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PROCEEDINGS

AND

TRANSACTIONS

OF THE

LIVERPOOL BIOLOGICAL SOCIETY.

VOL. VII.

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### ERRATA.

On p. xx, line 6 from foot for "Dames's" read "Steinman and Döderlein."

On p. 185, line 27 for "11" read "2."

„ p. 202, line 7 for "xxiii" read "xxii."

„ p. 203, line 31 for "xxxiii" read "xxiii."

„ p. 204, lines 2, 6, 10, 27 for "xxxiii" read "xxiii."

„ p. 204, line 18 for "xxxii" read "xxiii."

„ p. 211, line 1 for "xxv" read "xxvi."

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[WORK FROM THE PORT ERIN BIOLOGICAL STATION.]

REVISED REPORT on the COPEPODA of  
LIVERPOOL BAY.

BY ISAAC C. THOMPSON, F.L.S., F.R.M.S.

With Plates XV to XXXV.

[Read February 10th, 1893.]

THREE previous Reports have been issued upon the Copepoda of the L.M.B.C. District, the last being in the year 1889. Since that time so many species new to the district have been found that it was thought advisable to draw up a complete Report of all the species recorded in the district up to the present time.

Previous to the work of the L.M.B.C., commenced in 1885, very little in this group had been done, six species only of marine Copepoda having been recorded in our area. The present Report deals with 136 species of which 18 are new to British seas, 11 of them being new to science. Those new to British seas are as follows:—

*Labidocera acutum*, Dana, *Euchaeta marina*, Prestandrea, *Giardella callianassæ*, Canu, *Monstrilla danæ*, Claparède, *Monstrilla rigida*, Thompson, *Sabelliphilus sarsii*, Claparède, and *Artotrogus orbicularis*, Boeck. Those new to science are:—

*Herdmania styliifera*, *Cyclops marinus*, *Hersiliodes puffini*, *Jonesiella hyænæ*, *Ameira attenuata*, *Stenhelia denticulata*, *Stenhelia hirsuta*, *Monstrilla longicornis*, *Laophonte spinosa*, *Cletodes monensis*, and *Lichomolgus maximus*.

The total number 136 species are divided amongst the various families as follows: Calanidæ 13 species, Pontellidæ 4, Misophridæ 3, Cyclopidæ 7, Notodelphidæ 7, Harpacticidæ 72, Monstrillidæ 4, Sapphirinidæ 11, Arto-

trogidæ 6, Chondrocanthidæ 1, Caligidæ 6, Lernæidæ 1, and Lernæopodidæ 1 species.

It will be noticed that the above enumeration includes both the free swimming and semi-parasitic and wholly parasitic species, any exact line of division being impracticable as many of the semi-parasitic species are free swimmers at night being also occasionally taken by townet during the day. This is especially the case with members of the family Caligidæ.

During the many expeditions in the "Hyæna," "Spin-drift," "Mallard" and other vessels, townets at the surface and at various depths have been systematically employed; and washings from dredged material have often yielded good results. The establishment of the Marine Biological Station upon Puffin Island early on in our work, under the directorship of Professor Herdman, F.R.S., proved of the greatest service as regards the investigation of Copepoda, for besides affording the opportunity of frequent personal visits, the resident curator during the greater part of the time forwarded regularly townettings, dredged mud, &c., for examination taken at various hours day and night and throughout the entire year. After five years work at Puffin Island, the removal of the L.M.B.C. Station to Port Erin at the south-west corner of the Isle of Man in the summer of last year has proved a complete success. The accessibility of the new station and its more completely equipped laboratory have facilitated the ready examination of living specimens immediately on landing from the boats, a circumstance of great value when dealing with minute forms of life like the Copepoda subject to rapid decomposition.

The muddy bottom of Port Erin Bay inside the break-water has proved an exceedingly rich hunting ground for Copepoda, several of the new species having been taken

there as well as several rare ones not taken in any other part of the district. Indeed it seems probable that it is from dredged material in such localities that we must look chiefly for additions to our microscopical fauna, the free swimming forms of our district being more completely tabulated.

Experience further leads me to the opinion that small isolated tracts, probably local depressions in a muddy or sandy bottom are particularly rich in Copepoda, apparently similar material taken from near such local centres having at the same time proved most unprolific or nearly altogether destitute of life. The rock pools at Hilbre Island as well as those of Puffin Island have proved valuable hunting grounds worked with a fine hand trowel.

The parasitic species in the Report found in the branchial sacs of Ascidians have all been sent to me by Prof. Herdman. To him also and to his "Fisheries Laboratory" Assistant Mr. P. J. F. Corbin I am indebted for a large number though hitherto not a great variety, of fish parasites. The recent establishment of this Fisheries Laboratory gives promise of much valuable opportunity for the study of this important and rather neglected branch of our Copepodan fauna. Many of the other fish parasites here recorded were collected by our lamented colleague Mr. Frank Archer, B.A., while staying at Bull Bay, Anglesey.

A new form of *Lichomolgus*, *L. agilis*, has been recently described by Mr. Thomas Scott, F.L.S., of the Scottish Fishery Board, from specimens inhabiting the inside of Cockle shells. This species I have found in the water of all the fresh cockles examined and it is probably very common, although previously overlooked. I had, however, taken it two years ago in a night trowelling off Puffin Island, and put it aside as a new form, but deferred any

description in the hope of finding more specimens. Still more recently I have found in the shells of the *Pecten maximus* a large *Lichomolgus* herein described as *Lichomolgus maximus*. It is probable that the examination of other mollusca obtained when dredging may lead to the discovery of further new species of parasitic Copepoda. A closely allied species to the two last mentioned, *Sabeliphilus sarsii*, Claparède, was sent to me by Mr. Chadwick, adherent to the tentacles of a species of *Sabella* collected on the Beaumaris shore. I have since found it attached to the same host around Puffin Island and think it probable that although apparently hitherto unrecorded elsewhere in British waters, it only requires looking for.

As a preservative fluid for Copepoda I have always found a mixture composed of equal parts of Alcohol, Water and Glycerine with 1 per cent. of Carbolic Acid most useful. Specimens may be transferred direct to it from sea water and can be so preserved for any desired period of time, to be mounted direct without further preparation in either Glycerine Jelly or Farrants Medium. I can confirm the value of Canon Norman's "excellent device" for capturing Copepoda and other small Crustacea while alive from freshly dredged material as given by Mr. A. O. Walker, F.L.S. (Report on the Higher Crustacea of Liverpool Bay taken in 1889) Fauna of Liverpool Bay, Report III, p. 239, 1892, many rare Copepoda having come to me through this means. Recently I have employed a still more exhaustive method with the greatest advantage, particularly when as is often the case material or dredged mud or sand requires to be kept a considerable time before it can be examined, viz., the dredged material is washed through a coarse sieve into a finely meshed silk bag into which a running stream of water from a tap is allowed to fall. By careful kneading with the hands



all the soluble or very finely suspended particles are washed away through the texture of the bag. The clean residue is then placed in a large flat dish of water and stirred round, when the fine floating organic portion, often very rich in Foraminifera, Diatomacea, Ostracoda, Amphipoda, and Copepoda can be strained off and placed in preservative fluid for examination.

As a ready means of detecting and naming species must be of value to the sea side naturalist, I have in the plates (XV to XXXV) given small outline sketches of the forms treated of in this Report together with reference to special points of distinction so far as space allowed. They are mostly taken direct from the animal under the microscope, a few being taken in part from the drawings of Claus, Brady, &c. In the cases of genera including several species, the distinctive points only of some are given.

The importance to man of the distribution of Copepoda in our lakes, seas and oceans is twofold—firstly from a sanitary point of view, as purifying agents, and secondly economically as affecting our food supply of fishes. Neither can indeed be easily overrated. As the chief and ever active scavengers of our seas, seizing upon impurities and decomposing matter which might else become a scourge too terrible to contemplate, these minute crustaceans by means of their internal laboratories, convert decay and refuse into their own organizations which in turn become the chief food of fishes. As might naturally be expected, Copepoda are most plentiful near to land, thither probably attracting shoals of fishes, in their turn the valuable food of man. Our direct material indebtedness to Copepoda can thus be easily traced.

In this work as in other matters biological, I have constantly availed myself of the always ready help of my

friend and instructor Professor Herdman, F.R.S. In much of the earlier collecting and sorting out of specimens I enjoyed the co-operation of Mr. W. S. McMillan, F.L.S., and I am indebted to our colleague Mr. A. O. Walker, F.L.S., of Colwyn Bay and to others for material and specimens collected. Lastly my sincere thanks are due to my friend Dr. G. S. Brady, F.R.S., of Sunderland, for frequent help in the examination and confirmation of specimens and whose distinguished work on British Copepoda has formed the chief basis for my classification.

Since completing the manuscript of this Revision the very beautiful and comprehensive work of Dr. Giesbrecht, of Naples, "Pelagische Copepoden," (Fauna und Flora des Golfes Von Neapel, 1892) has appeared, and in a few instances I have adapted the nomenclature in accordance with the results of his important researches. In the following enumeration of species all the measurements given are taken from the rostrum or anterior portion of the cephalothorax to the termination of the caudal segments, and do not include anterior or caudal setæ.



Map of L.M.B.C. District.

## COPEPODA.

## Family I.—CALANIDÆ.

*Calanus finmarchicus*, Gunner. (Pl. XV, fig. 1.)

Length 2.80 mm. A thoroughly pelagic species, common throughout the year but rarely or never taken except in the open sea. When found at considerable depths it is usually of a dark red colour and contains a quantity of oil. It constitutes the chief food of the Greenland whale.

*Metridia armata*, Boeck. (Pl. XV, fig. 2.)

Length 1.80 mm. Single specimens have been rarely found and only in the open sea at a considerable distance from land. The broad leafy terminations (*a*) of the swimming feet easily distinguish it.

*Pseudocalanus elongatus*, Baird. (Pl. XV, fig. 3.)

Length 1.30 mm. Very common throughout the district and seldom absent in any townet gathering. The females are often found with three or four large ova.

*Pseudocalanus armatus*, Boeck. (Pl. XV, fig. 4.)

Length 1.75 mm. A pair of this rare species was taken by surface townet in Port Erin Bay, in 1889, during an illumination of the surface of the sea by electric light from the "Hyæna." Its only other occurrence in the district was in the "Mallard" cruise of 1892 when a single specimen was found among some dredged material taken at a depth of 20 fathoms outside Port Erin. I was at first in doubt whether those specimens were *Ætidius armatus*, Brady, and after careful examination of them with Brady's description of the latter, I am disposed to query whether the two species are not synonymous. The lateral spines of the posterior end of the cephalothorax readily distinguish it from *P. elongatus*.

*Paracalanus parvus*, Claus. (Pl. XV, fig. 5.)

Length 1.30 mm. One specimen only of this rare form was taken by townet off Puffin Island.

*Acartia clausii*, Giesbrecht. (Pl. XV, fig. 6.)

Length 1.45 mm. Common in the open sea.

Giesbrecht separates *A. clausii* from *A. longiremis*, the slight points of difference being chiefly in the 5th feet, the spinal termination of the female 5th foot of *A. clausii* (*b*) being much shorter and stronger than that of *A. longiremis*. It is probable that we may have both species but those I have dissected for examination all belong to the former.

*Acartia discaudatus*, Giesbrecht. (Pl. XV, fig. 6.)

Length 1.20 mm. Taken frequently off the mouth of the Dee and about the Anglesea coast. It may be readily distinguished from *A. clausii* by the caudal segments (*c*) which are about as broad as long.

*Temora longicornis*, Müller. (Pl. XV, fig. 7.)

Length 1.75 mm. Perhaps the most common British surface species, although rarely or never taken outside British waters. The caudal segments (*b*) form a sufficiently distinguishing feature.

*Eurytemora clausii*, Hoek. (Pl. XV, fig. 8.)

Length 1.40 mm. Generally met with in brackish water estuaries or pools and in salt marshes. Abundant in pools behind Leasowe embankment.

*Eurytemora affinis*, Poppe. (Pl. XVI, fig. 1.)

Length 1.75 mm. A large number of this species were taken by townet off the sandbanks at the mouth of the Mersey in 1886. It was not subsequently recorded in the district until 1891, when the filter beds of the Bootle Corporation baths were found to be swarming with it. Mr. Ascroft has since sent me specimens found in tidal pools at Lytham. The males I have found are conspicuous by the number of spermatophores attached to them.

*Isias clavipes*, Boeck. (Pl. XVI, fig. 2.)

Length 1.60 mm. Frequently taken by townet in the open sea but never abundantly.

In a former paper "Second Report on the Copepoda of Liverpool Bay," Proc. Biol. Soc., L'pool, Vol. II, I pointed out the existence of a pair of curved spines trifold at apex, one on each side of the tubercular genital prolongations on the first abdominal somite of the female. Brady's drawing and description of the fifth foot of the male are not quite correct. He says the inner branch "of the right side is provided with swimming setæ and is two jointed," and he so figures it. This accidental error led M. Canu in "Les Copepodes libres Marins du Boulonnais," (Bulletin Scientifique de la France, Paris, 1888) to suppose that a male specimen he examined differing in the fifth feet from Brady's drawing could not be *I. clavipes* and he accordingly named it *I. bonnieri*. On examining my specimens of *I. clavipes* I found they agreed with Canu's *I. bonnieri*, and on the matter being referred to Dr. Brady he at once saw that Canu's drawing is correct for *I. clavipes*. *I. bonnieri* must therefore be withdrawn.

*Centropages hamatus*, Lilljeborg. (Pl. XVI, fig. 3.)

Length 1.30 mm. Common in the open and seldom absent from the townets. It is rather surprising that so far as I am aware the allied species *C. typicus* has never been found in the L.M.B.C. district.

*Parapontella brevicornis*, Lubbock. (Pl. XVI, fig. 4.)

Length 1.30 mm. Occasionally taken in surface townet also rarely in tidal pools. The two lateral abdominal spines (*c*) easily distinguish this species.

#### Family II.—PONTELLIDÆ.

*Labidocera wollastoni*, Lubbock.

Length 2.50 mm. During the autumn months we have taken this somewhat rare species plentifully in surface townets off Puffin Island and in the open sea. Males

and females seem equally plentiful. The fifth feet (*b, c, d*) readily distinguish it.

*Labidocera acutum*, Dana. (Pl. XVI, fig. 6.)

Length 2.50 mm. One specimen, a male, of this rare exotic species was found in dredged material taken off Puffin Island in 10 fathoms when in company with Dr. Brady.

*Anomalocera patersoni*, Templeton. (Pl. XVI, fig. 7.)

Length 3.75 mm. This large striking Copepod has been frequently taken in the district, but generally when it has occurred, as on two dredging expeditions round about the Isle of Man, it has been in such profusion for a few days as to almost fill the townets and to be clearly visible on the surface from the steamer's deck. When living it is of a deep green colour interspersed with blue and red but so far I have been unsuccessful in preserving its natural colour. What becomes of these tremendous shoals at other times remains a mystery. Dr. J. Murray considers it unlikely that an animal so coloured could be a deep water species, and we have never taken it at any great depth, nor does it appear to be of wide geographical distribution. Male and females were equally plentiful.

*Eucheta marina*, Prestandrea. (Pl. XVI, fig. 8.)

Length 3.0 mm. A single specimen of this well known southern species, never I believe before recorded in British seas was found adherent to the branchial sac of an Ascidian dredged by Prof. Herdman in Garwick Bay, Isle of Man. The presence of this animal so essentially a free swimmer, in such a situation is most unaccountable. Its transversely notched rostrum with two sharp teeth readily distinguishes it from any other known species.

## Family III.—MISOPHRIIDÆ.

*Misophria pallida*, Boeck. (Pl. XXI, fig. 1.)

Length 0.75 mm. An exceedingly rare species, one specimen only having been recorded in the district, dredged in 10 fathoms off Puffin Island in July, 1891. Curiously enough, Boeck and Brady each also found only one specimen. The inner branch of posterior antenna (*b*) in my specimen is itself two branched, the smaller one being one jointed with terminal setæ.

*Cervinia bradyi*, Norman. (Pl. XXVII, fig. 7.)

Length 1.30 mm. The beautiful stags horn character of the posterior antennæ clearly distinguishes this striking Copepod from any other known species.

The anterior antennæ (*b*) of all of my specimens have a remarkable two jointed branch springing from the base of the third joint, the basal joint being about equal to the third joint of main the branch, and the terminal being very small, both terminated with long plumose setæ. Norman did not observe any fifth feet. They are certainly very small but distinctly present and consist (*a*) of a short basal joint and a longer second joint having one lateral seta and terminated by one long and one short seta. All the specimens taken were (like Norman's) of one sex and were dredged on only one occasion in mud at 39 fathoms about 12 miles out from Port Erin.

## HERDMANIA, n. gen.

First pair of antennæ, (Pl. XXVIII, fig. 11) nine-jointed; second pair (fig. 4) two branched, the primary branch composed of two long joints, the secondary branch of one long joint and three small terminal joints. Mandibles (fig. 5) small, armed with short sharp teeth and palp composed of two one jointed branches.

Maxillæ (fig. 6) with well developed palp, bearing four

appendages, the apical one three jointed. First pair of foot jaws (fig. 7) four jointed, the second foot jaw is not yet determined. The first pair of swimming feet (fig. 8) has its inner branches two jointed, the outer branches three jointed. The second, third and fourth pairs have both branches three jointed. The fifth feet are two jointed in the female, and three jointed in the male.

*Herdmania styliifera*, n. sp. (Pl. XXVIII, figs. 1—12.)

Length 0.60 mm. Body ovate, rounded anteriorly with a small rounded rostrum. Anterior antennæ of female (fig. 2) nine jointed, the first joint being the largest and produced into a beaky spine at the apex of the inner side. The second and third joints are about equal in length, and both rather smaller than the first. The fourth joint is about one quarter the length of the third; the fifth is about as long as the sixth and seventh together. The eighth is long and narrow, and the ninth is a very small apical prominence. Some of the setæ which thickly clothe the antennæ are plumose. The first joint of the male antennæ (fig. 3) is about the same length as that of the female its beaky spine being recurved downwards, the fourth and following joints forming a vesiculiform swelling, the apical joints being narrow and curved. Posterior antennæ (fig. 4) two branched, the inner branch composed of two joints; the outer branch is considerably shorter and composed of four joints, the basal joint of which is about equal to that of the inner branch, the three terminal segments being very short. Mandibles (fig. 5) have four sharp teeth, and a two branched palp with numerous short setæ. Maxilla (fig. 6) has a large lobe and four branches, the apical of which is composed of three very small joints. First foot jaw (fig. 7) is four jointed and is covered with spines and setæ.

Diligent search of the only two specimens found and



careful dissection of one failed to reveal the presence of posterior foot jaws, so if present any description of these appendages must await the capture of more specimens. Inner branch of first pair of swimming feet (fig. 8) two jointed, the inner side of apical joint being produced into a long digit-shaped spine with rounded end. The outer branch of first pair and both branches of second, third, and fourth feet and of the fifth feet of male are all three jointed, the inner terminations of the first and second joints of the inner branches of the second and fourth feet (fig. 10) forming strong beak like spines. The fifth feet of the female (fig. 11) are two jointed, the second being more than twice the length of the first and bearing three lateral and three apical spinous setæ. The fifth feet of the male (fig. 12) are alike and both three jointed. Abdomen six jointed with sharply pointed lateral terminations to the second, third and fourth segments. Caudal stylets very long and narrow, swollen at the upper end and gradually widening to the base, with outer lateral setæ one on each near the end and having several terminal setæ.

Two specimens only, a male and female of this remarkably elegant but minute species were taken by the mud dredge at 39 fathoms in the Irish Sea about twelve miles out from Port Erin. I feel a peculiar pleasure in connecting the name of the genus with that of my friend Prof. Herdman.

#### Family IV.—CYCLOPIDÆ.

*Oithona spinifrons*, Boeck. (Pl. XVII, fig. 1.)

Length 1 mm. Generally present in townet gatherings throughout the year. It is easily recognized by its delicate whip like antennæ clothed with long setæ.

*Cyclopina littoralis*, Brady. (Pl. XVII, fig. 2.)

Length 0.75 mm. Frequently found amongst sea-weeds between tide marks about Puffin Island. Though seldom

taken in any abundance, I recollect on one occasion finding hundreds in one night's townetting off Puffin Island in May, 1889. The many jointed anterior antennæ serve to distinguish this from the next species.

*Cyclopina gracilis*, Claus. (Pl. XVII, fig. 3.)

Length 0.45 mm. Less common than the last species, but occurring occasionally in townettings taken near land. Anterior antennæ, eleven jointed.

*Cyclops marinus*, n. sp. (Pl. XXIX, fig. 1—8.)

Length 1.20 mm. Body ovate (fig. 1) with long abdomen. Anterior antennæ (fig. 2.) 12 jointed, the first joint being the longest, and the eighth almost as long but narrower, the third and sixth joints being very short. Posterior antennæ (fig. 3) four jointed, the joints being of nearly equal length. Mandibles (fig. 4) have six long sharp teeth at apex. Palp reduced to a small tubercle from which spring four spinous setæ. Maxillæ (fig. 5) without palp, having two large teeth at apex and a number of lateral small ones. Anterior foot jaw (fig. 6) four jointed, with numerous spinous setæ, some of them plumose. Posterior foot jaw (fig. 7) three jointed, the upper one dividing into three branches terminated with spinous setæ.

First four pair of swimming feet (fig. 8) all three jointed, the inner joint of all except the fourth pair having a curved spine at the apex. Fifth feet (fig. 9) two jointed, the second joint being more than double the size of the first and having seven strong setæ. Abdomen four jointed, the first joint being nearly as long as the second and third together. Caudal segment about three times as long as broad, each bearing five terminal setæ and one short lateral seta.

Two specimens only, both females were dredged in 20 fathoms about 20 miles out from Southport pier, during the "Mavis" expedition.

Through scarceness of specimens and absence of males I regret the necessarily imperfect description of this very important addition to our fauna of a marine species of *Cyclops*, assuming as seems probable that *Cyclops ewarti*, Brady, found by Mr. T. Scott, F.L.S., about five miles above Queen's Ferry, Firth of Forth, 1887, may have found its way thither from a fresh water source.

*Thorellia brunnea*, Boeck. (Pl. XVII, fig. 4.)

Length 1.30 mm. Solitary specimens are occasionally taken in the open sea and in dredged material.

*Hersilioides puffini*, Thompson. (Pl. XVII, fig. 5.)

Length 0.80 mm. A few specimens were taken by townet off Puffin Island a few years ago when weekly gatherings of material were sent to me from there for examination, but it has not occurred since in the district.

*Giardella callianassæ*, Canu. (Pl. XVII, fig. 6.)

Length 0.75 mm. A single specimen was taken by townet in Liverpool Bay during the "Despatch" expedition, 1886. This species was described by M. Canu in "Bulletin Scientifique" series III, 1888, p. 410.

#### Family NOTODELPHYIDÆ.

*Notodelphys allmani*, Thorell. (Pl. XVII, fig. 7.)

Length 4.0 mm. A few specimens were found by Prof. Herdman in the branchial sacs of the Ascidian *Ciona intestinalis* dredged off the south end of the Isle of Man.

*Doropygus pulex*, Thorell. (Pl. XVII, fig. 8.)

Length 1.30 mm. Found by Prof. Herdman in company with the preceding species, and also in the branchial sac of *Ascidiella scabra*, dredged in Groudle Bay, Isle of Man; also in the branchial sac of *Ascidia plebeia*, dredged from the "Hyæna," off the Calf of Man, in twenty fathoms. The male (*b*) is smaller than the female (*a*).

*Doropygus poricauda*, Brady. (Pl. XVIII, fig. 1.)

Length 2.50 mm. One specimen of this species was amongst several of the last preceding taken from the branchial sac of *Ascidia plebeia*.

*Doropygus gibber*, Thorell. (Pl. XVIII, fig. 2.)

Length 3.20 mm. Found in the branchial sac of *Ascidia plebeia* dredged from the "Hyæna" in 1890.

*Botachus cylindratus*, Thorell. (Pl. XVIII, fig. 3.)

Length 1.75 mm. Found by Professor Herdman in the branchial sacs of *Ascidia mentula* and *Ascidia plebeia*, from the Isle of Man.

Thorell and so far as I know all subsequent observers have failed to find the male of this species. In each of the several ascidians in which the females were found were a few minute specimens which generally correspond to the males of other species and are evidently the male of *Botachus cylindratus*. (Fig. 3. a.) Prof Herdman tells me that they were in appearance like minute commas attached to the inner folds of the branchial sac of the Ascidian, and from their minute size and very tenacious hold might easily be overlooked.

*Ascidicola rosea*, Thorell. (Pl. XVIII, fig. 4.)

Length 3.75 mm. Several specimens of this species have been found in the branchial sacs of Ascidians dredged off the Isle of Man.

*Notopterophorus papilio*, Hesse. (Pl. XVIII, figs. 5, 6.)

A few specimens of each, male and female of this most remarkable and beautiful Copepod were found in Ascidians dredged in Garwick Bay, Isle of Man by Prof. Herdman. The female is described by Brady (Copepoda of British Islands, Ray Society, Vol. I, p. 142) from Hesse's first memoir in which no mention is made of the male. It was subsequently however found by him and briefly described in a later paper but not figured. It is about 2 mm. in length, the female measuring about double that size.

The Cephalothorax has five segments the head segment being distinct from the rest. The second and third segments have each a pair of dorsal papillæ projecting laterally and upwards, and the fourth has one larger dorsal papilla. The abdomen is about equal in length to the rest of the body and is composed of three segments each being about twice as long as broad, and terminated like the female with short caudal segments armed with hook spines. The two pair of antennæ are similar to those of the female as are the other appendages and first four pair of swimming feet. The fifth pair are however wanting in the female, while the male possesses a pair of two jointed fifth feet each terminated by a single seta.

As was the case with the specimens examined by Brady the wing-like expansions of the females we found were somewhat lacerated from immersion in alcohol but their general form and long pointed apices are very characteristic. The terminal posterior wing is decidedly larger than that in Brady's drawing and though too lacerated to be certain of its form, it affords indication of the three pointed terminations figured from Hesse. The cephalothorax in our female specimens is much more robust than in Brady's drawing the last body segment being the widest and filled with ova. The first and second abdominal segments are funnel shaped, the narrow extremity of which is the same width as the two terminal segments which are of similar size to those of the male.

It is difficult to imagine any use to the animal of the extraordinary appendages in the female so much resembling in general appearance the wings of a butterfly.

#### Family HARPACTICIDÆ.

*Longipedia coronata*, Claus. (Pl. XVIII, fig. 7.)

Length 1.25 mm. One of the commonest of British

species. Common both as a free swimmer and in material dredged from a sandy bottom. It is easily recognised by its beautiful plumed anterior antennæ and by the length of the inner branch of the second swimming feet.

*Ectinosoma spinipes*, Brady. (Pl. XVIII, fig. 8.)

Length 1.25 mm. Frequent in dredged material from a muddy bottom about low water mark.

*Ectinosoma curticorne*, Boeck. Pl. XVIII, fig. 8. e.)

Length 1.25 mm. This species is so nearly allied to the foregoing that I feel very doubtful as to its separate identity. The only important difference appears to be in the fifth feet and even here the gradation from one to the other is very slight.

*Ectinosoma erythrops*, Brady. (Pl. XVIII, fig. 8. c. d.)

Length 0.75 mm. Occasionally dredged in 10 fathoms off Puffin Island, and in 4 fathoms in Port Erin Bay. Its two brilliant red eye spots and the small size of the fifth feet are its distinguishing features.

*Ectinosoma melaniceps*, Brady. (Pl. XXI, fig. 2. a.)

Length 0.75 mm. Very similar in character to the three former species. Brady says "it is much smaller and more delicate in structure than *E. spinipes*, and is moreover always distinguished by a cloudy blackish patch on the head." We have taken it in the dredge at Port St. Mary and off the Calf of Man.

*Ectinosoma atlanticum*, Brady & Rob. (Pl. XIX, fig. 1.)

Length 0.50 mm. An easily distinguished species of slender build, long and narrow. Taken by townet in the open sea occasionally, and on one occasion by electric light in Port Erin Bay.

*Tachidius brevicornis*, Müller. (Pl. XXI, fig. 2. b. c.)

Length 0.80 mm. A brackish water species. We have taken it in quantity from material sent by Mr. Dwerryhouse from a brackish tributary of the Mersey at Hale,

also at the mouth of the Alt. The broad square fifth feet of the female (*b*) serve to distinguish it.

*Tachidius littoralis*, Poppe. (Pl. XIX, fig. 2.)

Length 0.60 mm. Very similar to *T. brevicornis* but differing chiefly in the anterior antennæ and the fifth feet. Found in fucus about low water mark at Penmon Point and Puffin Island.

*Euterte acutifrons*,\* Dana. (Pl. XIX, fig. 3.)

Length 0.50 mm. Frequently taken by townet in the open sea and near to Puffin Island during the autumn months especially. Males and females equally common. I have generally been able to detect this species in material from its crescent shaped appearance.

*Robertsonia tenuis*, Brady & Robertson. (Pl. XIX, fig. 4.)

Length 0.60 mm. A rare species. Taken by dredge on two occasions in 10 fathoms off Puffin Island.

*Amymone spherica*, Claus. (Pl. XIX, fig. 5.)

Length 0.38 mm. Occasionally dredged off Puffin Island and found in dredged material sent by Mr. A. O. Walker from Colwyn Bay, and recently in Port Erin Bay.

Although some of our specimens differ from Claus's drawings in being less spinous I can see no good reason for supposing them not to be the same species.

*Amymone longimana*, Claus. (Pl. XIX, fig. 5. *b*.)

Length 0.50 mm. The only specimen we have taken was dredged in 5 fathoms off Port Erin. Distinguishable from the previous species by the posterior foot jaw (*b*).

*Stenhelia hispida*, Brady. (Pl. XIX, fig. 6.)

Length 0.35 mm. Found in rock pools at Hilbre and Puffin Islands; also in mud taken at Garth Ferry at low water, and in Port Erin Bay. The chitinous spear like inner branch of the male second foot is a distinguishing feature.

\* *E. gracilis* in plate.

*Stenhelia ima*, Brady. (Pl. XXI, fig. 2. *d. e. f.*)

Length 1.25 mm. Dredged in Soderick Bay, Rhos Colin Bay, and Port Erin Bay, but nowhere common. Recognizable by the swollen bases of the caudal setæ (*f.*)

*Stenhelia denticulata*, n. sp. (Pl. XXX, fig. 1—11.)

Length 1 mm. Body ovate with long rostrum. Anterior antennæ (fig. 2) 8 jointed, the first and third joints being about twice as long as broad; the second and fourth about three times as long as broad, the latter having a long filament at apex; the four terminal joints are together, about the length of the fourth. The first joint has a small tooth and the second joint has a strong tooth on the under side. Posterior antennæ (fig. 3) three jointed with inner branch also three jointed. Mandible (fig. 4) has toothed apex and two one jointed lateral protuberances.

Anterior foot jaw (fig. 6) two jointed, the apical joint terminated by several spinous setæ and having two lateral branches. Second foot jaw (fig. 7) with falciform claw. Four first pair of swimming feet (figs. 8 and 9) have inner and outer branches all three jointed. Fifth feet composed of triangular basal joint with lengthened tapering joint springing from it, both bearing spinous setæ. Abdomen five jointed, about the same length as the rest of the body. Caudal segments about as long as broad; each having two long central apical setæ and one small one on either side. Two specimens only, both females were dredged from the muddy bottom inside Port Erin breakwater.

*Stenhelia hirsuta*, n. sp. (Pl. XXXI, fig. 1—13.)

Length 1 mm. Rostrum long and pointed. Anterior antennæ (figs. 2, 3) eight jointed, the first, second and fourth being much larger than the others; thickly covered with long setæ. Inner branch of posterior antennæ (fig. 4) three jointed, the middle one very small. Claw of second foot jaw (fig. 8) is swollen at base, the inner margin of hand bearing two spinous setæ and several short setæ.



First, second, third, and fourth swimming feet (figs. 9—11) all three jointed in both branches with the exception of the inner branch of the second feet in the male (fig. 10) in which a pair of stout claws takes the place of the 3rd joint. The inner branch of the first pair (fig. 9) is nearly twice the length of the outer, its basal joint being about equal in length to the two following joints. Basal joint of fifth feet (fig. 12) broad and long in the female with fine terminal spinous setæ. Second joint ovate with several lateral spines and long terminal spine. The fifth feet of the male (fig. 13) are smaller and more angular than those of the female and have fewer spines. The caudal stylets are slightly tapering towards the apex and are about three times as long as broad. A few specimens, male and female were dredged in mud at 39 fathoms in the Irish Sea about 12 miles west from Port Erin. The hirsute character of the antennæ, the inner branch of the second foot in the male together with the caudal stylets serve to distinguish the species from others of the genus.

*Ameira longipes*, Boeck. (Pl. XIX, fig. 7.)

Length 0.45 mm. Dredged in 20 fathoms off the Calf of Man, also off Puffin Island, and the Little Orme. Brady speaks of the perplexing resemblance between this species and *Stenhelia ima*. The length of the caudal segments however readily distinguishes them, being about five times as long as broad in the former and very short in the latter species.

*Ameira attenuata*, n. sp. (Pl. XXXII, figs. 1—11.)

Length 0.40 mm. Rostrum short, obtuse. Anterior antennæ (figs. 3 and 4) eight jointed in the female, seven jointed in the male, the short penultimate joint being absent in the latter. The second joint is much longer and wider than any of the others. In the male (fig. 4) a hinge

occurs between the 5th and 6th joints. A long filament springs from the 4th joint. Posterior antennæ (fig. 5) two jointed, the inner branch being composed of one joint with three terminal setæ.

Hand and claw of the second foot jaw slender. First joint of the inner branch of first pair of swimming feet (fig. 7) about the same length as the entire outer branch, the middle joint has two small setæ on the inner side; the outer side of the outer joint is ciliated. Both branches of the second, third and fourth feet (fig. 8) are three jointed. The basal joint of the fifth pair of female (fig. 9) is triangular bearing three terminal setæ: the second joint is long, slightly oval, ciliated at each side and bearing four setæ. The fifth feet of the male (fig. 10) are very similar to those of the female but are rather smaller, and not ciliated and have fewer setæ. The abdomen of the female is five jointed, in the male four jointed. Caudal segments about four times as long as broad and slightly tapering, terminated by two long and several short setæ.

Several specimens of this species nearly all females were lately found in mud dredged from seven fathoms inside Port Erin breakwater. Their extreme minuteness and delicacy render dissection difficult and the mouth organs I have not been able to make out clearly.

*Jonesiella fusiformis*, Brady & Rob. (Pl. XIX, fig. 8.)

Length 1.25 mm. Dredged off the Calf of Man in 20 fathoms and off Puffin Island.

*Jonesiella hyænæ*, Thompson, (Pl. XX, fig. 1.)

Length 0.65 mm. First dredged from steamer "Hyænæ" in Port Erin Bay, and since found there in considerable number on a muddy bottom. It is described in Appendix to 3rd Report on the Copepoda of Liverpool Bay. Proc. L'pool Biol. Soc., 1888-9, Vol. III, p. 192.

*Bradya typica*, Boeck. (Pl. XIX, fig. 8. b. c.)

Length 0.80 mm. A few specimens all females were recently dredged with mud in Port Erin Bay.

*Delavalia palustris*, Brady. (Pl. XX, fig. 2.)

Length 0.80 mm. Several of this mud loving species have been found in mud taken about Puffin Island, Port Erin, Garth Ferry, and Hale. Among them is one male which so far as I am aware has not been hitherto known.

*Delavalia reflexa*, Brady and Robertson. (Pl. XX, fig. 3.)

Length 0.70 mm. One specimen a female was dredged in 20 fathoms in Redwharfe Bay, Anglesea, and one male was found in mud from Garth Ferry taken at low water.

*Mesochra lilljeborgii*, Boeck. (Pl. XX, fig. 4.)

Taken by townet off Puffin Island, also found in mud taken in a brackish tributary of the Mersey at Hale.

*Paramesochra dubia*, Scott. (Pl. XXVII, fig. 8. a.)

Length 0.65 mm. Quantities of this species recently described and figured by Mr. Thomas Scott, F.L.S. (Tenth Annual Report of the Fishery Board for Scotland) I found in mud dredged at 7 fathoms in Port Erin Bay, males and females being equally plentiful. Since then I find it in mud collected by Mr. Corbin from the Duddon cockle beds at the mouth of the River Duddon near Barrow.

*Tetragoniceps bradyi*, Scott. (Pl. XXVII, fig. 8. b.—f.)

Length 1 mm. Found only at same times and habitat as the last named species, (*Paramesochra dubia*) Scott found no males; they were however plentiful in the Port Erin gathering. The conspicuous 5th feet (c) at once render the female of this species recognisable.

*Diosaccus tenuicornis*, Claus. (Pl. XX, fig. 5.)

Length 1.30 mm. Found in rock pools at Hilbre and Puffin Islands, and dredged in Port Erin Bay. It is distinguishable by its long anterior antennæ (a).

*Laophonte serrata*, Claus. (Pl. XX, fig. 6.)

Length 1.0 mm. Taken in townet by electric light at Port Erin, also between the Isle of Man and Liverpool and off Puffin Island, but rare.

*Laophonte spinosa*, n. sp. (Pl. XXXIII, figs. 1—13.)

Length 1 mm. Body elongated, the first segment being about equal in length to the five following segments. Rostrum short and blunt. Anterior antennæ (figs. 2, 3) four jointed, and with marked differences bearing a general similarity in both sexes to those of *Laophonte serrata* and even more serrated than in the latter species. The second joint has a large, strong spine in both sexes. The third joint in the female is longer than the others and is less setose than that of *L. serrata*. Fourth joint of male very similar to that of *L. serrata*, the others being dissimilar. Posterior antennæ (fig. 4) very similar to *L. serrata*. Mandible (fig. 5) bluntly spinous with small setiferous palp. Posterior foot jaw (fig. 7) is slender with very long slender claw.

The peduncle of first pair of feet (fig. 8) is composed of two long slender joints, the outer branch two jointed and very slender springing from the middle of second peduncle joint and about half the length of the first joint of inner branch which is armed with a strong falciform terminal claw. The two jointed outer branch of second, third and fourth feet (figs. 9, 10) in the female is nearly as long as the three jointed inner branch.

The fifth pair of feet in the female (fig. 12) have large triangular basal joints with three curved lines of fine markings on the surface; they have five plumose setæ. The second joint is ovate and is attached laterally to first joint and also has five plumose spinous setæ. The fifth feet of the male (fig. 11) are very small and two jointed. The caudal segments (fig. 13) are about four times as long

as broad and have each a strong curved claw extending dorsally situated rather above the centre, two strong spinous setæ adorning the opposite side. The caudal segment is terminated by a strong central spine, and on the inner side has a stout bluntly rounded spine about half the length of the caudal segment, and a short fine seta on the outer side.

Two specimens, male and female of this strongly marked Copepod were lately dredged at a depth of seven fathoms on the muddy ground inside Port Erin breakwater. In the general character of the antennæ this species somewhat resembles *L. serrata* for which it might at first sight be mistaken, but the swimming feet are different, and the caudal segments and their remarkable appendages clearly distinguish it from any known species.

*Laophonte thoracica*, Boeck. (Pl. XXI, fig. 5. e.—g.)

Length 0.60 mm. Our only specimen was taken by townet amongst the Algæ round Puffin Island.

*Laophonte horrida*, Norman. (Pl. XX, fig. 7.)

Length 1.25 mm. This ferocious looking animal is at once recognisable by its array of dorsal projecting spines. A few specimens male and female were recently dredged at four fathoms in Port Erin Bay and one specimen was dredged at 39 fathoms, 12 miles from Port Erin. They were imbedded in mud which was so tenaciously held by the spines that it was most difficult to clean them. It appears to be an exceedingly rare species.

*Laophonte similis*, Claus. (Pl. XXI, fig. 5. a.—d.)

Length 1 mm. Found in tidal pools about the submarine forest at Leasowe, also in dredged material from Colwyn Bay.

*Laophonte curticauda*, Boeck. (Pl. XXI, fig. 3.)

Length 1 mm. Found in tidal pools at Hilbre Island, Leasowe, and Puffin Island.

*Laophonte lamellifera*, Claus. (Pl. XX, fig. 8.)

Length 0.85 mm. Frequently taken by townet amongst the Algæ about Puffin Island.

*Laophonte hispida*, Brady & Robertson. (Pl. XXI, fig. 4.)

Length 1.80 mm. One specimen only was taken by surface townet near Puffin Island.

*Normanella dubia*, Brady and Robertson. (Pl. XXI, fig. 6.)

Length 0.40 mm. A few specimens of this very minute species were dredged in mud from four fathoms in Port Erin Bay.

*Cletodes limicola*, Brady. (Pl. XXI, fig. 7.)

Length 0.80 mm. Found in mud taken at low water at Penmont Point, Anglesea, and at Garth Ferry.

*Cletodes longicaudata*, Brady & Rob. (Pl. XXI, fig. 8. *f.*)

Length 0.50 mm. Found sparingly in mud from Llanfairfechan shore at low water. The long, thin caudal segments (*f*) readily distinguish it.

*Cletodes linearis*, Claus. (Pl. XXI, fig. 8. *a.—c.*)

Length 1. mm. Found in mud from Hale shore taken at low water.

*Cletodes monensis*, n. sp. (Pl. XXXIV, figs. 1—11.)

Length about 1.20 mm. First joint of cephalothorax about equal to the two following and armed with a strong slightly hooked spine on the dorsal side. A double spine terminates the posterior dorsal end of abdomen. A minute row of spines clothes the edges of all the cephalothoracic and abdominal segments, with the exception of the first.

Anterior antennæ (fig. 2) seven jointed, the first being the longest, and the second about equal to any two of the following. Posterior antennæ (fig. 3) three jointed a single stout seta taking the place of an inner branch. First pair of swimming feet (fig. 8) very small, the second, third and fourth gradually increasing in length, the fourth (fig.

9) being more than double the length of the first. The inner branch of all four is very short, two jointed, and terminated by a long seta; the outer branch of each is much longer than the inner and is three jointed, it being in the fourth feet at least six times the length of the inner branch. The fifth feet (fig. 10) are each composed of three inner spines, the central one plumose, then a long single segment with spinous apex, and the foot terminated by a short segment bearing a long seta. Caudal stylets (fig. 11) long and narrow with one outer seta near apex and a central inner seta, and long terminal spines. Several specimens all females of this striking species were taken by the mud dredge at a depth of 39 fathoms about 12 miles out from Port Erin. It is easily recognised by the anterior and posterior dorsal spines, its stout build and long diverging caudal stylets.

*Enhydrosoma curvatum*, Brady & Rob. (Pl. XXII, fig. 1.)

Length 0.60 mm. Found in mud from Llanfairfechan and Garth shores at low water. Its minute size and its adherence to its muddy surroundings render it difficult of detection or examination.

*Platyhelipus littoralis*, Brady. (Pl. XXII, fig. 2.)

Length 1.20 mm. This striking species occurs in abundance in mud taken at low water at Puffin Island, Llanfairfechan, Garth Ferry and Hale, males and females being about equally plentiful.

*Dactylopus tisboides*, Claus. (Pl. XXII, fig. 3.)

Length 1.90 mm. Frequently dredged off Puffin Island and Port Erin, also found in tidal pools. It is easily distinguishable by the first pair of feet (*b*) and by the markings on the fifth feet (*c*).

*Dactylopus stromii*, Baird. (Pl. XXII, fig. 4. *a. b.*)

Length 1. mm. Frequently found in tidal pools and attached to Algæ. It bears considerable resemblance to

*D. tisboides* the anterior antennæ of the latter however is nine jointed, that of *D. stromii* being eight jointed.

*Dactylopus tenuiremis*, Brady & Rob. Pl. XXII, fig. 4. c. d.)

Length 0.80 mm. One specimen only taken by surface townet near Port Erin. Its caudal segments (*d*) form a distinguishing feature.

*Dactylopus flavus*, Claus. (Pl. XXIII, fig. 5. a.—d.)

Length 0.80 mm. This is evidently a rare species. We have occasionally taken it, by dredge off or near the Calf of Man in 20 fathoms. It is of a dark yellow colour and easily recognizable by its short compact somewhat boat-shaped appearance.

*Dactylopus brevicornis*, Claus. (Pl. XXII, fig. 4. e. f. g.)

Length 0.60 mm. A few specimens were found in tidal pools at Douglas, Isle of Man. The short, densely setose anterior antennæ at once distinguish it from others of the genus.

*Dactylopus minutus*, Claus. (Pl. XXII, fig. 5. e. f.)

Length 1. mm. A single specimen was dredged in 20 fathoms near the Calf of Man. It is evidently one of the rarest species of the genus.

*Thalestris helgolandica*, Claus. (Pl. XXII, fig. 7.)

Length 0.80 mm. A few specimens have been dredged off the Little Orme and near Puffin Island, also in Port Erin Bay. The presence of a middle joint in the inner branch of the posterior antennæ and the shape of the fifth feet sufficiently distinguish this species.

*Thalestris rufocincta*, Norman. (Pl. XXII, fig. 6.)

Length 1.25 mm. Common both free swimming and in dredged material throughout the district. It is of a yellowish colour, the edges of the body segments being usually lined with crimson. This together with the plumose character of the spines on the swimming feet (*a*) easily distinguish it.



*Thalestris harpactoides*, Claus. (Pl. XXII, fig. 8.)

Length 1.25 mm. Frequent in rock pools about Puffin Island and Douglas. This rarer species somewhat resembles *T. rufocincta* in colour. It is however more slender and may be recognised by the aculeate character of its caudal setæ.

*Thalestris clausii*, Norman. (Pl. XXII, fig. 6. b. c.)

Length 1 mm. Found in tidal pools at Fleshwick Bay, Isle of Man, and at Puffin Island. The first pair of swimming feet serve to distinguish it.

*Thalestris rufo-violescens*, Claus. (Pl. XXIII, fig. 1.)

Length 1. mm. A rare species in the district. A few specimens were found in mud dredged from 4 fathoms in Port Erin Bay. The chitinous character of the edges of most of its segments is a very distinguishing feature. This is specially noticable on the joints of the anterior antennæ (*a*) and in the fifth feet (*d*).

*Thalestris serrulata*, Brady. (Pl. XXIII, fig. 2. a.)

Length 2. mm. One specimen was taken by surface townet off Puffin Island. The widely separated serrated markings on the outer edge of the caudal segments (*a*) seem a strong distinguishing feature.

*Thalestris hibernica*, Brady & Rob. (Pl. XXIII, fig. 2. b. — f.)

Length 0.80 mm. A few specimens were found in rock pools at Hilbre and Puffin Islands. It may be recognized by the fifth feet (*e*).

*Thalestris longimana*, Claus. (Pl. XXIII, fig. 3. a. b.)

Length 1.30 mm. Common in rock pools at Hilbre and Puffin Islands. The powerful posterior foot jaw renders it easily recognizable.

*Thalestris peltata*, Boeck. (Pl. XXXIII, fig. 3. c. d.)

Length 0.80 mm. A few specimens were found in material dredged off Little Orme and more recently at 20 fathoms off Port Erin. Its ovate form, rostrum and eye

spot distinguish this species from the others of the genus.

*Westwoodia nobilis*, Baird. (Pl. XXXIII, fig. 4.)

Length 1. mm. Occasionally found in rock pools at Hilbre and Puffin Islands. The one jointed inner branch of the feet of the first pair at once distinguishes this species.

*Harpacticus chelifera*, Müller. (Pl. XXXIII, fig. 5.)

Length 1.25 mm. Common throughout the district as a free swimmer and in dredged material. The chelifate posterior foot jaw (*c*) clearly distinguishes this species.

*Harpacticus fulvus*, Fischer. (Pl. XXXIII, fig. 6. *a. b. c.*)

Length 1.25 mm. Abundant in rock pools at Puffin Island, generally of a bright red colour and very conspicuous on the green alga *Enteromorpha*.

Prof. Herdman's experiments as to the capacity of this crustacean to adapt itself to various degrees of salt and fresh water are given in Report III of the Marine Biological Station on Puffin Island, 1889, p. 36.

*Harpacticus flexus*, Brady & Rob. (Pl. XXXII, fig. 6. *d. e. f.*)

Length 1.25 mm. Very similar in general appearance and characters to *H. chelifera*, but smaller and recognizable by the second foot jaw which is slender and without the excavated toothed hand so characteristic of that species.

*Zaus spinatus*, Goodsir. (Pl. XXIII, fig. 7.)

Length 0.65 mm. A pretty minute species frequently found in tidal pools at Hilbre and Puffin Islands, &c.; also dredged in Port Erin Bay.

*Zaus goodsiri*, Brady. (Pl. XXXIII, fig. 8.)

Length 1.30 mm. Dredged off the Calf of Man in 20 fathoms and off the Little Orme, and in Colwyn Bay. In some of the specimens from the first locality the three central body segments are of a brilliant crimson colour.

*Alteutha depressa*, Baird. (Pl. XXIV, fig. 1. *c.*)

Length 1.30 mm. Common throughout the district, chiefly a littoral species, also frequently found in the night

surface townets as a free swimmer. On some occasions when we have left a townet tied to a buoy all night, numbers of this species have been captured.

*Alteutha interrupta*, Goodsir. (Pl. XXIV, fig. 1. *a. b.*)

Length 1.30 mm. Frequently found in similar situations to the last species. The shape of the terminal joint of the fifth feet (*b*) and the number of the spines thereon distinguish this from the preceding species.

*Alteutha crenulata*, Brady. (Pl. XXIV, fig. 2.)

Length 1 mm. A gaily coloured uncommon species. Our examples have been taken in Redwharfe Bay, Anglesea, and about Puffin Island, chiefly amongst the littoral Algæ.

*Porcellidium tenuicauda*, Claus. (Pl. XXIV, fig. 3.)

Length 1 mm. Our only specimen was dredged from the "Mallard" (1892) outside Port Erin Bay in 20 fathoms.

*Porcellidium viride*, Philippi. (Pl. XXIV, fig. 3. *a.*)

Length 0.80 mm. One specimen only was dredged in Port Erin Bay amongst mud, at 4 fathoms. The caudal segments of this species (*a*) distinguish it from the preceding species.

*Idya furcata*, Baird. (Pl. XXIV, fig. 4.)

Length 1.25 mm. Common throughout the district amongst Algæ and in rock pools; also common as a free swimmer near the land. The tufts of plumose setæ at the apices of the spines of the first pair of feet at a glance distinguish this species.

*Scutellidium tisboides*, Claus. (Pl. XXIV, fig. 5, *a* to *c.*)

Length 0.65 mm. One specimen only recorded in the district, taken by townet in Douglas Bay.

*Scutellidium fasciatum*, Boeck. (Pl. XXIV, fig. 5. *d* to *f.*)

Length 1 mm. Not uncommon in tidal rock pools at Hilbre Island; also dredged in Port Erin Bay, where it was also taken by townet during electric light illumination. One specimen, found in a tidal pool at Hilbre Island, has

minute nodules in the middle of many of the setæ of the swimming feet.

*Cylindropsyllus lævis*, Brady. (Pl. XXV, fig. 6.)

Length 1.20 mm. One specimen only of this easily recognizable species was recently taken by the dredge on the muddy bottom inside of Port Erin breakwater, the only specimen recorded in the L.M.B.C. district. Under high magnification the entire surface is seen to be finely dotted. A spermatophore is in this specimen attached to the first abdominal segment.

#### Family MONSTRILLIDÆ.

*Monstrilla rigida*, Thompson. (Pl. XXIV, fig. 6. a.)

Length 1.75 mm. One specimen taken by townet off Puffin Island. This species has two abdominal segments, and three setæ on each furcal segment.

*Monstrilla danæ*, Claparède. (Pl. XXIV, fig. 6. b.)

Length 1.30 mm. One specimen was taken by townet about two miles from Puffin Island, and lately several have turned up near Port Erin Bay, one haul of a townet capturing three. This species has three abdominal segments, and four setæ on each furcal segment.

*Monstrilla anglica*, Lubbock. (Pl. XXIV, fig. 7.)

Length 1.75 mm. Two specimens have been taken by townet off Puffin Island, three years apart. This species has four abdominal segments and five setæ on each furcal segment.

*Monstrilla longicornis*, Thompson. (Pl. XXIV, fig. 8.)

Length 1.50 mm. One specimen was taken by townet off Puffin Island in 1889. This species has four abdominal segments and four setæ on each furcal segment. It may be easily recognised by its long straight antennæ which are nearly as long as the entire body. It appears to be identical with a single specimen recently described by

Giesbrecht (Pelagischen Copepoden des Golfes von Neapel, 1892) as *M. longiremis* but as his only specimen was a female, and mine a male, there must still remain some doubt as to their identity.

Family SAPPHIRINIDÆ.

*Lichomolgus fucicolus*, Brady. (Pl. XXV, fig. 1.)

Length 1 mm. Frequently found amongst Algæ round Puffin Island, also in dredged material from Colwyn Bay, and Port Erin Bay.

*Lichomolgus liber*, Brady & Rob. (Pl. XXV, fig. 2. a. b.)

Length 1.30 mm. Dredged off Calf of Man in 20 fathoms, and in Port Erin Bay in 4 fathoms.

*Lichomolgus thorellii*, Brady & Rob. Pl. XXV, fig. 2. c.)

Length 1.80 mm. One specimen found in mud dredged in Port Erin Bay, in 4 fathoms.

*Lichomolgus furcillatus*, Thorell. (Pl. XXV, fig. 3.)

Length 1 mm. A few specimens occurred in mud dredged in Port Erin Bay, in 4 fathoms.

*Lichomolgus albens*, Thorell. (Pl. XXV, fig. 3. c.)

Length 1.20 mm. In algæ on rocks at Puffin Island.

*Lichomolgus agilis*, Scott. (Pl. XXV, figs. 4\* and 8. d.)

Length 1.25 mm. This species was very recently described by Scott (Ann. and Mag. of Nat. Hist., Sept., 1892) who found it plentiful in the shell of the cockle (*Cardium edule*) in specimens from Morecambe, Lancashire, and from the Firth of Forth. Upon examining fresh cockles of our district I found several specimens of this active little Copepod in every bivalve opened. They may be readily found by carefully taking up the water contained in the shell by means of a camel hair brush and washing it into water contained in a watch glass under the microscope when they will probably be seen actively

\* Labelled *L. albens* by mistake.

darting about. In general appearance it much resembles *L. albens*, Thorell, but is easily distinguishable from this and other species of the genus by the inner branch of the fourth pair of swimming feet which is three jointed (fig. 4. d.) while in the other species it is two jointed. The anterior antennæ are also diagnostic.

*Lichomolgus maximus*, n. sp. (Pl. XXXV.)

Length of female 2.60 mm. Length of male 1.65 mm. Cephalothorax ovate, composed of five segments, the first being more than half the entire length. Rostrum short and blunt. Anterior antennæ (fig. 3) about two-thirds the length of the first segment, seven jointed and alike in male and female. The proportionate lengths of the joints are about as follows:

1	2	3	4	5	6	7
6	16	4	12	9	6	4

and all are well supplied with setæ. Posterior antennæ (fig. 4) stout, four jointed, the first and second joints being of about equal length, the third and fourth rather smaller. The apical joint is terminated by a pair of powerful curved claws and four hooked spines.

Mandible (fig. 5) is curved with a fringe of short spines at the upper apical portion, short cilia fringing the similar portion of the under side; the palp has two fine terminal spines. Anterior foot jaw (fig. 6) is long and sickle shaped with tooth shaped spines on the upper side gradually increasing in size from the apex. The posterior foot jaws differ in the two sexes. That of the male (fig. 7) is three jointed, the middle joint of which is lined with short setæ upon the inner edge, the third joint being very small. From the latter springs a long curved falciform terminal claw with a slight protuberance in the middle on the under side. There is also a small curved spine springing from the same base. The female foot jaw (fig. 8) is three

jointed and bears at the apex a small papilla or protuberance without any spine or setæ.

The first four pairs of swimming feet have both branches three jointed. In the outer branch of the first pair (fig. 9) the second joint has one and the third joint three spines with foliaceous expansions and aculeate edges. The spines of the other swimming feet are mostly foliaceous but not aculeate. The fourth pair (fig. 10) has two foliaceous spines on the third segment of the outer branch, being terminated by a long dagger-like spine and having five very long lateral plumose setæ. The third inner joint of the fourth pair has one long and one short terminal spine but no lateral setæ. The fifth feet (fig. 11) which are alike in both sexes are composed of one joint with one long and one short terminal spine.

The abdomen of the male is five jointed, that of the female being four jointed. In the male the first joint has two leafy pointed folds each terminating posteriorly with three short spines. The four terminal joints are nearly equal in length and gradually narrower to the extremity. The first joint in the female abdomen is broad and rounded posteriorly and devoid of spines; the other joints are much the same as those of the male. The caudal segments are about eight times as long as broad and equal in length to the two last abdominal segments. Each has four terminal setæ and one lateral seta at one sixth of the distance from the extremity.

About half a dozen specimens of each sex were obtained by carefully washing the branchial folds and other parts of specimens of *Pecten maximus* dredged at 20 fathoms near Port Erin Bay. I was led to look for this unknown Copepod through the similar habitat of *Lichomolgus agilis*, Scott, as parasitic on *Cardium edule*. Its size, nearly twice that of any hitherto described species of

*Lichomolgus* renders the name appropriate. It agrees with *L. agilis* in having the inner branch of the fourth pair of swimming feet three jointed but differs from it in most particulars, especially in the posterior antennæ and foot jaws. It seems probable that many more parasitic species may be found in similar habitats.

*Sabelliphilus sarsii*, Claparède. (Pl. XXV, fig. 5.)

Length 2 mm. This species was first found in the L.M.B.C. District and sent to me by Mr. H. Chadwick of Manchester upon the tentacles of a species of *Sabella* found on the Beaumaris shore, to which they were tenaciously adherent. Finding no record of it I described the species as *Lichomolgus sabellæ*, but since then find it is synonymous with *Sabelliphilus sarsii*, Claparède, to which I now assign it. I have since found it on Puffin Island adherent to the tentacles of *Sabella*.

#### FAMILY ARTOTROGIDÆ.

*Cyclopicera nigripes*, Brady & Robertson. (Pl. XXV, fig. 7.)

Length 1.25 mm. Occasionally dredged off Puffin Island.

*Cyclopicera lata*, Brady. (Pl. XXV, fig. 8.)

Length 1.75. Isolated specimens have been dredged off Puffin Island, and in the Isle of Man, off Port Soderick and in Port Erin Bay.

*Cyclopicera gracilicauda*, Brady. (Pl. XXVI, fig. 1.)

Length 0.75 mm. Taken by townet off Puffin Island; and by dredge in Redwharfe Bay, and during "Mavis" expedition, 15 miles off Southport. Also more recently in April, 1893, during a dredging expedition in "Lady Loch" when I found numbers of this species in washings from dredgings taken off Port Erin at a depth of 20 fathoms.



*Artotrogus boeckii*, Brady. (Pl. XXV, fig. 2.)

Length 1.30 mm. Dredged off the Calf of Man in 20 fathoms.

*Artotrogus magniceps*, Brady. (Pl. XXVI, fig. 3.)

Length 1.25 mm. Dredged off the Calf of Man, and the Little Orme, and taken in townet off Puffin Island.

*Artotrogus normani*, Brady & Robertson. (Pl. XXVI, fig. 5.)

Length 1.25 mm. A single specimen was dredged off the Calf of Man in 20 fathoms.

*Artotrogus orbicularis*, Boeck. (Pl. XXVI, fig. 4.)

Length 1.65 mm. A single specimen of this beautiful and striking copepod was found by Prof. Herdman underneath a stone on the spit at Puffin Island. Though diligently searched for we have never succeeded in finding another.

*Acontiphorus scutatus*, Brady & Rob. (Pl. XXVI, fig. 8.)

Length 0.80 mm. A few specimens have been found in rock pools at Hilbre and Puffin Islands.

#### Family CHONDRACANTHIDÆ.

*Lernentoma lophii*, Johnston. (Pl. XXVII, fig. 1.)

Numerous specimens of this species were recently found by Mr. Corbin adherent to Cod, Ling and Lophius taken off Barrow. The female is from  $\frac{1}{4}$  to  $\frac{1}{2}$  an inch or more in length and is adorned with numerous blunt spines or tubercles over the surface of the body. The oviferous tubes are very long, slender and twisted. The males of this genus are very small and rudimentary, living parasitically on the body of the female.

#### Family CALIGIDÆ.

*Caligus rapax*, M. Edwards. (Pl. XXVII, fig. 4.)

Length 4.50 mm. This species is common throughout the district, being frequently taken at night by the townet

as a free swimmer, and is often found parasitic upon the cod and other fishes.

*Caligus curtus*, Leach. (Pl. XXVII, fig. 3.)

Length 5.0 mm. Less common than the preceding species, but found under similar conditions and attached to the cod and plaice. The conspicuous lunules or sucking discs situated on the lower surface of the frontal plates and having the appearance of eyes distinguish the genus *Caligus* from the rest of the family Caligidæ.

*Lepeoptheirus stromii*, Baird. (Pl. XXVII, fig. 6. b.)

Length 2.50 mm.

*Lepeoptheirus nordmannii*, M. Edw. (Pl. XXVII, fig. 5. a.)

Length 4.50 mm.

*Lepeoptheirus hippoglossi*, Kroyer. (Pl. XXVII, fig. 6. a.)

Length 4.50 mm.

*Lepeoptheirus obscurus*, Baird. (Pl. XXVII, fig. 5. b.)

Length 2.60 mm. All the specimens I have received of the above four species of the genus *Lepeoptheirus* were sent to me from Bull Bay by the late Mr. Frank Archer who had obtained them from the local fishermen.

#### Family LERNÆIDÆ.

*Lernæa branchialis*, Linn. (Pl. XXVI, fig. 7.)

Two very minute Crustacea (fig. 1) were taken in the tow-net off Puffin Island, which appeared to be larval forms of a *Lernæa*. Since then two more highly developed specimens (one from the same locality) have been found, apparently belonging to the same species as the larval specimens. They agree in the main with *Lernæa branchialis*, Linn., described and figured by Claus in his "Beobachtungen ueber Lernæocera, Peniculus und Lernæa, 1868," corresponding in most particulars with the male and female described by Claus, and I have provisionally included them under this species. *Other* specimens differ

from those figured by Claus chiefly in the form of the prehensile posterior antennæ and in the segmentation of the abdomen; but this animal appears to vary much in these very particulars according to age and sex, and it is therefore quite likely that Claus's specimens may represent slightly different stages of development. The group is extremely interesting, as exhibiting progressive and retrogressive development, and deserves more attention than it appears to have hitherto received. The female is about 1-18th inch in length, the male rather smaller, and the larval form about half the size of the female.

Since the above were recorded Prof. Herdman has found a number of adult specimens of *Lernæa branchialis* adherent to the gills of whittings taken in the Rock Channel.

#### Family LERNÆOPODIDÆ.

*Anchorella uncinata*, Müller. (Pl. XXVII, fig. 2.)

Length (without ovaries) 2.20 mm. Several specimens were found by Mr. Corbin on the gills of whiting taken in the Mersey estuary. Microscopical examination of one of them in situ shows the parasite impaled by the rounded knob at end of arms to one of the clusters of gill rakers which occurs at regular intervals along the concave side of the branchial arches. These rakers serve to arrest the passage of any solid substances into the gill cavities and appear also to form a secure anchorage for parasites which in *Anchorella* are surrounded by a tough transparent membrane. There are no males among those I have examined.

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#### EXPLANATION OF PLATES.

##### PLATE XV.

Fig. 1. *Calanus finmarchicus*, Gunner. *a*, Rostrum,  
*b*, terminal spine of swimming feet.

- Fig. 2. *Metridia armata*, Boeck. *a*, terminal spine of swimming feet. *b*, fifth foot of male. *c*, fifth foot of female.
- Fig. 3. *Pseudocalanus elongatus*, Baird. *a*, Posterior antenna. *b*, fifth pair of feet of male.
- Fig. 4. *Pseudocalanus armatus*, Boeck. *a*, Foot of second pair. *b*, foot of fifth pair of male.
- Fig. 5. *Paracalanus parvus*, Claus. *a*, termination of swimming feet. *b*, fifth foot of male. *c*, fifth foot of female.
- Fig. 6. *Acartia clausii*, Giesbrecht. *a*, terminal spine of swimming feet. *b*, fifth foot of female. *c*, Caudal segments of *Acartia discaudatus*.
- Fig. 7. *Temora longicornis*, Müller. *a*, terminal spine of swimming feet. *b*, caudal segments.
- Fig. 8. *Eurytemora clausii*, Boeck. *a*, terminal spine of swimming feet. *b*, fifth foot of female.

## PLATE XVI.

- Fig. 1. *Eurytemora affinis*, Poppe. *a*, anterior antenna of male. *b*, fifth foot of female.
- Fig. 2. *Isias clavipes*, Boeck. *a*, fifth foot of male. *b*, fifth foot of female.
- Fig. 3. *Centropages hamatus*, Lilljeborg. Fifth foot of male. *a*, terminal spine of swimming feet.
- Fig. 4. *Parapontella brevicornis*, Lubbock. *a*, fifth pair of feet of male. *b*, fifth foot of female. *c*, Abdomen of male.
- Fig. 5. *Labidocera wollastoni*, Lubbock. *a*, anterior antenna of male. *b*, right foot of fifth pair of male. *c*, left foot of fifth pair of male. *d*, fifth pair of feet of female.
- Fig. 6. *Labidocera acutum*, Dana. *a*, fifth pair of feet of male. *b*, fifth foot of female. *c*, abdomen and

posterior thoracic angles of male. *d*, abdomen and posterior thoracic angles of female.

Fig. 7. *Anomalocera patersonii*, Templeton.

Fig. 8. *Euchæta marina*, Prestandrea. *a*, posterior antenna.

#### PLATE XVII.

Fig. 1. *Oithona similis*, Claus.

Fig. 2. *Cyclopina littoralis*, Brady. *a*, posterior antenna. *b*, mandible and palp. *c*, fifth foot.

Fig. 3. *Cyclopina gracilis*, Claus. *a*, posterior antenna. *b*, mandible and palp. *c*, anterior foot jaw. *d*, posterior foot jaw.

Fig. 4. *Thorellia brunnea*, Boeck. *a*, posterior antenna. *b*, mandible and palp. *c*, posterior foot jaw. *d*, last thoracic segment with fifth feet and first two abdominal segments.

Fig. 5. *Hersiliodes puffini*, Thompson. *a*, anterior antenna. *b*, mandible. *c*, one of fifth feet.

Fig. 6. *Giardella callianassæ*, Canu. *a*, posterior antenna. *b*, one of fifth feet.

Fig. 7. *Notodelphys allmani*, Thorell. *a*, posterior antenna. *b*, one of fifth feet.

Fig. 8. *Doropygus pulex*, Thorell. *a*, female. *b*, male.

#### PLATE XVIII.

Fig. 1. *Doropygus poricauda*, Brady. *a*, posterior antenna. *b*, one of fifth feet.

Fig. 2. *Doropygus gibber*, Thorell. *a*, posterior antenna. *b*, one of fifth feet.

Fig. 3. *Botachus cylindratus*, Thorell. *a*, male. *b*, female.

Fig. 4. *Ascidicola rosea*, Thorell. *a*, mandible and palp.

Fig. 5. *Notopterophorus papilio*, Hesse. *a*, side view, male. *b*, dorsal view, male.

Fig. 6. Ventral view, female.

Fig. 7. *Longipedia coronata*, Claus.

Fig. 8. *Ectinosoma spinipes*, Brady. *a*, first foot jaw. *b*, second foot jaw. *c*, *Ectinosoma erythropros*, Brady, first foot jaw. *d*, second foot jaw. *e*, *Ectinosoma curticorne*, Boeck, fifth foot.

#### PLATE XIX.

Fig. 1. *Ectinosoma atlanticum*, Brady and Robertson. *a*, anterior antenna, female. *b*, posterior antenna. *c*, anterior foot jaw. *d*, posterior foot jaw.

Fig. 2. *Tachidius littoralis*, Poppe. *a*, anterior antenna, male. *b*, posterior antenna. *c*, posterior foot jaw. *d*, fifth pair of feet, female. *e*, *Tachidius brevicornis*, Müller, antenna of female.

Fig. 3. *Euterpe gracilis*, Claus, male. *a*, anterior antenna, female. *b*, posterior antenna. *c*, fifth foot, male. *d*, fifth foot, female.

Fig. 4. *Robertsonia tenuis*, Brady and Robertson, female. *a*, anterior antenna, male. *b*, posterior antenna. *c*, posterior foot jaw. *d*, fifth foot, female.

Fig. 5. *Amymone spherica*, Claus, male. *a*, mandible and palp. *b*, *Amymone longimana*, Claus, posterior foot jaw.

Fig. 6. *Stenhelia hispida*, Brady, female. *a*, posterior foot jaw. *b*, second foot of male. *c*, fifth foot of female.

Fig. 7. *Ameira longipes*, Boeck, female. *a*, anterior antenna, female. *b*, anterior antenna, male. *c*, posterior foot jaw. *d*, fifth foot, female.

Fig. 8. *Jonesiella fusiformis*, Brady and Robertson. *a*, anterior antenna, female. *b*, *Bradya typica*, Boeck, anterior antenna, female. *c*, tail.

## PLATE XX.

- Fig. 1. *Jonesiella hyænæ*, Thompson, female. *a*, posterior antenna. *b*, anterior foot jaw. *c*, posterior foot jaw. *d*, fifth foot, female.
- Fig. 2. *Delavalia palustris*, Brady, male. *a*, anterior antenna, female. *b*, foot of first pair.
- Fig. 3. *Delavalia reflexa*, Brady and Robertson, female. *a*, posterior foot jaw. *b*, fifth foot.
- Fig. 4. *Mesochra lilljeborgii*, Boeck, female. *a*, anterior antenna, female. *b*, anterior antenna, male. *c*, posterior foot jaw. *d*, fifth foot, female.
- Fig. 5. *Diosaccus tenuicornis*, Claus. *a*, anterior antenna, female. *b*, first foot. *c*, fifth foot, female.
- Fig. 6. *Laophonte serrata*, Claus, male. *a*, anterior antenna, female. *b*, posterior antenna. *c*, posterior foot jaw. *d*, mandible and palp.
- Fig. 7. *Laophonte horrida*, Norman, female. *a*, dorsal view. *b*, lateral view. *c*, posterior foot jaw. *d*, first foot. *e*, fifth foot, female.
- Fig. 8. *Laophonte lamellifera*, Claus. *a*, anterior antenna, female. *b*, posterior foot jaw. *c*, fifth foot, female. *d*, tail.

## PLATE XXI.

- Fig. 1. *Misophria pallida*, Boeck. *a*, anterior antenna, female. *b*, posterior antenna. *c*, mandible and palp.
- Fig. 2. *a*, *Ectinosoma melaniceps*, Boeck, second foot jaw. *b*, *Tachidius brevicornis*, Müller, fifth feet, female. *c*, fifth foot, male. *d*, *Stenhelia ima*, Brady, second foot jaw. *e*, fifth foot, female. *f*, one of tail segments.
- Fig. 3. *Laophonte curticauda*, Boeck, female. *a*, anterior antenna, female. *b*, posterior antenna. *c*, pos-

terior foot jaw. *d*, Inner branch of second foot, male.

- Fig. 4. *Laophonte hispida*, Brady and Robertson. *a*, anterior antenna, female. *b*, posterior foot jaw. *c*, one of caudal segments. *d*, fifth foot.
- Fig. 5. *Laophonte similis*, Claus. *a*, anterior antenna. *b*, fifth foot, female. *c*, fifth foot, male. *d*, appendages of first abdominal segment. *e*, *Laophonte thoracica*, Boeck, anterior antenna. *f*, posterior foot jaw. *g*, fifth foot.
- Fig. 6. *Normanella dubia*, Brady and Robertson. *a*, anterior antenna, female. *b*, mandible. *c*, posterior foot jaw. *d*, first foot.
- Fig. 7. *Cletodes limicola*, Brady. *a*, anterior antenna, female. *b*, anterior antenna, male. *c*, posterior antenna. *d*, fifth foot, female. *e*, fifth foot, male.
- Fig. 8. *Cletodes linearis*, Claus. *a*, anterior antenna, female. *b*, posterior foot jaw. *c*, inner branch of posterior antenna. *d*, outer branch of foot of third pair, male. *e*, fifth foot, male. *f*, *Cletodes longicaudata*, Brady and Robertson, caudal segments.

#### PLATE XXII.

- Fig. 1. *Enhydrosoma curvatum*, Brady and Robertson. *a*, anterior antenna, female. *b*, anterior antenna, male. *c*, posterior antenna. *d*, anterior foot jaw. *e*, posterior foot jaw. *f*, fifth pair of feet.
- Fig. 2. *Platychelipus littoralis*, Brady. *a*, anterior antenna, female. *b*, anterior antenna, male. *c*, posterior foot jaw. *d*, foot of first pair.
- Fig. 3. *Dactylopus tisboides*, Claus. *a*, posterior antenna. *b*, first foot. *c*, fifth foot, female.



- Fig. 4. *a*, *Dactylopus stromii*, Baird, anterior antenna, female. *b*, inner branch of second foot, male. *c*, *Dactylopus tenuiremis*, Brady and Robertson, anterior antenna, male. *d*, one of tail segments. *e*, *Dactylopus brevicornis*, Claus, anterior antenna, female. *f*, second foot jaw. *g*, fifth foot, female.
- Fig. 5. *Dactylopus flavus*, Claus. *a*, anterior antenna, female. *b*, fifth foot, male. *c*, fifth foot, female. *d*, caudal segments, female. *e*, *Dactylopus minutus*, Claus, anterior antenna, female.
- Fig. 6. *Thalestris rufocincta*, Norman. *a*, one of swimming feet, showing aculeate spines. *b*, *Thalestris clausii*, Norman, first pair swimming feet. *c*, posterior foot jaw.
- Fig. 7. *Thalestris helgolandica*, Claus. *a*, anterior antenna, male. *b*, posterior antenna. *c*, fifth pair of feet, female.
- Fig. 8. *Thalestris harpactoides*, Claus. *a*, anterior antenna, female. *b*, anterior antenna, male. *c*, posterior antenna. *d*, posterior foot jaw. *e*, fifth foot, female.

## PLATE XXIII.

- Fig. 1. *Thalestris rufo-violescens*, Claus. *a*, anterior antenna, female. *b*, posterior antenna. *c*, posterior foot jaw. *d*, fifth foot, female.
- Fig. 2. *a*, *Thalestris serrulata*, Brady, caudal segments. *b*, *Thalestris hibernica*, Brady and Robertson, anterior antenna. *c*, inner branch, posterior antenna. *d*, posterior foot jaw. *e*, fifth foot, female. *f*, fifth foot, male.
- Fig. 3. *Thalestris longimana*, Claus. *a*, fifth foot, female. *b*, fifth foot, male. *c*, *Thalestris peltata*, Boeck,

anterior antenna, rostrum, and eye spot, female.  
*d*, fifth foot, female.

Fig. 4. *Westwoodia nobilis*, Baird. *a*, posterior antenna.  
*b*, posterior foot jaw. *c*, first foot.

Fig. 5. *Harpacticus chelifera*, Müller. *a*, inner branch  
of posterior antenna. *b*, spine of posterior an-  
tenna. *c*, posterior foot jaw. *d*, fifth pair of feet.

Fig. 6. *a*, *Harpacticus fulvus*, Fischer. Inner branch of  
second foot, male. *b*, posterior foot jaw. *e*, first  
foot. *d*, *Harpacticus flexus*, Brady and Robert-  
son, posterior foot jaw. *c*, inner branch of second  
foot, male. *f*, fifth foot, female.

Fig. 7. *Zaus spinatus*, Goodsir. *a*, anterior antenna,  
male. *b*, posterior antenna. *c*, mandible and  
palp. *d*, foot of fifth pair, female.

Fig. 8. *Zaus goodsiri*, Brady. *a*, posterior foot jaw.  
*b*, fifth foot, female.

#### PLATE XXIV.

Fig. 1. *Alteutha interrupta*, Goodsir. *a*, anterior antenna,  
male. *b*, fifth foot. *c*, *Alteutha depressa*, Baird,  
anterior antenna, male. *d*, fifth foot.

Fig. 2. *Alteutha crenulata*, Brady. *a*, anterior antenna,  
female. *b*, anterior antenna, male. *c*, posterior  
foot jaw. *d*, foot of fifth pair, male, and angle  
of first abdominal segment.

Fig. 3. *Porcellidium tenuicauda*, Claus. *a*, *Porcellidium*  
*viride*, Philippi, fifth pair of feet, abdomen, and  
tail of male.

Fig. 4. *Idya furcata*, Baird. *a*, posterior antenna. *b*,  
foot of first pair. *c*, fifth foot, female.

Fig. 5. *Scutellidium tisboides*, Claus. *a*, first foot. *b*,  
anterior foot jaw. *c*, posterior foot jaw. *d*, *Scu-*  
*tellidium fasciatum*, Boeck, anterior foot jaw.

*e*, posterior foot jaw. *f*, fifth foot, female.

- Fig. 6. *Monstrilla rigida*, Thompson. *a*, anterior antenna, male. *b*, *Monstrilla danae*, Claparède, abdomen and caudal segments.
- Fig. 7. *Monstrilla anglica*, Lubbock. *a*, anterior antenna, male. *b*, feathery plume on apical segment.
- Fig. 8. *Monstrilla longicornis*, Thompson. *a*, anterior antenna, male. *b*, genital appendage on first abdominal segment of *M. anglica*, male.

#### PLATE XXV.

- Fig. 1. *Lichomolgus fucicolus*, Brady. *a*, posterior antenna. *b*, posterior foot jaw of male. *c*, posterior foot jaw of female. *d*, fourth foot.
- Fig. 2. *Lichomolgus liber*, Brady and Robertson. *a*, foot of fifth pair. *b*, abdomen of male. *c*, *Lichomolgus thorellii*, Brady and Robertson, abdomen and tail of female.
- Fig. 3. *Lichomolgus furcillatus*, Thorell. *a*, anterior antenna, female. *b*, mandible. *c*, *Lichomolgus albens*, Thorell. Abdomen, tail, and fifth feet.
- Fig. 4. *Lichomolgus agilis*, Scott. *a*, anterior antenna, female. *b*, posterior foot jaw, male. *c*, posterior foot jaw, female. *d*, foot of fourth pair.
- Fig. 5. *Sabelliphilus sarsii*, Claparède. *a*, anterior antenna, female. *b*, posterior antenna. *c*, posterior foot jaw. *d*, foot of fifth pair.
- Fig. 6. *Cylindropsyllus laevis*, Brady. *a*, anterior antenna, female. *b*, posterior antenna. *c*, foot of fifth pair, female. *d*, foot of fifth pair, male.
- Fig. 7. *Cyclopicera nigripes*, Brady and Robinson. *a*, anterior antenna, female. *b*, posterior antenna. *c*, posterior foot jaw. *d*, fifth foot, female.

- Fig. 8. *Cyclopicera lata*, Brady. *a*, abdomen and fifth feet, female. *b*, anterior antenna, female. *c*, posterior antenna. *d*, *Lichomolgus agilis*. Scott.

## PLATE XXVI.

- Fig. 1. *Cyclopicera gracilicauda*, Brady. *a*, posterior antenna. *b*, anterior foot jaw. *c*, posterior foot jaw. *d*, fifth foot.
- Fig. 2. *Artotrogus boeckii*, Brady. *a*, posterior antenna. *b*, posterior foot jaw. *c*, maxilla. *d*, fifth foot.
- Fig. 3. *Artotrogus magniceps*, Brady. *a*, anterior antenna. *b*, anterior foot jaw. *c*, posterior foot jaw. *d*, foot of fifth pair.
- Fig. 4. *Artotrogus orbicularis*, Boeck.
- Fig. 5. *Artotrogus normani*, Brady and Robertson. *a*, anterior antenna. *b*, pittings on shell. *c*, posterior antenna. *d*, posterior foot jaw.
- Fig. 6. *Dyspontius striatus*, Thorell. *a*, anterior antenna. *b*, posterior foot jaw. *c*, abdomen of female.
- Fig. 7. *Lernæa branchialis*, Linn. *a*, adult male. *b*, adult female.
- Fig. 8. *Acontiophorus scutatus*, Brady and Robertson. *a*, anterior antenna, female. *b*, posterior antenna. *c*, fifth foot, female.

## PLATE XXVII.

- Fig. 1. *Lernentoma lophii*, Johnston.
- Fig. 2. *Anchorella uncinata*, Müller.
- Fig. 3. *Caligus curtus*, Leach.
- Fig. 4. *Caligus rapax*, Mln. Edwards.
- Fig. 5. *a*, *Lepeoptheirus normanni*, Mln. Edw. *b*, *Lepeoptheirus obscurus*.
- Fig. 6. *a*, *Lepeoptheirus hippoglossi*, Kroyer. *b*, *Lepeoptheirus stromii*, Baird.

- Fig. 7. *a*, *Cervinia bradyi*, Norman. *b*, anterior antenna.  
*c*, posterior antenna. *d*, foot of second pair.  
*e*, foot of fifth pair.
- Fig. 8. *a*, *Paramesochra dubia*, Scott, female. *b*, *Tetragoniceps bradyi*, Scott, anterior antenna, female.  
*c*, abdomen, female. *d*, foot of fifth pair, male.  
*e*, caudal stylet, female. *f*, caudal stylet, male.

## PLATE XXVIII.

- Fig. 1. *Herdmania stylifera*, n. sp., female.  
 Fig. 2. Anterior antenna, female.  
 Fig. 3. ,, male.  
 Fig. 4. Posterior antenna.  
 Fig. 5. Mandible and palp.  
 Fig. 6. Maxilla.  
 Fig. 7. First foot jaw.  
 Fig. 8. First foot.  
 Fig. 9. Third foot.  
 Fig. 10. Fourth foot.  
 Fig. 11. Fifth foot, female.  
 Fig. 12. ,, male.

## PLATE XXIX.

- Fig. 1. *Cyclops marinus*, n. sp., female.  
 Fig. 2. Anterior antenna.  
 Fig. 3. Posterior antenna.  
 Fig. 4. Mandible and palp.  
 Fig. 5. Maxilla.  
 Fig. 6. Anterior foot jaw.  
 Fig. 7. Posterior foot jaw.  
 Fig. 8. Foot of first pair.  
 Fig. 9. Fifth pair of feet and abdomen

## PLATE XXX.

- Fig. 1. *Stenhelia denticulata*, n. sp., female.  
 Fig. 2. Anterior antenna.  
 Fig. 3. Posterior antenna.  
 Fig. 4. Mandible and palp.  
 Fig. 5. Maxilla.  
 Fig. 6. Anterior foot jaw.  
 Fig. 7. Posterior „  
 Fig. 8. Foot of first pair.  
 Fig. 9. Foot of third pair.  
 Fig. 10. Foot of fifth pair.  
 Fig. 11. Caudal segments.

## PLATE XXXI.

- Fig. 1. *Stenhelia hirsuta*, n. sp., female.  
 Fig. 2. Anterior antenna, female.  
 Fig. 3. Anterior antenna, male.  
 Fig. 4. Posterior antenna.  
 Fig. 5. Mandible and palp.  
 Fig. 6. Maxilla.  
 Fig. 7. First foot jaw.  
 Fig. 8. Second foot jaw.  
 Fig. 9. Foot of first pair.  
 Fig. 10. Inner branch of second foot, male  
 Fig. 11. Foot of third pair.  
 Fig. 12. Fifth foot, female.  
 Fig. 13. Fifth foot, male.

## PLATE XXXII.

- Fig. 1. *Ameira attenuata*, n. sp., female.  
 Fig. 2. „ „ „ male  
 Fig. 3. Anterior antenna, female.  
 Fig. 4. „ „ „ male.  
 Fig. 5. Posterior antenna.

- Fig. 6. Second foot jaw.
- Fig. 7. Foot of first pair.
- Fig. 8. „ third pair.
- Fig. 9. „ fifth pair, female.
- Fig. 10. „ „ male.
- Fig. 11. Caudal segments.

## PLATE XXXIII.

- Fig. 1. *Laophonte spinosa*, n.sp., male.
- Fig. 2. Anterior antenna.
- Fig. 3. „ female.
- Fig. 4. Posterior antenna.
- Fig. 5. Mandible and palp.
- Fig. 6. Maxilla.
- Fig. 7. Second foot jaw.
- Fig. 8. First foot.
- Fig. 9. Third foot.
- Fig. 10. Fourth foot.
- Fig. 11. Fifth foot, male.
- Fig. 12. „ female.
- Fig. 13. One of caudal segments.

## PLATE XXXIV.

- Fig. 1. *Cletodes monensis*, n. sp., female.
- Fig. 2. Anterior antenna, and dorsal anterior end of cephalothorax.
- Fig. 3. Posterior antenna.
- Fig. 4. Maxilla.
- Fig. 5. Mandible and palp.
- Fig. 6. Anterior foot jaw.
- Fig. 7. Posterior foot jaw.
- Fig. 8. Foot of first pair.
- Fig. 9. Foot of fourth pair.
- Fig. 10. Fifth pair of feet.
- Fig. 11. Caudal stylets.

## PLATE XXXV.

- Fig. 1. *Lichomolgus marimus*, n. sp., male.  
 Fig. 2.                    "                    "                    female.  
 Fig. 3. Anterior antenna.  
 Fig. 4. Posterior antenna.  
 Fig. 5. Mandible and palp.  
 Fig. 6. Anterior foot jaw.  
 Fig. 7. Posterior foot jaw, male.  
 Fig. 8.                    "                    "                    female.  
 Fig. 9. Foot of first pair.  
 Fig. 10. Foot of fourth pair.  
 Fig. 11. Foot of fifth pair.

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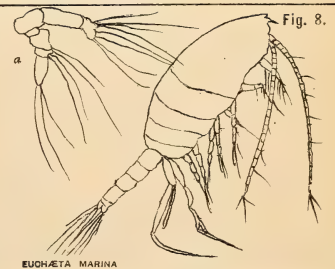
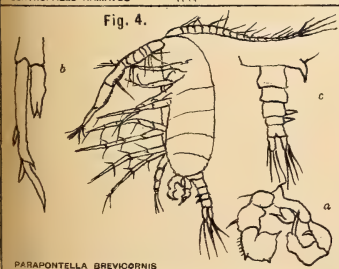
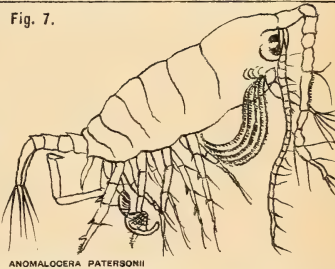
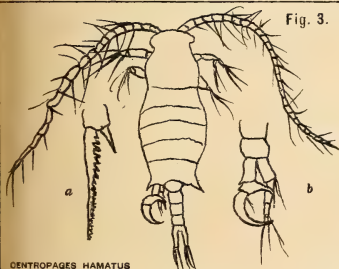
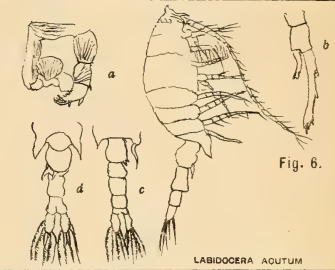
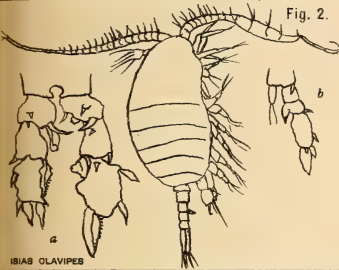
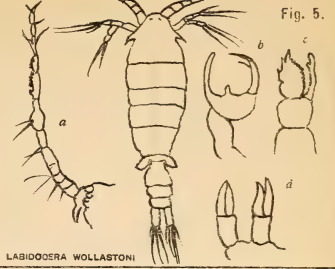
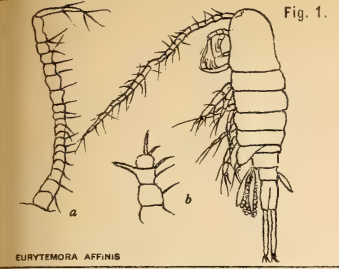


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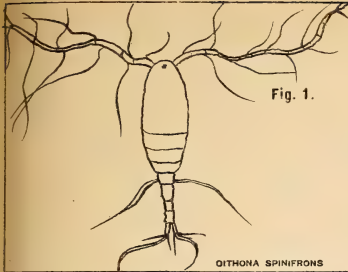


Fig. 1.

DITHONA SPINIFRONS

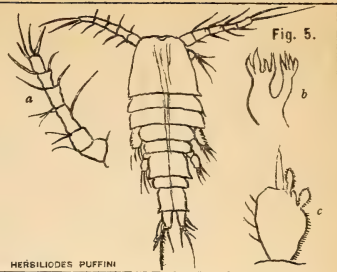


Fig. 5.

HERBILICODES PUFFINI

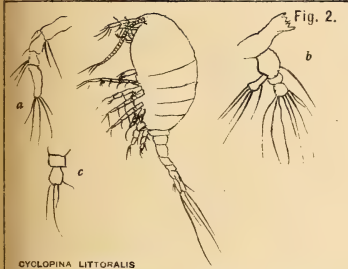


Fig. 2.

CYCLOPINA LITTORALIS

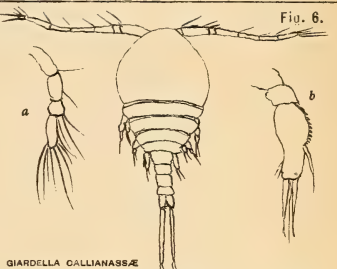


Fig. 6.

GIARDELLA CALLIANASSÆ

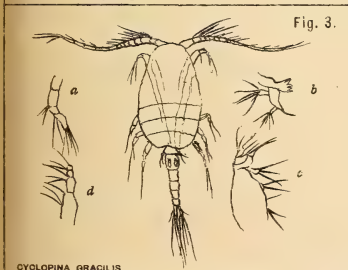


Fig. 3.

CYCLOPINA GRACILIS

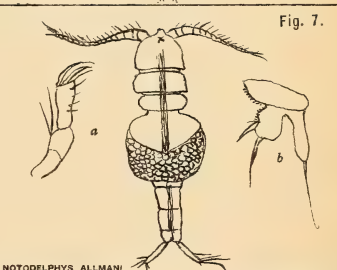


Fig. 7.

NOTODELPHYS ALLMANI

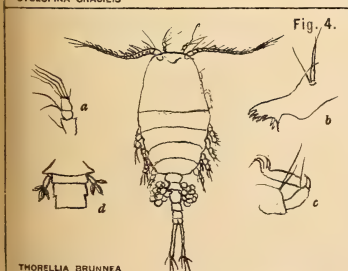


Fig. 4.

THORELLIA BRUNNEA

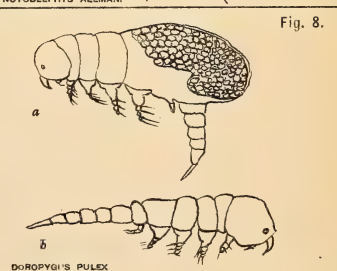
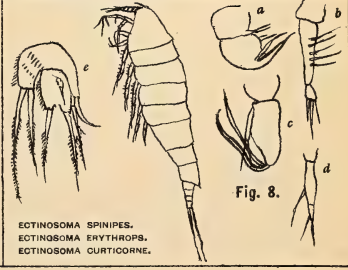
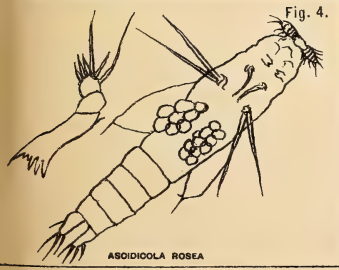
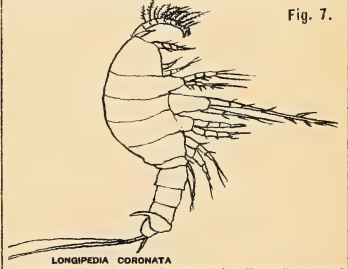
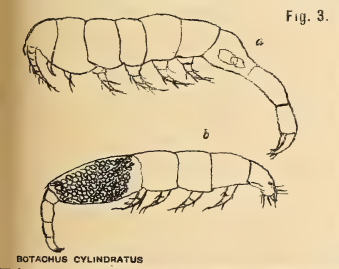
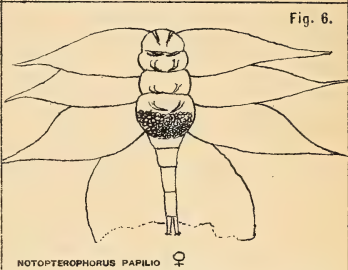
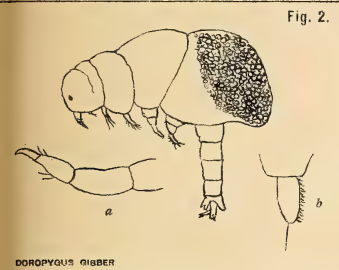
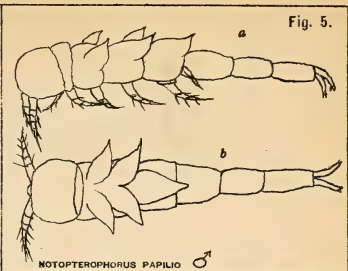
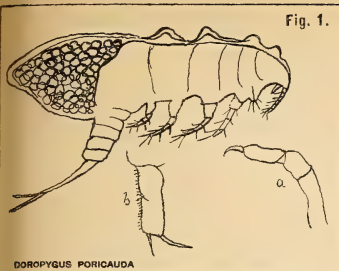


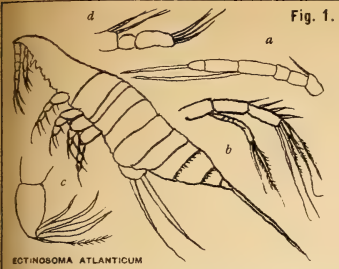
Fig. 8.

DOROPYGI'S PULEX

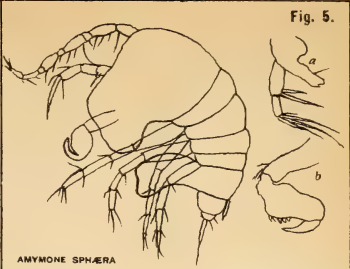
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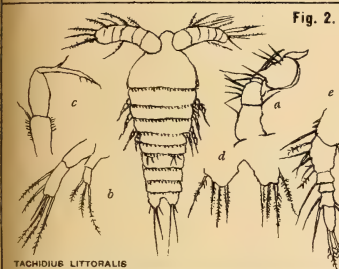
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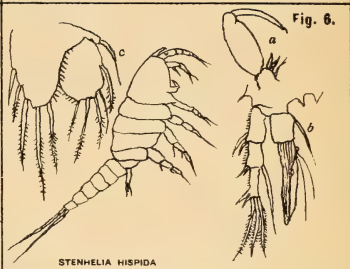
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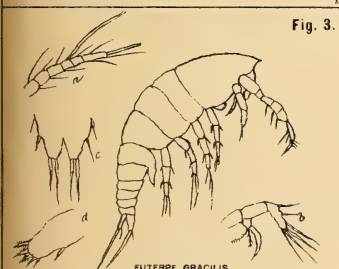
ANYMONE SPHAERA



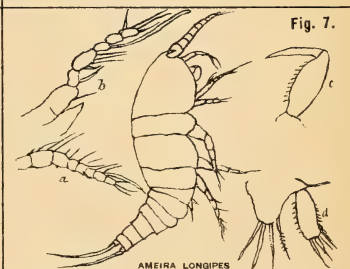
TACHIDIUS LITTORALIS



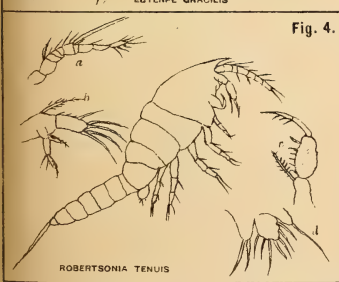
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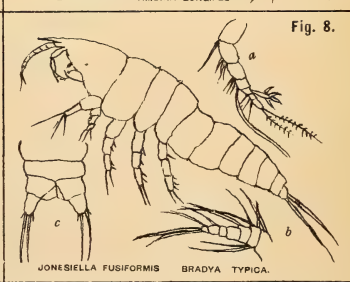
EUTERPE GRACILIS



AMEIRA LONGIPES



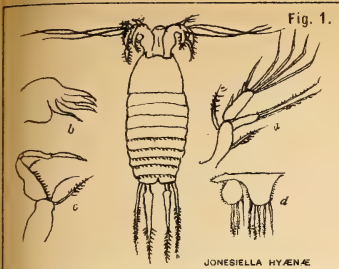
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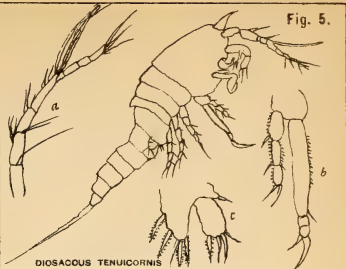
JONESIELLA FUSIFORMIS BRADYA TYPICA.

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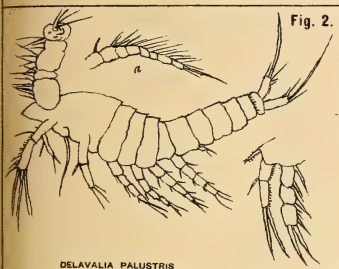




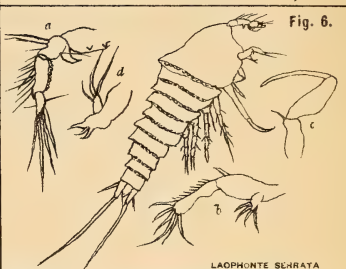
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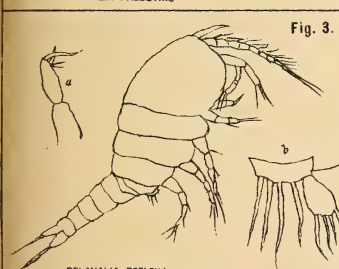
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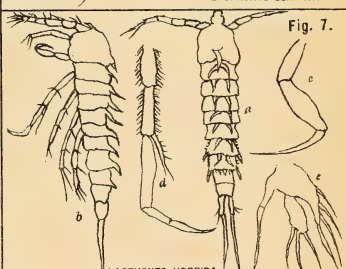
DELAVALIA PALUSTRIS



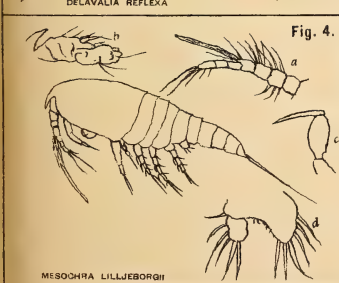
LAOPHONTE STRIATA



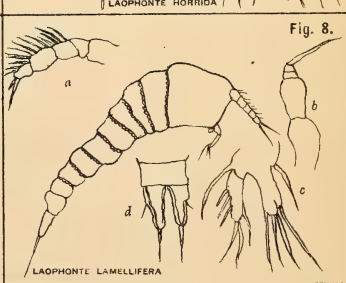
DELAVALIA REFLEXA



LAOPHONTE HORRIDA

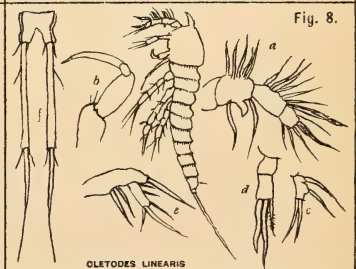
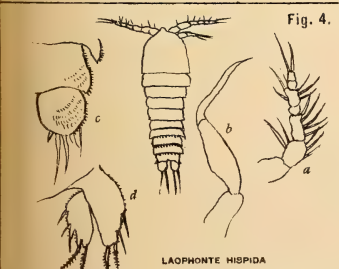
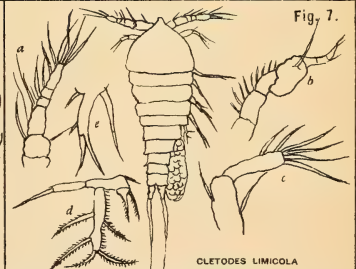
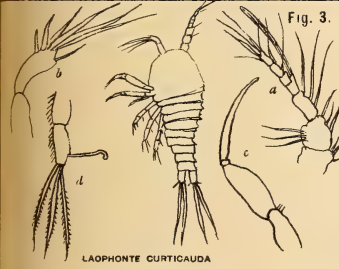
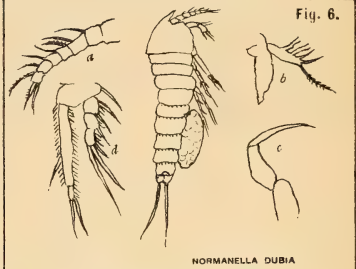
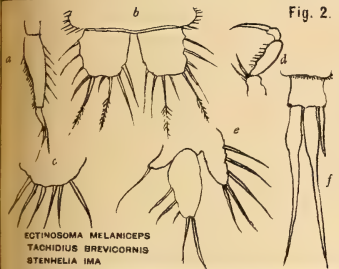
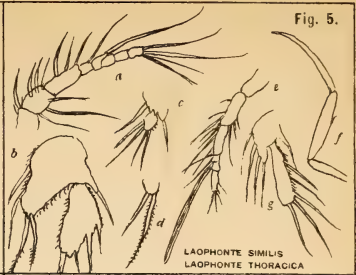
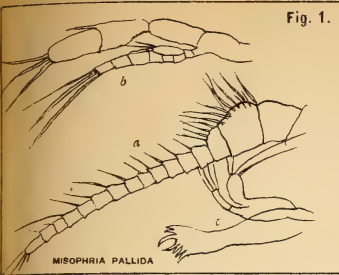


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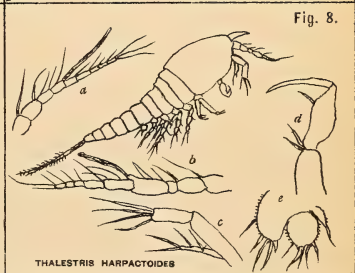
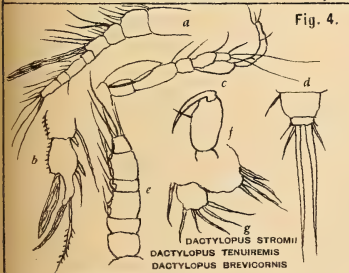
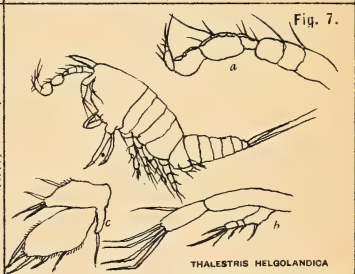
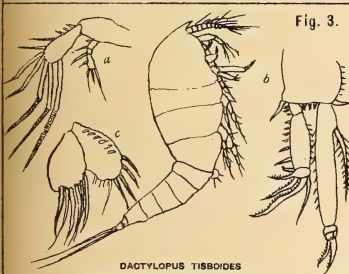
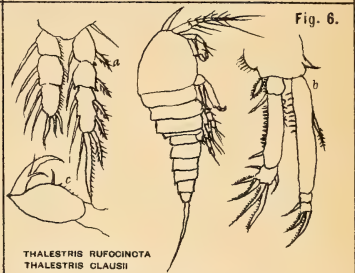
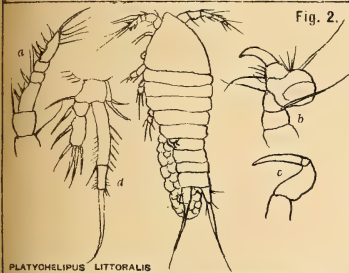
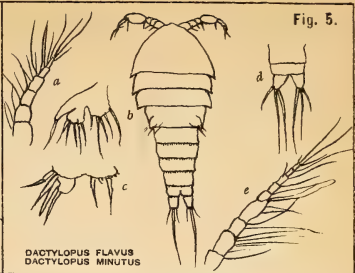
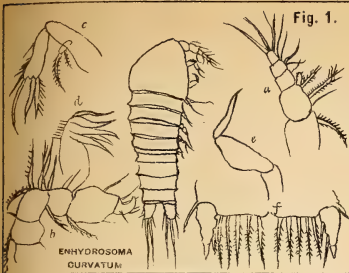


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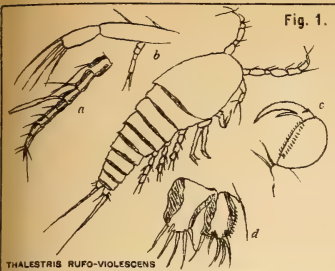
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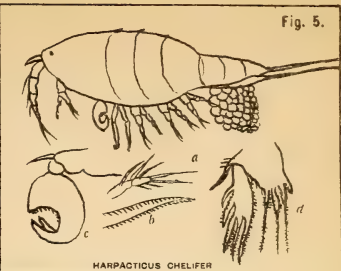
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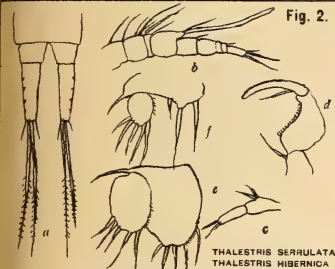
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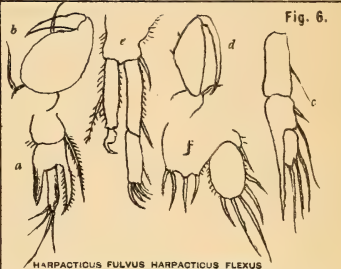
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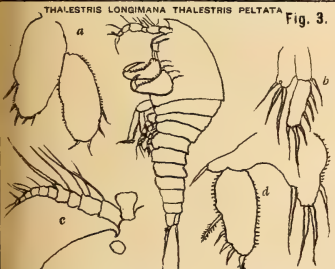
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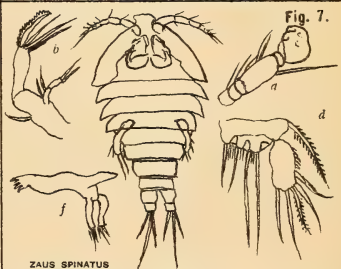
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THALESTRIS HIBERNICA



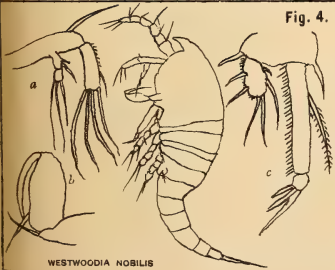
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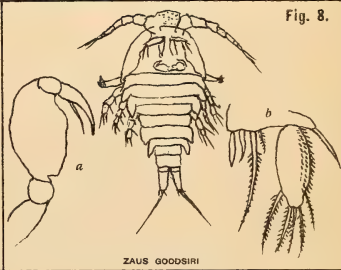
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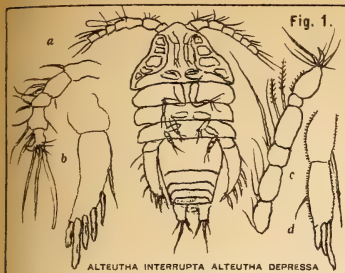


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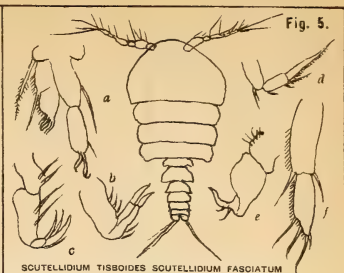


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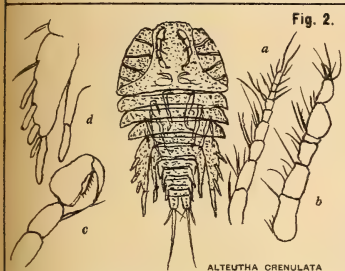
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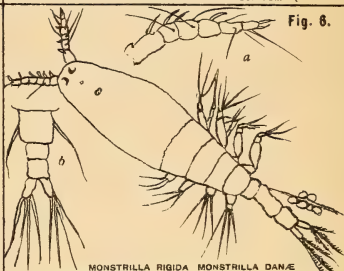
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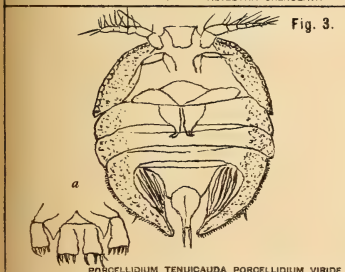
SCUTELLIDIUM TISBOIDES SCUTELLIDIUM FASCIATUM



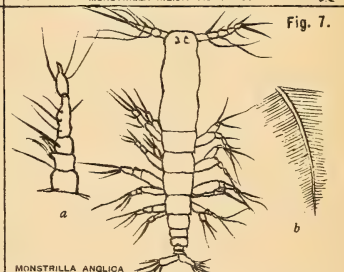
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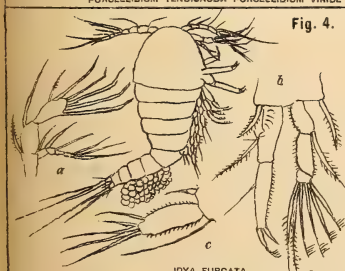
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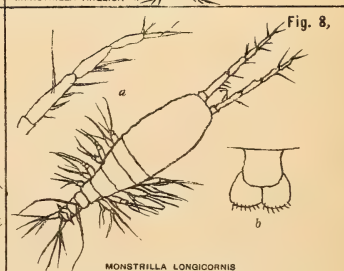
PORCELLIDIUM TENUICAUDA PORCELLIDIUM VIRIDE



MONSTRILLA ANGLICA



IDYA FURCATA



MONSTRILLA LONGICORNIS

I. C. T., del.

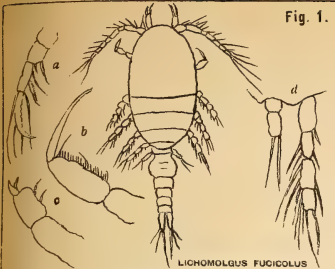


Fig. 1.

LICHOMOLGUS FUCICOLUS

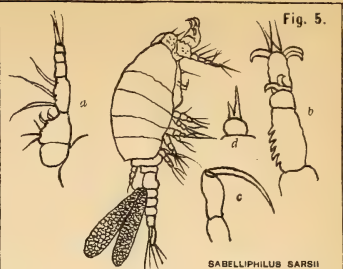


Fig. 5.

SABELLIPHILUS SARSII

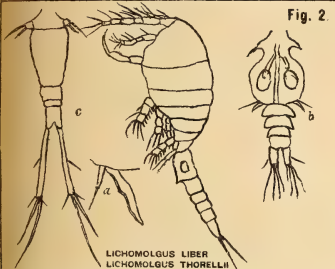


Fig. 2.

LICHOMOLGUS LIBER  
LICHOMOLGUS THORELLII

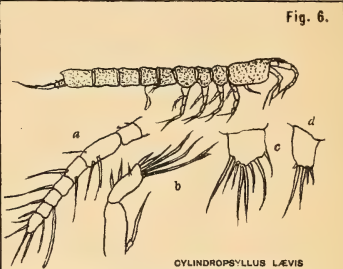


Fig. 6.

CYLINDROPSYLLUS LEVIS

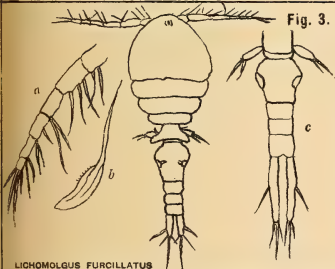


Fig. 3.

LICHOMOLGUS FURCILLATUS

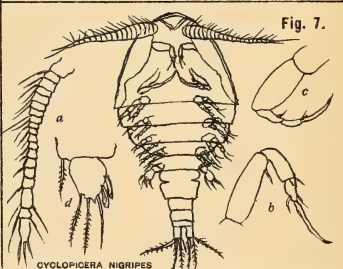


Fig. 7.

CYCLOPICERA NIGRIPES

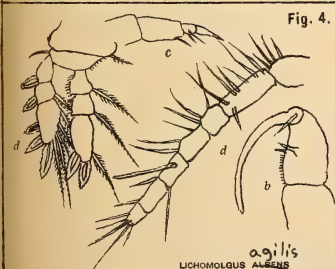


Fig. 4.

LICHOMOLGUS AENEUS  
*agilis*  
LICHOMOLGUS AGRIS

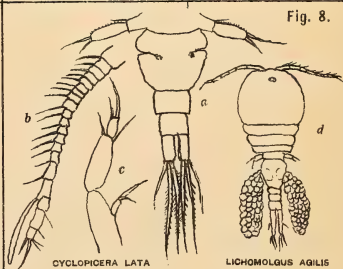
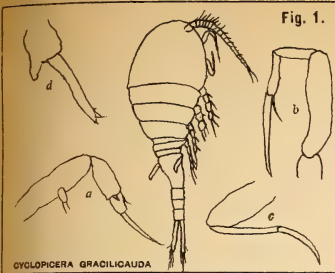


Fig. 8.

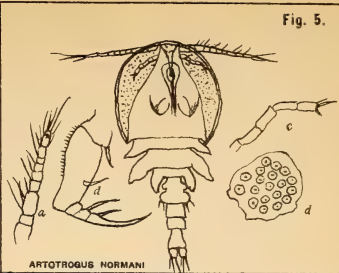
CYCLOPICERA LATA

LICHOMOLGUS AGRIS

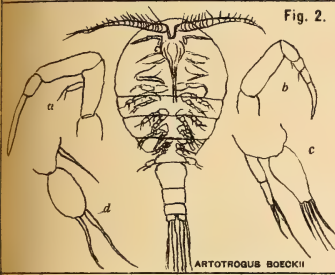
I. C. T., del.



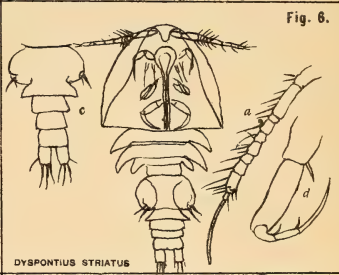
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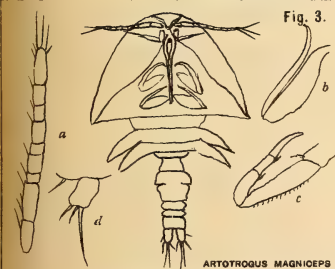
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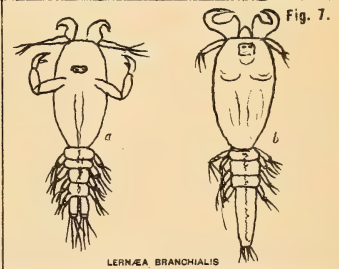
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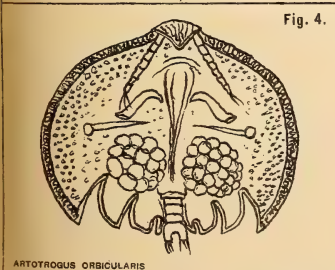
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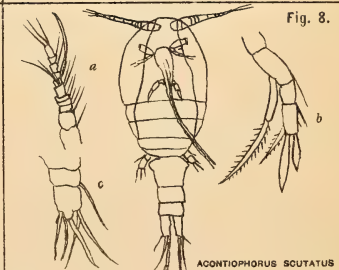
ARTOTROGUS MAGNICEPS



LERNÆA BRANCHIALIS



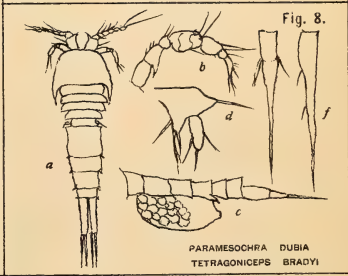
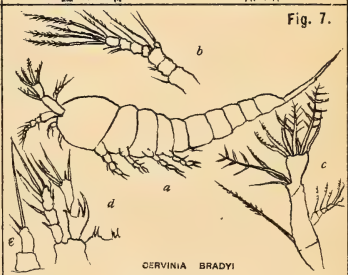
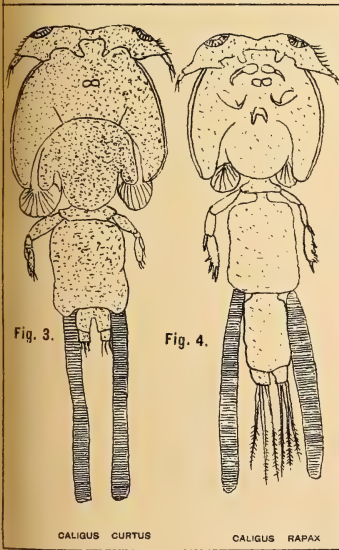
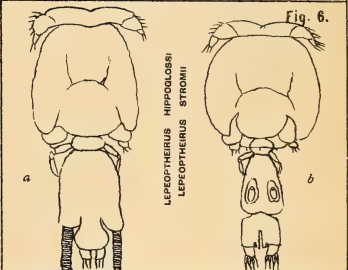
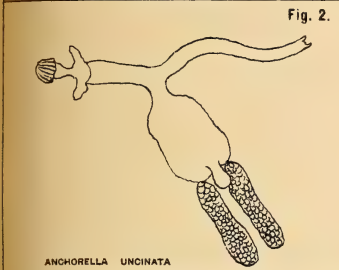
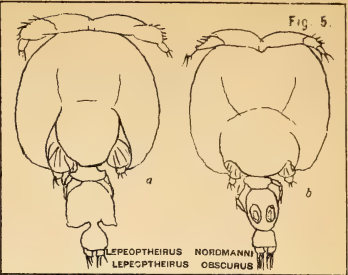
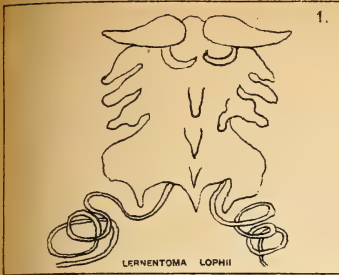
ARTOTROGUS ORBICULARIS



ACONTIPHORUS SCUTATUS

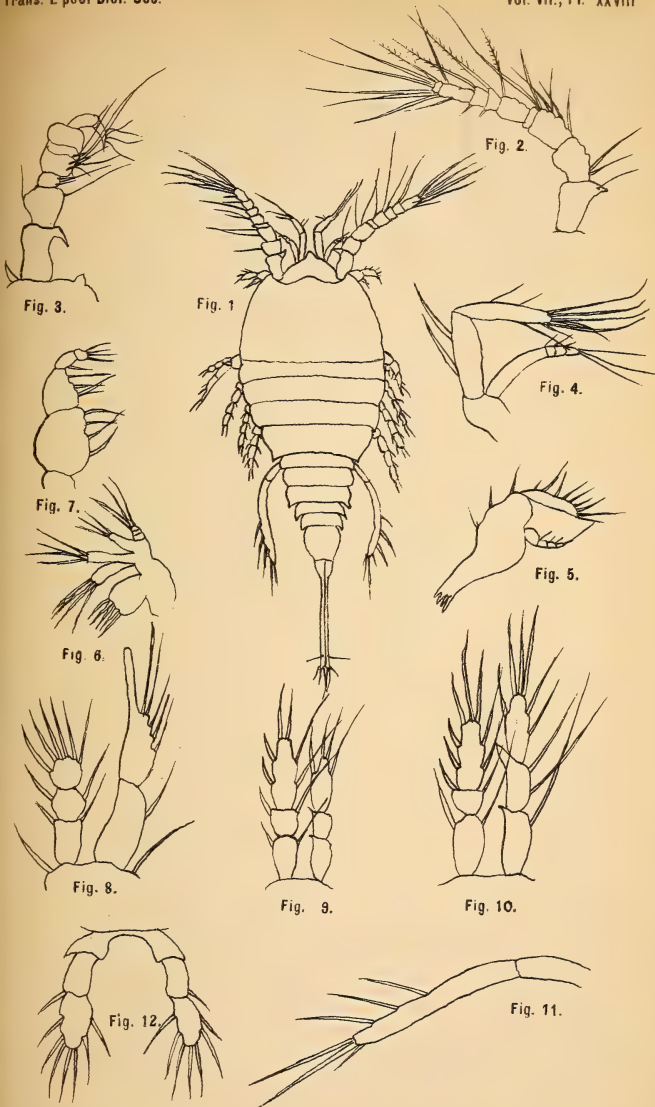
I. C. T., del.

COPEPODA OF LIVERPOOL BAY.



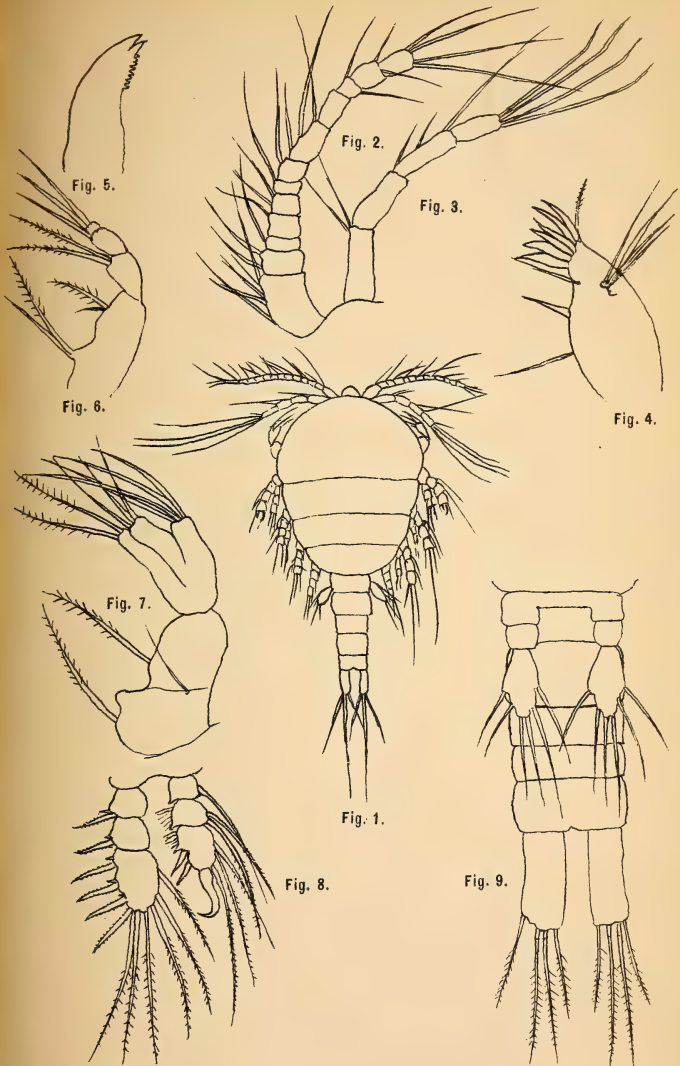
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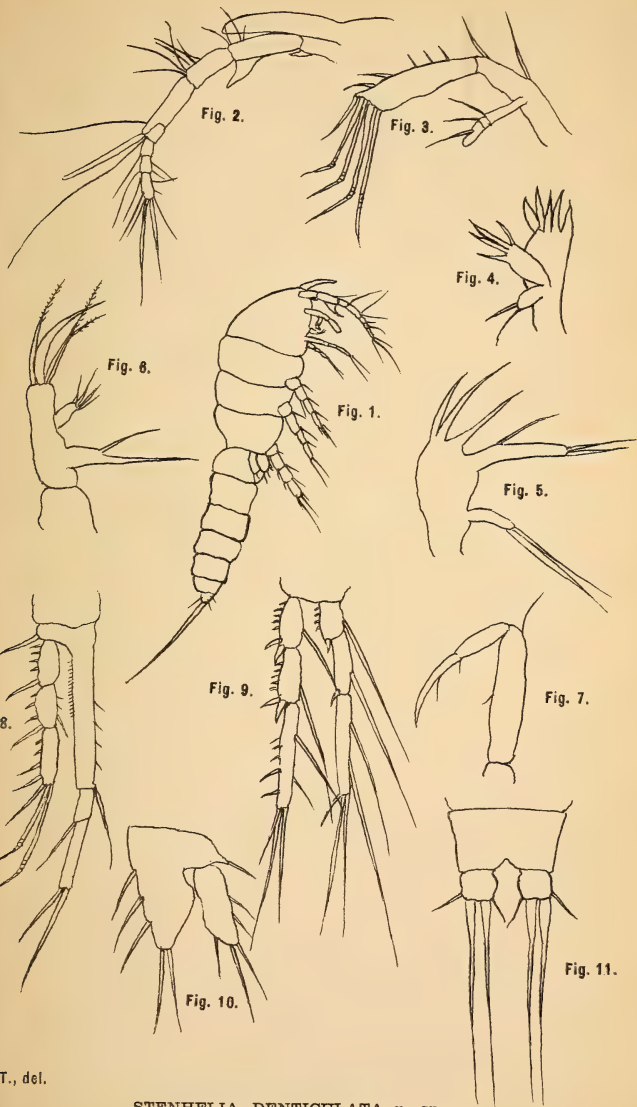


I. C. T., del.

*HERDMANIA STYLIFERA*, n. sp.

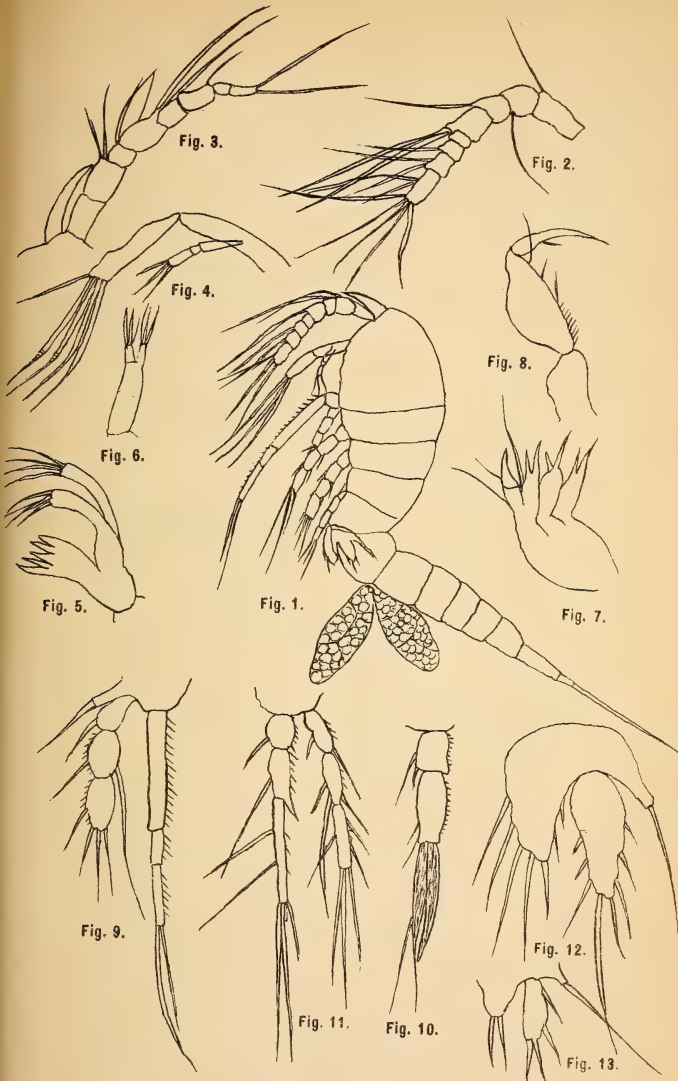


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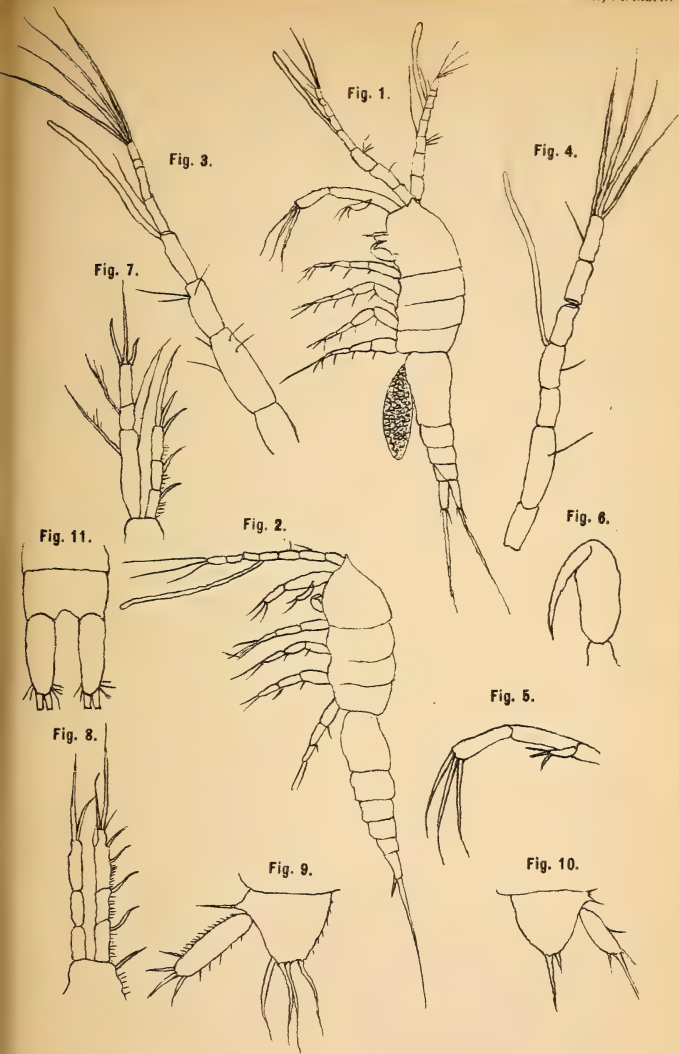
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*STENHELIA DENTICULATA*, n. sp.



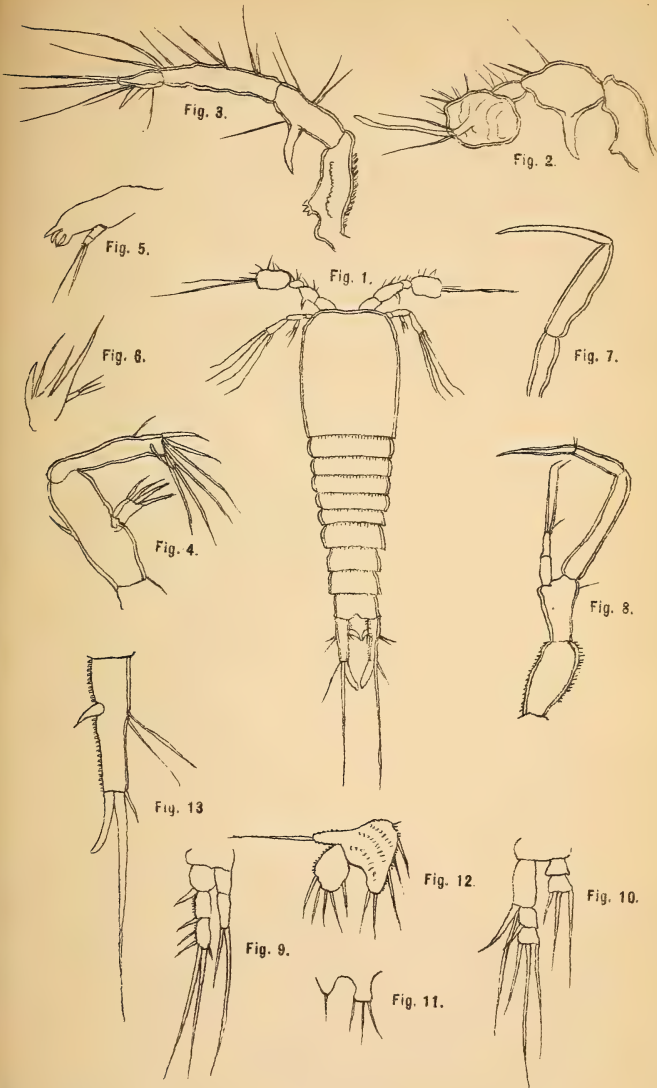
I. C. T., del.

*STENHELIA HIRSUTA*. n. sp.



I. C. T., del.

*AMEIRA ATTENUATA*, n. sp.



I. C. T., del.

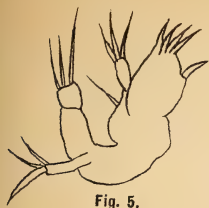


Fig. 5.

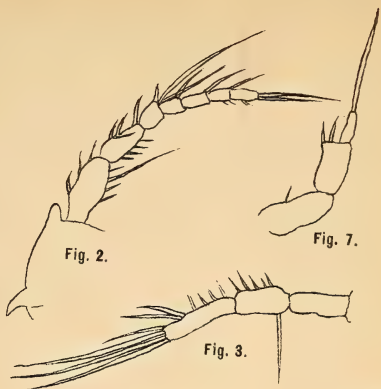


Fig. 2.

Fig. 7.



Fig. 6.

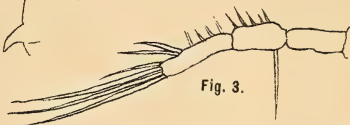


Fig. 3.

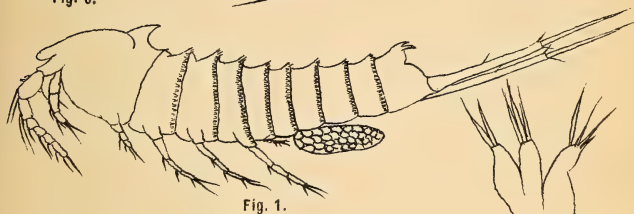


Fig. 1.



Fig. 4.

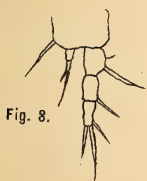


Fig. 8.



Fig. 9.

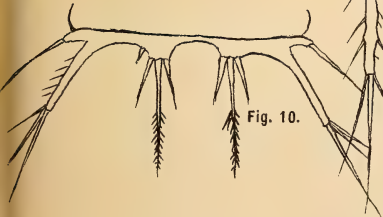
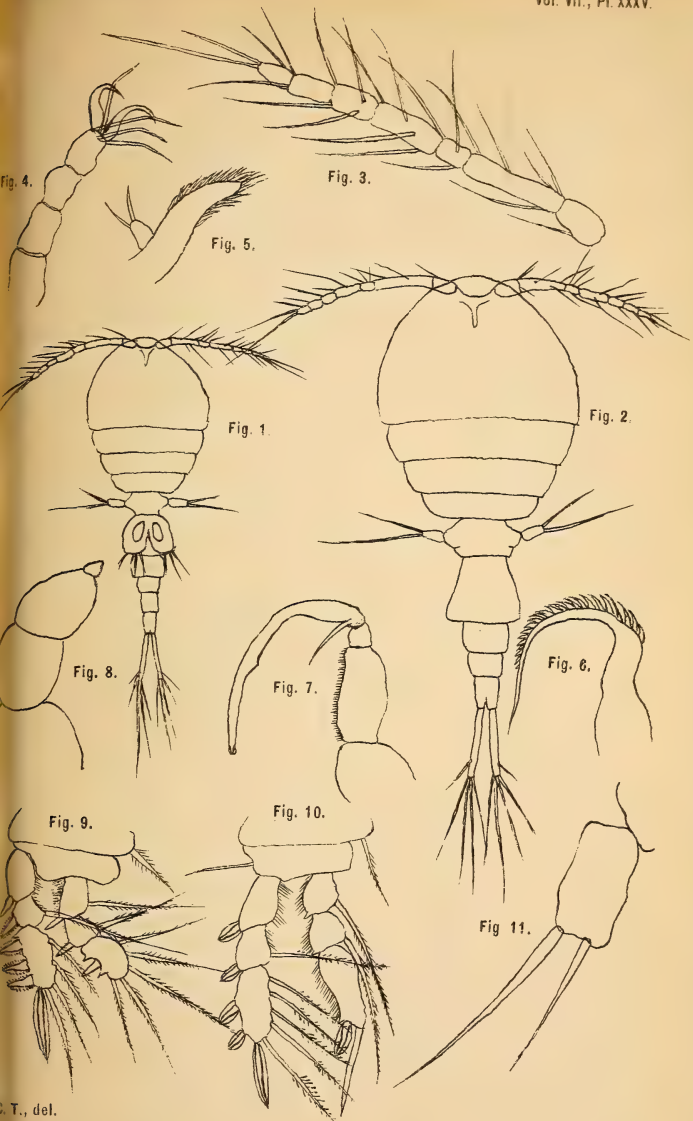


Fig. 10.



Fig. 11.

T., del.



J. T., del.

LICHOMOLGUS MAXIMUS, n. sp.