

The Euphausiidæ in the Neighbourhood of Plymouth. III. *Thysanoessa inermis*.

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With Plates I-V.

In a former paper (Lebour, 1924) attention was called to the eggs, Calyp-
topis and first Furcilia stages of *Thysanoessa inermis* together with the
form *neglecta*, which was regarded as a different species, mainly on account
of the size of the eggs shed by the females in glass jars in the aquarium,
those of the *neglecta* form being much smaller than those of the *inermis*
form. Certain differences were also found between the males of the two
forms.

Having through the kindness of Mr. C. F. Hickling obtained a number
of *Thysanoessa* from the Atlantic Slope, chiefly in the region of the
Smalls trawling ground, I found both forms present, which were usually
much larger than those from the Channel, and presented certain other
differences. Specimens of the two forms from both localities were sent
to Dr. H. J. Hansen, of Copenhagen, who has kindly examined them
and pronounced them all to belong to the same species, e.g. *Thysanoessa*
inermis. It is an interesting fact that the specimens from the Smalls
district are usually much larger than those from the Channel, and the
neglecta form has the long legs much longer and stouter. Specimens from
Iceland, for which I am indebted to Dr. Hansen, are also of a large size.

As Hansen has already pointed out (1911, 1915), *Thysanoessa inermis*
which has a wide range of distribution has two forms, a short-legged
form, formerly known as *Rhoda inermis* and a long-legged form, formerly
known as *Thysanoessa neglecta*; these may be referred to respectively
as the *inermis* and *neglecta* forms. Both enter the English Channel and
breed there, but are very small, the females breeding at 13-14 mm.,
the adult males barely reaching 14 mm. in length. The only records
from the Channel are those found in the Plymouth district and off the
Dodman. Adults occur in spring, when they are breeding, larvæ occurring
through the summer and gradually disappearing. It is a curious fact
that although there are many males of the *inermis* form, those of the
neglecta form are exceedingly rare, only three from the Channel having

been seen, two young and one fully grown. These males, however, agree with the *inermis* form with regard to the modification of the pleopods and general armature of the antennule, a slight difference being seen in the number of setæ on the lobe of the first peduncular segment and in the hooks on the second peduncular segment, which are fewer in the *neglecta* form. This difference was also seen in specimens from Aberdeen and from Trondjem, Norway, kindly sent by Dr. A. Bowman and Dr. Nordhaus respectively. It is possible that these differences are due to age. Slight differences in the pleopods of the male are probably to be accounted for as variations within the species.

Bearing in mind these differences besides the legs the two forms are here regarded as one species.

The Atlantic specimens procured by Mr. Hickling are usually very large with the long legs of the *neglecta* form much stouter and longer than in those from the Channel. They reach a length of 17-19 mm., and may be still immature although adult females with spermatophores similar to the Channel specimens also occur in the same locality. Again there are very few males. Indeed, males are scarce here in both forms, and large catches of females only were made in the autumn and winter. It is thus probable that the females go about in swarms by themselves until joined by the males in the breeding season, and they apparently come into shallower from deeper water to breed. Large males occurred in both forms, but the pleopods and antennules differed from the adults, so much so that I was inclined to regard them as a different species until advised by Dr. Hansen that they were immature. The immature Atlantic forms are thus frequently larger than adults from the Channel.

In some Atlantic samples procured by Mr. Hickling in March, 1925, from near the coast both *Meganyctiphanes norvegica* and *Thysanoessa inermis* were breeding. Females with spermatophores of the latter species, *inermis* form, occurred, and its eggs as well as those of *Meganyctiphanes* were also present. The latter were rather smaller than those from the Channel, but those of *T. inermis* were the same size as the eggs shed by the *inermis* form brought in from the Channel and shed in glass jars in the aquarium. No very small eggs were seen similar to those shed by the *neglecta* form. Nauplii of both *Meganyctiphanes* and *Thysanoessa* were to be seen emerging from these Atlantic eggs, and could be quite easily distinguished. The nauplius of *Meganyctiphanes norvegica* is described and figured by myself in an earlier paper (1924), that of *Thysanoessa inermis* is described here for the first time as are also the following larval stages.

The nauplii are slightly more slender than those of *Meganyctiphanes* and more pointed anteriorly and posteriorly, otherwise they are very similar and they are typical nauplii.

The first nauplius (Plate I, 1) measures 0.48 mm. long, without posterior setæ and with three pairs of biramous swimming appendages.

The second nauplius (Plate I, 2) measures 0.51 mm. long and has two posterior setæ with the limbs more developed.

The metanauplius (Plate I, 3-5) measures 0.58 mm. long, and is again more slender than *Meganyctiphanes* and slightly larger, the carapace being bordered with regular short spines except at the extreme posterior end, thus differing from *Meganyctiphanes* who has irregular spines. The carapace is folded under the body at the sides and in front projects over the lobe bearing the eye. The antennules project forwards, the antennæ forwards and laterally, whilst the mandibles are now uniramous stumps. Behind the mandibles can be seen the rudiments of the fourth, fifth and sixth limbs. The abdomen projects behind the carapace, and is armed with twelve spines.

From the metanauplius comes the first Calyptopis, and both this and the second Calyptopis occurred in the samples with the eggs and nauplii. These are essentially the same as those found in plankton from round about Plymouth, the only difference being that they were slightly smaller.

It has already been shown (1924) that the Calyptopis stages of *Thysanoessa* from the Channel when alive is perfectly transparent and colourless except for conspicuous crimson chromatophores on the telson, one pair in the first, two pairs in the second and third Calyptopis. No colour showed in the preserved specimens from the Atlantic.

The last Calyptopis was not found among the Atlantic samples, neither were the early *Furcilia* stages, although later on in the year many later *Furcilia* stage and *Cyrtopia* stages occurred. The only early *Furcilia* was one (the first stage) from over deep water, which was exceedingly small and almost certainly belonged to *Thysanoessa longicaudata*, a few later larval stages of (presumably) this species were also found. These, although recognisable as separate species, differed only slightly from *T. inermis*.

A short description will now be given of the various stages in the life history of *Thysanoessa inermis*. In working this out special care was taken to find out whether any difference existed in the larval stages of the two forms, and whether the Atlantic larvæ were the same as those from the Channel. There is, in fact, very little difference between the larvæ of the two forms, which can only be distinguished with certainty in about the eleventh *Furcilia* stage, and then only by their legs. A very slight difference in the telson was usually seen in the younger stages, but it was occasionally variable. This was the comparative straightness or roundness of the hind margin of the telson, which in the *neglecta* form was straighter and more oblong than in the *inermis* form which was more rounded. I have called these two forms of telson A and B (Plate II,

9 and 10). This difference was noticeable in the later Furcilia stages with seven terminal spines, but seems to apply to the younger stages too, even showing in the last Calyptopis stages which could presumably be separated in this way. All the late Furcilia stages and the Cyrtopia stages are easily separated by their legs, but otherwise the larvæ cannot be distinguished with certainty, so that if, as is frequently the case, the legs are broken, it is practically impossible to distinguish the form.

As regards the Atlantic material the larvæ cannot usually be separated, except by the legs, from the Channel specimens. A slight difference was seen in some of the early Cyrtopia stages which were developing more rapidly than those from the Channel, the first Cyrtopia in some cases having five terminal spines on the telson instead of seven, the second having three instead of five. A slight difference was also seen in the size of the larvæ, which were often smaller than the Channel specimens in the same stage. This is rather strange as the adults are usually larger. With the exceptions mentioned above the larvæ are alike. In the following survey of the various stages the figures are taken from both Atlantic and Channel material.

THE LIFE HISTORY OF THYSANOESSA INERMIS (KROYER).

The eggs, nauplii, and metanauplius have already been described in the present paper (p. 3). The three Calyptopis stages have been briefly described before (1924), but a few more notes are given here.

THE CALYPTOPIS STAGES.

The Calyptopis stages are all characteristically slender and easily distinguishable from those of Nyctiphanes and Meganectiphanes, the only other euphausiids found to occur in the Channel, and the only other common forms in Mr. Hickling's Atlantic material.

First Calyptopis (Plate II, 1-6) measures 1.2-1.3 mm. in the Channel specimens. In those from the Atlantic they measure about 1.04-1.05 mm. in length. It is an interesting fact that there are six terminal spines on the telson both in the Metanauplius and first Calyptopis, the central spine being absent and only appearing in the second Calyptopis. Seven terminal spines is the usual number, but in the larvæ of *Stylocheiron Suhmii* recently investigated from Alexandria, Egypt, a description of which will, it is hoped, shortly be published, there are six up to the time when reduction takes place and then there are four; in this case the central spine not being present until the appearance of the single spine of the adolescent form. There is thus shown to be a tendency to suppress the central spine which brings the euphausiid larvæ into closer line with the Caridean larva in which the central spine is always lacking. (See

Gurney, 1925.) It is to be noted that the first larval stage of *Upogebia* has no central spine (Webb, 1919).

The appendages of the first *Calyptopis* (Plate II, 3-6) have no special features, and are much like those of *Nyctiphanes* and *Meganectiphanes*. The endopodite of the first maxilla is, however, in one piece and not two jointed, as in a figure of a *Calyptopis* figured by Hansen (1925) which he regards as a *Thysanoessa*, and which, he says, becomes unjointed in a later stage.

Second Calyptopis (Plate II, 7, 8) measures about 2 mm. in length from the Channel, and about 1.6 mm. from the Atlantic, otherwise they are essentially the same. The telson (Fig. 8) is now armed with seven terminal spines besides the four pairs of laterals, the laterals being arranged in the usual way, one pair behind the centre of the telson, one short pair just above the corners and two pairs of long laterals at the corners. The compound eyes are beginning to form. The carapace which has no trace of a lateral denticle (and this is the same in all stages) has a slight protuberance dorsally near the centre, which is often hardly or not at all discernible. The abdomen consists of five segments. The thoracic segments show as minute divisions, and the first thoracic limb is well developed.

Third Calyptopis (Plate II, 9, 10, and Plate III, 1, 2) measures 2.4-2.7 mm. in length from the Channel. It has six abdominal segments and the uropods are present. There are no more thoracic limbs behind the first. The eye is more developed, but still uncovered. In preserved specimens, however, it has a tendency to come out from the covering carapace and is so figured in Fig. 1, Plate III.

THE FURCILIA STAGES.

Twelve Furcilia stages have been found, but there are almost certainly fourteen, for one may infer that there is a stage, the seventh, between the form with five pairs of non-setose pleopods and the form with two pairs of setose and three pairs of non-setose pleopods, and also that there is one, the tenth, with four pairs of setose and one pair of non-setose pleopods. This latter stage was found in *Thysanoessa longicaudata*, and almost certainly exists in other species.

All are very transparent when alive with little pigment except on the telson, although a diffuse pinkish colour may be present, especially near the mouth parts. The Furcilia stages measure 3 mm. to 5.3 mm. in length, the first having no pleopods, the four last having all the pleopods biramous and setose. They correspond in a general way with the Furcilia stages of *Nyctiphanes* and *Meganectiphanes*, but there is an essential difference in the development of the pleopods, there being a stage (the sixth) in which all five pairs of pleopods

are simple and non-setose, whereas in *Nyctiphanes* and *Meganyctiphanes* the first pair becomes setose before the development of the fifth pair. The order of appearance of the pleopods appears to be of importance, and all the species of a genus probably develop in the same way, as do also closely related genera. Thus *Nyctiphanes* and *Meganyctiphanes* develop similarly, *Thysanoessa* differently and *Stylocheiron* differently from all others so far as is known. No lateral denticle is present in any stage, which is interesting, as it occurs in other species of different genera when lacking in the adult, but here it agrees with *Stylocheiron*, which has no lateral denticle in any stage. The dorsal carination of the carapace is only faintly marked, and in preserved specimens the small prominence which lies almost centrally is often indistinguishable. The rostrum is at first cut off straight, but gradually tapers from the sides and is not square as in *Nyctiphanes* and *Meganyctiphanes*. In the later stages it becomes more pointed.

The antennules are of the usual larval form, but the flagella remain very short, even in the last *Furcilia* stage. The antennæ hardly alter at all, but remain as conspicuous swimming organs. The mandibles have scarcely a trace of the palp even in the last stage. The first and second maxillæ have no special characters. The first thoracic limb is well developed, and is much like the adult in the first stage. The second thoracic limb which is only a small bud in the first stage is long, and shows definitely the *neglecta* or *inermis* form from at least the eleventh stage, sometimes earlier. The eleventh stage has the third thoracic limb well developed and slightly bent, the fourth small and straight, the fifth rudimentary. The twelfth, thirteenth and fourteenth are similar to the eleventh, but slightly larger and with the limbs more developed, the sixth thoracic limb still very rudimentary in the last stage.

First Furcilia (Plate III, 3, 4), 3.2 mm. long. No pleopods. Seven terminal spines to telson (there are seven in all the *Furcilia* stages).

Second Furcilia (Plate III, 5), 3.2 mm. long. One pair of simple pleopods.

Third Furcilia (Plate III, 6), 3.5 mm. long. Two pairs of simple pleopods.

Fourth Furcilia (Plate III, 7, 8), 3.6 mm. long. Three pairs of simple pleopods.

Fifth Furcilia (Plate III, 9), 3.6 mm. long. Four pairs of simple pleopods.

Sixth Furcilia (Plate III, 10), 3.6 mm. long. Five pairs of simple pleopods.

Seventh Furcilia, not found. Should have one pair of setose and four pairs of simple pleopods.

Eighth Furcilia (Plate III, 11), 3.8 mm. long. Two pairs of setose pleopods, three pairs simple.

Ninth Furcilia (Plate III, 12), 4 mm. long. Three pairs of setose pleopods, two pairs simple. Rudiment of the second thoracic limb in the *neglecta* form longer than in the *inermis* form, so that from now onwards they can be distinguished.

Tenth Furcilia (Plate III, 13), *Thysanoessa longicaudata* was found in this stage (3.5 mm. in length). Almost certainly a corresponding stage exists in *T. inermis*, but has not yet been found. Four pairs of setose pleopods, one pair simple.

Eleventh Furcilia (Plate III, 14), 4.2 mm. long. All pleopods setose. Fifth thoracic limb rudimentary. Second thoracic limb long in the *neglecta* form, reaching to beyond the corner of the carapace, third not bent, fourth very short.

Twelfth Furcilia (Plate III, 15; Plate IV, 1), 4.5 mm. long. Bend of second thoracic limb in the *neglecta* form, reaching to about the first third of the eye; fourth and fifth thoracic legs longer than in the eleventh stage, fifth not segmented.

Thirteenth Furcilia (Plate IV, 2), 4.9-5 mm. long. Similar to eleventh and twelfth, fifth thoracic leg still unjointed but with rudimentary exopodite and gill, fourth longer but not bent.

Fourteenth Furcilia (Plate III, 16; Plate IV, 3, 11), 5-5.3 mm. long. Similar to eleventh, twelfth, and thirteenth, but with legs more developed, fifth jointed, sixth rudimentary with one seta, fourth bent.

In all these four *Furcilia* stages with pleopods all setose the two forms can be easily separated by the legs, and from now onwards there is no difficulty at all in separating them.

THE CYRTOPIA STAGES.

The *Cyrtopia* stages gradually lead up to the mature form, the first stage measuring 5-6 mm. in length, the adult measuring from 13-19 mm. or more. It is to be noted that the small mature forms are fully developed, unlike *Nyctiphanes* which breeds before its appendages are completely formed. It is an interesting fact that in the development of the seventh thoracic leg in *Thysanoessa inermis* the endopodite is formed last, unlike the legs in front of it and unlike the same leg in *Nyctiphanes* and *Meganyctiphanes*, in which it is formed first, and it is not cut off from the base until late, not apparently until maturity is reached (Plate V, 6, 8). Young stages show the leg very like the male with no separate endopodite. Thus in the larger specimens from the Atlantic the seventh leg in the female may be at 18 mm., still like the male and without an endopodite, whereas in the Channel mature females of 13 mm. have a well-developed endopodite. The reason is presumably the fact

that in *Thysanoessa* the endopodite of the seventh leg being always rudimentary its early development is not essential, as it is in the long and useful leg in *Nyctiphanes* and *Meganyctiphanes*. The pleopods and antennules of the male are apparently modified late in the development, for no sexual differences can be made out in specimens up to 10 mm. or more from the Atlantic. This may, of course, mean that no young males were present, but in the Channel specimens of 11 mm. were nearly mature. It is probable that external sexual differentiation takes place late. In the Atlantic specimens immature males up to 18 and 19 mm. in length had very different antennules and pleopods from the adult, the antennules being about half-way between females and males, the pleopods being more like those of a different species, having sharp, short processes and more setæ round the setiferous lobe (Plate V, 1). The telson in the first *Cyrtopia* usually still has seven terminal spines (Plate IV, 6), those from the Atlantic sometimes having five. The second *Cyrtopia* has five (Plate IV, 7), the third three (Plate IV, 8), and the fourth one (Plate IV, 9). The fifth (Plate IV, 10) is without the outer pair of long lateral spines, so that from the fifth to the adult the spines only undergo a change of form. The antennules at first have the flagella very short, and the spine on the outside of the first peduncular segment large, these gradually attaining the adult form. The antennæ although differentiated into scale and flagellum are in the first stage much like the swimming antennæ of the *Furcilia*, but the flagellum soon elongates (Plate IV, 11, 12). The mandible has at first only the vestige of a very small palp, which gradually develops. The spine above the telson is present in the second *Cyrtopia*, the spine below having appeared in the eleventh *Furcilia*. The sixth thoracic legs are rudimentary in the first *Cyrtopia*, the seventh leg beginning with its luminous organ in the second *Cyrtopia*. The rudimentary eighth thoracic leg soon follows, and from now onwards the antennular flagella elongate and the species is easily recognisable, although as stated above the sexes are difficult to separate until later.

First Cyrtopia (Plate IV, 4, 5, 6, 12, 14, 15, 16), 5-6.3 mm. long, the smaller specimens occurring from the Atlantic. Seven terminal spines to telson, occasionally five in the Atlantic specimens. In these with seven and five spines there seems to be no other difference except in length. The sixth thoracic leg is rudimentary with rudimentary exopodite, legs one to four bent, fifth jointed but not bent. Antennular flagella still short. Flagella of antennæ short, but three jointed.

Second Cyrtopia (Plate IV, 7, 13), 6-6.5 mm. long. Five terminal spines to telson, predecessors of three spines which can be seen underneath the cuticle in some specimens. There are occasionally three terminal spines in this stage from the Atlantic. Seventh thoracic leg rudimentary with gill and luminous organ, eighth a small bud. Bend of long leg in

the *neglecta* form reaches nearly to the end of the second peduncular joint of the antennule. Flagellum of antenna projects well beyond the scale and beyond the third peduncular joint of the antennule.

Third Cyrtopia (Plate IV, 8), 6.5 mm. long. Three terminal spines to telson. Seventh thoracic leg short with three-lobed gill.

Fourth Cyrtopia (Plate IV, 9), 6.75–7 mm. long. One spine to telson with two pairs of long laterals. Seventh leg slightly longer.

Fifth Cyrtopia (Plate IV, 10), 7.25–7.5 mm. long. Outer pair of long lateral spines of telson gone. Seventh leg slightly longer.

Sixth Cyrtopia, 8 mm. long. Seventh leg beginning to form exopodite, four-lobed gill.

Seventh Cyrtopia, 8.5 mm. long. Base and exopodite of seventh leg each with one seta. Eighth leg very short.

Eighth Cyrtopia, 9 mm. long. Exopodite of seventh leg longer.

Ninth Cyrtopia, 9.5 mm. long. Exopodite and base of seventh leg each with two setæ.

Tenth Cyrtopia, 10 mm. long. Exopodite of seventh leg with three setæ, quite distinct from base.

Eleventh Cyrtopia, 10.5 mm. long. Exopodite of seventh leg divided into two, with three terminal setæ and one lateral. No endopodite in female at present.

Twelfth Cyrtopia (Plate V, 2), 11 mm. long. Very like the eleventh, still no endopodite to seventh leg in female. The male from the Channel may have its antennules and pleopods modified, so that it is nearly like the adult. In the Atlantic specimens not nearly so far advanced.

From now onwards the *Cyrtopia* gradually merges into the adult, fully mature specimens occurring in the Channel at 13–14 mm., the females carrying spermatophores at 13 mm., the males being fully modified at 14 mm. (In specimens from Aberdeen mature males measured 15 mm.) It is, therefore, certain that *Thysanoessa inermis* can breed at that size although apparently the Atlantic specimens of the same size are not nearly mature. All the females with spermatophores had the endopodite of the seventh thoracic leg fully formed, the antennules and pleopods of the males from the Channel being fully formed at 14 mm. There is a very distinct difference in the size of breeding individuals on the one hand from the Channel, Aberdeen, and parts of Norway, and on the other hand from the Atlantic in the region of the Smalls Trawling Ground and from Iceland. The difference in size in the Atlantic specimens is correlated with a distinct difference in the length and stoutness of the long legs in the *neglecta* form.

We see from these notes that the life history of *Thysanoessa inermis* corresponds closely with that of *Nyctiphanes Couchii* and *Meganyctiphanes norvegica*, although it is always distinguishable at any stage. The young

are all more slender, the rostrum more pointed in the *Furcilia* and *Cyrtopia*, and there is no lateral denticle to the carapace at any stage. The colouring differs slightly. The pleopods are developed in a different order. The endopodite of the seventh thoracic leg of the female is developed long after the exopodite which is unlike the development of the legs in front and unlike *Nyctiphanes* and *Meganyctiphanes*. Apparently all legs are complete before breeding, which is unlike *Nyctiphanes* which may breed before the legs and gills are fully formed.

We have now completed the life histories of all the euphausiids known up to the present time in the English Channel, e.g. *Nyctiphanes Couchii*, *Meganyctiphanes norvegica*, and *Thysanoessa inermis* (both *inermis* and *neglecta* forms). Of these the only species which apparently live all the year round in the Channel itself is *Nyctiphanes Couchii*, the others seem to enter the Channel for breeding in the late winter and spring, and adults are not to be found there at other times of year.

Meganyctiphanes and *Thysanoessa* are oceanic and approach the coast to breed, *Nyctiphanes* is truly neritic, and it is of great interest to find that with the shallow water habit is correlated a hurrying up of the development. Thus *Nyctiphanes* carries her eggs which are set free from the egg sac in an advanced stage, the nauplius being only found within the sac and having its mandibles uniramous and not developed as swimming organs, whereas the eggs of *Meganyctiphanes* and *Thysanoessa* are shed in the one-celled stage, and the first nauplius having three pairs of biramous swimming appendages is hatched into the sea. The development of *Nyctiphanes* continues to be abbreviated, and we have the late *Furcilia* and *Cyrtopia* stages all further advanced than similar stages in the other two species, until finally we have *Nyctiphanes* breeding before it is fully developed.

Nyctiphanes seems to breed all the year round both in the Atlantic and in the Channel, but its maximum breeding time seems to be the spring. In the autumn, winter, and spring it is usually present in the Plymouth district in large quantities, usually dwindling in the summer. *Meganyctiphanes* and *Thysanoessa* seem only to breed in the late winter and spring.

The elucidation of these life histories is of importance from the point of view of the food of fishes. Euphausiids are much eaten by Hake, Mackerel, Herring, Pilchards and many other fishes. Hickling (1925) finds that *Meganyctiphanes* is a very important food of the Hake. Herrings feed on euphausiids to a large extent (Hardy, 1924; Lebour, 1924, and many others), especially *Nyctiphanes*, and the period of maximum numbers of *Nyctiphanes* corresponds to the time of the Herring fishery in Devon and Cornwall. Although Herring do not usually eat much at the breeding season, still they undoubtedly sometimes have their stomachs

full of *Nyctiphanes*, both before and after and even occasionally during the breeding season.

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EXPLANATION OF PLATES.

PLATES I and II are drawn to the same scale as Plates I to V in the first paper (Nov., 1924), and Plates III to V are drawn to the same scales as Plates I to IX in the second paper (Oct., 1925).

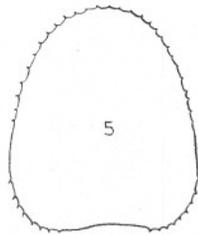
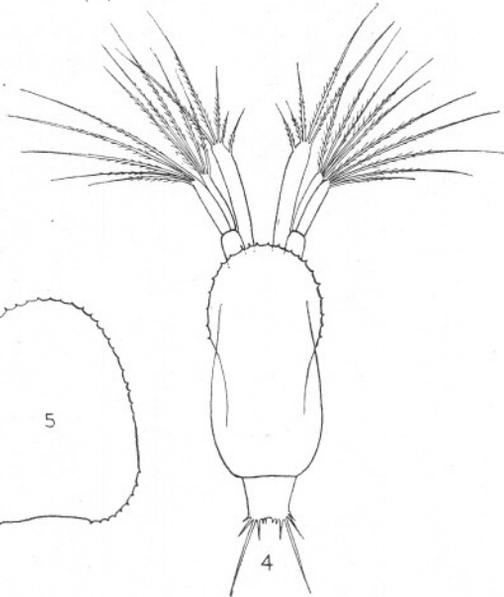
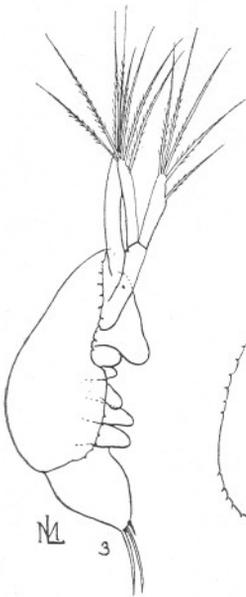
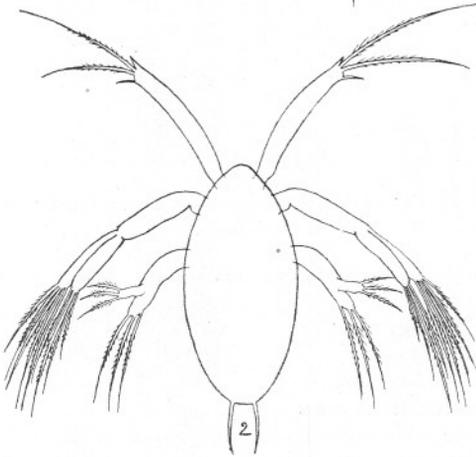
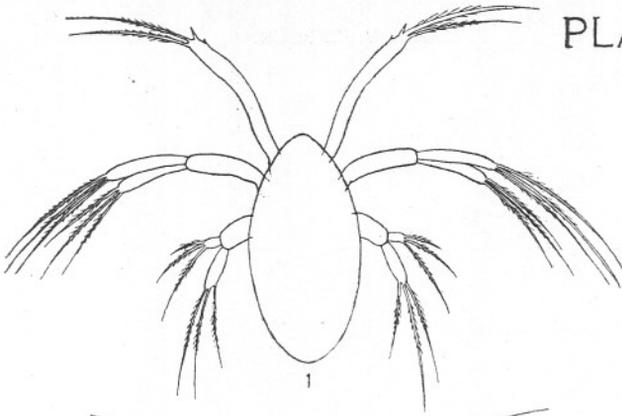
PLATE I.

Nauplii and Metanauplius of *Thysanoessa inermis*, from the Atlantic.

FIG.

1. First Nauplius, 0.048 mm. long.
2. Second Nauplius, 0.51 mm. long.
- 3-5. Metanauplius, 0.58 mm. long.
 3. Side view.
 4. Dorsal view.
 5. Carapace spread out.

PLATE I.



Thysanoessa inermis.

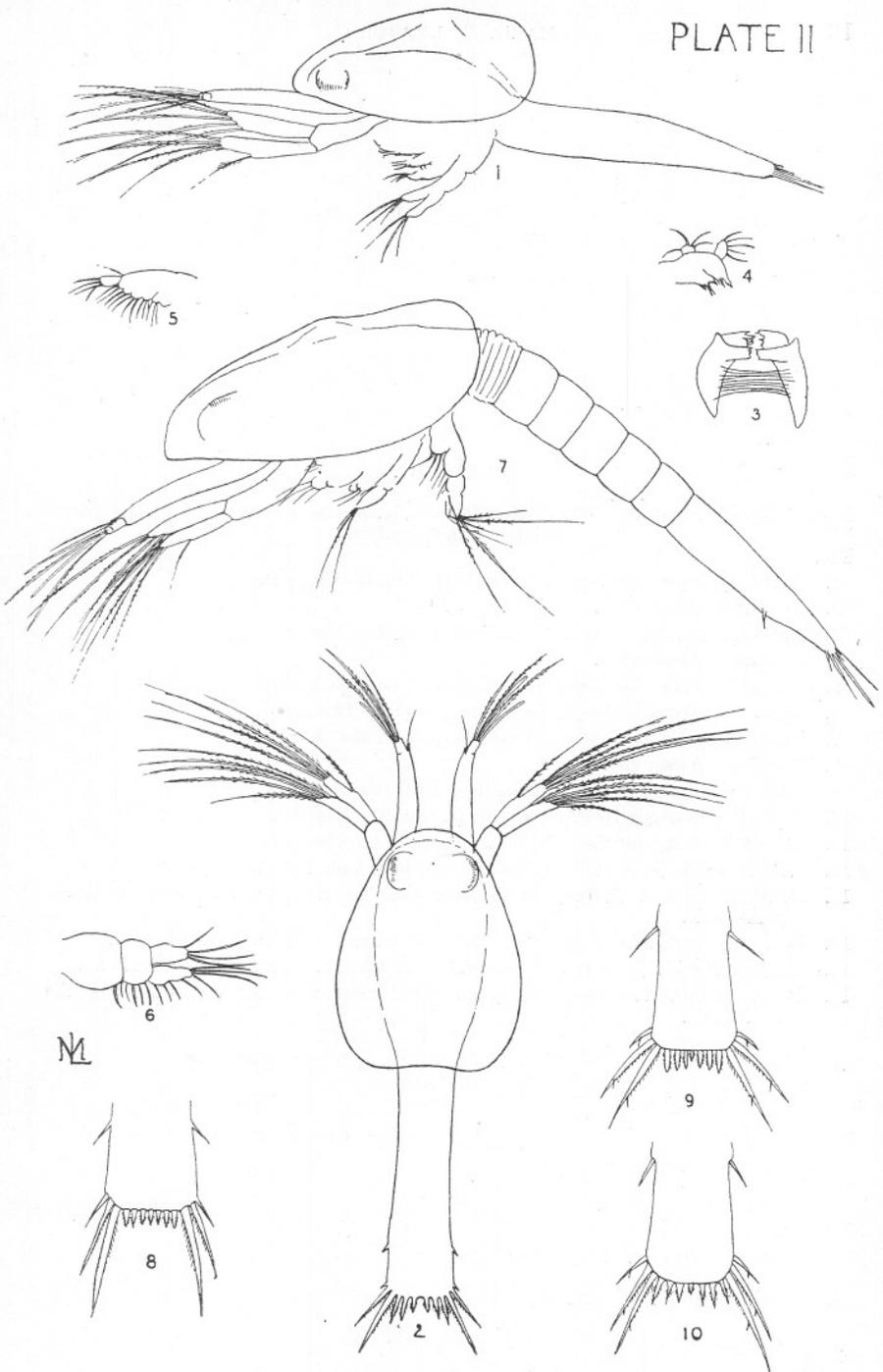
PLATE II.

First and Second Calyptopis of *Thysanoessa inermis* and telson of Third Calyptopis.

FIG.

1. First Calyptopis, side view, 1.04 mm. long, from the Atlantic.
2. The same dorsal view.
3. Mandible of same.
4. First Maxilla of same.
5. Second Maxilla of same.
6. First Thoracic Leg of same.
7. Second Calyptopis, side view, 1.6 mm. long, from the Atlantic.
8. Telson of same.
9. Telson of third Calyptopis, form A (probably *neglecta*).
10. Telson of third Calyptopis, form B (probably *inermis*).

PLATE II



Thysanoessa inermis.

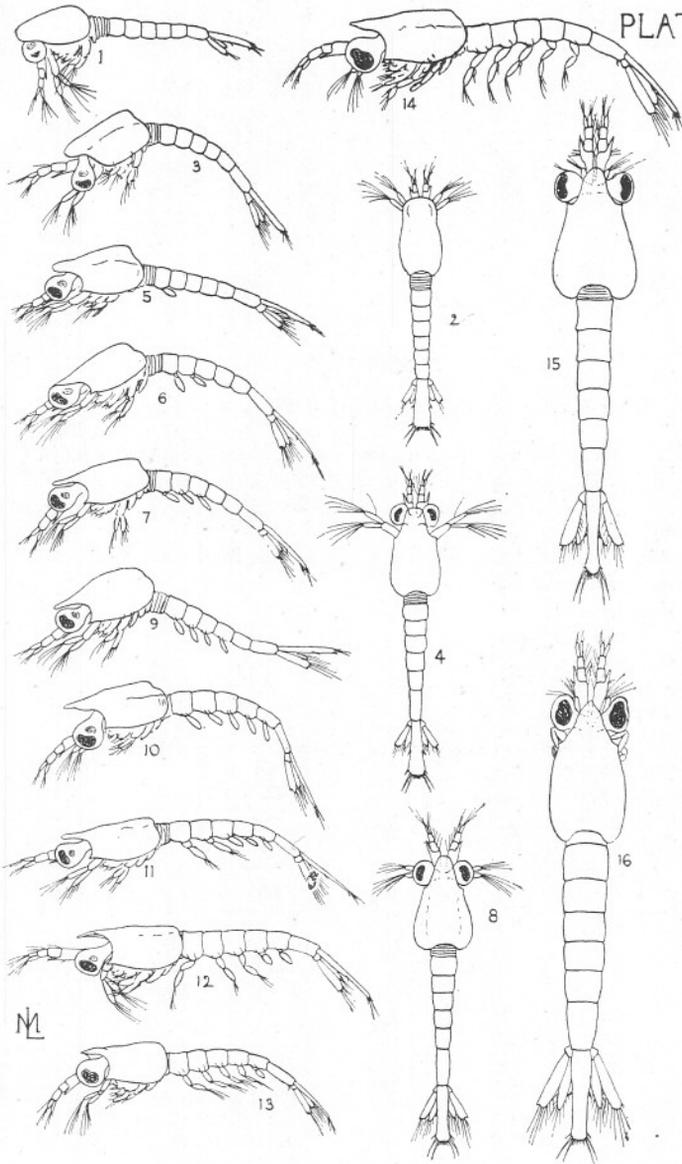
PLATE III.

Last Calyptopis, first to eleventh Furcilia of *Thysanoessa inermis* (except the tenth, which is *T. longicaudata*).

FIG.

1. Last Calyptopis, side view, 2.4 mm. long, from the Channel.
2. The same, dorsal view.
3. First Furcilia, side view, 3.2 mm. long, from the Channel.
4. The same, dorsal view.
5. Second Furcilia, side view, 3.2 mm. long, from the Channel.
6. Third Furcilia, side view, 3.5 mm. long, from the Channel.
7. Fourth Furcilia, side view, 3.6 mm. long, from the Channel.
8. The same, dorsal view.
9. Fifth Furcilia, side view, 3.6 mm. long, from the Channel.
10. Sixth Furcilia, side view, 3.6 mm. long, from the Channel.
11. Eighth Furcilia, side view, 3.8 mm. long, from the Channel.
12. Ninth Furcilia (*neglecta* form), side view, 4 mm. long, from the Channel.
13. Tenth Furcilia of *Thysanoessa longicaudata*, side view, 3.5 mm. long, from the Atlantic.
14. Eleventh Furcilia (*neglecta* form), side view, 4.2 mm. long, from the Channel.
15. Twelfth Furcilia (*neglecta* form), dorsal view, 4.5 mm. long, from the Channel.
16. Fourteenth and last Furcilia (*neglecta* form), dorsal view, 5.2 mm. long, from the Atlantic.

PLATE III



Thysanoessa inermis and *T. longicaudata*.

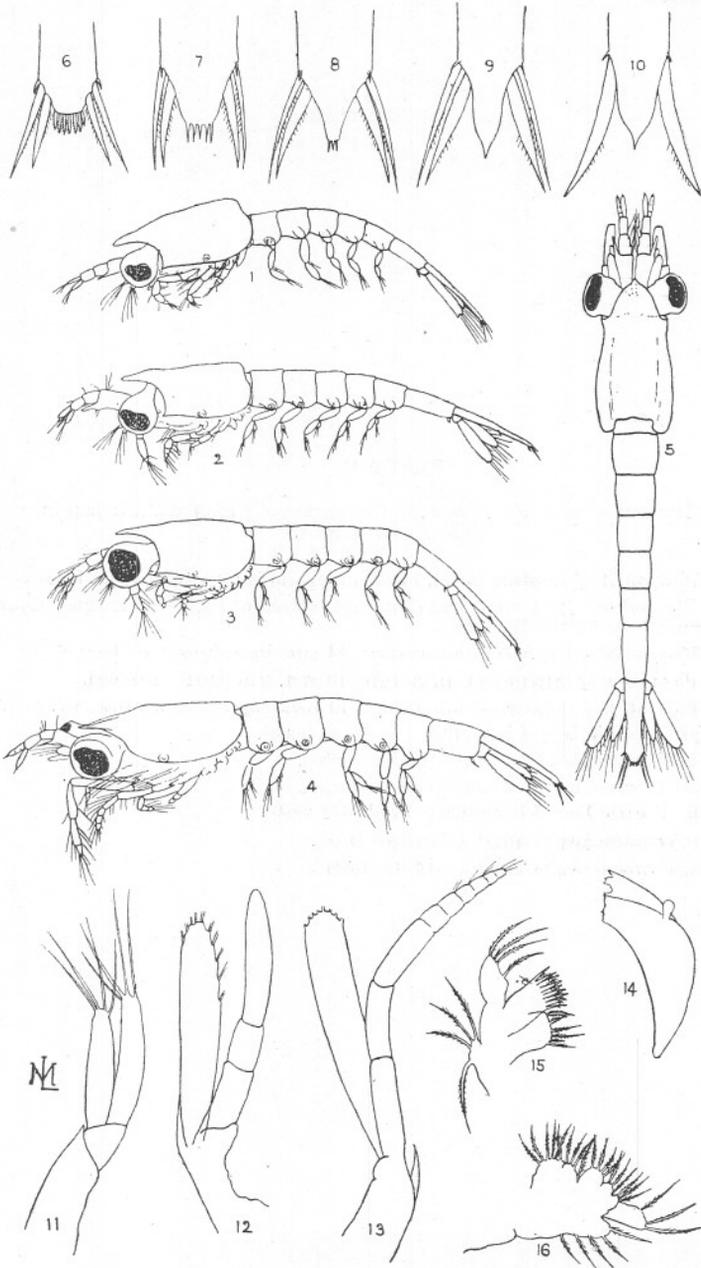
PLATE IV.

Later Furcilia and Cyrtopia stages of *Thysanoessa inermis*.

FIG.

1. Twelfth Furcilia (*neglecta* form), side view, 4.5 mm. long, from the Channel.
2. Thirteenth Furcilia (*neglecta* form), side view, 4.9 mm. long, from the Atlantic.
3. Fourteenth and last Furcilia (*neglecta* form), side view, 5.2 mm. long, from the Atlantic.
4. First Cyrtopia (*neglecta* form), side view, 6 mm. long, from the Channel.
5. The same, dorsal view.
6. Telson of same.
7. Telson of second Cyrtopia.
8. Telson of third Cyrtopia.
9. Telson of fourth Cyrtopia.
10. Telson of fifth Cyrtopia.
11. Antenna of last Furcilia.
12. Antenna of first Cyrtopia.
13. Antenna of second Furcilia.
14. Mandible of first Cyrtopia.
15. First Maxilla of Cyrtopia.
16. Second Maxilla of Cyrtopia.

PLATE IV



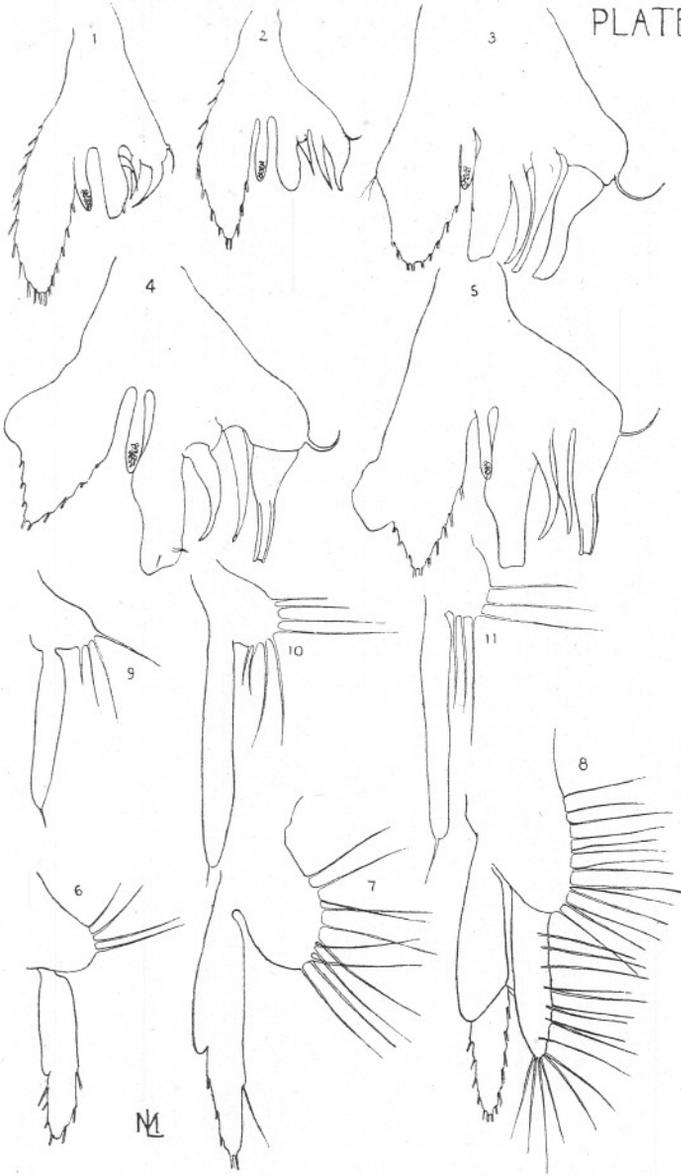
Thysanoessa inermis.

PLATE V.

Development of male pleopods and of seventh and eighth thoracic legs in
Thysanoessa inermis.

FIG.

1. First Pleopod of ♂ (*neglecta* form), 17 mm. long, immature, from the Atlantic.
2. First Pleopod of ♂, 11 mm. long (form not certain as legs were broken off), immature, from off the Dodman.
3. First Pleopod of ♂ (*inermis* form), mature, 14 mm. long, from the Channel.
4. First Pleopod of ♂ (*neglecta* form), mature, 13 mm. long from Aberdeen.
5. First Pleopod of ♂ (*neglecta* form), mature, 14 mm. long, from the Channel.
6. Seventh Thoracic Leg of immature ♀ (*neglecta* form).
7. Seventh Thoracic Leg of adult ♂ (*neglecta* form).
8. Seventh Thoracic Leg of adult ♀ (*neglecta* form).
9. Eighth Thoracic Leg of immature ♀ (*neglecta* form).
10. Eighth Thoracic Leg of adult ♂ (*neglecta* form).
11. Eighth Thoracic Leg of adult ♀ (*neglecta* form).



Thysanocessa inermis.

