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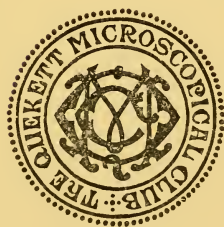
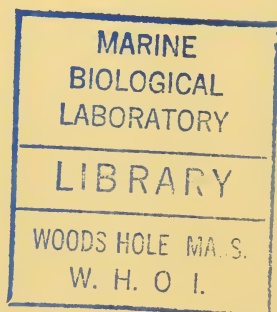
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# A PRELIMINARY ACCOUNT OF THE ENTOMOSTRACA OF NORTH WALES.

By D. J. SCOURFIELD.

(Read September 20th, 1895.)

## PLATE VIII.\*

The following list of fresh and brackish water Entomostraca is based mainly upon the results of a personal examination of some of the lakes, etc., of North Wales, principally in the Snowdon and Cader Idris districts, made during two short visits at the end of July and beginning of August last year and at the end of May and beginning of June of the present year. I have been enabled, however, to considerably increase the number of species recorded, through the kindness of Prof. G. S. Brady, F.R.S., who generously placed at my disposal several preserved collections obtained in 1888 and 1891, for which, and also for valuable assistance in connection with the identification of doubtful species, I wish to express my sincerest thanks. A few further species have been added on the authority of records in Prof. Brady's "Monograph of British Copepoda" and "Revision of the British Species of Freshwater Cyclopidae and Calanidae."

## CLADOCERA.

**Sida crystallina**, O. F. Müller. This does not seem to be a very abundant species in North Wales. I only have notes of its occurrence in Llyn Ogwen,† Llyn Cwm-ffynnon, Llyn Creigenen, and Llyn Gwernan. In each of these it was obtained by working the net among clumps of horse-tails and other aquatic vegetation.

**Daphnella brachyura**, Liévin. (*D. Wingii*, Baird, "Nat. Hist. Brit. Ent.") Llyn Padarn, Llyn Peris, Llyn Cwm-ffynnon, and Bala Lake are the only places where this species has been found.

\* Plate VIII. is unavoidably held over for the next number.—ED.

† The lakes, etc., referred to throughout this paper can be identified by a reference to Baddeley and Ward's "North Wales." (Thorough Guide Series. Dulau and Co.).

It occurred in parts of Llyn Peris in August, 1894, in great abundance, and almost to the exclusion of everything else.

**Latona setifera**, O. F. Müller. Only seen from Llyn Padarn, where it was obtained in August, 1894, by bringing up sediment from the bottom of the lake at some distance from the shore.

This fine species (one of my specimens was  $\frac{1}{8}$  in. in length and most beautifully coloured) was first added to the British fauna by Mr. Conrad Beck, who found it in the Lake District in 1881. More recently Mr. T. Scott has reported its occurrence in Loch Morar, Inverness-shire. These are the only British records known to me.

**Ceriodaphnia pulchella**, G. O. Sars. (Plate VIII., Figs. 1 and 2.) The form here referred to is extremely close to that recorded by me as *C. quadrangula*, Müller (see the previous volume of this Journal, p. 65, Pl. IV., Figs. 4-7). It differs from that species, however, in that the post-abdomen lacks the two short inner rows of pre-anal spines. The head, too, is somewhat smaller than in the "quadrangula" form, and does not project so far ventrally, while the forehead in front of the antennules is produced into a more noticeable angle. Altogether, it seems to agree very well with Sars's *C. pulchella*, and that name has, therefore, been adopted. The following are the localities where it has been found: Reservoir-Penmaenmawr (G. S. B.),\* Llyn Cwm-ffynnon, Llyn Ogwen, Llyn Teyrn, and marsh near Barmouth Junction.

**Ceriodaphnia reticulata**, Jurine. (*Daphnia reticulata*, Baird, "Nat. Hist. Brit. Ent.") Only recorded from the marsh near Barmouth Junction.

**Simocephalus vetulus**, O. F. Müller. (*Daphnia vetula*, Baird, "Nat. Hist. Brit. Ent.") All the specimens of *Simocephalus* have been of the typical "vetulus" type. They have only occurred in marshes, ditches, and small tarns.

**Daphnia longispina**, O. F. Müller. Llyn Padarn is the only lake that has yielded this species in any abundance, but it has been seen in several other localities, including Bala Lake.

**Daphnia hyalina**, Leydig. Limited to Llyn Padarn so far as yet observed.

**Bosmina longispina**, Leydig. This large species is in a certain sense a characteristic of the North Welsh Entomostracan fauna, at least as contrasted with that of our south-eastern portion of

\* The records marked (G. S. B.) refer to Prof. Brady's collections.

England,\* for it occurs plentifully, and apparently to the complete exclusion of *B. longirostris*, which is the typical representative of the genus in the latter district.

**Acantholeberis curvirostris**, O. F. Müller. I have only seen this in a collection from Arthog Marsh (G. S. B.).

**Drepanothrix dentata**, Eurén. Two localities have yielded this peculiar species, viz., a tarn near the summit of Allt Wen (G. S. B.) and Llyn Padarn.

**Eurycercus lamellatus**, O. F. Müller. A fairly common species, but not usually found in the larger lakes.

**Acroperus harpæ**, Baird. Not very common, the rôle it plays in the south-eastern part of England being partly undertaken perhaps by *Alonopsis elongata*.

**Camptocercus macrurus**, O. F. Müller. The few examples seen were from Llyn Padarn. They were of the type called "rectirostris" by Schoedler, which is probably the common British form, for the drawings given by Baird and also by Norman and Brady seem to indicate this variety, and, so far as I can remember, it is the only one I have ever taken.

**Alonopsis elongata**, G. O. Sars. (*Lynceus elongatus*, Norman and Brady, "Mon. Brit. Ent.") This is one of the most abundant and most widely distributed of the Cladocera of North Wales, but it was not found either in Llyn Padarn or in Bala Lake. Most of the specimens seen were of a very dark colour, some, indeed being almost black.

**Leydigia acanthocercoides**, Fischer. Only one locality has yielded this species, viz., a tarn near the summit of Allt Wen (G. S. B.). The specific name *acanthocercoides* has been retained because it is believed that Fischer's species is the same as Leydig's *Alona quadrangularis*. If there is a genuine difference between the two, as asserted by some authors, then there is no doubt that the present, which is the common British form, should be called *L. quadrangularis*, Leydig.

**Alona quadrangularis**, O. F. Müller. Examples of this species have only been obtained from a "pool above high-water mark" east of Penmaenmawr (G. S. B.).

**Alona affinis**, Leydig. This species, which is probably the same as P. E. Müller's *A. oblonga*, has been noted in company

\* By this phrase is intended the whole district lying to the east of a line drawn from The Wash to the Isle of Wight.

with the foregoing and also from Conway Marsh (G. S. B.), Llyn Padarn, and Llyn Creigenen. As it has not previously been recorded as British, it may be useful to give a few of the details by which it can be distinguished from *A. quadrangularis*, the species to which it is most nearly related. In the first place, it is a somewhat larger animal, measuring  $\frac{1}{30}$ – $\frac{1}{25}$  in., while *A. quadrangularis* rarely reaches  $\frac{1}{30}$  in. Another difference is that it possesses, in addition to the coarser lines on the shell, a series of closely-set longitudinal striæ, which, although very variable in intensity, are always extremely fine and difficult of detection, except with high magnification. The arrangement of the olfactory hairs on each Antennule is a further point of distinction, for while *A. affinis* has one of these hairs much longer than the others, and also one inserted a little farther back than the rest, in *A. quadrangularis* all these hairs are sub-equal and all are inserted on the end of the Antennule. Again, in *A. affinis* each of the two longest setæ on each branch of the swimming Antennæ is provided with a little thorn at the point where it is imperfectly jointed. These thorns are absent in *A. quadrangularis*. Lastly, each of the terminal claws, with its accessory basal tooth, is much more plainly setose in the present species than in *A. quadrangularis*.

**Alona guttata**, G. O. Sars. This little species has only been seen from Cwm Glas, Snowdon. It was there found inhabiting some masses of wet alga in company with *Canthocamptus pygmaeus* and *C. MacAndrewæ*.

**Alona intermedia**, G. O. Sars. Only recorded from Llyn Peris, where it was found in some alga taken from among clumps of horse-tails.

**Alonella excisa**, Fischer. I found this in several localities in May last, and it also occurs in three of Prof. Brady's collections, but I did not notice it in 1894. The living specimens seen by me were usually much darker than I find them here.

**Alonella nana**, Baird. (*Acroperus nanus*, Baird, "Nat. Hist. Brit. Ent.") "Tarn near the summit of Allt Wen" (G. S. B.) is the only place where this has been found.

**Pleuroxus trigonellus**, O. F. Müller. This also depends on a single record, viz., one from Llyn Padarn in August, 1894.

**Peracantha truncata**, O. F. Müller. A fairly common species. Very dark-coloured examples were taken in several of the lakes.

**Chydorus sphericus**, O. F. Müller. In North Wales, as in most other parts of the British Isles, this is probably the commonest of all the forms of Cladocera.

**Chydorus cælatus**, Schoedler. Seen only in two localities, viz., Llyn Padarn and Llyn Dwythwen.

This species was first recorded as British by Prof. G. S. Brady, in 1868, in the "Intellectual Observer," Vol. xii., p. 423, under the name of *Lynceus sphericus*, var. *favosa*. It does not appear to have been subsequently noted, and has most probably been mistaken for the common *C. sphericus*. It is easily distinguished from the latter, however, by its shell sculpture, which consists of rows of deep pits (most plainly developed on the ventral and posterior portions of the valves) unaccompanied by any evident reticulation. The valves of typical *C. sphericus*, on the other hand, are never pitted, but always reticulated. In other respects the present form is extremely close to *C. sphericus*.

**Chydorus latus**, G. O. Sars. This is the same as recorded by me in 1892 as *C. ovalis*, Kurz. ("J. Q. M. C.," Ser. II., Vol. v., p. 68). I now think that this form agrees better with *C. latus* than *C. ovalis*, and I have, therefore, adopted the former name. The two species, however, seem to be very closely allied, and have even been considered identical, as by Hellich, for example. The records for this species have been Llyn y Cwn, Llyn Teyrn, and Bog near Llyn Peris. All the specimens seen were rather smaller than those recorded from Leytonstone in the above-mentioned paper.

**Polyphemus pediculus**, De Geer. During August, 1894, this species occurred pretty frequently in the Snowdon district, but I saw very few specimens in May last.

**Bythotrephes longimanus**, Leydig (*B. Cederströmii*, Beck—"Some New Cladocera," &c.) Recorded only from Llyn Padarn and Llyn Peris. It no doubt lives in many of the larger and deeper lakes, but owing to its exclusively pelagic habits it is not easily captured without the aid of a boat.

**Leptodora hyalina**, Lilljeborg. Like the foregoing, this species is difficult to capture from the shore, but I managed to get it in this way in Llyn Llydaw. The other localities where it has been noted are Llyn Padarn, Llyn Peris, and Bala Lake.



## OSTRACODA.\*

**Cypria ophthalmica**, Jurine. Only seen from Arthog Marsh (G. S. B.), Bala Lake, and Llyn Padarn.

**Cypria serena**, Koch. Apparently the commonest of the Ostracoda of North Wales. For all that, however, it is not particularly abundant, as it has only been seen in seven localities. Some of the specimens were exceptionally dark-coloured.

**Cypris obliqua**, G. S. Brady. Llyn Cwm-ffynnon and Barmouth Junction Marsh are the only places where this has been obtained.

**Cypris prasina**, Fischer. As a species having a decided preference for water with a trace of salt in it, this finds a congenial home in the Marsh near Barmouth Junction, and there it occurred plentifully in May last. It has not, however, been noted in any of the other brackish water collections.

**Herpetocypris reptans**, Baird. Recorded only from Conway Marsh (G. S. B.).

**Cypridopsis vidua**, O. F. Müller. This was found in the marsh below Llyn Padarn and also in the portion of the same lake which is cut off by the railway embankment.

**Cypridopsis aculeata**, Lilljeborg. A brackish water species, and found consequently in such places as Arthog Marsh (G. S. B.), pools near high-water, Llanfairfechan (G. S. B.), and Barmouth Junction Marsh.

**Notodromas monacha**, O. F. Müller. This was pretty abundant in the marsh and ditches near Barmouth Junction last May, and it also occurs in a gathering made by my friend, Mr. Soar, in July, from Llyn y Gader, Cader Idris.

**Limnocythere inopinata**, Baird. Pools above high-water, Llanfairfechan (G. S. B.).

**Cytheridea torosa**, Jones. Brackish pond, Pwllheli (G. S. B.).

In addition to the above a single, probably immature, specimen of a *Candona* was taken among alga, etc., near Llangollen, but the species is uncertain.

\* The nomenclature of this Order is in accordance with Brady and Norman's "Monograph of the Ostracoda of the N. Atlantic and N.W. Europe."

## COPEPODA.\*

**Eurytemora Clausii**, Hoek. Seen from one locality only, viz., Brackish pond, Pensarn, Merionethshire (G. S. B.).

**Diaptomus gracilis**, G. O. Sars. This is an extremely common form, and often occurs in enormous numbers. As a rule, according to my observations, specimens inhabiting the more elevated lakes (say 800 feet and upwards) are of a brilliant red colour, while those in the lower lakes are not abnormally coloured. Males with and males without a process on the antepenultimate joint of the right first antenna have been seen, but the former seem to be more abundant than the latter.

**Diaptomus hircus**, G. S. Brady. Presumably a rare species, specimens having been taken only from Llyn Padarn and possibly a few also from Llyn Idwal. Those from the latter lake were immature and could not be quite certainly identified.

**Cyclops fuscus**, Jurine. (*C. signatus*, Koch). Only recorded from the following localities: Llyn yr Afon (G. S. B.), pool above high-water east of Penmaenmawr (G. S. B.), Llyn y Cwn, Llyn Ogwen, and marsh at southern end of Llyn Cynweh, Dolgelley.

**Cyclops albidus**, Jurine. (*C. tenuicornis*, Claus.). Conway Marsh (G. S. B.), Llyn Padarn, Llyn Peris, and Llyn Dwythweh.

**Cyclops oithonoides**, G. O. Sars (*C. Scourfieldi*, var., G. S. Brady). Found only in marsh ditches near Cwm y Glo.

**Cyclops strenuus**, Fischer. This species is more capable of being "pelagic" in its habits than almost any other of the genus, and may be found, as in Llyn Padarn, in company with such forms as *Bythotrephes longimanus* and *Leptodora hyalina*. On the other hand, it may often be found in the smallest of pools. Corresponding to this diversity of habitat is its remarkable variation, which has led to the formation of several so-called species, e.g., *C. vicinus*, *C. abyssorum*, etc. In the present state of our knowledge, however, these cannot be considered as good species, scarcely even as permanent varieties, and it seems best, therefore, to group all these forms under the one name, *C. strenuus*, as is done by several recent writers, e.g., Schmeil, Richard, Mrázek, etc.

\* As far as possible the nomenclature used in Schmeil's "Deutschlands freilebende Süßwasser-Copepoden" has been adopted.



In North Wales this is a moderately common species in the mountain lakes and tarns.

**Cyclops viridis**, Jurine. All the examples seen, representing nine localities, were of the "gigas" type.

**Cyclops vernalis**, Fischer. With the exception of the mere mention of the name in this Journal among the lists of objects found at the excursions of the Club during 1894 (*ante*, p. 74), this species has not been previously recorded as British. It is, however, a fairly common species, but has hitherto been included under the comprehensive name of *C. bicuspidatus*. In North Wales it has been seen from five different localities.

**Cyclops bisetosus**, Rehberg (*C. bicuspidatus*, Brady, "Rev. Brit. Species of Cyclopidae and Calanidae"). This has only been recorded from a bog pool on Y Garn and from the margin of Bala Lake.

**Cyclops bicuspidatus**, Claus, var. **Lubbockii**, G. S. Brady (*C. insignis*, Brady, "Mon. Brit. Copepoda," and "Rev. Brit. Sp. Cyclopidae and Calanidae"). There can be no doubt that the Cyclops referred by Prof. Brady to *C. insignis*, Claus, is not really that species, but the variety of *C. bicuspidatus* (= *C. Thomasi*, Herrick), described by Rehberg as *C. helgolandicus* and by Schmankeiwitsch as *C. odessanus*. As, however, Prof. Brady had, as early as 1868, described the form under review as *C. Lubbockii* ("On the Crustacean Fauna of the Salt Marshes of Northumberland and Durham," in "Nat. Hist. Trans., North. and Dur.," Vol. iii.), it seems only right to use this name for the variety, instead of that of either Rehberg or Schmankeiwitsch. The importance of having a recognised varietal name in this instance depends upon the fact that the variety is exclusively a brackish water form, while the typical *bicuspidatus* is exclusively an inhabitant of fresh water.

The following are the places where this variety has been found in North Wales:—Brackish pond, Pwllheli (G. S. B.); brackish pond, Pensarn (G. S. B.), and the marsh near Barmouth Junction.

**Cyclops languidus**, G. O. Sars. This has only been previously noticed as British in lists of objects found at excursions given in the previous volume of this Journal, pp. 398 and 400. It has now been seen from a bog by side of Llyn Teyrn, and from Llyn y Gader, Cader Idris.

**Cyclops bicolor**, G. O. Sars. (*C. diaphanus*, Scourfield, "J. Q. M. C.," Vol. v., p. 407). Like the preceding this has only

previously been recorded as British in the lists given in the last volume of the Club's Journal.

The marsh below Llyn Padarn and the portion of the same lake cut off by the railway embankment are the only places where it has been obtained.

**Cyclops serrulatus**, Fischer. Undoubtedly the commonest Copepod of North Wales. It seems rarely to be absent from any piece of water whatever, whether large or small, high or low, brackish or fresh. In the case of Llyn du'r Arddu, Snowdon, it was the only species of Entomostraca that could be found after most diligent search.

**Cyclops affinis**, G. O. Sars. Only seen from the side portion of Llyn Padarn already referred to.

**Cyclops fimbriatus**, Fischer. Recorded in Prof. Brady's "Revision, etc.," from pools near high water, Penmaenmawr. No other record.

**Cyclops æquoreus**, Fischer. This is essentially a brackish water species. It has only been seen from brackish pools at Pensarn (G. S. B.) and Pwllheli (G. S. B.).

**Tachidius brevicornis**, O. F. Müller. This is another exclusively brackish water species. Brackish pond, Pensarn (G. S. B.), is the only record.

**Canthocamptus staphylinus**, Jurine. (*C. minutus*, Baird, Brady, etc.) Curiously enough this, which is usually considered to be a very common form, has only been seen in North Wales from the margin of Bala Lake.

**Canthocamptus minutus**, Claus. (Not *C. minutus*, Müller). Like the preceding this was taken from the margin of Bala Lake, and nowhere else.

My friend Mr. T. Scott, F.L.S., has quite recently announced the discovery of this little species in Scotland—"Annals of Scottish Nat. Hist.," July, 1895, p. 173)—otherwise it has not previously been placed on record as British.

**Canthocamptus hirticornis**, T. Scott. Full details of this new species will be published by Mr. Scott in the Annual Report of the Fishery Board for Scotland for the current year. In North Wales it was obtained from the marsh near Barmouth Junction. This does not necessarily indicate that it is a truly brackish water species, and Mr. Scott informs me that in nearly all the localities where he has found it (in Barra, North Uist, Shetland,

etc.) the water has been fresh. Nevertheless it is a noticeable fact that it has not yet been found far from the sea.

My specimens seemed to lack the "down" of fine setæ on the first and second joints of the first pair of antennæ, otherwise they agreed very well indeed with the original figures, proofs of which have been kindly sent to me by Mr. Scott.

**Canthocamptus crassus**, G. O. Sars. (*Attheyella spinosa*, Brady). Mentioned in the Monograph of British Copepoda as being found in the river a little west of Pwllheli.

**Canthocamptus pygmæus**, G. O. Sars. (*Attheyella cryptorum*, Brady). In wet mosses and bogs this is almost constantly present, though I have not often seen it in great numbers. It has also been recorded from the margins of several of the larger lakes.

**Canthocamptus MacAndrewæ**, T. and A. Scott. (*Attheyella MacAndrewæ*, T. and A. Scott, "Annals and Magazine of Nat. Hist.," Ser. VI., Vol. xv., June, 1895, p. 457). A few examples of this quite newly described species were found in wet alga from Cwm Glas, Snowdon.

**Mesochra Lilljeborgii**, Boeck. Brackish pond, Pensarn (G. S. B.).

**Laophonte Mohammed**, Blanchard and Richard. (Plate VIII., Figs. 3-9). Prof. Brady, who very kindly identified this species for me, says that it does not seem to have been met with since first described by MM. Blanchard and Richard from certain Salt Lakes in Algeria. ("Mém. Soc. Zool. France," Vol. iv., 1891, p. 526, Pl. VI., Figs. 1-15).

At the time of its description it was the only known brackish water species of the genus, but in 1893 a second brackish water species, *L. littorale*, was described by Messrs. T. and A. Scott from several localities in Scotland. ("On some New and Rare Crustacea from Scotland," "Annals and Magazine of Nat. Hist.," Ser. VI., Vol. xii., p. 238). All the other species are exclusively marine, except that, very rarely, *L. similis* has been taken in estuarine pools.

The figures given on the accompanying Plate will, I think, be sufficient to enable anyone to recognise this species without the aid of a long description. The lengths of my specimens were, ♀  $\frac{1}{8}$  in., ♂  $\frac{1}{45}$  in.

**Dactylopus tisboides**, Claus. This, although typically a marine species, is sometimes found in brackish water, when it

varies slightly from the marine form, as noticed by Prof. Brady in his Monograph of British Copepoda. Recorded only from pools near high water, Llanfairfechan (G. S. B.).

The foregoing list shows that up to the present the total number of Entomostraca recorded from North Wales has been 67, made up as follows :—Cladocera, 30 ; Ostracoda, 10 (of which three are brackish water forms) ; and Copepoda, 27 (of which seven are brackish). Considering the very moderate amount of work that has as yet been done, these figures, at least as regards the Cladocera and Copepoda, must, I think, be considered as satisfactory. The comparative smallness of the list of Ostracoda is no doubt somewhat surprising, but I am inclined to think that it corresponds to a real deficiency in the number of these animals actually living in the district.

The list also shows a more than usually large proportion of species which may reasonably be considered either as rare or specially interesting. Two of the Cladocera, *Ceriodaphnia pulchella* and *Alona affinis*, and one of the Copepods, *Laophonte Mohammed*, are new to the British fauna, while there are quite a number of species, e.g., *Latona setifera*, *Acantholeberis curvirostris*, *Drepanothrix dentata*, *Chydorus latus*, *C. cœlatus*, *Bythotrephes longimanus*, *Diaptomus hircus*, *Cyclops languidus*, *C. bicolor*, *Canthocamptus minutus*, Claus, *C. MacAndrewæ*, and *C. hirticornis*, which have at most only been recorded a few times in the British Isles.

It is certainly premature to make any serious attempt to compare the Entomostracan faunas of different districts of the United Kingdom, but in looking over this record from North Wales, I cannot help noticing a few points in which it differs from that of the district with which we are most familiar, viz., the South-east of England. Among the Cladocera, some eight species appear in the present list, i.e., more than one-fourth of the whole, that have never been seen, so far as I am aware, in this part of the country. These are *Latona setifera*, *Ceriodaphnia pulchella*, *Bosmina longispina*, *Acantholeberis curvirostris*, *Drepanothrix dentata*, *Alonopsis elongata*, *Bythotrephes longimanus*, and *Leptodora hyalina*. On the other

hand we have many forms living here which do not figure in the Welsh list, but of course it would be very unwise, looking to the large amount of collecting that has been done here compared with North Wales, to put these forward as evidence of the difference between the two faunas. Nevertheless one cannot help being struck by the fact that such familiar species to us as *Daphnia pulex*, *Bosmina longirostris*, etc., should be conspicuous only by their absence from the records from North Wales. It is also very strange, by the way, that the list of Cladocera should contain no representative of the so-called Hyalodaphnias, e.g., *Daphnia kahlbergensis*, etc. Of all places in the United Kingdom where I should have thought it perfectly safe to predict the occurrence of these typically "pelagic" creatures, it would have been the lakes of North Wales. The list of Ostracoda shows no peculiar forms, as every one of the species given has also been found in this part of the country. Of Copepoda, however, the present record contains three species that are characteristic so far as the present comparison is concerned, viz.: *Diaptomus hircus*, *Canthocamptus MacAndrewæ*, and *Canthocamptus hirticornis*. The essentially brackish water species have been left out of account, as I do not think they have been properly worked on our coasts. It may further be interesting to note that not a single characteristic species of Cyclops has been recorded.

I should have liked to have given some details as to the characteristic Entomostracan faunas of the larger lakes, of the high mountain tarns, of bog-pools, of mosses and algæ, etc., but my records from individual localities are necessarily for the most part so meagre that it is useless to attempt anything of the kind at present. The most that can be done will be to give an account of the fauna of the Llanberis Lakes, Llyn Padarn and Llyn Peris, which have been more worked than any of the others. They may probably be taken as typical examples of the larger Welsh Lakes, and, as they are so intimately connected, it will be quite good enough for present purposes to consider them together. I will attempt to classify the species according to whether they were found to belong to the "pelagic," "littoral," or "bottom" fauna. The phrase "bottom" fauna, it should be explained, includes those species collected from the bottom of the lakes at some distance from the shore, in depths varying from 25 to 100 feet, or thereabouts.



## ENTOMOSTRACAN FAUNA OF LLYN PADARN AND LLYN PERIS.

## PELAGIC FAUNA.

## CLADOCERA.

*Daphnella brachyura.*  
*Daphnia longispina.*  
 „ *hyalina.*  
*Bosmina longispina.*  
*Polyphemus pediculus.*  
*Bythotrephes longimanus.*  
*Leptodora hyalina.*

## OSTRACODA.

*Nil.*

## COPEPODA.

*Diaptomus gracilis.*  
 „ *hircus.*  
*Cyclops strenuus.*

## LITTORAL FAUNA.

## CLADOCERA.

*Eurycercus lamellatus.*  
*Acroperus harpœ.*  
*Alonopsis elongata.*  
*Alona intermedia.*  
*Alonella excisa.*  
*Pleuroxus trigonellus.*  
*Peracantha truncata.*  
*Chydorus sphericus.*  
 „ *cælatus.*

## OSTRACODA.

*Cypria ophthalmica.*  
 „ *serena.*  
*Cypridopsis vidua.*

## COPEPODA.

*Cyclops albidus.*  
 „ *viridis (gigas).*  
 „ *bicolor.*  
 „ *serrulatus.*  
 „ *affinis.*  
*Canthocamptus pygmæus.*

## BOTTOM FAUNA.

## CLADOCERA.

*Latona setifera.*  
*Drepanothrix dentata.*  
*Camptocercus macrurus.*  
*Alona affinis.*  
*Chydorus sphericus* (also  
 littoral).

## OSTRACODA.

*Cypria serena* (also littoral).

## COPEPODA.

*Cyclops serrulatus* (also lit-  
 toral).  
*Canthocamptus pygmæus* (also  
 littoral).

It will be seen from the above, that these two lakes alone have yielded practically half of the recorded species, viz. 32 out of 67, and no doubt this falls considerably short of the number of species actually living in them.



I do not think my records and observations justify any further remarks directly dealing with the Entomostraca of North Wales, but before concluding I would like to say a few words on two points having an important, if indirect, bearing upon the subject in hand, viz., the general character of the lakes, and the methods of collecting.

As regards the first point, the most noticeable feature is that the lakes of North Wales are remarkably uniform in type, and in complete contrast to all those of this South-eastern part of England. They are almost without exception collections of the clearest and purest water, lodged in rocky basins of considerable depth, and surrounded by stony margins, which may, however, be more or less obscured by peat and bog-moss. They are, moreover, practically free from macro-vegetation. Micro-plants, especially free-swimming algæ, are probably not less common in the lakes of North Wales than they are here, but the luxuriant masses of *Myriophyllum*, *Elodea*, *Starwort*, *Duckweed*, etc., found in the majority of *our* lakes and ponds are quite without parallel there so far as my experience goes. Many of the lakes are absolutely destitute of any visible vegetation, except perhaps some bog-mosses or a rather weak growth of filamentous alga on the stones near the margin, and where higher forms of plant life do occur they are generally limited to horse-tails (*Equisetum*), *Lobelia* (*L. Dortmanna*), or more rarely buck-bean (*Menyanthes trifoliata*). Probably in the depths of many lakes members of the Characeæ flourish, but the only direct evidence I have of this is that I obtained a species of *Nitella* pretty plentifully from several parts of the bottom of Llyn Padarn.

Such being the general features of the lakes and their vegetation, it could not be expected that the littoral fauna, which in all branches of pond-life includes the bulk of the species, should be a very rich one, and this accounts, no doubt, for the absence of many of what are to us the commonest species. On the other hand, the lakes seem eminently suited to the pelagic forms, and these, as regards the Entomostraca, have already been shown to be well represented,\* for although the number of species recorded (10 or 11)

\* This is probably true also of the Rotifera. I have repeatedly found *Conochilus unicornis* in the lakes of North Wales, and *Asplanchna priodonta*, *Notholca longispina*, *Anuræa aculeata*, etc., have also been seen.

does not sound very formidable, it must be remembered that from the point of view of individuals these forms far outweigh all the others put together. It is the capture of these pelagic animals, too, which constitutes the chief peculiarity of "pond-hunting" in North Wales, and this leads to the consideration of the second point I wish to mention. It is quite useless to think that, with a net attached to a stick, worked by hand from the shore, any idea of the pelagic fauna of a lake can be obtained. The only really reliable method of getting the creatures belonging to this group is by the use of a boat. From this the net can be used not only at the surface, but by means of a line and plummet can also be lowered to various depths, or dragged along the bottom. It is absolutely necessary to be able to use the net in these various ways, for it often happens that while the surface is almost devoid of life, a rich collection of pelagic forms may be secured at a considerable depth. But boats are only to be had on a few lakes, and if we want to study the pelagic fauna in the others some different means of collection must be adopted.

Under favourable conditions some specimens of this fauna can usually be obtained by the simple means of attaching the net to a line and throwing it out as far as possible. Of course the net must be weighted in some way, and I found it a good plan to substitute for the usual glass tube at the end of the net a small cylindrical tin into which some molten lead had been run. With the majority of the higher lakes this method of throwing out the net is perhaps the only one open to a person who, like myself, simply does his collecting incidentally during a holiday. In North Wales, however, I found a most fatal objection to this method to be that, very commonly, even in lakes known to be of considerable depth, there was a margin of comparatively shallow water, extending well beyond the point to which the net could be thrown, and thus effectually preventing the examination of the deeper water. Several more complicated methods of collecting, by means of floats, etc., have been proposed for this kind of work, and have, I believe, proved fairly successful. At some future time I hope to be able to give some of these a trial, at least in the more accessible lakes. In the meantime if anyone interested should be willing to continue this subject of the Entomostraca of North Wales, in any of its branches, I shall be only too glad to do anything I can to help in the work.

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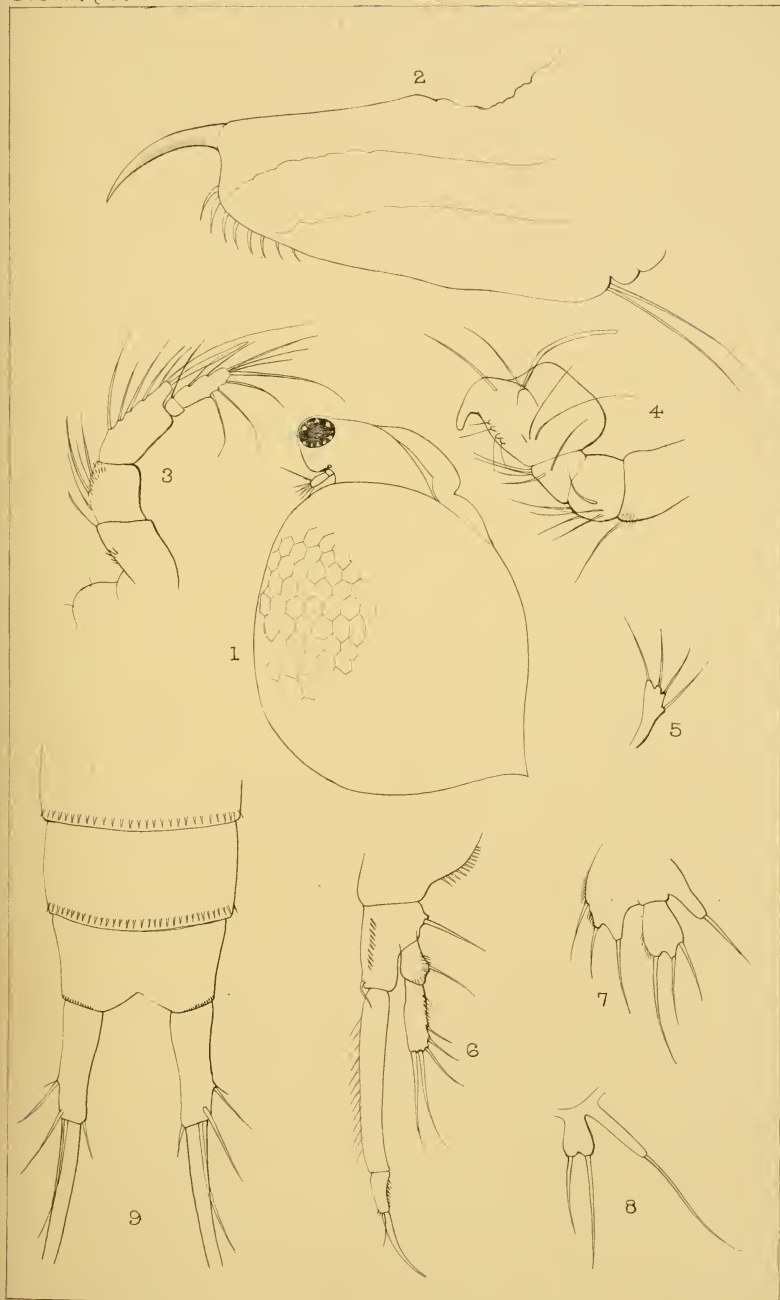
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## EXPLANATION OF PLATE VIII.

- FIG. 1. *Ceriodaphnia pulchella*, ♀ × 80.  
 „ 2. „ „ Post-abdomen, ♀.  
 „ 3. *Laophonte Mohammed*, Antenna of 1st pair, ♀.  
 „ 4. „ „ „ „ „ ♂.  
 „ 5. „ „ Accessory branch of Antenna  
 of 2nd pair.  
 „ 6. „ „ Foot of 1st pair.  
 „ 7. „ „ Foot of 5th pair, ♀.  
 „ 8. „ „ „ „ „ ♂.  
 „ 9. „ „ End of abdomen and Furca,  
 ventral side, ♀, × 240.
-



D.J.Scourfield del.

West, Newman sc.

*Ceriodaphnia pulchella* & *Laophonte* Mohammed.