast of Norway, in about 100 fathoms, where the bottom was soft and muddy.

During the past summer, while examining a bottom tow-net gathering collected near the head of Loch Fyne in November, 1901, I observed several specimens, both males and females, of this interesting species; but though most of the male specimens were adult, the females, with the exception of one, were more or less immature. The drawings of the male prepared by Prof. G. O. Sars are perfectly characteristic, but the figures given here may be useful to those who have not seen the drawings of the learned author referred to.

The species is a moderately large one, the adult male (fig. 6) is very nearly two millimetres in length, while the adult female (fig. 5) is somewhat larger, being 2.19 mm. (about $\frac{1}{11}$ of an inch). The description of the fifth feet of the male may be best given in Prof. G. O. Sars' own words:—"Last pair of legs in the male largely developed and very asymmetrical, right leg slender and terminating in a strong denticulated claw, left leg much coarser, with the antepenultimate joint the largest" (fig. 10). The distal portion of the right leg can apparently be folded completely back upon the proximal portion as shown in the figure.

The female antennules resemble those of the male; they are equally elongated and composed of twenty-four joints, the second and eighth joints are each nearly as long as the combined lengths of the two joints which immediately follow them. The antennules are only sparingly setiferous, and are furnished with several small sensory filaments (fig. 7). The fifth pair in the female appear also to be asymmetrical; in the only adult specimen obtained the left leg of the fifth pair is considerably longer than the right one, but this appears to be the only difference (fig. 9).

In the female, each of the first three abdominal segments expands posteriorly into a ridge which is fringed with fine hairs, as shown in fig. 2.

In the adult male represented by the drawing, the second pair of thoracic feet (fig. 8) are alike on both sides, the outer branches being both three-jointed and the inner two-jointed. Prof. G. O. Sars, in his description of the only male specimen he had, states that the outer branch of the right foot of the second pair was only two-jointed; but such a difference is rather unusual among the Calanoida, and probably his specimen may

have been defective, as no such difference was observed in Clyde specimens. The Clyde is, so far, the only known British habitat for this interesting species.

Genus *Pseudophænna*, G. O. Sars (1900).

Pseudophænna? typica, G. O. Sars. Pl. ii., figs. 11–15.

1902. *Pseudophænna typica*, G. O. Sars. An Account of the Crustacea of Norway, vol. iv., p. 44, pl. xxix., xxx.

A single male specimen of a Calanoid, which I have referred, though somewhat doubtfully, to *Pseudophænna typica*, G. O. Sars, was obtained in a bottom tow-net gathering of Crustacea collected last year near the head of Loch Fyne. The specimen agrees very closely with *Pseudophænna typica* in its general outline and in the structure of the various appendages so far as these can be made out, except that the fifth feet slightly differ from the drawing given in the work of Prof. G. O. Sars referred to above, but not so much in their general structure as in the apical part of the right leg (fig. 15).

This Loch Fyne specimen measures fully one and a half millimetres; the thorax is moderately stout, but the abdomen is slender (figs. 11 and 12). The antennules, which reach to about the distal end of the thorax, appear to be composed of twenty-one joints. The basal joints, from the third to the seventh, are shorter than the others; the right is elongated and appears to be indistinctly articulated near the distal end. The antennules are only sparingly setiferous, but they are well supplied with sensory filaments as shown in the drawing (fig. 13). The species will not be satisfactorily determined till more specimens of both sexes are obtained.

In his note on the distribution of this Calanoid, Sars states that he has obtained it at several places, from Christiania Fjord to Vardö, and that it is a true bottom form, it is therefore probable that the species may not be rare in the deeper water off the Scottish coast.

Genus *Pseudocyclops*, G. S. Brady (1872).

Pseudocyclops obtusatus, Brady and Robertson. Pl. vi., figs. 13–15.

1873. *Pseudocyclops obtusatus*, B. and K., Ann. and Mag. Nat. Hist. (4), vol. xii., p. 128, pl. viii., figs. 4–7.

1878. *Pseudocyclops obtusatus*, Brady, Mon. Brit. Copep., vol. i., p. 84, pl. xii., figs. 1–13.

Although the distribution of this species seems to be extensive, it does not appear to be anywhere very common. The female represented by the drawing (fig. 13) was obtained during the past summer by washing the filters at the Hatchery, Bay of Nigg. The species, which is fairly well marked, has been described by Brady and Robertson in the Annals and Magazine of Natural History, and by Prof. G. S. Brady in his Monograph of the British Copepoda.

In this species the rostrum is of a somewhat broadly triangular form and the antennules (fig. 14) are short and moderately stout, and are apparently composed of seventeen joints and are furnished with numerous plumose setæ; the basal joint also carries two moderately long sensory filaments.

The outer branches of all the thoracic feet are armed with stout dagger-like spines on their outer aspect. The inner branches of the fifth pair are considerably shorter than the outer ones, and the end joints terminate abruptly, as shown in the figure; moreover, the marginal setæ on the

inner edges of both the inner and outer branches have the basal half distinctly thicker than the distal portion, so much so as to be observable without dissection (fig. 15).

This species has also been obtained in the Moray Firth and in the Firth of Forth as well as in the Clyde, but seldom more than one or two specimens have been noticed in any single gathering.

Genus *Labidocera*, Lubbock (1853).

Labidocera wollastoni, Lubbock.

1857. *Pontella wollastoni*, Lubb., Ann. Nat. Hist. (2), vol. 20, p. 406, pl. 10, 11.

This somewhat rare species was captured in Loch Fyne with the surface tow-net at Station XIII. (off Largymore), October 9, 1901. It also occurred in a bottom tow-net gathering collected at Station XIII., near the mouth of the Clyde estuary, on November 11, 1901. In the gathering at Station VIII. there were also obtained *Candacia pectinata*, *Metridia lucens*, *Parapontella brevicornis*, and other forms.

Fam. HARPACTICIDÆ.

Genus *Ectinosma*, Boeck (1864).

Ectinosma curticorne, Boeck. Pl. vi., fig. 1.

1885. *Ectinosoma curticorne*, Boeck, Abhandl. Natur. Vereins zu Bremen, ix. Bd., p. 194, t. vi., figs. 1–12.

1895. *Ectinosoma curticorne*, T. and A. Scott, Trans. Linn. Soc., vol. vi. (Zool.), p. 430, pl. 36, figs. 22, 30, 34, et. seq.

This is a marine species, and though recorded from several British localities it does not appear to be anywhere very common; it is, however, more frequently met with amongst the fronds and roots of algæ in the littoral zone than in off-shore waters. It is usually of a brownish colour, and there is also usually a dark-coloured blotch at the bases of the antennules, such as is observed in *Bradya minor*, but in that species the outline of the blotch is more distinctly defined. Specimens of this species have been obtained in gatherings collected some years ago in shallow water near Musselburgh and Granton, Firth of Forth, but which have only recently been examined. In this species, as in one or two others, the furcal joints are each provided at the apex with a short but stout cone-shaped spine and with two other short setæ which are moderately stout and spiniform, as shown in the drawing (pl. vi., fig. 1). There are also, as in other Harpactids, one or two elongated terminal setæ, the principal of which is moderately stout.

A few other *Ectinosomas* were obtained in the Musselburgh gatherings along with *E. curticorne*, two of which may be referred to here, viz. *E. gracile* and *E. herdmani*. *Ectinosoma gracile*, T. and A. Scott, is a small and slender form which was first discovered near St. Monans, Firth of Forth, and has since been found sparingly in several British localities. This species was moderately frequent in one of the gatherings from Musselburgh. *Ectinosoma herdmani*, T. and A. Scott, though a larger form than the last, is also moderately slender, and was also first observed near St. Monans. Most of the *Ectinosomas* require careful examination, but this is one of a few that are comparatively easily identified. This species was one of the more common Harpactids in the Musselburgh gatherings; it is readily noticed by its elongated slender form and the opaque white colour it assumes when preserved in spirit.

Genus *Ameira*, Boeck.

Ameira pusilla, T. Scott, sp. nov. Pl. v., figs. 1–10.

Description of the Female.—Body elongated and slender, resembling generally a small *Canthocamptus* or *Attheyella*; length about three and a half millimetres (about $\frac{1}{10}$ of an inch), rostrum short (fig. 1).

The antennules are only moderately elongated and composed of seven joints, the second joint is considerably longer than any of the others, and the antepenultimate one is apparently the smallest, as shown by the drawing (fig. 2).

The antennæ, which are moderately stout (fig. 3), are furnished with a small unarticulated secondary branch.

The mandibles are of a narrow cylindrical form and are armed with several small teeth or spinules on the obliquely truncate apex; the palp is of moderate size and is composed of a somewhat dilated basal joint bearing two small one-jointed branches (fig. 4).

The second maxillipeds are small, two-jointed, and armed with a small but moderately stout terminal claw (fig. 5).

In the first pair of thoracic feet the inner branches, which are three-jointed, are very long, but this is owing to the elongation of the first and third joints, the middle joint being a short one, the first joint reaches to about the extremity of the three-jointed outer branches, while the third joint is fully half the length of the first and twice the length of the second joint; the inner branches are also slender in proportion to the length (fig. 6).

The inner branches of each of the following three pairs are all shorter than the outer ones, which are somewhat elongated, and both branches in all the three pairs, and especially of the third and fourth, are moderately slender (figs. 7 and 8).

In the fifth pair the inner produced portion of the basal joint is broadly sub-cylindrical, and does not reach to the end of the secondary joint; it appears to be provided with four apical setæ, the two inner ones being moderately short and spiniform, but the two others are longer. The secondary joint is also somewhat cylindrical in form, and rounded at the ends, its breadth being nearly equal to half the length; it appears to be provided with only three apical setæ, arranged as shown in the drawing (fig. 9), the middle one being very long and slender and the inner one also slender and elongated, but the outer is short.

The furcal joints are fully half as long as the last segments of the abdomen, and the principal tail setæ are very long and slender (fig. 10).

Habitat.—Off Musselburgh, Firth of Forth, in shallow water, but not very common.

Remarks.—This species has a close general resemblance to some forms of *Canthocamptus*, not only in its general configuration but also in some of its appendages; this is especially noticeable in the structure of the first thoracic feet, which do not differ much from *Canthocamptus staphylinus* or *C. northumbrius*; this pair is also somewhat similar to those of *Stenelia ima*, but the terminal joints of the inner branches are proportionally considerably longer. The structure of the antennæ and mandibles shows its relationship with *Ameira*, but it differs in the structure of the first and fifth pairs of thoracic feet from any species previously described, so far as these are known to me.

Ameira ambigua, T. Scott, sp. nov. Pl. v., figs. 11–19.

Description of the Female.—This form, which somewhat resembles *Ameira longipes* in general appearance, is comparatively small; the

specimen represented by the drawing (fig. 11) measures only .56 mm. (about $\frac{1}{4}$ of an inch). In this form the rostrum is small and the furcal joints short.

The antennules (fig. 12) are elongated and slender and composed of eight joints, the smallest joints counting from the proximal end are the fifth and seventh, while the second is the largest. The proportional lengths of the various joints are shown approximately by the annexed formula:—

Lengths of the joints,	·	15 · 18 · 12 · 11 · 7 · 8 · 5 ·
Numbers of the joints,	·	1 · 2 · 3 · 4 · 5 · 6 · 7 · 8

The antennæ appear to be two-jointed and moderately stout, but the secondary branch is small and composed of a single joint (fig. 13).

The mandibles are very small and of a cylindrical form, the distal end is obliquely truncated and armed with minute spines; the palp is also very small, and has the basal part slightly dilated and provided with a minute one-jointed branch (fig. 14).

The second maxillipeds are moderately stout and two-jointed, and armed with an elongated and slender terminal claw (fig. 15).

The first pair of thoracic feet have the inner branches elongated and moderately stout; the first joint is about three times as long as the entire length of the second and third joints, but these two joints are small and sub-equal. The outer branches are moderately slender, and they are shorter than the first joint of the inner ones (fig. 16).

The next three pairs are all elongated and moderately stout. In the second pair (fig. 17) the inner branches, which are somewhat shorter than the outer, taper towards the distal end, as shown in the drawing, the first joint being more dilated than the second, and the second than the last; each of the three joints is furnished with a slender seta on its inner margin. The outer branches are slender, and the exterior marginal spines are elongated; the second joint is also provided with one, and the third with two slender setæ on the inner edge.

In the fourth pair the inner branches are also, as in the second pair, shorter than the second branches, but they are scarcely so stout as those of that pair; moreover, the first and second joints are each furnished with a seta on the inner margin, while the third bears two setæ. The outer branches do not differ much from the same branches in the second pair (fig. 18).

In the fifth pair the inner produced portion of the basal joint bears four slender setæ on its broadly rounded apex, the second one from the inside being much longer than the others. The secondary joints are sub-cylindrical in general form, but with the ends rounded; they are each about twice as long as broad and carry five setæ round the outer margin and apex, but the two innermost are considerably longer than the others (fig. 19).

Habitat.—Off Musselburgh, Firth of Forth; apparently rare.
Remarks.—This is one of those troublesome forms which, while differing in one or other of its structural details from any of the described species I am acquainted with, yet exhibits no single character prominently distinctive, such as we have in *Ameira longicaudata*, T. Scott. The following three characters, however, taken in combination will, I think, enable this species to be distinguished—(1) the structure of the somewhat slender antennules, (2) the comparatively long first joint of the inner branches of the first thoracic legs, along with the short second and third joints, and (3) the form and armature of the fifth pair in the female. The male has not been observed.

Genus *Delavalia*, G. S. Brady.

Delavalia minutissima, T. Scott, sp. nov. Pl. iv., figs. 3-10.

Description of the Female.—The female of this species resembles the type-form of the genus in its general outline, and also generally in its structural details, but it is the smallest of any species that has yet been described, being scarcely .4 mm. (about $\frac{1}{25}$ of an inch).

The antennules appear to consist of seven joints; the end joint is about twice as long as the penultimate one, but the others are sub-equal in length, and, as usual, become gradually stouter towards the proximal end (fig. 4).

The antennæ and mouth organs, being so small, were difficult to get hold of, and are not figured, but so far as they could be made out they resembled very closely those of *Delavalia æmula* (T. Scott).

The first pair of thoracic feet resemble in some measure the first pair in *Delavalia robusta*, Brady and Robertson, and of *D. reflexa* of the same authors, but the principal terminal spine of the inner branches is distinctly different, and the spine on the inner distal angle of the second basal joint is remarkably elongated, as shown by the figure (fig. 5).

The next three pairs (figs. 6 to 8) resemble those of *Delavalia æmula*, but are more slender and moderately elongated, and while in the second and third pairs the outer and inner branches are of nearly equal length, the outer branches of the fourth pair are considerably longer than the inner, as shown by figure 8.

The fifth pair, though small, are, in their general character, similar to those of the group to which the species belongs. The basal joint is furnished with four setæ on the broadly truncate apex; a short and a long seta near its inner aspect and a pair somewhat similar towards its exterior aspect, with a distinct space between the two pairs; the secondary joints are each armed with four setæ on the broadened, truncated end, the two middle setæ being much smaller than the others, as shown by the drawing (fig. 9).

The caudal segments are proportionally more elongated and slender than those of any other of the described species of the genus; these segments, besides being very narrow, are at least equal to the entire length of the last two segments of the abdomen (fig. 10).

Habitat.—Moray Firth; apparently rare. No males have been observed.

Remarks.—What first attracted my attention towards this species was its small size and the remarkable length of the furcal joints. It is the smallest species of the group that I have yet observed, and though apparently rare, that may be partly accounted for by its being so easily overlooked. The specimen from which the figures have been prepared was obtained in a gathering of dredged material collected in the Moray Firth several years ago, but the description of it was delayed in the hope that other specimens might turn up, which would have enabled me to present a more complete series of detail drawings, but this hope has not yet been realised. The description and figures given here are, however, along with the small size of the copepod, sufficient to distinguish it from those already described, indeed, its extremely long furcal joints would alone mark it out as different, and these taken along with the peculiar armature of the inner branches of the first thoracic feet, and also of the fifth pair, give to the species a character distinct from other *Delavalias*.

Canthocamptus.

Canthocamptus inconspicuus, T. Scott.

1900. *Canthocamptus inconspicuus*, T. Scott, 18th Ann. Rept. Fishery Board for Scotland, pt. iii., p. 390, pl. xiv., figs. 1-8.

This small Harpacticid was obtained in a gathering of Entomostraca collected off Musselburgh in 1894, but only recently examined: this is the first time it has been obtained in the Firth of Forth, and it has only previously been recorded from the Moray Firth. *Canthocamptus inconspicuus* somewhat resembles *C. parvus*, T. and A. Scott, in general appearance, and like that species it has antennules composed of six joints; but it differs in several particulars, and one of the more obvious differences is the longer furcal joints, and by this character alone it can be distinguished from *E. parvus*.

Canthocamptus parvus, T. and A. Scott.

1896. *Canthocamptus parvus*, T. and A. Scott, Ann. Nat. Hist. (6), vol. xviii., p. 6, pl. ii., figs. 14-22.

This species has recently been obtained in several gatherings, one of which consisted of small Crustacea collected in the pond at the Sea-fish Hatchery, Bay of Nigg, June 25, 1902. Like the *Canthocamptus* previously mentioned, this one usually occurs very sparingly in any single gathering, but it has apparently a wider distribution, and has been observed not only at different times in the Firth of Forth, where it was first discovered, but also in the Moray Firth and in the Firth of Clyde. In this species the furcal joints are very short, and it thus differs from *C. inconspicuus*. *C. parvus* is usually found near the shore about the roots of algæ, and especially where there is a muddy bottom.

Genus *Neobradia*, T. Scott.

Neobradia pectinifer, T. Scott.

1892. *Neobradia pectinifer*, T. Scott, 10th Ann. Rept. Fishery Board for Scotland, pt. iii., p. 249, pl. xiii., figs. 19-32.

A single specimen of this rare species occurred in a gathering of small Crustacea collected at the north end of Inchkeith, on November 15th, 1889, but not examined till October, 1902. The species was first observed among some dredged materials collected off St. Monans, and it was afterwards obtained in the Firth of Clyde,* but though its distribution appears to be somewhat extensive, I have only rarely observed it.

Genus *Tetragoniceps*, G. S. Brady.

Tetragoniceps pygmæus, T. Scott, sp. nov. Pl. iv., figs. 11-19.

Some time ago, when re-examining a gathering of small Entomostraca collected near Musselburgh in 1894, I observed odd specimens of a slender copepod very like *Tetragoniceps incertus*, T. Scott—a species described in the Tenth Annual Report of the Fishery Board for Scotland—but rather smaller than that form, and the fact that one or two of them were provided with ovisacs showed that their smaller size could not be ascribed to immaturity, but on account of their likeness to the species named they

* Brit. Assoc. Handbook on the Natural History of Glasgow and the West of Scotland (1901), p. 353.

had probably on previous examinations been passed over as being merely a form of it. Recently, however, a more careful scrutiny of these smaller forms has revealed certain structural differences which render their removal from that species necessary, and as this form is distinctly smaller than the other, I propose to call the new species *Tetragoniceps pygmaeus*, and the following is a description of it:—

Description of the Female.—The female closely resembles the female of *Tetragoniceps incertus* but is distinctly smaller, measuring only a little over .5 mm. (about $\frac{1}{47}$ of an inch). (*Tetragoniceps incertus* is about one millimetre in length). The body is very slender, with a small but distinct rostrum (fig. 11).

Antennules almost similar to those of *Tetragoniceps incertus*, differing only to a small degree in the proportional lengths of the different joints (fig. 12). The antennæ and mouth organs are also very similar.

The first four pairs of thoracic feet are also very similar to the same appendages in *Tetragoniceps incertus*, but the first pair are rather more slender, especially the inner branches, while the seta on the inner margin of the first joint appears to be situated nearer the middle of it, the outer branches appear also to be proportionally rather longer (fig. 14).

The fifth pair (fig. 16) are not only smaller, but differ in form and armature; they are more bluntly rounded at the apex, and instead of terminating in a single stout apical spine as in the species referred to, there is at the base of the larger spine another one, small but distinct; the arrangement of the supplementary setæ is also different in the two species, as shown by the drawings.

The furcal joints, which are somewhat dilated in the middle, taper towards the distal end; the principal apical seta of each furcal joint is moderately short, and the outer portion of it terminates somewhat abruptly, but is continued by a slender portion which forms a peculiar loop where the two portions join, as indicated by the figure; this peculiarity is not found in *Tetragoniceps incertus* (fig. 19).

The male resembles the female, except in the following particulars. The antennules (fig. 13) are modified for grasping, they differ slightly from the male antennules in *Tetragoniceps incertus*.

The inner branches of the third pair of thoracic feet (fig. 15) are small and three-jointed; the first and second joints are very short, but the inner part of the second is produced into a long bent spiniform process which extends considerably beyond the extremity of the branch; the last joint is also small and bears a minute terminal spine. In *Tetragoniceps incertus* this branch has a long straight process arising from its inner basal aspect and is furnished with two terminal setæ.

The fifth pair are smaller than those of the female, they also differ in their armature as shown by the drawing (fig. 17). The supplementary foot on the first abdominal segment is furnished with three setæ (fig. 18).

Remarks.—This form, though perhaps it does come somewhat near to *Tetragoniceps incertus*, is not difficult to distinguish from that species, even without dissection, by its smaller size and by the difference in the character of the fifth feet and the furcal joints, and these differences are of course more easily observed when one has both forms under observation.

Genus *Laophonte*, Philippi (1840).

Laophonte gracilis, T. Scott, sp. nov. Pl. vi., figs. 6–12.

Description of the Female.—The body is slender and sub-cylindrical, and appears to be covered with exceedingly minute hairs. It has a small blunt rostrum, and the furcal joints are scarcely so long as the last

abdominal segment (fig. 6). Length about .67 mm. (about $\frac{1}{39}$ of an inch). The antennules (fig. 7) are short and composed of seven joints; the first three joints are moderately large, but the others are small.

The antennæ and mouth organs are not unlike those of *Laophonte intermedia*, except that the second maxillipeds are long and narrow, and the terminal claw very slender and elongated (fig. 8).

The first pair of thoracic feet are slender, and the first joint of the inner two-jointed branches is elongated and narrow, but the second joint is short and armed with a moderately stout terminal claw; the inner branches are three-jointed, and just about half as long as the first joint of the inner branches (fig. 9).

The second, third, and fourth pairs, which are somewhat similar to each other in structure, are also slender. The fourth pair is represented by the drawing (fig. 10). In this the outer branches are of moderate length, and composed of three sub-equal joints, but the inner branches are short and two-jointed, the first joint being a small one.

The fifth pair (fig. 11) are comparatively large and foliaceous, and have a general resemblance to those of *Laophonte similis*; the basal joint, which is sub-triangular in outline, is produced interiorly so that its apex reaches to about the middle of the secondary joint; there are three stout setæ on the inner margin of the basal joint and two smaller apical setæ. The secondary branch is sub-ovate, somewhat longer than broad, and provided with about five setæ on the lower half of the outer margin and apex, the second seta from the inside is of moderate length, but the others are short. One ovisac with several small ova.

Habitat.—In an old quarry at Granton into which the tide ebbs and flows. Rare. This is different from any species known to me.

The following other species of *Laophonte* were also found in the same gathering with the species just described:—

Laophonte littorale, T. Scott.

Laophonte intermedia, T. Scott.

Laophonte hispida (Brady and Robertson).

Laophonte thoracica, Boeck.

Laophonte inopinata, T. Scott.

Laophonte curticauda, Boeck.

Laophonte lamellifera (Claus).

1863. *Cleta lamellifera*. Die frei-lebenden Copepoden, p. 123, t. xv., figs. 21–25.

This fine species occurred sparingly in a gathering of copepods washed from some dredgings collected in shallow water off Musselburgh, Firth of Forth. In the same gathering, as well as in another from near the same place, collected by means of a hand-net, between tide marks, another *Laophonte*, *L. intermedia*, T. Scott,* was much more frequent, and as it somewhat resembles *L. lamellifera* might be mistaken for it, but *L. intermedia* has shorter furcal joints, and the outer branches and second basal joint of the first pair of thoracic feet have a dense covering of minute hairs, which may frequently be seen without dissection.

Laophonte denticornis, T. Scott.

1894. 12th Ann. Rept. Fishery Board for Scotland, pt. iii., p. 246, pl. vii., figs. 13–23.

One or two specimens of this species were found in the same gathering

* *Thirteenth Annual Report of the Fishery Board for Scotland*, Part III., p. 168. figs 10-20 (1894).

with the last; it is a rare form, and has not hitherto been observed on the south side of the Forth. *Laophonte denticornis* differs from *L. serrata*, Claus, in having the outer branches of the first thoracic feet three-jointed, and in the different form of the fifth feet in both the male and female; the female also wants the posterior dorsal spine which is characteristic of the female of *L. serrata*. *Laophonte hispida* and *thoracica* were also obtained in this Musselburgh gathering.

Genus *Laophontodes*, T. Scott (1894).

Laophontodes typicus, T. Scott.

1894. *Laophontodes typicus*, T. Scott. 12th Ann. Rept. Fishery Board for Scotland, pt. iii., p. 249, pl. viii., figs. 2-8.

This species, which is not difficult to identify, even without dissection, by the peculiar form of the fifth thoracic feet in the female, was moderately frequent in the gathering from the old quarry at Granton in which *Stephos scotti* was obtained.

Genus *Cletodes*, G. S. Brady (1872).

Cletodes neglecta, T. Scott, sp. nov. Pl. iv., figs. 20-31.

Description of the Female.—Body elongated, narrow, cylindrical; all the segments distinct except the first and second of the abdomen, which are slightly coalescent. The first three segments of the abdomen have their lateral angles produced into small spiniform processes. Rostrum short and broadly triangular. Caudal joints narrow and elongated and equal to nearly one and a half times the length of the last abdominal segment (fig. 20).

The antennules are short and stout and composed of five (or six) joints; the end joint is narrower and rather longer than the others, while the penultimate one is very small; the last four joints are also all setiferous, as shown by the drawing (fig. 21).

Antennæ two-jointed and of moderate length; the end joint is provided with spiniform, marginal and terminal, setæ; a few of the terminal setæ are elongated, but the others are moderately short. The secondary branches of the antennæ are rudimentary, and are represented by a single short hair as in *Cletodes limicola*, G. S. Brady (fig. 23).

The mandibles are stout, elongated, sub-cylindrical, and armed with a few stout apical teeth. The palp is composed of a single one-jointed branch, and is provided with several plumose setæ (fig. 24).

The second maxillipeds are composed of two moderately slender joints, and the terminal claw is also slender and elongated (fig. 25).

The first pair of thoracic feet (fig. 26) resemble in their structure and armature the first pair in *Cletodes limicola*; both branches are short, but the three-jointed outer branches are rather longer than the two-jointed inner ones. In the inner branches the end joint is narrower and about one and a half times longer than the other. Moreover, the seta on the outer angle as well as the one on the inner angle of the second basal joint are both elongated, the inner one being also plumose. In the second pair (fig. 27) the outer branches are elongated and slender, but the inner two-jointed branches are short; the second joint of the inner branches is narrow, and fully twice as long as the first joint; two very long hairs spring from its truncate apex, but otherwise it is unarmed; the outer branches are provided with long slender spines on the exterior distal angles of all the three joints; there is also a single slender seta on the

lower half of the inner margin of the middle joint. The third pair (fig. 28) are somewhat similar to the second, except that they are rather more slender, and that the second joint of the inner branches bears a small spine on the distal end of its outer margin in addition to the two long terminal setæ. The fourth pair, on the other hand, scarcely differ from the third except that the outer branches are rather more elongated (fig. 29).

The fifth pair resemble very closely the fifth pair of the female in *Cletodes limicola*, so much so that, with the exception of the basal joint being rather more produced, the general configuration and armature of this pair are in the two species almost identical (fig. 30).

The male is very similar to the female. The antennules of the male have, as usual, a modified structure (fig. 22), and the fifth pair of thoracic feet are very small (fig. 31). In the fifth pair of feet the basal joint is nearly rudimentary, and the secondary joint, which is of a narrow cylindrical form, is provided with only two apical setæ, as shown by the drawing.

Habitat.—Moray Firth; moderately rare.

Remarks.—The form just described has been known to me for a considerable time, but has been left over from year to year, as I was in doubt whether the differences observed were of any real value. As, however, I have not been able to find any described species to which this form could be assigned, I have described it here under a distinct name.

This form belongs to a group of *Cletodes* which are all closely related to each other, and exhibit this relationship by the similarity in the structure of the antennules and of the first pair of thoracic feet, but especially in the structure and armature of the female fifth pair; and perhaps the most typical species of the group is the *Cletodes limicola* of G. S. Brady. In this group the antennules are usually composed of five joints, the penultimate one being very small; in the first pair of thoracic feet both branches are short, but the inner rather shorter than the outer; the second joint of the inner branches is also distinctly narrower and considerably longer than the first joint. In the fifth pair the basal joint is small, and only slightly produced interiorly—sometimes not at all—and provided with few, usually two or three, setæ. The secondary joints, on the other hand, are elongated and narrow and usually furnished with five setæ—two at the apex, one on the lower part of the inner margin, and two widely separated on the outer margin. The form just described, while agreeing in some of its structural details with several members of this group, differs in one point or another from them all, so far as they are at present known to me.

Cletodes propinqua, Brady and Robertson.

1875. *Cletodes propinqua*, B. and R., Brit. Assoc. Report, p. 196.

This curious little Harpactid occurred very sparingly in the same Musselburgh gathering with the *Laophontodes* just referred to. Its bathymetrical distribution appears to extend from the littoral zone down to moderately deep water. The furcal joints are short and pyriform, and seem to be characteristic of the species. One or two other species of *Cletodes*, including *C. limicola*, G. S. Brady,* and *C. lata*, T. Scott,† were also obtained in the same gathering.

* *Nat. Hist. Trans. Northumb. and Durham*, vol. iv., p. 438, pl. xxi., figs. 10-17 (1872).
 † *Tenth Annual Report of the Fishery Board for Scotland*, Part III., p. 257, pl. x., figs. 10-18 (1892).

Genus *Enhydrosoma*, Boeck (1872).

Enhydrosoma gracile, T. Scott, sp. n. Pl. ii., figs. 16–26; pl. iii., fig. 1.

Description of the Female.—Body slender, cylindrical, slightly incurved, but otherwise similar to *E. curvatum*, Brady and Robertson (fig. 16). Length of specimen represented by the drawing about 45 mm. ($\frac{1}{5}$ of an inch).

Antennules very short, moderately stout, and sparingly setiferous; they are composed of four joints, the first three being sub-equal in length, but the last is considerably smaller than any of the others (fig. 17). The formula shows approximately the proportional lengths of the various joints:—

$$\begin{array}{cccc} 1 & \cdot & 2 & \cdot & 3 & \cdot & 4 \\ \hline 22 & \cdot & 18 & \cdot & 19 & \cdot & 11 \end{array}$$

The antennæ (fig. 18) appear to be somewhat like those of *E. curvatum*. The mandibles (fig. 19) are also similar to those of the same species.

The second maxillipeds (fig. 20) have basal joint short, but the preceding one is elongated, and the terminal claw is slender and moderately short.

The first thoracic feet are somewhat like those of *E. curvatum*; the inner branches are short and two-jointed, the second joint being only slightly longer than the first, and their extremities, which do not reach to the end of the second joint of the outer branches, bear two elongated slender setæ feathered at the end; the outer branches are three-jointed; the first joint is fully as long as the entire length of the next two, but the end joint is shorter than the second one; each of the three joints is furnished with a moderately long and very slender seta on its outer aspect, while the end one also carries two elongated terminal setæ similar to those on the inner branches (fig. 21).

The second, third, and fourth pairs (figs. 22 and 23), which appear to differ little from each other, have the inner branches very short and composed of two joints, the first being very small, while the end joint is furnished with a few terminal setæ as shown by the figures; the outer branches are three-jointed and of moderate length and stoutness, the middle joint is slightly shorter than the first or third.

The fifth pair are broadly foliaceous, distinctly two-branched, and both branches are broadly sub-truncate at the end and provided with five moderately stout and elongated setæ, the lengths of which vary to some extent as shown in the drawings; a single seta springs from a small lobe near the outer distal angle of the outer branch (fig. 24).

The furcal branches are very short (fig. 26).

The ovisac is small and contains very few ova.

The male appears to differ little from the female except in the structure of the antennules (pl. ii., fig. 1), and also to some extent in the form of the fifth feet. The fifth pair in the male consists of a rectangular plate about half as long as broad, and obscurely divided into two portions; the inner portion is furnished with two moderately elongated setæ on the lower edge, while the outer portion bears three or four setæ as shown by the drawing (pl. i., fig. 25).

Habitat.—Shore at Musselburgh, Firth of Forth; moderately rare.

Remarks.—This species occurred with a number of other curious forms in a gathering collected in 1894. Several other new species were obtained in this gathering, but some of these have already been described.* This

* See *Thirtieth Annual Report of the Fishery Board for Scotland*, Part III., p. 167, et seq.; *Ann. and Mag. Nat. Hist.* (6), vol. xv., pp. 52–53; *Ann. Scot. Nat. Hist.*, January, 1895.

Enhydrosoma is a smaller and more slender form than *E. curvatum*; the female antennules are apparently only four- instead of five-jointed, the third and fourth joints in *E. curvatum* being in this species completely coalescent. The first pair of thoracic feet are also somewhat different in the two species, but a greater difference is observed in the structure of the female fifth pair; in *E. curvatum* there is a distinct though small secondary branch, but in the present species the branches, which are sub-equal, do not appear to be distinctly separated.

Enhydrosoma minutum, T. Scott, sp. nov. Pl. iii., fig. 25; pl. vi., figs. 1–5.

Description of the Female.—This is a small but moderately stout species as shown by the drawing (fig. 1, pl. vi.). Its entire length, exclusive of antennules and tail setæ, scarcely reaches to 4 m.m. (about $\frac{1}{50}$ of an inch).

The antennules (fig. 2, pl. vi.) are composed of five joints, but the fourth is very small; the armature consists of a number of moderately stout setæ, a few of them being plumose, and the end joint carries a stout terminal spine as shown by the figure.

The mouth organs resemble generally those of *E. gracile*, but the second maxillipeds are comparatively rather stouter (fig. 3, pl. vi.).

The first pair of thoracic feet, which appeared to be somewhat similar in structure to the first pair in *E. gracile*, were accidentally damaged, so that a correct drawing of them could not be prepared.

The second, third, and fourth pairs are all somewhat alike in structure (pl. iii., fig. 25; pl. vi., fig. 4), and their outer branches do not differ greatly from the outer branches of the feet similar to them in *E. curvatum*, but the inner branches are very small, they each consist of two joints, the first joint being much shorter than the other, while the end joint tapers towards the distal end, and carries a single elongated terminal seta.

The fifth pair (fig. 5, pl. vi.) are broadly foliaceous and resemble those of *E. gracile*; but the secondary branches are more distinctly articulated to the basal joints, and the setæ of the two joints appear to be stouter.

The furcal joints are extremely short. The female appears to carry one ovisac with several moderately large ova.

Habitat.—Aberdeen Bay, Station V., Nov. 12, 1901. One specimen only.

Remarks.—*Enhydrosoma minutum* differs from the species already described by the difference in the structure of the antennules, and by the form and armature of the inner branches of the second, third, and fourth pairs of feet. No male specimen has been observed.

Enhydrosoma curvatum (Brady and Robertson).

1875. *Rhithrothrix curvata*, B. and R., Brit. Assoc. Rept., p. 197.
1880. *Enhydrosoma curvatum*, Brady, Mon. Brit. Copepoda, vol. ii., p. 98, pl. lxxxi., figs. 12–15; pl. lxxxii., figs. 11–19.

This also occurred in the gathering from the old quarry near Granton; it is quite distinct from the two species, *E. gracile* and *E. minutum*, just described; the difference in the structure of the fifth thoracic feet would alone be sufficient to separate them; it is, moreover, a somewhat larger species. There is a previous record of this species from the Forth district, but from a different part of the estuary,* as well as from other places around the Scottish coasts.

* *Eighth Annual Report of the Fishery Board for Scotland*, Part III., p. 319 (1890).

Genus *Nannopus*, Brady (1880).*Nannopus palustris*, Brady.

1880. *Nannopus palustris*, Brady, Mon. Brit. Copepoda, vol ii., p. 100, pl. lxxvii., figs. 18-20.
 1902. *Nannopus palustris*, T. Scott, 20th Ann. Rept. Fishery Board for Scotland, pt. iii., p. 466, pl. xxiii., figs. 13-25.

This somewhat rare species was observed very sparingly in the gathering from the old quarry near Granton in which several other interesting forms have been obtained, and it also occurred in a hand-net gathering of small Crustacea collected between tide marks at Musselburgh. *Nannopus palustris* appears to be a true littoral or brackish-water species, and is rarely met with in deep water off shore. Another species with a somewhat similar habitat to *Nannopus*, viz. *Palatychelipus littoralis*, G. S. Brady, was also obtained in the vicinity of Musselburgh, where it was observed in 1892,* and was then new to the Scottish coasts. It is now ascertained that the species has a wide distribution, but it does not appear to be anywhere very common.

Genus *Dactylopus*, Claus (1863).*Dactylopus littoralis*, T. Scott, sp. nov. Pl. iii., figs. 2-8.

Description of the Female.—Body moderately slender, rostrum short (fig. 2).

Antennules (fig. 3) short and composed of eight joints, the third is shorter than the one which precedes or follows, the fifth and seventh joints are small, while the last is about as long as the combined lengths of the sixth and seventh. The proportional lengths of the various joints are shown approximately by the formula:—

$$\frac{8 \cdot 11 \cdot 9 \cdot 11 \cdot 4 \cdot 6 \cdot 4 \cdot 9}{1 \cdot 2 \cdot 3 \cdot 4 \cdot 5 \cdot 6 \cdot 7 \cdot 8}$$

The second maxillipeds are stout with a moderately stout terminal claw, a somewhat long spine-like seta springs from the inner aspect and near the distal end of the second joint, but, with the exception of another small hair, this joint appears to be devoid of armature of any kind. The first joint is provided with two or three small spine-like hairs at the distal end, while the end joint is almost as narrow as the base of the terminal claw (fig. 4).

The first pair of thoracic feet are moderately short and stout, the first joint of the inner branches is somewhat longer than the outer branches, but the last two joints are small, and the end one is armed with two terminal spines, one being short and stout, the other longer and setiform; the outer are composed of three sub-equal joints similar to those of the species previously described (fig. 5).

The second, third, and fourth pairs are moderately elongated, but the fourth is rather longer than the others; both branches are three-jointed, and the inner branches are shorter than the outer ones; the marginal spines of the outer branch are moderately long and slender, and the setae on both branches elongated and plumose (fig. 6 represents the fourth pair).

The fifth pair are moderately broad and foliaceous, especially the outer

* Tenth Annual Report of the Fishery Board for Scotland, Part III., p. 205, pl. v., figs. 11-13 (1893).

or secondary joints; these joints, which are of an ovate form and about one and a half times as long as broad, bear five setae round the lower outer margin and end, the middle one being rather longer than the others; the produced inner portion of the basal joints, which scarcely reach to the end of the outer secondary ones, have the sides slightly rounded and taper to the narrowly-rounded apex; they are each furnished with five setae—three on the lower inner margin and two close together at the apex, as shown by the following drawing (fig. 7).

The furcal joints are shorter than the last abdominal segment; they each appear to be abruptly truncate, and their principal setae are elongated and slender (fig. 8).

Habitat.—In a shore gathering collected at Musselburgh, Firth of Forth, in 1894; rather rare.

Remarks.—The copepod described above has as great resemblance to *Stenhelia* as to *Dactylopus* in its general appearance and in some of its structural details, as, for example, in the structure of the first thoracic feet, but in the structure of the antennules, mandibles, and fifth thoracic feet its relationship appears to be closer to *Dactylopus*; it differs from described species in structure of the antennules, in the comparatively stout form of the first thoracic feet, and in the form and armature of the fifth pair. It appears to be a littoral species, as I have only observed it in inshore gatherings.

Dactylopus vararensis, T. Scott, sp. nov. Pl. iii., figs. 17-24.

Description of the Female.—Body moderately stout, length about .75 mm. (about $\frac{3}{4}$ of an inch).

Rostrum prominent, slightly incurved (fig. 17).

Antennules short, eight-jointed, the first four and last joints sub-equal in length, the other three short; the first four joints are also considerably stouter than the last four (fig. 18); the formula shows approximately the proportional lengths of the joints:—

$$\frac{23 \cdot 22 \cdot 29 \cdot 18 \cdot 6 \cdot 10 \cdot 7 \cdot 20}{1 \cdot 2 \cdot 3 \cdot 4 \cdot 5 \cdot 6 \cdot 7 \cdot 8}$$

The secondary branches of the antennae are composed of three joints, but the middle one is small.

The mandibles are stout and sub-cylindrical, and the biting part is somewhat oblique and armed with about three strong and several small spiniform teeth; the basal joint of the palp is somewhat dilated, and carries two branches, the proximal one being considerably smaller than the other, as shown in the drawing (fig. 19).

The second maxillipeds have the penultimate joint moderately elongated and narrow, with a fringe of small setae on the inner aspect of its proximal half; the end joint is scarcely broader than the base of the terminal claw, which is moderately long and slender, and incurved toward the extremity (fig. 20).

In the first pair of thoracic feet, the outer branches, which are composed of three sub-equal joints, are rather longer than the first joint of the inner branches; the first two joints are armed with moderately strong spines on the outer distal angles, while the end joint bears, at the apex, two slender spines and two setae; the first joint of the outer branches is moderately stout, but scarcely twice as long as the combined lengths of the outer two, which are small, narrow, and sub-equal: the inner branches are armed with a stout terminal claw and two setae; the first and second joints are also each provided with a seta near the distal end of the inner

margin (fig. 21). The second, third, and fourth pair are somewhat similar to those of the species previously described (fig. 22 represents the fourth pair).

The fifth pair are small and foliaceous, the produced inner portion of the basal joint reaches to about the end of the secondary joints and bears five setæ on its broadly rounded end; the two outermost setæ are, like the next two, situated near to each other, but there is a comparatively wide space between each pair, the innermost seta is smaller and spiniform; the outer secondary joints are broadly ovate, being only a little longer than broad, and are each provided with five spines, the middle one of which appears to be more slender than the others, as shown by the drawing (fig. 23).

The furcal joints are very small, being almost rudimentary, while the principal tail setæ are short and stout (fig. 24).

Habitat.—Moray Firth, Station IV., collected 1898; apparently rare.

Remarks.—This species is readily distinguished by the peculiar structure of the first thoracic feet, and the comparatively small fifth feet of the female; the fifth pair is not unlike the fifth pair of *Dactylopus minutus*, Claus, but the first pair is very different. *Dactylopus vararensis* was obtained in a gathering of small Crustacea collected in the Moray Firth in 1878, but as the form could not be recognised at the time it was put aside for further study, and I am still unable to identify it with any described species.

Dactylopus mixtus, T. Scott, sp. nov. Pl. iii., figs. 9–16.

Description of the Female.—This form has a general resemblance to both *D. tenuiremis*, G. S. Brady, and *D. longirostris*, Claus. The body is moderately robust, and in specimens preserved in spirit the abdomen is considerably reflexed; there is a prominent rostrum, but the furcal joints are very short (fig. 9). Length .6 mm. (about $\frac{1}{42}$ of an inch).

The antennules (fig. 10) are moderately elongated and composed of eight joints; the second joint is the largest, the fourth and last are also comparatively long, being about half as long again as the one immediately preceding; the third, fifth, sixth, and seventh joints are small. The antennules are thus somewhat like those of *D. longirostris*, Claus, in structure, as shown by the drawing.

The antennæ are provided with three-jointed secondary branches similar to those of *D. strömii*, Baird.

The mandibles are well developed, the biting edge is armed with several spine-like teeth, the two outer ones are stout, but the others are slender; the basal joint of the mandible palp moderately dilated, and bears two small branches towards its distal end; the inner branch is somewhat smaller than the other and is apparently two-jointed; the other branch consists of a single joint (fig. 11).

First maxillipeds somewhat similar to those of *D. strömii*.

The second maxillipeds are of moderate size (fig. 12); the terminal claw springs from a narrow joint about half as long as itself; the second joint is furnished with several small spine-like setæ on the inner margin, and the first joint also carries one or two small hairs at its distal end.

The inner branches of the first thoracic feet are elongated, the first joint being longer than the entire outer branches; the second joint is very small, but the second and third together are about equal to half the length of the first joint; the first joint is fringed interiorly with minute slender hairs, while a moderately long seta springs from its inner distal angle, the proximal part of the outer margin is provided with a number

of minute spines; the second joint bears a feathered seta interiorly, and a few small hairs on the exterior edge; while the end joint, besides being furnished with a few minute spines on the outer margin, bears also a short but moderately stout terminal claw and two slender hairs—the one very short and the other about twice the length of the claw. The outer branches, which are shorter than the first joint of the inner ones, are composed of three sub-equal joints, the first and second are each armed with a strong dagger-like spine on the outer distal angle, and the second bears also a moderately long seta on its inner distal angle; the end joint is furnished with four spines on the outer margin and apex, but two of the marginal spines are comparatively small, a slender and slightly bent seta also springs from the inner apical angle, as shown in the drawing (fig. 13).

The second, third, and fourth pairs have both branches three-jointed, the inner being shorter than the elongated outer branches. The structure and armature of the second and third pairs are not unlike those of the same appendages in *D. strömii*. In the fourth pair the inner branches scarcely reach beyond the end of the second joints of the outer branches, the first and second joints are each provided with one seta near the distal end of the inner margin, while the third joint bears two marginal and two apical setæ; a small slender spine also springs from near the end of the outer margin. In the second and third pairs of feet the second joint of the inner branches is furnished with two setæ on its inner aspect, while the end joint of the second pair carries one marginal and two terminal setæ, and a small and slender terminal spine; but the same joint of the third pair has five marginal and apical setæ in addition to the small apical spine. The outer branches of the fourth pair do not differ much in structure and armature from the outer branches of the second and third pairs; the first and second joints are each provided with a spine on the outer and a plumose seta on the inner distal angles; the third joint bears two small spines on the outer margin and another on the outer angle of the apex, besides setæ on the inner margin and apex, as shown by the drawing (fig. 14).

The fifth pair, which are lamelliform, have the inner produced portion of the basal joint broadly sub-cylindrical, with the apex obliquely truncate and armed with five setæ, the two inner setæ are stout and spiniform, but the other three are more slender; the two outer setæ are close together, but the others are more widely separated; the secondary joint is also broadly sub-cylindrical, scarcely one and a half times longer than broad and obliquely truncate at the end; the three outermost are sub-equal, moderately short and stout; the next two are slender, one being more elongated than the others, while the innermost seta springs from a sub-marginal notch, as shown by the drawing (fig. 15).

The furcal joints are very short, and the principal tail setæ are somewhat dilated at the base. This species carries two ovisacs, as shown in the drawing (fig. 16).

Habitat.—Granton, Firth of Forth (1894). Fishery Board's Hatchery at Bay of Nigg, Aberdeen, November 23rd, 1900.

Remarks.—I was at first inclined to ascribe this form to Claus's *Dactylopus longirostris*, but it differs rather markedly in the structure of the fifth feet of the female. *Dactylopus tenuiremis*, G. S. Brady, also resembles the form just described in its elongated antennules and in one or two other minor details, but it distinctly differs in the proportional lengths of the joints of the outer branches of the first feet and in form of the fifth pair; and I do not know of any other species with which it can be identified.

Dactylopus coronatus, T. Scott.

1894. *Dactylopus coronatus*, T. Scott. Twelfth Ann. Report Fishery Board for Scotland, pt. iii., p. 255, pl. ix., figs. 12-20.

This *Dactylopus* was obtained very sparingly in material dredged in shallow water off Musselburgh; it has been already taken near the Bass Rock and in Largo Bay, but is nowhere very common.

Dactylopus brevicornis, Claus.

1866. *Dactylopus brevicornis*, Claus. Die Copepoden fauna von Nizza, p. 29, t. iii., figs. 20-25.

1880. *Dactylopus brevicornis*, Brady. Brit. Copep., vol. ii., p. 118, pl. lvii., figs. 10-12; lviii., fig. 14.

Several specimens of this small species were obtained in the old quarry near Granton, Firth of Forth. It appears to be a littoral form, but is found also in moderately deep water, and has been recorded from several places round the Scottish coasts, but usually very sparingly. Among other *Dactylopus* from the same gathering was the well-marked *D. flavus*, Claus, and one or two other common forms.

Dactylopus debilis, Giesb. Pl. v., figs. 20-31.

1882. *Dactylopus debilis*, Giesb. Freileb. Copep. d. Kieler Fohrde, p. 122, pl. i., figs. 7, 19 et. seq.

Description of the Female.—Body slender, and, in spirit specimens, strongly reflexed (fig. 20). The length of the specimen represented by the drawing is only slightly over half a millimetre (about $\frac{1}{46}$ of an inch). The rostrum is moderately prominent, but the furcal joints are very short (fig. 31).

The antennules are of moderate length and composed of eight joints, the first four large but the others considerably smaller (fig. 21). The proportional lengths of the various joints are shown approximately by the annexed formula:—

Proportional lengths of the joints,	18 · 17 · 13 · 18 · 6 · 6 · 8 · 6 · 11
The numbers of the joints,	1 · 2 · 3 · 4 · 5 · 6 · 7 · 8

Antennæ short, moderately stout, two-jointed, and furnished with a three-jointed secondary branch (fig. 22).

Mandibles small, the biting edge armed with a number of small teeth; the basal joint of the palp is dilated and bears two small branches as shown in the drawing (fig. 23).

The second maxillipeds are moderately slender, so also is the elongated terminal claw with which they are armed (fig. 24).

The first pair of thoracic feet are somewhat similar to those of *Dactylopus minutus*, Claus; the first joint of the inner branches is long and slender, being about three times longer than the combined lengths of the second and third joints, and it is furnished with a small seta near the distal end of the inner margin; the terminal claw of the inner branches is moderately stout, and there are also two terminal setæ. The outer branches, which are also slender, are rather shorter than the first joint of the inner ones (fig. 25).

The next three pairs are also slender and resemble each other, except in the following particulars:—In the second pair the inner branches are slightly longer than the outer, and while the last joint of the inner branches is provided with a seta on the inner margin, the end joint of the outer branches has no seta similarly situated. In the third pair the inner

and outer branches are about equal in length, and in this pair, while the first and second joints of the inner branches are each provided with a single seta on their inner margin, the third joint bears two setæ. On the other hand, the inner margins of only the second and third joints are each provided with one seta (fig. 26). In the fourth pair the inner branches are rather shorter than the outer, and the armature of the inner margins of both branches resembles that of the third pair except that the last joint of the inner branches is furnished with one instead of two setæ on its inner edge (fig. 27).

The fifth pair are moderately large and foliaceous; the inner produced portion of the basal joint is generally of a sub-cylindrical form, but the distal end tapers to a blunt-pointed apex from which spring two setæ of moderate but unequal length; the distal half of the inner margin carries also two moderately stout spines, as well as an elongated seta, as shown in the drawing (fig. 29). The secondary joint has a sub-ovate outline, and its extremity extends somewhat beyond the end of the inner produced portion of the basal joint; it is nearly twice as long as broad and is furnished with five setæ which are arranged round the distal end of the joint as shown by fig. 9 already referred to.

The male somewhat resembles the female, but there are the following important differences in addition to the usual modification in the antennules:—(1) The inner branches of the second pair of thoracic feet are distinctly modified; these branches in the male appear to be only two-jointed, the first joint is moderately stout but short, the second extends into a prolonged and stout tapering process which reaches considerably beyond the ends of the outer branches; the first joint also bears one seta on its inner edge, but the elongated second joint is furnished with two (fig. 28).

The fifth feet in the male are small; the inner portion of the basal joint is broadly cone-shaped and carries two apical setæ; the secondary joint is moderately broad and of a somewhat ovate form, and is provided with five setæ, the two setæ on the outer margin are short and spiniform, the apical seta is elongated and slender, while the two on the inner edge are moderately stout and appear to be plumose (fig. 30). There is also a small trispinous appendage on the first segment of the abdomen.

Habitat.—Off Musselburgh, Firth of Forth; not common.

Remarks.—This small species seems to agree better with *Dactylopus minutus*, Claus, than with any other member of the genus, but it differs distinctly from that species by the structure of the antennules and of the fifth pair of feet in the female, and by the peculiar character of the second pair of feet in the male.

Genus *Thalestris*, Claus (1863).

Several species belonging to the genus *Thalestris* have been observed in gatherings recently examined, and the following are now recorded for the first time from the Firth of Forth.

Thalestris peltata, Boeck.

1864. *Anemophia peltata*, Boeck. Oversigt Norges Copepoder, p. 45.

1880. *Thalestris peltata*, Brady, Brit. Copep., vol. ii., p. 138, pl. liii., figs. 11-19.

1895. *Thalestris peltata*, T. and A. Scott, Ann. Nat. Hist. (6), vol. xiv., p. 351, pl. xv., figs. 11-15.; pl. xvi., figs. 1-8.

The somewhat aberrant species of *Thalestris* was obtained off Musselburgh in shallow water (3-4 fathoms). *Thalestris peltata* appears to be a

moderately rare species, but it has so much the appearance of a *Scutellidium* or a *Zaus* that it may have been frequently overlooked. *Thalestris rufocincta*, Norm., and *Thalestris clausii*, Norm., were taken in the same gathering with *T. peltata*.

Genus *Westwoodia*, Dana (1855).

Westwoodia nobilis, Baird.

1845. *Arpacticus nobilis*, Baird, Trans. Barw. Nat. Club, vol. ii., p. 155.

1880. *Westwoodia nobilis*, Brady, British Copepoda, vol. ii., p. 141, pl. lxiii., figs. 1-13.

This prettily-coloured Harpacticid was observed in the same gathering with the *Thalestris* just mentioned. It seems to be a littoral form, and its habitat here agrees with what is stated by Prof. G. S. Brady and Rev. A. M. Norman, but it has also been obtained in water of moderate depth, as off Portincross, Firth of Clyde, where it occurred at depths ranging from ten to thirty fathoms.*

LICHOMOLGIDÆ.

Genus *Paranthesius*, T. Scott, gen. nov.

Antennules short and seven-jointed. Antennæ four-jointed, armed with a stout terminal claw. Mandibles and maxillæ somewhat like those of *Lichomolgus fucicolus*. Anterior maxillipeds small, furnished with strongly curved and elongated terminal claws. The first three pairs of thoracic feet are similar to those of *Lichomolgus*, but in the fourth pair the inner branches appear to be entirely wanting. Fifth pair rudimentary or very small.

Paranthesius dubius, T. Scott, sp. nov. Pl. vi., figs. 16-24.

A single male specimen of a somewhat curious Lichomolgus-like copepod was obtained in some dredged material sent from the Clyde, and collected on June 13, 1899. It has been left unrecorded hitherto in expectation that other specimens, especially females, might be found, and a more exact knowledge obtained of its structure and affinities. It differs in several particulars from any described genus or species at present known to me, and I therefore submit the following description of it under the name of *Paranthesius dubius*.

The male in its general outline somewhat resembles *Pseudopsyllus elongatus*, a copepod described in my paper in Part III. of the Twentieth Annual Report. The body is elongated and narrow; the cephalo-thorax is composed of five segments, the first is rather broader than the others and is considerably longer than the combined lengths of the remaining four segments; these four segments, which are sub-equal in length, become gradually narrower, so that the last is narrower than the first segment of the abdomen. The first abdominal segment is considerably dilated, but the remaining segments are short and narrow; the furcal plates, which are moderately broad, are about as long as the last two segments of the abdomen (fig. 16). The length of the specimen is fully 2 mm. (about $\frac{1}{12}$ of an inch).

The antennules (fig. 17) are short and moderately stout and composed of seven joints, the second joint is the largest, the third and fourth are

* British Copepoda, vol. ii., p. 142 (1880).

very small, but the remaining three are about equal in length and taper slightly to the distal end. The antennules are also sparingly setiferous, and carry several stout and elongated sensory filaments.

The antennæ are composed of four joints, the first two are large and somewhat dilated, but the third and fourth are narrow—the third being also very short; the end joint is furnished at the apex with a stout, strongly-hooked claw and several spiniform setæ (fig. 18).

The mandibles and maxillæ resemble very closely the same appendages in *Lichomolgus fucicolus*, G. S. Brady. The mandible is small, with a dilated base, and carries two stout, moderately long, and strongly curved apical appendages and two small basal setæ. The maxillæ are small and digitiform, and at the apex furnished with two slender spiniform setæ (fig. 19).

Second maxillipeds very small, and each armed with a stout, strongly-curved, and moderately elongate terminal claw (fig. 20).

The first feet were damaged, and the inner branches are not figured. The outer branches are three-jointed; the first joint is short and bears a sabre-like spine on the outer distal angle, but no setæ on the inner margin. The second joint, which is also short, carries a sabre-like spine on the outer distal angle and a moderately long seta on the inner margin. The third joint, which is longer and narrower than those preceding, is furnished with three short sabre-like spines on the outer margin, and a similar but rather longer one at the apex. There are also four moderately long plumose setæ on the inner margin (fig. 21).

The second pair have the outer branches very similar to those of the first pair in structure and armature, except that the third joints have five setæ on the inner edge. The first and second joints of the inner branches have no spines or setæ on the outer margins, but the third joint is provided with a short spine near the distal end of the outer edge, and with two that are longer but of about equal length at the apex. The first joint has one seta on the inner margin, the second two, and the third three. The end joint is also considerably longer than the first or second (fig. 22).

In the third pair, the first and second joints of the outer branches are similar in structure and armature to the same joints in the second pair; the third joints are armed with two sabre-like spines on the outer margin, and with two similar terminal spines; there is also a row of five plumose setæ on the inner margin. The inner branches are provided with one seta on the inner edge of the first joint, and two on the inner edge of the second and third joints. The third joint bears also three moderately long sabre-like spines on its truncate apex, but there are no spines or setæ on the inner margins (fig. 23).

In the fourth pair, the inner branches seem to be entirely obsolete, for on either foot there is no appearance of the endopodites having been broken off.

The outer branches are normal and their armature is very similar to that of the outer branches of the third pair (fig. 24).

The fifth pair are rudimentary, and consist each of a minute digitiform process bearing two small hairs, as shown in fig. 16.

No form that could be regarded as the female of this species has yet been observed.

DESCRIPTION OF THE PLATES.

PLATE II.

<i>Stephos scotti</i> , G. O. Sars.		Diam.
Fig. 1.	Female, side view	× 70.
Fig. 2.	Male, side view	× 70.
Fig. 3.	Fifth pair of feet, female	× 360.
Fig. 4.	Fifth pair of feet, male	× 158.

Parastephos pallidus, G. O. Sars.

Fig. 5.	Female, side view	× 39½.
Fig. 6.	Male, side view	× 39½.
Fig. 7.	Antennule, female	× 70.
Fig. 8.	Foot of second pair	× 79.
Fig. 9.	Fifth pair of feet, female	× 106.
Fig. 10.	Fifth pair of feet, male	× 79.

Pseudophenna typica, G. O. Sars.

Fig. 11.	Male, side view	× 35.
Fig. 12.	Male, dorsal view	× 35.
Fig. 13.	Antennule, male	× 70.
Fig. 14.	Fifth pair of feet	× 154.
Fig. 15.	Extremity of left foot, greatly magnified.	

Enhydrosoma gracile, T. Scott, sp. nov.

Fig. 16.	Female, side view	× 158.
Fig. 17.	Antennule	× 360.
Fig. 18.	Antenna	× 360.
Fig. 19.	Mandible and palp	× 540.
Fig. 20.	Second maxilliped	× 540.
Fig. 21.	Foot of first pair	× 540.
Fig. 22.	Foot of second pair	× 540.
Fig. 23.	Foot of fourth pair	× 540.
Fig. 24.	Foot of fifth pair, female	× 720.
Fig. 25.	Foot of fifth pair, male.	× 720.
Fig. 26.	Furcal joints and last two segments of abdomen	× 270.

PLATE III.

Enhydrosoma gracile, T. Scott, sp. nov.

Fig. 1.	Antennule, male	× 360.
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Dactylopus littoralis, T. Scott, sp. nov.

Fig. 2.	Female, side view	× 70.
Fig. 3.	Antennule	× 360.
Fig. 4.	Second maxilliped	× 720.
Fig. 5.	Foot of first pair	× 360.
Fig. 6.	Foot of fourth pair	× 360.
Fig. 7.	Foot of fifth pair	× 540.
Fig. 8.	Furcal joints and last two segments of abdomen	× 240.

Dactylopus mixtus, T. Scott, sp. nov.

		Diam.
Fig. 9.	Female, side view	× 52.
Fig. 10.	Antennule	× 270.
Fig. 11.	Mandible and palp	× 360.
Fig. 12.	Second maxilliped	× 180.
Fig. 13.	Foot of first pair	× 240.
Fig. 14.	Foot of fourth pair	× 180.
Fig. 15.	Foot of fifth pair	× 270.
Fig. 16.	Furcal joints and last two segments of abdomen	× 133.

Dactylopus vararensis, T. Scott, sp. nov.

Fig. 17.	Female, side view	× 79.
Fig. 18.	Antennule	× 540.
Fig. 19.	Mandible and palp	× 720.
Fig. 20.	Second maxilliped	× 720.
Fig. 21.	Foot of first pair	× 360.
Fig. 22.	Foot of fourth pair	× 270.
Fig. 23.	Foot of fifth pair	× 270.
Fig. 24.	Furcal joints and last two segments of abdomen	× 105.

Enhydrosoma minutum, T. Scott, sp. nov.

Fig. 25.	Foot of second pair, female	× 540.
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PLATE IV.

Ectinosoma curticorne, Boeck.

Fig. 1.	Furcal joints and last two segments of abdomen	× 270.
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Dactylopus mixtus, T. Scott, sp. nov.

Fig. 2.	Antenna	× 270.
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Delavalia minutissima, T. Scott, sp. nov.

Fig. 3.	Female, lateral view	× 158.
Fig. 4.	Antennule	× 540.
Fig. 5.	Foot of first pair	× 720.
Fig. 6.	Foot of second pair	× 540.
Fig. 7.	Foot of third pair	× 540.
Fig. 8.	Foot of fourth pair	× 540.
Fig. 9.	Foot of fifth pair	× 540.
Fig. 10.	Furcal joints and last two segments of abdomen	× 270.

Tetragoniceps pygmaeus, T. Scott, sp. nov.

Fig. 11.	Female, lateral view	× 150.
Fig. 12.	Antennule	× 270.
Fig. 13.	Antennule, male	× 160.
Fig. 14.	Foot of first pair	× 540.
Fig. 15.	Foot of third pair, male	× 540.
Fig. 16.	Foot of fifth pair, female	× 540.
Fig. 17.	Foot of fifth pair, male	× 540.
Fig. 18.	Appendage to first abdominal segment	× 540.
Fig. 19.	Furcal joints and last two segments of abdomen	^ 270.

Cletodes neglecta, T. Scott, sp. nov.

	Diam.
Fig. 20. Female, dorsal view	× 79.
Fig. 21. Antennule	× 360.
Fig. 22. Antennule, male	× 270.
Fig. 23. Antenna	× 540.
Fig. 24. Mandible and palp	× 540.
Fig. 25. Second maxilliped	× 720.
Fig. 26. Foot of first pair	× 160.
Fig. 27. Foot of second pair	× 160.
Fig. 28. Foot of third pair	× 270.
Fig. 29. Foot of fourth pair	× 270.
Fig. 30. Foot of fifth pair, female	× 216.
Fig. 31. Foot of fifth pair, male	× 540.

PLATE V.

Ameira pusilla, T. Scott, sp. nov.

Fig. 1. Female, lateral view	× 158.
Fig. 2. Antennule	× 540.
Fig. 3. Antenna	× 720.
Fig. 4. Mandible and palp	× 1080.
Fig. 5. Second maxilliped	× 1080.
Fig. 6. Foot of first pair	× 720.
Fig. 7. Foot of second pair	× 540.
Fig. 8. Foot of fourth pair	× 360.
Fig. 9. Foot of fifth pair	× 1080.
Fig. 10. Furcal joints	× 270.

Ameira ambigua, T. Scott, sp. nov.

Fig. 11. Female, lateral view	× 106.
Fig. 12. Antennule	× 270.
Fig. 13. Antenna	× 360.
Fig. 14. Mandible and palp	× 540.
Fig. 15. Second maxilliped	× 540.
Fig. 16. Foot of first pair	× 270.
Fig. 17. Foot of second pair	× 270.
Fig. 18. Foot of fourth pair	× 270.
Fig. 19. Foot of fifth pair	× 360.

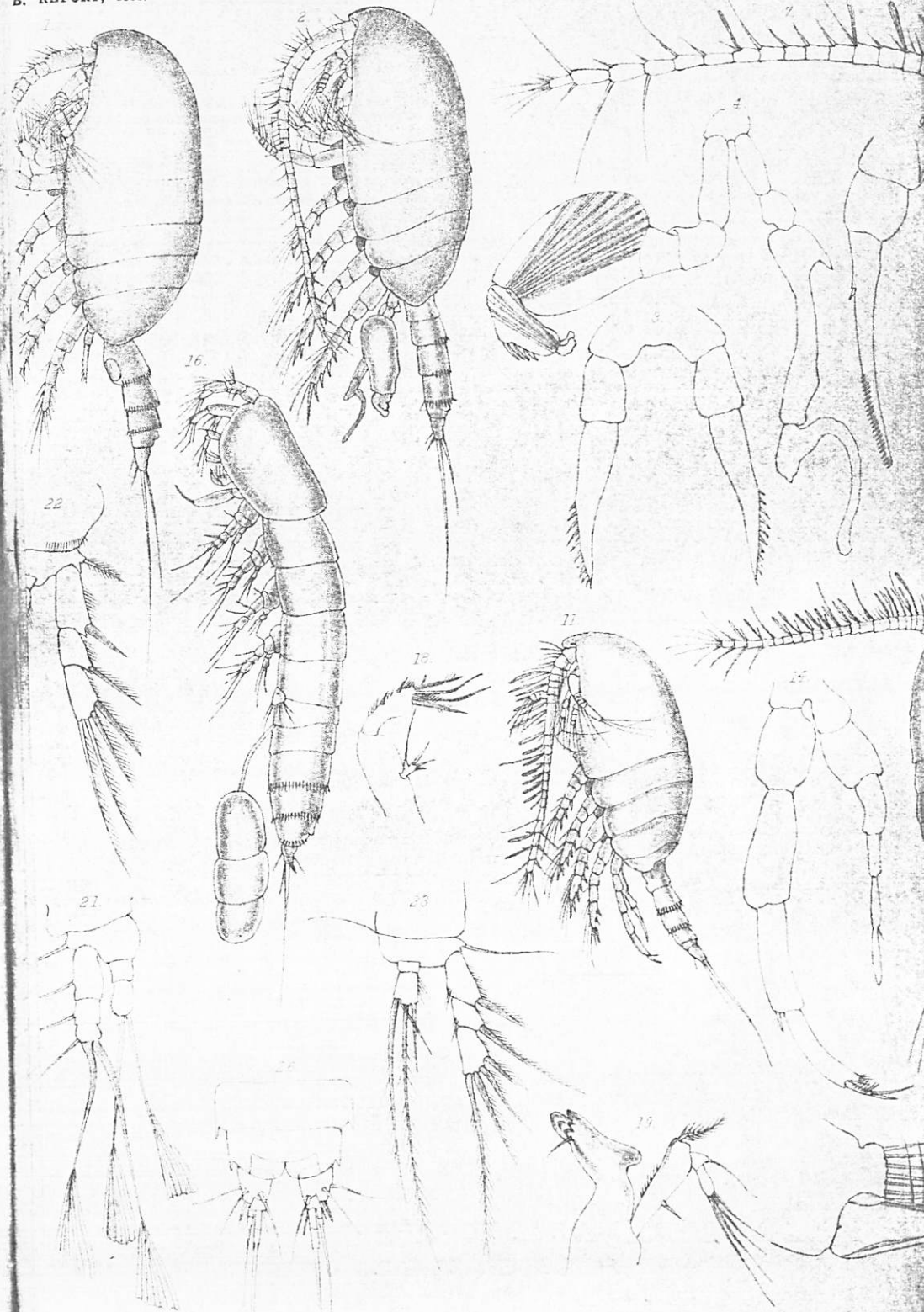
Dactylopus debilis, Giesbrecht.

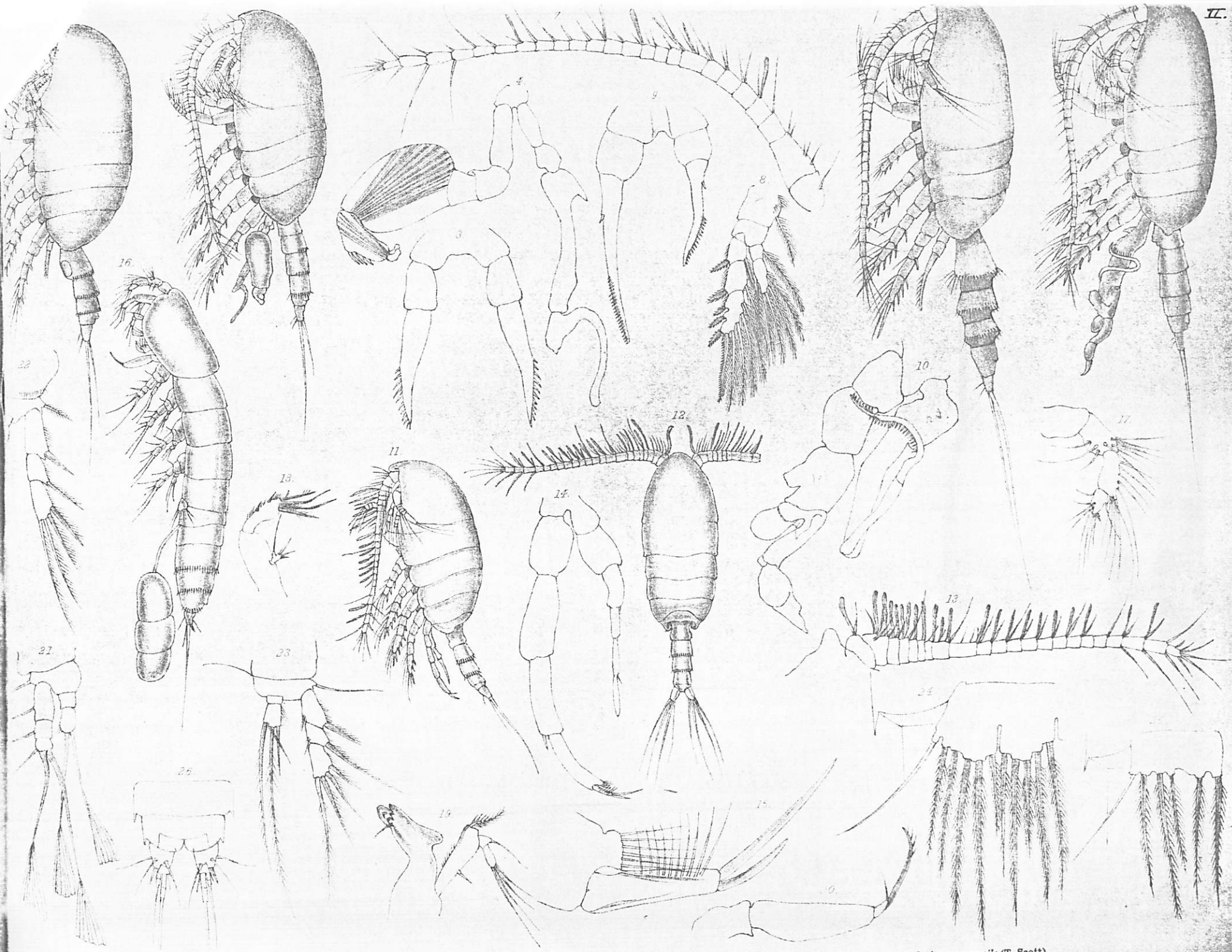
Fig. 20. Female, lateral view	× 106.
Fig. 21. Antennule	× 540.
Fig. 22. Antenna	× 540.
Fig. 23. Mandible and palp	× 720.
Fig. 24. Second maxilliped	× 720.
Fig. 25. Foot of first pair	× 540.
Fig. 26. Foot of third pair	× 540.
Fig. 27. Foot of fourth pair	× 540.
Fig. 28. Foot of second pair, male	× 540.
Fig. 29. Foot of fifth pair, female	× 720.
Fig. 30. Foot of fifth pair, male	× 1080.
Fig. 31. Furcal joints	greatly enlarged.

PLATE VI.

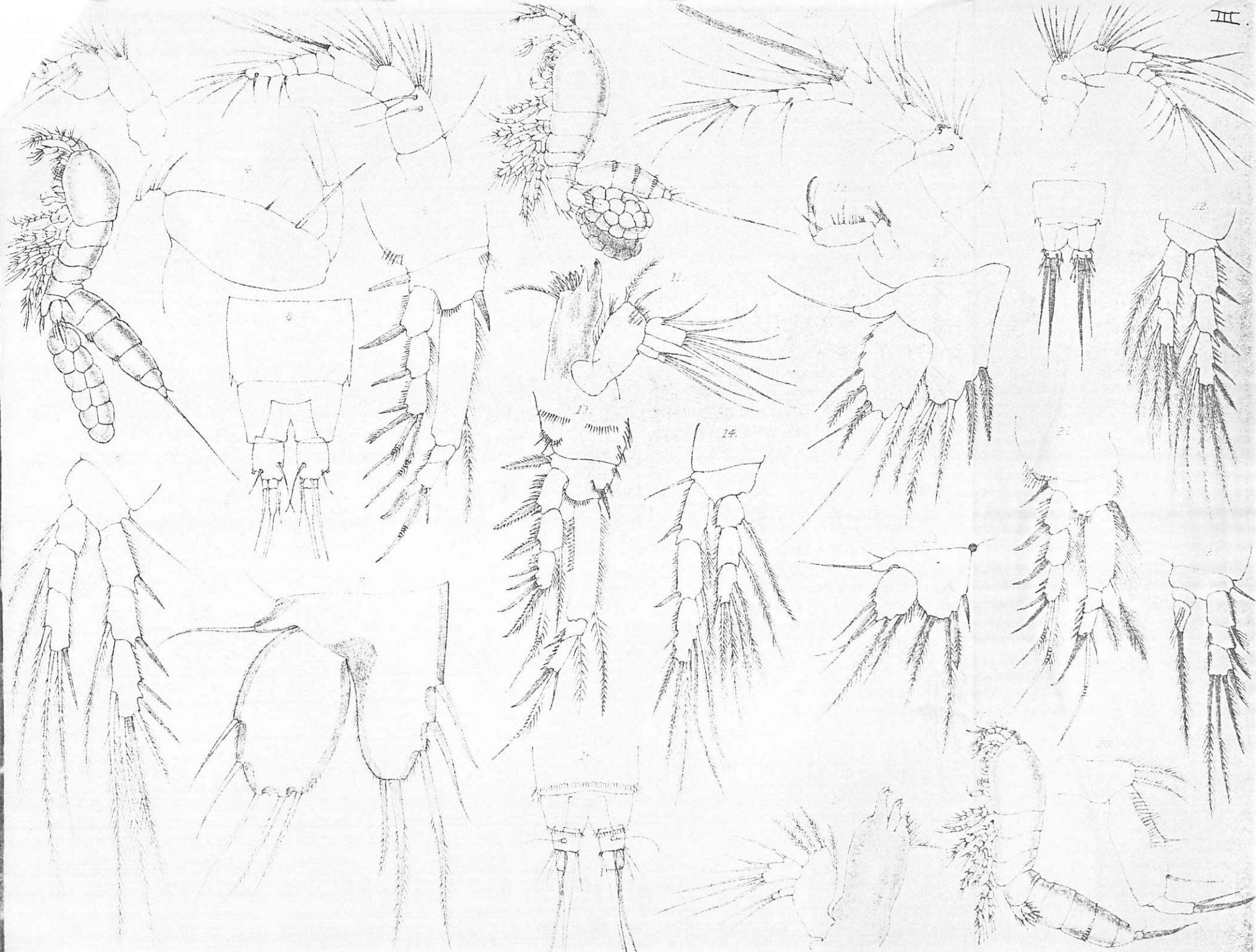
Enhydrosoma minutum, T. Scott, sp. nov.

Fig. 1. Female, lateral view	× 159.
Fig. 2. Antennule	× 540.
Fig. 3. Second maxilliped	× 720.
Fig. 4. Foot of fourth pair	greatly magnified.
Fig. 5. Foot of fifth pair	× 760.



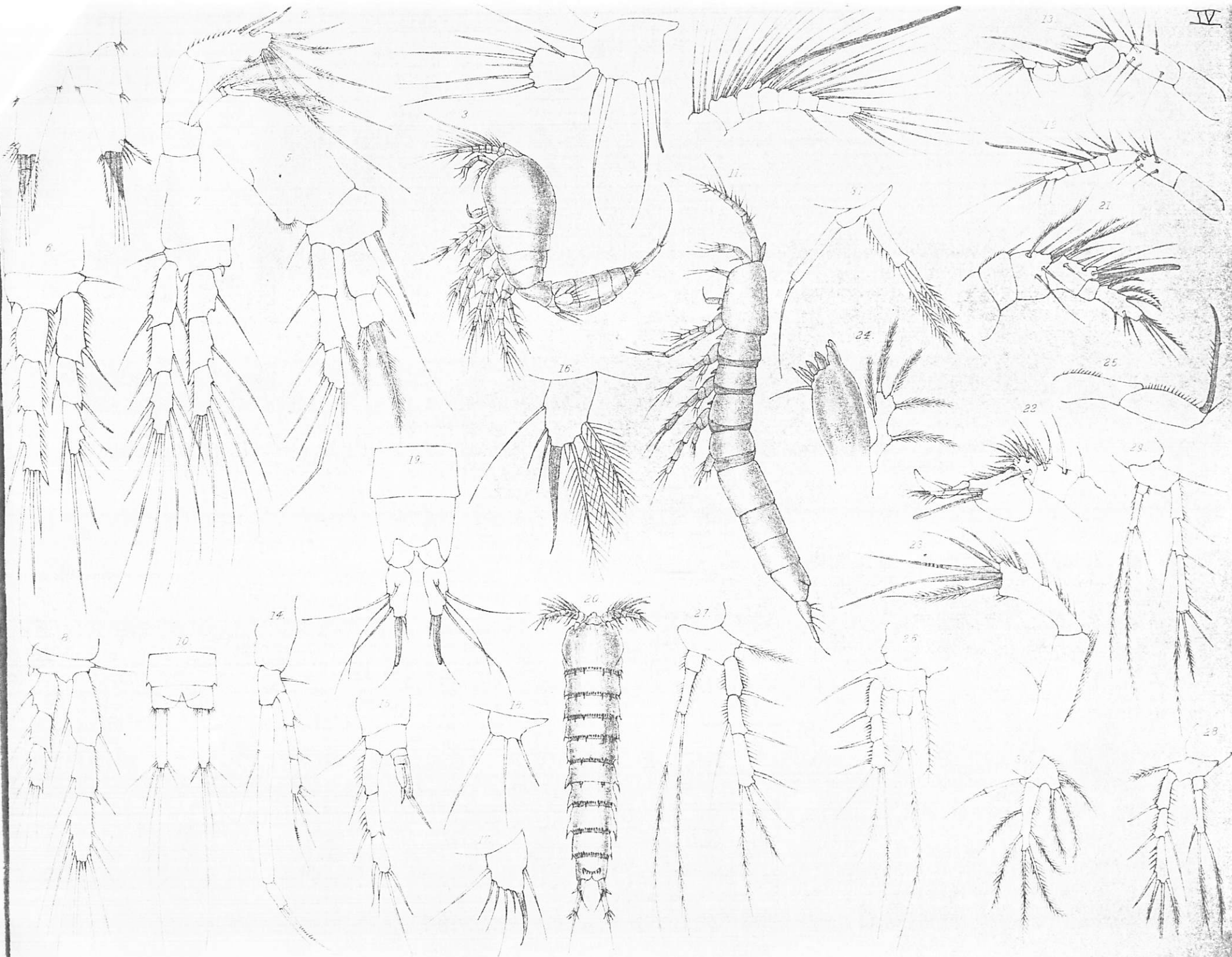


FIGS. 1-4.—*Stephos scotti* (G. O. Sars). FIGS. 5-10.—*Parastephos pallidus* (G. O. Sars). FIGS. 11-15.—*Pseudopharna typica* (G. O. Sars). FIGS. 16-26.—*Enhydrosoma gracile* (T. Scott).



A. SCOTT, del. ad nat.

FIG. 1.—*Enhydrosoma gracile* (T. Scott). FIGS. 2-8.—*Dactylopus littoralis* (T. Scott). FIGS. 9-16.—*Dactylopus mixtus* (T. Scott). FIGS. 17-24.—*Dactylopus vararensis* (T. Scott).
FIG. 25.—*Enhydrosoma minutum* (T. Scott).

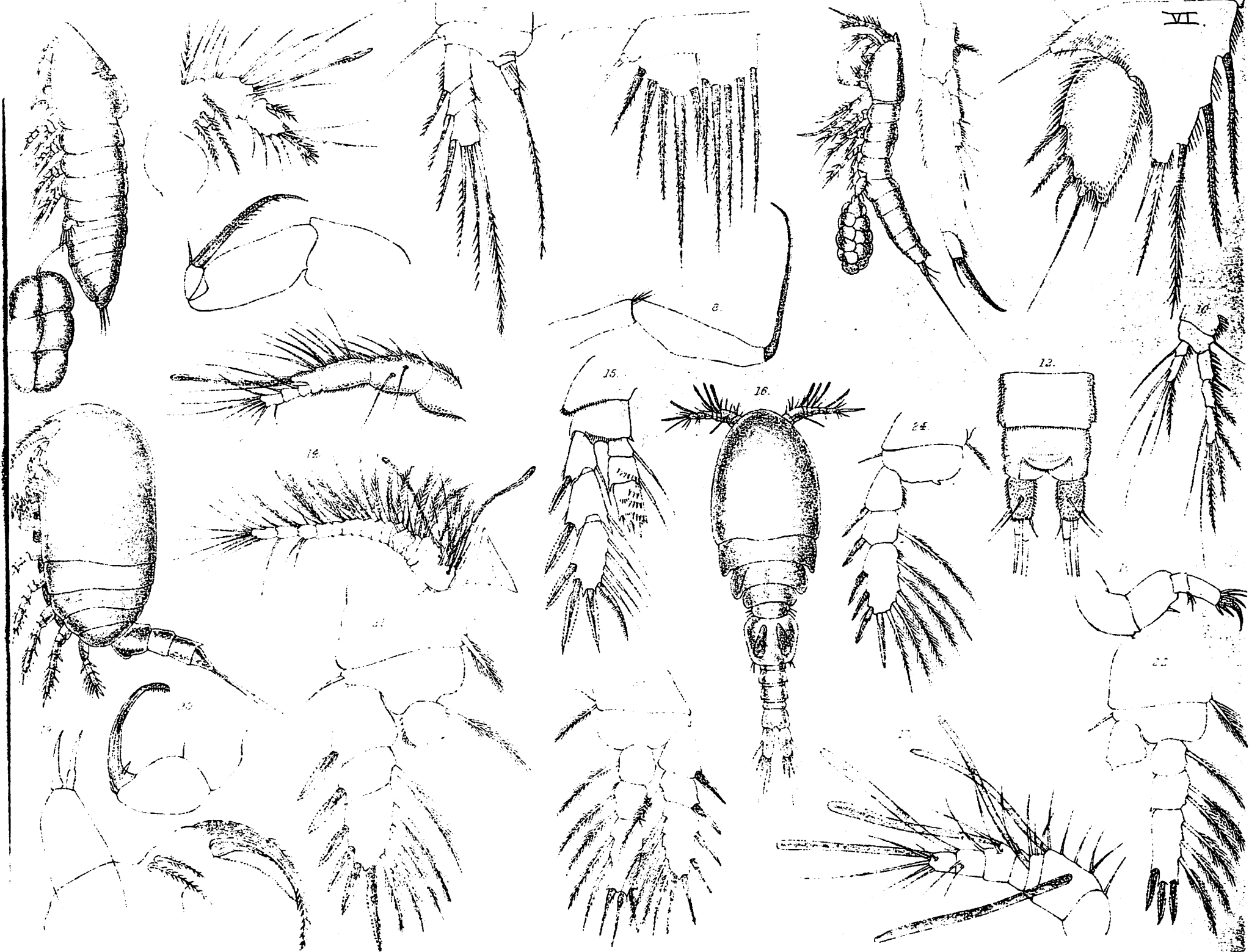


OTT. 51. ad not.

FIG. 1.—*Ectinosoma curticoxae* (Boeck). FIG. 2.—*Dactylopus rararvensis* (T. Scott). FIGS. 3-10.—*Delavalia minutissima* (T. Scott). FIGS. 11-19.—*Tetragonicaps pygmaeus* (T. Scott).



FIGS. 1-10.—*Ameira pusilla* (T. Scott). FIGS. 11-19.—*Ameira ambigua* (T. Scott). FIGS. 20-31.—*Dactylopus parvus* (T. Scott).



Laophonte gracilis, T. Scott, sp. nov.

Diam.

Fig. 6. Female, lateral view	. . . . .	× 79.
Fig. 7. Antennule	. . . . .	× 360.
Fig. 8. Second maxilliped	. . . . .	× 540.
Fig. 9. Foot of first pair	. . . . .	× 360.
Fig. 10. Foot of fourth pair	. . . . .	× 270.
Fig. 11. Foot of fifth pair	. . . . .	× 760.
Fig. 12. Caudal joints with last two segments of abdomen	. . . . .	× 240.

Pseudocyclops obtusatus, Brady and Robertson.

Fig. 13. Female, lateral view	. . . . .	× 79.
Fig. 14. Antennule and rostrum	. . . . .	× 180.
Fig. 15. Foot of fifth pair	. . . . .	× 270.

Paranthesius dubius, T. Scott, sp. nov.

Fig. 16. Male, dorsal view	. . . . .	× 35.
Fig. 17. Antennule	. . . . .	× 53.
Fig. 18. Antenna	. . . . .	× 79.
Fig. 19. Mandible and maxilla	(m—maxilla)	× 540.
Fig. 20. Second maxilliped	. . . . .	× 158.
Fig. 21. Foot of first pair, outer branch	. . . . .	× 158.
Fig. 22. Foot of second pair, inner branch	× 106.
Fig. 23. Foot of third pair	× 106.
Fig. 24. Foot of fourth pair	× 106.

5431

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