

THE BRITISH OCEANIC ENTOMOSTRACA.

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(With a Coloured Plate.)

UNDER the term "Oceanic Entomostraca" we include all those free-swimming species which are met with not far from the surface of the sea, either in littoral situations or in the open sea far away from land. We do *not* here take cognizance of those which haunt the sea bed and find their sustenance by crawling over weeds and rocks, their powers of swimming being either altogether wanting, or so slight as to serve only for very short excursions from the ground.

The species to which our present paper refers are met with during the warm months of summer in wonderful abundance near the surface; so numerous, indeed, are they that they constitute the chief food of very many fishes, and they may often be plainly seen to impart a turbid or specky appearance to the water. They are best taken by means of the towing-net, an appliance which, for the benefit of those who are not acquainted with it, we may briefly describe. It consists of a long funnel-shaped net of bunting, crinoline, or some other strong but loose-meshed material, attached to a ring of cane, eighteen inches or more in diameter. It is well to weight the ring moderately at one side, so as to sink it a little beneath the surface of the water. But besides the outer net above described, there should be an inner net made of the same material, of the same diameter, but only of half the length, and tapering more rapidly. This is to be left open, with an aperture of about a couple of inches at its narrow end, and is intended to act as a valve to prevent the regurgitation of the contents of the outer net when being dragged through the water. The apparatus will be more convenient if the outer net, instead of being sewed up close at the small end, be left with an open neck, to which a cupping glass or a strong glass bottle may be attached by a piece of string or elastic. The bottle thus attached will receive the contents of the net, which may be removed much more readily and with less injury than by turning a net inside out, which must be done if not provided with this arrangement. Three or four strings are to be attached at equal distances round the ring of the net, tied together at their free ends, and finally secured to a long and strong cord, by which the net is



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Amphibolus *Patersoni*, *Am.*

dragged through the water at the stern of a boat. It will often be found to collect (besides the small crustacea) great quantities of medusæ, free-swimming annelids, and larvæ of many kinds. These (except the medusæ, for which no good preservative fluid is yet known) may be put into spirit, and thus kept for examination.

Setting aside any special interest which these entomostraca may possess for those who give particular attention to them, there are some points in their structure and physiology which are exceedingly curious, and which cannot fail to interest any "intellectual observer." These are connected chiefly with sexual differences. In the family *Harpacticidæ* the males possess, for the most part, a large vesicular swelling on the upper antenna (see Fig. 1); while in the female the antenna is more slender, and destitute of this appendage. In the *Pontellidæ* and many of the *Calanidæ* the right antenna of the male is provided with a hinge-joint near the middle, for the purpose of clasping; and above and below the hinge there is a serrated plate which serves to render the grasp more secure. The left antenna of the male, and both those of the female, are destitute of the hinge. In the *Pontellidæ* there is likewise a large pyriform swelling near the middle of the male antenna. This, with serrated plates and hinge, is well shown in the coloured plate of *Anomalocera Patersonii*. In the two last-mentioned families, the fifth pairs of feet offer also remarkable sexual differences, and afford excellent specific characters; these, however, are so varied, that drawings of each species would be required to elucidate them. The right fifth foot of *Ichthyophorba denticornis* is shown at Fig. 4. The curious method of impregnation which obtains amongst the Copepoda has already been mentioned in the pages of the INTELLECTUAL OBSERVER. It consists in the attachment to the abdomen of the female of elongated cells termed "spermatophores" or "spermatic tubes." These may often be seen before their emergence from the body of the male. Fig. 5 exhibits a bundle of them attached to the abdomen of the female *Temora velox*.

The oceanic species with which we are concerned in this paper, belong to two distinct orders, Cladocera and Copepoda, both of which are well represented in all our fresh-water ponds, the first by the common *Daphniæ*, the second by the still more common genus *Cyclops*.

Dr. Baird, in his excellent *Natural History of the British Entomostraca*, published by the Ray Society in 1849, describes ten marine species of these two orders:—*Evadne Nordmanni*, Lovén; *Canthocamptus Stromii*, Baird; *C. furcatus*, Baird; *C. minuticornis*, Müller; *Harpacticus chelifera*,

Müller; *H. nobilis*, Baird; *Alteutha depressa*, Baird; *Temora Finmarchica*, Gunner; *Anomalocera Patersonii*, Templeton; *Cetochilus septentrionalis*, Goodsir. An eleventh species (*Notodelphys ascidicola*, Allman) is also provisionally included by Dr. Baird amongst the Copepoda, but this little parasite is now classed with the fish lice in the order Pæcilopoda.

More recently eight additional species have been described by Mr. Lubbock in the *Annals and Magazine of Natural History* (second series, vol. xx.) Of these, however, three are probably referable to previously published species, and one (*Monstrilla anglica*) is imperfectly known, and may very likely be found to belong to the order Pæcilopoda.

If to these we add *Peltidium purpureum*, Philippi, and *Hersilia apodiformis*, Philippi (two species first recognized as British by Mr. Spence Bate), a few others noticed by myself in Reports presented to the British Association and to the Tyneside Naturalists' Field Club, in 1863; lastly, eight species recorded for the first time in this paper, we shall have, I think, a complete list of all the known British marine species belonging to the two orders Cladocera and Copepoda.

To facilitate reference, I insert first a classified list of the British species, as far as our present knowledge extends, proceeding afterwards to notice more in detail those which are new to our fauna.

Order CLADOCERA.

Fam. POLYPHEMIDÆ.

- Evadne Nordmanni*, Lovén.
 „ *polyphemoides*, Leuckart.

Order COPEPODA.

Fam. HARPACTIDÆ.

- Tachidius brevicornis*, Müller.
Tisbe furcata, Baird.
Westwoodia nobilis, Baird.
Dactylopus Stromii, Baird.
 „ *tisboides*, Claus.
Thalestris longimana, Claus.
Harpacticus chelifer, Müller.

Fam. PELTIDIDÆ.

- Peltidium purpureum*, Philippi.
 (? *Oniscidium*, Claus.)
Hersilia apodiformis, Philippi.
Alteutha depressa, Baird.
 „ *bopyroides*, Claus.
Zaus spinosus, Claus.
 „ *ovalis*, Goodsir.

Fam. CORYCÆIDÆ.

- Monstrilla anglica*, Lubbock.
Corycæus anglicus, Lubbock.

Fam. CALANIDÆ.

- Cetochilus septentrionalis*, Goodsir.
Calanus anglicus, Lubbock.
 „ *Clausii*, Brady.
Dias longiremis, Liljeborg.
Temora Finmarchica, Gunner.
 „ *velox*, Liljeborg.
Ichthyophorba denticornis, Claus.
 „ *hamata*, Liljeborg.

Fam. PONTELLIDÆ.

- Anomalocera Patersonii*, Templeton.
Pontella brevicornis, Lubbock.
 „ *Wollastoni*, Lubbock.

EVADNE NORDMANNI, Lovén. Baird, *British Entom.*, p. 114, plate xvii., fig. 2.

This species occurs in considerable numbers, in the warm months of summer and autumn, on the east coast of Britain. I have taken it plentifully off the Durham coast, and have noticed it also in gatherings from the Shetlands, given to me by the Rev. Alfred Merle Norman. Mr. Goodsir took it in the Frith of Forth. It will probably be found to exist in all the British seas.

EVADNE POLYPHEMOIDES, Leuckart. Leuckart, *Weigmann's Archiv.*, 1859, p. 262.

First noticed at Nice by Leuckart, and described by him in *Weigmann's Archiv.*, which description is translated into the *Annals and Magazine of Natural History* (third series, vol. v., p. 445). It is of pretty frequent occurrence off the Durham and Northumberland coasts, and also in the Shetland gatherings mentioned above. The general appearance of the order Cladocera, to which these two Daphnians belong, will be understood by a reference to the figure of *Daphnia rotunda*, given in the INTELLECTUAL OBSERVER, vol. i., p. 448. The two species of Evadne here noticed are sufficiently distinct. *E. Nordmanni* has mostly a red tint, a large carapace, empty except when bearing ova, and tapering to a sharp point inferiorly, so as to give the animal a triangular outline. *E. polyphemoides* is smaller, has a very large spherical head separated from the body by a strongly marked neck; the carapace is very much rounded posteriorly and inferiorly, and has a straight anterior margin rounded at the antero-inferior angle. The abdomen projects anteriorly, and terminates in two strong spines directed downwards, thus giving the animal an appearance not unlike that of *Daphnia mucronata*.

TACHIDIUS BREVICORNIS, Liljeborg. Lilj, *Crust. ex. ord. tribus*, t. xxii., figs. 12—16; t. xxiii., figs. 1, 2, 9; t. xxvi., figs. 17, 18.

An entomostracan, referable apparently to this species, I have taken in a salt marsh on the river Wear, near Sunderland. The drawings, made with great care from my specimens, differ in at least one important particular from those of Professor Liljeborg, but from the extreme minuteness of the animal, and consequent difficulty of dissection, it is quite possible that I may have made some mistakes, and having been unable recently to find fresh specimens for further examination, I prefer rather to adopt this supposition than to describe my capture as a new species. It is probable that *T. brevicornis* may be identical with *Canthocamptus minuticornis*, Baird; but Dr. Baird's figures and descriptions are insufficient to enable us to settle that point satisfactorily. The principal diagnostic

character of the genus is found in the structure of the swimming feet, the first four pairs of which are alike, each foot consisting of two tri-articulated branches. The first antenna of the male bears a remarkably large vesiculiform swelling, a character not uncommon in this family, but nowhere better developed than in *Tachidius*. The antenna is beset also with long setæ of very diverse form and structure, the uses of which, as well as of the vesiculiform swelling, are very imperfectly, if at all, understood. The antenna is represented at Fig. 1.

TISBE FURCATA, Baird. *Canthocamptus furcatus*, Baird. *Brit. Ent.*, p. 210, plate xxv., figs. 1, 2; plate xxx., figs. 4—6.

A species of very common occurrence in littoral situations, and which has been described and figured elaborately by Baird, Liljeborg, and Claus. A peculiar parasite of polypoid form is noticed both by Baird and Claus as frequently infesting this species.

WESTWOODIA NOBILIS, Baird. *Arpacticus nobilis*, Baird. *Brit. Ent.*, p. 214, plate xxviii., fig. 2, a—e.

I do not know this species. Berwick Bay, Dover, and the North Foreland are given as habitats by Dr. Baird.

DACTYLOPUS STROMII, Baird. *Canthocamptus Stromii*, Baird. *Brit. Ent.*, p. 208, plate xxvii., figs. 3, 3a.

This pretty little creature seems to be of somewhat rare occurrence. I have taken it in rock pools on the Durham coast, and on the Isle of Man, but have seen no examples of it from other places. The localities given by Dr. Baird are all on the east coast, ranging from Berwickshire to Dover.

DACTYLOPUS TISBOIDES, Claus. Claus, *Die frei lebenden Copepoden*, p. 127, t. xvi., figs. 24—28.

A species which I had been accustomed to refer to *Harpacticus chelififer*, I have now little hesitation in recording as *D. tisboides*, Claus; though I am unable to state with certainty to which of the two species the figures and descriptions of Dr. Baird and Liljeborg refer. Probably they were taken indiscriminately from both species. Be this as it may, the form which I refer to *D. tisboides* is, so far as my observations extend, by far the more common of the two. I have taken it abundantly on the coasts of Northumberland and Durham, and in the Isle of Man, and it forms the bulk of one of Mr. Norman's Shetland gatherings. The characters by which it may most easily be distinguished from *Harpacticus chelififer* are (1) the form of the male antenna, which exhibits a large vesicular swelling similar to that of *Tachidius brevicornis*; (2), the first foot, which, besides minor differences, has, about the middle of the small inner branch, a long plumose bristle reaching nearly to the extremity of the ramus; and (3) the shape of the lower foot-jaw, which is a simple, somewhat oval, clawed

hand, bearing a single long bristle on the centre of its inner, slightly serrated edge.

THALESTRIS LONGIMANA, Claus. Claus, *Die frei lebenden Copepoden*, p. 130, t. xviii., figs. 1—11.

The genera *Thalestris* and *Dactylopus* are closely allied to *Canthocamptus*, from which they have been separated by Dr. Claus, in his recently published work on the Copepoda of Germany, the North Sea, and the Mediterranean. The following are the more important characters of the genus *Thalestris*. Lower foot-jaw armed with a strong prehensile hand; superior antennæ mostly with nine articulations; branches of the first pair of feet much elongated, prehensile; posterior feet of the female leaf-shaped, covering the ovisac. *T. longimana* is a fine species, richly coloured with deep brown and red. Its most remarkable feature is the largely developed chelate lower foot-jaw, which forms a very formidable and effective grasping apparatus. This is shown at Fig. 2. The first feet are very much elongated, and armed with long slender claws which, from their position, must be admirably adapted to cooperate with the antennæ and foot-jaws in the work of seizing and securing prey. The only British locality known to me for this species is Sunderland, where I have taken it in shallow tidal pools.

HARPACTICUS CHELIFER, Müller. Claus, *Copepoden*, p. 133, t. xix., figs. 12—20.

The species which I have usually considered to come under this designation is, as stated above, *Dactylopus tisboides*. The only examples I have hitherto seen of the true *H. chelifer*, are a few taken near Sunderland a year or two ago.

PELTIDIUM PURPUREUM, Philippi. White, *Pop. Hist. Brit. Crust.*, p. 308, plate xviii., fig. 4.

The family *Peltididae*, of which this species is the type, is very different in general appearance from the *Harpacticidae*, being much broader and flatter, and less adapted for active movement in the water. They may often be met with on the fronds of Fuci and Laminariæ in tide pools, but some of them are taken by the towing net in the open sea.

Of this species, I have seen only one specimen taken in a tide pool near Sunderland. Mr. Spence Bate has taken it on the south coast of England.

HERSILIA APODIFORMIS, Philippi. White, *Pop. Hist. Brit. Crust.*, p. 308.

I know nothing of this, except from the description referred to above. It has been taken in Britain only by Mr. Spence Bate.

ALTEUTHA DEPRESSA, Baird. Baird, *Brit. Entom.*, p. 216, plate xxx., figs. 1, 2, *a*, *b*.

Whether this be referable to the following species I cannot determine, not having seen authentic specimens of it. The only habitat given by Dr. Baird is Berwick Bay, where, he says, it is not common. It is to be hoped that *A. depressa* may again be captured, in order that its relation to the following species may be definitely made out.

ALTEUTHA BOPYROIDES, Claus. Claus, *Copepoden*, p. 143, t. xxii., figs. 10—17.

This species agrees in most of its characters with *A. depressa*, as described and figured in Dr. Baird's work; but the details of structure there given are not sufficient to allow of certainty in the matter. My specimens were taken in the towing net, three or four miles off the Durham coast.

ZAUS SPINOSUS, Claus. Claus, *Copepoden*, p. 146, t. xxii., fig. 25; t. xxiii., figs. 1—10.

The genus *Zaus* is nearly allied to *Alteutha*, from which it is separated by having both (instead of only the outer) branches of the first pair of feet armed with terminal claws, and also by the greater breadth of the rudimentary fifth feet.

I have a few specimens of *Z. spinosus* taken in tide-pools at Roker near Sunderland.

ZAUS OVALIS, Goodsir. Claus, *Copepoden*, p. 146, t. xxii., fig. 18; t. xxiii. figs. 11—18.

A much larger species than the foregoing. It is very much more elongated, has comparatively short tail setæ, and a different shell structure. I am indebted to C. Spence Bate, Esq., for specimens recently taken at Banff. I am not aware that it has previously been noticed on our shores. It was originally described by Mr. Goodsir in the *Annals of Natural History* for 1845.

MONSTRILLA ANGLICA, Lubbock. Lubbock, *Ann. and Mag. Nat. Hist.*, 2nd series, vol. xx.

CORYCÆUS ANGLICUS, Lubbock. Lubbock, *Ann. and Mag. Nat. Hist.*, 2nd series, vol. xx.

The descriptions given by Mr. Lubbock (*loc. cit.*) are our only authority for the existence of these two species. They do not appear to have been found by any other observer, and the characters given by their discoverer would lead us to suppose them referable to the Pæcilopoda or fish parasites.

CETOCHILUS SEPTENTRIONALIS, Goodsir. Baird, *Brit. Entom.*, p. 235, plate xxix., figs. a—g.

Dr. Claus has divided this into two species, *C. longiremis* and *C. Helgolandicus*, and being unable to determine to which of these two forms Goodsir's description was meant to apply, has dropped the original specific name altogether. This is to be regretted, as it is almost impossible that, in the early

days of the investigation of any particular group, the minute specific characters should be understood, or, indeed (in many cases), that the really important characters should be recognized as such. Under these circumstances it seems unfair that the names proposed by the first describer should be allowed to lapse, merely because their descriptions are not found to be minute enough for the purposes of more modern science. Where two or three forms, massed together by the original discoverers under one specific designation, afterwards prove distinct enough to require separation, any author describing them would do better to fix the original name upon one of these forms, even though doubtful as to the first reference, than to ignore the labours of a previous investigator by discarding his nomenclature altogether.

C. septentrionalis, as met with in our seas, agrees entirely with the characters ascribed by Dr. Claus to his *C. Helgolandicus*. I can, therefore, entertain no doubt that Goodsir's specific name is properly referable to that form, and have here retained it on the ground of priority. The characters which distinguish it from Dr. Claus's *C. longiremis* appear in the arrangement of the long setæ of the upper antennæ (Fig. 3), and in the presence of a row of serrations on the inner side of the basal joints of the fifth pair of feet. It haunts, indifferently, both the open sea and tidal-pools, and is often to be met with in countless numbers, appearing to be pretty generally distributed in our seas. I have specimens of it from Shetland, Northumberland, and Durham, and the Channel Islands.

CALANUS ANGLICUS, Lubbock. Lubbock, *Ann. and Mag. Nat. Hist.*, 2nd series, vol. xx.

Unknown to me, except from Mr. Lubbock's account of it.

CALANUS CLAUSII, Brady.

A new species, described by me in a report presented to the Tyneside Naturalists' Field Club, but not yet printed. The fifth feet of the male are long and straight, slender, and composed of simple cylindrical articulations, the last of which tapers to a fine point. The first joint of the abdomen is, in the female, very tumid anteriorly. I have found *C. Clausii* abundantly in gatherings of entomostraca from Shetland, the Channel Islands, and the coast of Durham, where it abounds both in tide-pools and in the open sea.

DIAS LONGIREMIS, Liljeborg. Liljeborg, *Crust. ex. ord. tribus*, t. xxiv., figs. 1—13.

This species is readily recognized by the knotted appearance and peculiar arrangement of the setæ on the upper antennæ, and by the characters of the fifth feet, which, with their uncouth and gouty-looking conformation, are not easily described except with the aid of figures, for which we have

not space. It is identical with Mr. Lubbock's *Calanus Euchaeta*. I have found it in the Channel Islands, Isle of Man, and Durham coast.

TEMORA FINMARCHICA, Gunner. Claus, *Copepoden*, p. 195, t. xxxiv., figs. 1—11.

There seems to me to be no doubt that this is the species described by Mr. Lubbock (*loc. cit.*) under the name of *Diaptomus longicaudatus*. It is, without exception, the most abundant of the British Marine Copepods, at all events in littoral situations, where, during the latter part of summer, it often occurs in such swarms as to form quite a consistent mass when taken up in the net. Shetland, Durham, and the Channel Islands have all afforded me this species in great numbers.

TEMORA VELOX, Liljeborg. Lilj. *Crust. ex. ord. tribus*, t. xix. figs. 9, 10; t. xx., figs. 1—9.

Four British localities, all of somewhat similar character, have yielded this species. One, a pool above high-water mark, in the Isle of Cumbrae, Frith of Clyde, where it was taken plentifully by the Rev. A. M. Norman; the others, brackish pools in salt marshes at Hylton, about three miles from the mouth of the river Wear, at Burgh Marsh, near Carlisle, and at Hartlepool. In all cases sea water could find access to the pools only at the very highest spring tides.

ICHTHYOPHORBA DENTICORNIS, Claus. Claus, *Copepoden*, p. 199, t. xxxv., figs. 1, 3—9.

ICHTHYOPHORBA HAMATA, Liljeborg. Claus, *Copepoden*, p. 199, t. xxxv., figs. 2, 10—12.

In this case, as in that of *Cetochilus septentrionalis*, Dr. Claus has divided a previously established species, discarding, at the same time, the original name. It is difficult to decide to which of Claus's species Liljeborg's descriptions and figures (*I. hamata*) are meant to apply; it is, indeed, possible that both species have "sat" for the one portrait, but as, in most respects, the original figures of *I. hamata* agree with the new *angustata*, I have, on principle, retained the prior name. The peculiar fifth foot of the male (Fig. 4) separates the genus from every other, and the two species (besides minor differences) may be distinguished by the presence or absence, on the outer edge of the basal half of the superior antenna, of several strong toothed processes, these being present in *I. denticornis* and wanting in *I. hamata*. The two forms occur mostly intermixed, and I have them from Shetland, the Channel Islands, and the Durham coast. The genus is mostly pelagic.

ANOMALOCERA PATERSONII, Templeton. Baird, *Brit. Entom.*, p. 229, t. xxvii., figs. 1, a—i; 2, a—c.

A species first described by Mr. Templeton in the *Transactions of the Entomological Society*, vol. ii. (1837), and

afterwards, under the name of *Irenæus splendidus*, by Goodsir, in the *Edinburgh New Philosophical Journal* for 1843. Dr. Claus, in his recent monograph of the Copepoda, has adopted Goodsir's generic name, on the ground that *Anomalocera*,* which evidently has precedence, is inapposite, as all the family to which this species belongs have the males with dissimilar antennæ. But if we admit the right of authors to ignore prior names, merely on account of a fancied impropriety, which gives rise to no manner of inconvenience, we shall speedily have our nomenclature in a state of inextricable confusion. We therefore adhere to the original generic name of *Anomalocera*.

A. Patersonii is the finest of all the British Copepoda, both as to size and colouring. When alive it glows with a splendid iridescent lustre, the prevailing colours being blue, red, and green. The antennæ and caudal segments are mostly a brilliant blue, while the body is mottled with varying shades of red and green. The specimens from which our coloured plate was drawn were taken by the Rev. A. M. Norman, on the east coast of Scotland, in the summer of 1863, and having been mounted while alive in a gelatine medium, still preserve their colouring in its original brilliancy. The species seems to be distributed generally throughout the British seas.

PONTELLA WOLLASTONI, Lubbock. Lubbock, *Ann. and Mag. Nat. Hist.*, 2nd series, vol. xx.

Of this species I know nothing. It is, however, in all probability, identical with *P. Helgolandica*, Claus.

PONTELLA BREVICORNIS, Lubbock. Lubbock, *Ann. and Mag. Nat. Hist.*, 2nd series, vol. xx.

A fine species taken by Mr. Lubbock at Weymouth, and by the present writer in the Channel Islands.

REFERENCE TO PLATE.

Fig. 1. Upper antenna of male *Tachidius brevicornis*, magnified 200 diameters.

Fig. 2. Lower foot-jaw of *Thalestris longimana* (copied from Claus).

Fig. 3. Upper antenna of *Dias longiremis*, magnified 60 diameters.

Fig. 4. Fifth foot (right) of male *Ichthyophorba denticornis*, magnified 50 diameters.

Fig. 5. Abdomen of female *Temora velox*, with spermatophores attached, magnified 40 diameters.

Fig. 6. Male *Anomalocera Patersonii*, magnified 30 diameters: *a*, rostrum, or beak; *b*, upper antenna (right); *c*, upper antenna (left); *d*, lower antenna; *e*, foot-jaws; *f f f*, swimming feet; *g*, fifth foot (right); *h*, fifth foot (left); *i*, abdomen; *k*, eye.

* From ἀνωμαλος, dissimilar; and κέρασ, a horn.