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Contribution to our knowledge of pelagic
parasitic Crustacea and Lernaeae, and
other new or previously poorly known
parasitic Copepoda

By J. Jap. Sm. Steenstrup and Chr. Fred. Lütken

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Snyltekrebs og Lernaeer samt om nogle andre nye
eller hidtil kun ufuldstaendigt kjendte
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known Parasitic Copepoda^{26.}

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samt om nogle andre nye eller hidtil kun unfuldstaendigt
kjendte parasitiske Copepoder. ^{fuldstaendigt}

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Contribution to ^{our} knowledge

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~~Parasitic Crustaceans~~ and Lernaeae
l.c.

and ~~also about~~

~~some other new or until now less known~~ previously poorly

~~Parasitic Copepoda~~
l.c.

by

J. Jap. Sm. Steenstrup, and Chr. Fred. Lütken

Professor

Dr. phil.

Introductory remarks about Morphology and Systematics
of the Copepoda.

Before we start on our actual task, namely to describe some new, or until now not very well known species of the groups of the parasitic crustaceans (Siphonostomata) and the Lernaea, it will be convenient to advance some brief remarks about the general morphological conditions of the Copepoda. Recognition of the fact that all Copepoda, parasitic as well as free-living are built according to an identical ~~schedule~~ or basic plan, to the same extent as ~~also~~ is the case with for instance all Hedriophthalme or podophthalme crustaceans, does not appear to be quite clear to

most of the zoologists who occupy themselves with these groups of animals. This would however seem to be a necessity in order to obtain a satisfactory scientific understanding of them. Well has Dana, who also possessed a wider knowledge about the numerous groups of the free-living Copepodae than anybody before him, described the morphology of these animals in an all-together satisfactory way, but his work is hardly so generally known that one to advantage could limit oneself to referring to them, even though one in every respect could applaud his terminology. In the following remarks about the Morphology of the Copepodae we have, however, intended to give the necessary explanations of the terminology employed in the following descriptions, if it should deviate from that of earlier authors.

According to our idea, the body of all Copepodae, free-living or parasitic, consists of 3 main parts: The front body, the rear body and the tail.

The front body (cephalothorax) is usually undivided, only in Pontella and some closely related forms is it divided into two sections. Typically, it carries the following parts: The eyes, 2 pair of feelers (antennae), a pair of cheeks (Mandibles) (in the parasitic crustaceans converted into stinging-tools and encased in a trunk or beak), a pair of jaws (Maxillae) and 2 pair of jaw-legs (Maxilliped). It may there, just as the "head" of the Isopodae and the Amphipodae be considered as consisting of 7 segments. In descriptions of Lerne-types it most often, although less correctly is mentioned as the "head".

The rear body (abdomen) consists of 5 segments, which in the typical types each carries a pair of legs or feet. Such a leg or "foot" consists of a two-jointed base-piece and two, typically three-jointed branches with numerous feather-tufts. In the genus Cyclops and in numerous, although not in all parasitic crustaceans, the first abdominal segment is assimilated in the cephalothorax (in the Saphirini however, this condition seems to vary from species to species), and the first pair of legs is then located under the hind-most part of the cephalothorax. In the following type-descriptions therefore, by the "abdomen" we mean only the part of it that is separate from cephalothorax, and the abdominal segment carrying the second actual pair of legs is designated the "first abdominal segment" even though it actually is the second, and so forth. In many freeliving Copepoda the fifth pair of legs has been transformed in different ways in order to aid in the propagation. In others it is rudimentary, for instance in the Cyclops and in most parasitic types it disappears altogether and with it the corresponding abdominal segment, probably because it is fused together with or assimilated into the first tail segment or genital segment which in these types is strongly developed. A fact in favor of this interpretation is also that one finds just in this genital segment in many Celigini and Pandarini, ^(a) however microscopic rudiment of a fifth pair of legs. In this way, the number of distinct, free, abdominal segments is never more than three in the parasitic crustaceans, each segment carrying its (second to

fourth) pair of legs. That the boundary between the abdominal segments in many of the parasitic, more transformed abnormal types is indistinct or unrecognizable, and that the limbs of the abdomen as well as those of the cephalothorax studied in a large number of parasitic crustaceans and Lernae undergo a retrogressive development until complete disappearance, is so well known that only a bare mention of the fact is necessary here. Even if there are types with very definite antennae, Maxilliped and regular legs etc. that previously have been considered deprived of any trace of limbs--such as Prof. Brühl^x has shown for the Lernaeocerae and we in the following will show for the Pennellae and Lernae--it has never the less been proved there are types belonging here that lack any trace of these parts, as for instance the genus (Harpyllobius) so peculiar by its simple sack-shape, that lives on Annelidae and which is described later on.

The tail (cauda, postabdomen) is typically consisting of five segments of which the last carries the tail-blades (foliula caudalis s. appendices caudales), two un-jointed blades, each with (4) feather-tufts^x. They could probably be compared to the so-called "tail-adhesions" of the Isopodae and in this way be supposed to represent a pair of tail legs. Only seldom are rudimentary legs found under the foremost tail segments, unless the previously mentioned rudimentary pair of legs on the genital segment should be considered as

x) Mitteilungen aus dem keiserliche königliche Institute der Universität Pest. Wm. (Reports from the Imperial Royal University)

~~pair of legs on the genital segment should be considered~~
~~and~~ such. In both sexes the genital organs open on the first tail segment and from this the egg-sacks or egg-strings are suspended. In the free-living types, where this segment is of a minor size, there can be no doubt that it actually belongs to the tail, but in many of the parasitic types, in accordance with the

considerable power of propagation, this so-called genital segment (annulus genitalis) is of considerable size, and it is then convenient and easier for the survey, ^(when describing) to recognize it as an independent part of the body. We will therefore in the following designate the other four tail-segments located behind the genital segment and behind the base of the egg-sacks as the tail. Their number is often reduced by being fused together. In many, more diverging types, the tail is un-jointed, without tail-blades or even completely diminished and only recognizable by a slight indication.

In all genuine Copepodae the body then typically consists of seventeen segments (7+5+5), and when one starts out from the higher crustaceans, one may state that of their 21 joints two abdominal joints and two tail-joints have disappeared completely except for some specific Copepodae that have a larger number (up to 7) tail joints. As we do not wish to give a complete detailed description of the Morphology of the Copepodae or to pursue the development of the individual pairs of legs or antennae through the

whole series of types, it should in this respect be sufficient for a temporary orientation to refer to tables 71, 72 and 92 of Dana's great work on crustaceans. We must however point out that the diagram for the build of the Copepoda set up here does not fit all Entomostraca, nor Limulus, Trilobiti, Phyllopodae, Cladocerae, or Ostracodae, nor the genus Argulus. Together with Zenker, we could not consider the last mentioned type a Copepoda at all, but would rather refer it to the Phyllopodae as the representative of the parasites in this group ^{*)}. That it will be applicable to the Cirripedia is more than doubtful.

The systematics of the parasitic Copepoda does not appear to us to be in a completely satisfactory state, whether one prefers to stick to the divisions given by Milne Edwards or those by Dana. This is also felt by some authors who lately, occasionally, have been dealing with the systematic comparison of these animals and expressed an opinion about the limits of the different genera and their mutual relationship. We think that we already here should point out a so-far less noticed condition which seems to us to be able to serve as a guide in the Labyrinth of types that are left when one sees oneself forced to abandon the existing attempts at grouping. There are actually a

*) With this, the only so far known parasitic Copepoda without external egg-sack^{ck} or egg-string is eliminated, because the ~~Saccinidae~~^{Saccinidae} and the Peltogastridae are, as Liljeborg has proved, not Copepoda, but without doubt Cirripedia.

number of types in which the egg-sacks take the shape of strings in which the flat, slice-shaped eggs are located in a single row or stack above each other like the dollars in a roll of money, whereas they in an other number of types are actual sacks, in which the more ball-shaped eggs lie in disorder and, just as in the free-living Saphirini and Cyclops, not in a single row, but several, side by side ^{xxx)} --That the so-called "strings" sometimes are quite short and thick and the "sacks" on the other hand sometimes long and thin (f. inst. in *Chondracanthus lophii*), does of course not eliminate the importance of this division.

If this characteristic now is applied to all of the families of parasitic Copepoda drawn up by Milne Edwards it will show that all his Caligini, Pandarini and Dichelestini have two egg-strings of the above-mentioned type, and all Ergasilini on the other hand have two egg-sacks just as the Cyclops and Saphirini. The very natural group of the Lernaeopoda in this respect join the Ergasilini and also the genera *Chondracanthus*, *Saluis* and *Tucca* and also *Lerneocera*, which up until now had a very un-natural place in the Pennelleri group. One will however on the other hand find that the last mentioned, which, by excluding the genuine Lernaeocea

*) Dana has already applied this characteristic in order to differentiate between "Ergasilioidea" and "Caligoidea" within his "poecilopoda", but drops it altogether as far as the second section, the "Leraeadae", is concerned where it says "eggs sometimes in bags or sacks as in the Ergasilioidea and sometimes in slender tubes as in the Caligoidea"!

obtains a very natural content, lies the identical shape and construction of the egg-strings as the Caligini, Pandorini and Dichelestini (the genus Lernanthropus will have to be referred to the last mentioned) and as the genera Clavella, Peniculus and Cycnus, in which prof. Claus already, quite correct, has acknowledged the natural connecting link between the Pennellini and the Dichelestini^{xx}). It will finally, by using this characteristic on the different species within several of the so far described genera, be quite evident that there in certain genera have been included foreign elements, which in this way might, and should, be eliminated. While in this way the genuine Clavella and Lernaeonema species have egg-strings, Clavella Scari ~~Krøyer~~ and Lernaeonema Murteli van Beneden have egg-sacks. But instead of disproving our recently expressed opinion about the feasibility of using the egg-sacks as a characteristic for larger groups of parasitic Copepoda, these apparent exceptions just confirm it, because the two types mentioned actually differ so much from the typical Clavellae and Lernaeonemae, that they, even disregarding the condition of the egg-sacks, should be separated from the genera, the names of which they at present carry. The result of this is that the two old groups Siphonostomata and Lernaeadae must be dissolved and the parasitic Copepoda

xx) One will from this see that most of the points in the re-grouping suggested by us actually are available in part already, but some had not been published and some had not yet come to our knowledge when we had reached the results published here.

genera be re-organized in two parallel series which both start with types that are quite close to the free-living typical Copepodae but end up with genera which, on account of their retrogression and the primitive build of an early stage of zoological development even may find their place among the worms. Therefore one may be able to point out partly analogous genera in both series.

A. With 2 egg-strings. To this belong:

- 1) Milne Edwards Peltocephali with the two groups Calginiⁱⁱ⁾ and Pandariniⁱⁱⁱ⁾ the limitations of which will be discussed in the following.
- 2) Milne Edwards Dichelstini (Pachycephali p.p.)ⁱⁱⁱⁱ⁾
- 3) The Clavella-group (Clavella, Peniculus, Cygnus), which
- 4) The Pennella-group (Lernaea, Lernaeonema, Lernaeonicus and Pennella, possible also Sphyrion and Lophura) will join quite naturally. (Staurosoma also seems to belong to this series, the analogous Anthecheres however to the next. As far as the first is concerned however, this undeniably needs confirmation.)

B. With 2 egg-sacks. The types belonging are, at least so far, easily separated in smaller groups.

-
- *) Caligus, Synestius nob., Parapetalus nob., Calistes, Trebius, Dysgamus nob., Caligeria, Elytrophora and Euryphorus.
 - **) Pandarus, Nogagus, Dinematura, Echthrogaleus nob., Phyllophorus, Gangliopus, Perissopus nob., Cecrops and Laemargus.
 - ***) Krögeria (Lonchidium), Pagodina, Eudactylina, Congericola, Ergasilina (the egg-sacks unknown), Lernanthropus, Dichelestium, Nemesis, Lamproglina and Anthosoma.

- 1) The Ergasilini (Ergasilus, Bomolochus, Doridicola and Nicothoë)
- 2) The Lernaeopodae (Tracheliastes, Basamistes, Achtheres, Brachiella, Lernaeopoda and Anchorella.)
- 3) The Chondracanthini (Chondracanthus, Antheacheres, Selius, Tucea, Aithon / "The egg-sacks unknown" and also "Clavella Scari Kr." and "Lernaea gobina Fabr.")
- 4) The Lernaeocerae (Lernaeocerae, "Lernaeonema Musteli v. B"^④) and also Herpyllobius arcticus nob.)

One will however, hardly be able to remain with this, although one probably now must acknowledge that there cannot be drawn any natural boundary between the free-living and the parasitic Copepodae, neither from their way of living nor from their external or internal construction. Professor Claus has already pointed out that the Saphirini, the females of which live in salpae while the males live free, erase the boundary between both groups. But if this is the case, this admission should also be expressed in the zoological grouping and one must therefore in our second series (B), consisting of Copepodae with egg-sacks, besides the above indicated four groups of parasitic types also include the partly

- ④) The great similarity which exists between the males of this type, of the Lernaeopoda - group and the Chondracanthus - genus seems to indicate that these three groups naturally belong together. About the so-far unknown male Mennella, see the following.

In order to prevent misunderstanding, we will not omit to remark that we do not at all consider those, for the sake of the survey, here mentioned small groups, f. inst. the Ergasilini and the Chondracanthini or the details of the grouping on the whole as scientifically proved, but, to the contrary, are of the opinion that too few types are yet known to dare to establish more than quite temporary families.

or completely free-living types that have the same characteristics, that is, the genus *Cyclops* (s. str.) and the Saphirini - group. It is doubtful however, if the Monstrilli and the Thaumaleus - group belong here as they have not yet been observed with egg-sacks. The Notodelphys - group still also have its place here if the content of its peculiar egg-bag may be considered as corresponding to the two egg-sacks of the *Cyclops* and not to f. inst. the unmated egg-sacks of the Pontelleri.

A series different from this will probably be made up by the free-living ^{res/}Copodae which have only one external egg-sack or by the numerous genera grouped around Calanus^{x)}, Pontella, Harpacticus and Setella. This series, which actually should have been put first, contains at the moment only free-living types; the series A, actually the third, only parasitic types, whereas the series B goes through the whole scale of transformation from *Cyclops* to *Lernaeocera*.

The following table will perhaps make it easier to conceive what we here have tried to explain.

x) Even if one does not know of genuine *Calani* with egg-sack, one in any case know very closely related genera of the Calan-group itself with single un-mated egg-sack.

	<u>One egg-sack.</u>	<u>Two egg-sacks.</u>	<u>Two egg-strings.</u>
Free-living types	Calanus	Cyclops (s.str)	
	Pontella	Monstrilla	
	Harpacticus	Thaumaleus	
	Setella	Saphirina	
Parasitic types		Notodelphys	Caligus
		Ergasilus	Pandarus
		Lernaeopoda	Dichlestim
		Chondracantus	Clavella
		Lernaeocera	Penalla

The material for the present treatis is mainly made up of pelagic parasitic crustaceans from the Atlantic Ocean, for the most part collected for the museum over a number of years by Captain D^{md}. V. Hygom. It is in this way a contribution to the preparation of the considerable material gathered and stored by the museum of the University for the knowledge about the pelagic fauna. But we have also believed that we should include in our studies several other new or less known types that may further the knowledge of the topic treated in this article. A brief excerpt from this treatis was published in the Reports of the Treatises of the Academy of Science for 1860 and an even shorter report on our idea of the natural grouping of the Copepodae is found in the accounts from the convention of Scandinavian naturalists in Copenhagen in 1860.

First group of parasitic Copepodae: with egg-strings,
containing a single row of flat, disc-shaped eggs.

The first large main section of this group (Caligidae Dana, Peltoccephali M. Edw.) may be characterized by the shape of the shield and build of the antennae. The shield is almost always crescent - or horseshoe-shaped, a shape that is derived from the fact that its side-pieces continue farther back than the middle piece, so that its rear edge always is more or less concave. It is nearly always divided into two side-pieces and one middle-piece and has, as a rule, special frontal plates and brims *). The first pair of antennae almost always **) consists of only two joints, one wider base-joint that carries a number of tufts or spikes along the upper edge and a slender end-joint equipped with some tufts at the end. The second pair is always hook-shaped and in this way forms a tool with which to hold on to things. This section embraces the groups Caliginae and Pandarinae. The second main section (Dichelestidae Dana, Pachycephali M. Edw.) which includes Dichelestini and Lernanthropodini, always has the first pair

*) This brim as well as the seams in the shield are lacking in Pandarus (♀) only, the frontal plates however are present and even in P. bicolor is the rear edge still concave. Perissopus (Lepidopus) armatus, (♀) however is an exception if it otherwise is correctly described by Dana; its shield is not crescent-shaped.

**) We do not know of any other exception from this rule than Laemargus muricatus, where it is three-jointed.

of antennae string-shaped and multi-jointed (5-10 jointed), but the second forms either a pair of pincers or a band or it is hook-shaped just as in the first section. The shield here is never crescent-shaped and always lacks the brims, frontal plates and seams.

Even Milne Edwards established a differentiation between Caligini and Pandarini, and Dana retained it, although with a different limitation and with other characteristics. Milne Edwards characterizes the first mentioned group by its lack of the dorsal blades (elytra), so characteristic for the last mentioned group, and he referred the genera Caligus (and Chalimus), Trebius and Nogagus to it and to the Pandarini he referred Dinemura, Pandarus, Phyllophorus, Cecrops and Laemargus. Dana was more correct in his differentiation between these two groups, by the proboscis (beak) of the Caligini being short and blunt ("subovatus, obtusus"), while in the Pandarini it is long, thin and pointed, but the additional sign of differentiation, taken from the shape and position of the jaws (Maxillae) seems to be based on a mistake.*) The genera (Caligus, Lepeophtheirus, Chalimus, Caligeria, Calistes and Trebius)

*) It is in our opinion not the same part that Dana in both instances designate as such. What he in the Caligini defines as "maxillae" are presumably lacking in several Pandarini but are also often found in them in a more or less developed state and always in the same place as in the Caligini. In our opinion this part is an appendix to the base part of the second pair of maxilliped, just as "hamule" is to the second pair of antennae, and not any transformed independent pair of limbs.

which Dana has referred to the Caligini actually belong very close together, but it is not very fortunate that Edwards and Dana have referred the Euryphorus which is very closely related to them - and which Dana no doubt has not known by sight - to the Pandarini, from which it also seems less natural to exclude the Cecropidi. But the Caligini and the Pandarini could, aside from the shape of the proboscis - which probably is connected with a modification in the way of living or a parasitic life on other fish varieties - be separated by the shape of the first pair of legs which in the Caligini always has the shape and build known from the genera Caligus and Trebius, which is substantially the same, whether the inner small branch is present or missing, where, to the contrary, the two branches always are evenly developed in the Pandarini. Lastly, the two foremost abdominal segments in all Caligini with the exception of Trebius are assimilated in the shield and only the last one is free, whereas in all Pandarini the three abdominal segments are free and independent of the shield.

**) Under this also the subgenus Lepeophtheirus (Caligi "lunulis nullis" and the Chalimus - varieties (Caligi appendice frontali affixi); even if it should be proved that there were Caligus-varieties, the females of which all through their life were attached by a frontal string, they would at the most form only a subgenus of Caligus. All Caligini known to us have the so-called "furca" (fork); but it does not seem of any generic significance if the "lunulae" and the auxiliary hooks of the antennae are present. We, therefore, have not included these conditions in the genus characteristics, but mostly considered the difference in the build of the legs. We, therefore still, for the time being consider Sciaenophilus von Bened with its very elongated genital ring and tail as a somewhat diverging Caligus - variety, that perhaps may form a separate subgenus.

(The two asterisks of this footnote could not be found in the original text. - Translator's note).

With this limitation the group Caligini include the 9 genera mentioned below, the characteristics of which will be evident by the following analysis:

A. Fourth pair of legs single

(Only the outer branch is developed and its tufts are never feathered)

B. Fourth pair of legs two-pronged

(Only in Elytrophora (?) and Caligeria are the tufts not feathered)

Without Dorsal Blades

1. Caligus Mull (♀♂)

The inner branch of the first pair of legs is missing or quite rudimentary. The branches of the second pair of legs are three-jointed. The base joint of the third pair form a large plate, its branches are quite small and two-jointed. The first two abdominal segments which carry the second and third pair of legs are assimilated in the shield of the cephalothorax.

2. Synestius nob. (♀)

The genital segment extends backwards in the form of 4 long club-shaped extensions otherwise it has the characteristics of

5. Calistes Dana (♀)

The first pair of legs has at least traces of an inner branch. The branches of the third and fourth pair of legs are three-jointed. Otherwise, it has the characteristics of the genus Caligus.

6. Trebius Kröyer (♀♂)

The first pair of legs has a smaller two-jointed inner branch. The second abdominal segment which carries the third pair of legs is free. Otherwise as Calistes.

7. Dysgamus nob. (♂)

The first pair of legs as in Trebius. Second, third and fourth

the genus Caligus.

3. Parapetalus nob. (♀)

The genital segment is equipped with a wide brim and the tail with a wing-shaped extension on each side. Otherwise it has the characteristics of the genus Caligus.

pair of legs two-jointed. The first two abdominal segments are assimilated in the shield as in Caligus.

With two dorsal blades (at least in the females) extending from the free abdominal segment. The two abdominal segments ahead of this, in all varieties known up until now and belonging here are assimilated in the shield of the cephalothorax just like in the Caligus.

4. Gloiopotes nob. (♀)

The first pair of legs has no inner branch; second, third and fourth substantially as in Caligus; two large plate-shaped dorsal blades cover the largest part of the genital segment, which extends backwards in the shape of two long points.

8. Caligeria Dana (♀)

(First pair of legs unknown); the outer branch of the fourth pair of legs is three-jointed, the inner is smaller and two-jointed; their tufts are not feathered; the two dorsal blades are small.

9. Elytrophora Gerstäcker (♀♂)

The first pair of legs approximately as in Trebius, second and third as in Caligus, but the third has three-jointed branches; the fourth as in Caligeria (?). Besides two

small dorsal blades which are to be found in both sexes, the female has a pair of small blades at the base of the genital segment.

10. Euryphorus Nordmann (♀ ♂)

All four pair of legs are substantially as in the previous genus, but the tufts of the fourth pair of legs are feathered. Just as in *Elytrophora*, the female has, besides the small dorsal blades, which are to be found in both sexes, also a pair of small blades at the base of the genital segment, which in the female is about the same as in Parapetalus. In the male the tail has a wing-shaped extension on each side and in the female this has been developed into a large wing-brim.

While the Pandarini for the most part must be considered as belonging to the pelagic fauna and chiefly are inhabitants of sharks *), the largest number of Caligini

*) Only *Cecrops* and *Laemargus*, who live on moon fish (*Orthogoriscus*, sensu latiore), make an exception in this respect.

belong to the "fish-lice" of the littoral fauna. As pelagic Caligini we must however mention Caligus Thynni and C. productus Dana (from a bonito), the C. coryphaenae nob. (from a dolphin), Caligeria bella Dana (from an albacore or tuna), Dysgamus atlanticus nob. and Gloiopotes Hygomianus nob. (from what fish is unknown) and also Euryphorus nympa nob. (from a bonito). From the data we so far have obtained it then seems as if the relationship in the pelagic fauna between the large fish varieties of the genera Shark and mackerel and their parasites of the Copepodae group is this: The sharks are preferably pestered by numerous Pandarini, the mackerel varieties by a smaller number of Caligini. Beside these above-mentioned, in a stronger sense pelagic Caligini from the Atlantic Ocean, we will on this occasion describe two new genera (Parapetalus and Synestius) from the Indian Ocean (also from Scomberoidae) and a couple of exotic Caligus - species and also a couple of so far unknown or only incompletely known species, among them a fresh water species of the same genus belonging to the Danish fauna.

I. Caligus Mull.

The varieties of this genus, described in the following, all have a fork (furca) with individual branches and with the exception of C. branchialis, all have the front edge equipped with "lunulae". Besides the characteristics, which our predecessors have pointed out, we have found two conditions that are particularly well suited as

variety characteristics, namely the shape of the spikes or hooks located at the base of the outer branches of the third pair of legs, and that there besides the end tufts of the fourth pair of legs also exist two or even only one similar tuft on the outer edge, regarding these conditions there is never any difference between the two sexes of the same variety.

Of the varieties we ourselves have had occasion to study, we have established the following survey:

A Survey of the Species of the genus Caligi known
to us.

A. Provided with lunulae; palpi are simple

a. The tail blades extend past the anus.

*) The fourth pair of abdominal legs is provided with four tufts. The tail is short, not segmented.

1. C. curtus Müll. Kr. C. Mülleri Leach, Nordmann, Baird;
C. Tricuspidatus Nordm; C. elegans v. ^{e/}Benden; **
C. diaphanus Baird? *** C. Americanus Dana.

The female's genital segment has a rectangular shape with rounded corners, the rear edge is concave; in the male it is wider and shorter with several incisions at the rear; very short tail; the end-bristles on the fourth pair of legs are very long, and serrated.

2. C. lacustris nob. (♀)

The female's genital segment is shorter and wider, its rear edge is straight; the tail is longer and slimmer, and

the end-tufts on the fourth pair of legs are very long, not serrated.

3. C. Balistoe nob. (♂♀)

The shape of the genital segment of the female is about the same as of the previous species described above, with more accentuated concavity in the rear edge, the male's genital segment has a semi-crescent shape, with very concave and incised edge, and sharp outer angles. The tail is short and wide. The tufts on the fourth pair of legs have about the same length; they are slender and very long.

**) The fourth pair of abdominal legs are provided with five tufts, the tail is more or less elongated, two jointed, or unjointed.

4. C. Productus Dana (♀)

The genital segment is barrel-shaped, the rear edge is deeply incised; the tail is elongated and two-jointed. The fourth pair of legs is two-jointed; the tufts are slightly curved, they increase gradually in length and at the end they are longer than the rest.

There are no feather-tufts on the first pair of legs.

5. C. isonyx nob. (♀)

The genital segment is barrel-shaped/straight rear edge, shorter tail, not jointed; the inner branches of the

fourth pair of legs are three-jointed, the tufts slightly curved, their length increasing somewhat unevenly, but not to any great extent.

6. C. rapax M. Edw. Baird (♀ ♂)

The female's genital segment is barrel-shaped, with straight rear edge; the male's segment is oval shaped; the tail of the female is shorter and unjointed; the male's longer and two-jointed, the first joint shorter. The first tuft on the fourth pair of legs is nearly straight, others are slightly curved, the rest generally is more than twice as long.

b. Tail blades never extending past the anus.

7. C. Coryphoene nob. (♀ ♂)

The hooklike accessories of the antennae are missing here; the spike at the base of the outer branch of the third pair of legs is quite straight, the genital segment of the female is elongated, dorsal shieldlike shape is noticeable, with rear corners developed into rather big lobes. The male's is broad, short, with prominent rear corners. The female's tail is elongated, four-jointed, the male's is short and two-jointed; the tail tufts are very long; the feather-tufts are threadlike, in the apex of the first pair of antennae they are very long, and also in the rear corners of the genital segment similar in both sexes. The branches of the fourth pair of legs are three-jointed, with five bristles slightly curved and comblike.

B. No lunulae, palpi divided (lepeophtheirus Nordm.)

- a. Fork with simple prongs, the fourth pair of abdominal legs are provided with four or five tufts. The topmost (the fifth) is rudimentary.

*) Elongated tail, at least in the female is unjointed, possibly two-jointed with distinct anal segment.

8. Caligus sturionis. Kr. *) (♀)

The genital segment of the female is barrel-shaped and truncated at rear, the last segment of the abdomen is less distinct; the fourth pair of legs is fairly large, with slender branches, where the two last tufts are fairly even, and the length of the others is often considerably longer.

9. Caligus salmonis Kr. (C. vespa M. Edw. Lepeophtheirus Strömli Baird) (♂ ♀).

The genital segment of the female is elongated, rectangular with rounded corners, and the rear edge is deeply concave, in the male it is small and oval; the female's tail is elongated and narrow. The male's is short and broad; the last tuft on the fourth pair of legs is not more than twice as long as the others.

10. Caligus branchialis Mlm. (C. gracilis v. Beneden) (♀)

The genital segment of the female is barrel-shaped with slightly concave rear edge. The fourth pair of legs is insignificant, almost straight, the last tuft very

often is longer than the other three tufts which are very short.

**) Very short tail in both sexes.

11. Caligus pectoralis Mull. (♀ ♂)

The genital segment of the female is very large, broad, and barrel-shaped and truncated in rear, the male's is small and round; minute tail, fourth pair of legs is insignificant, the last tuft somewhat longer than the others.

b. Fork with divided prongs, the fourth pair of abdominal legs ^{is} ~~are~~ provided with five tufts.

12. Caligus hippoglossi (♀ ♂)

The genital segment of the female is of medium size, oval, bi-lobed at rear. The male's has the same shape, but smaller; the tail is very short. The fourth pair of legs is big, with slender branches, the last tuft twice as long as the others.

I. Caligus lacustris. Stp. & Ltk (♀)

Tab. I - Ill. 2.

As far as we know, it has not previously been established that any Caligus variety lived in fresh water. It was therefore an interesting addition to the genus and to our fauna when Mr. R. Conradsen, curator at the Zoological Museum of the University, reported that a few

specimens of this small species, all female, but of a somewhat varying size, some (6 mm. long) off a pike from lake Fuur, others (4 mm.) taken from perch and shells in lake Tiustrup, also here in Sjaelland.

C. lacustris is closest to C. curtus Müll., but it is already in its size so different from this, that a mistake is nearly impossible; the shape of the whole body, of the "palpae", of the "fork" and of the slightly curved spike located at the base of the outer branch of the third pair of legs are substantially the same. As differences we note that the genital segment in C. lacustris (♀) is somewhat shorter and wider and the tail a little longer than in C. curtus (♀); that the first pair of maxilliped in C. curtus has a much longer, more slender "underarm"; that the free abdominal segment is quite indistinct in C. lacustris, while it, to the contrary, in C. curtus is sharply defined, and that the fourth pair of legs in C. lacustris is relatively longer and more slender and the long end-tuft of its two-jointed end branch is without saw-teeth. Otherwise, we refer to the illustrations. The length of the egg-strings may be considerable, but conform somewhat to ^(the) size of the individual. The museum also is in possession of a couple of young ones in the Chalimus-stage, attached by their frontal strings to the tail-fin of a small Cyprinoid, the genital segment is relatively very narrow^w and the limbs, for instance first pair of Maxilliped and fourth pair of legs only clumsily and incompletely developed; the auxilliary hooks are

present, but we did not succeed in observing the fork. *)

2. Caligus Balistae Stb. & Ltk. (♀♂)

Tab. I - Ill. 1

Of this species we have found some specimens on the body and fins of a West Indian Balistes.

The male reaches a length of 4 mm., the female $4\frac{1}{2}$ mm. The shield of the male is as usual larger than that of the female, while the genital segment is less developed. It may, in the male be described as crescent-shaped with sharp, pointed horns protruding backwards, ending

*)

The number of the feather-tufts and the hooks on each separate joint of the first three pair of legs seems to be pretty constant in the *Caligus* species, namely: first pair of legs has 3 feather-tufts and 4 shorter end-tufts or hooks; the outer branch of the second pair of legs has 4 spikes and $6 + 1 + 1 = 8$ feather-tufts;

while the inner branch of same has $6 + 2 + 1 = 9$ feather-tufts; the outer branch of the third pair of legs has 4 spikes (besides the large one at its base) and $4 + 1 = 5$ feather-tufts; while its inner branch has $6 + 1 = 7$ feather-tufts.

As exceptions from this rule, we may report that we, in *C. lacustris* and *C. isonyx*, only found 5 feather-tufts on the end-joint of the outer branch of the second pair of legs and in the last mentioned only 4 on the same joint of the inner branch of the same pair of legs.

in a pair of quite short tufts. A similar group of tufts is located on a small wart on either side of the concave rear edge, close to the root of the wide and quite short, unjointed tail. In the female the genital segment is larger and thicker; it has, just like in the male, rounded side-edges and concave back edge, from the middle of which the tail protrudes; but its rear corners are thick and rounded, not sharp and pointed as in the male and under the microscope show traces of some tiny spikes close to their edge.

The tail blades are attached to the rear edge of the tail; in the male they are a little more elongated, in the female relatively shorter and wider. In both, they are equipped with three thin feather-tufts (besides a smaller one on each side), but these are in the female only half as long as in the male. Quite contrary to what is the case in other species, the free abdominal segment is a little more developed in the female than in the male, because the fourth pair of legs is somewhat stronger in the female than in the male. The end joint of the first antenna pair is longer and more slender than usual, but its tufts are not particularly long. The illustration shows the second pair of antennae and its well developed auxiliary hooks, indicating the difference between the two sexes. The first pair of maxilliped has the spike on the upper (inner) side of the "under-arm" located quite close to the so-called "hand". Second pair of maxilliped here shows a marked difference between the two sexes as the base joint is shorter

and wider in the male and on its upper edge equipped with a protuberance which meets the point of the end hook. This protuberance is not developed in the female. The "palpi" are slender, curved and pointed. The branches of the fork are likewise quite slender. The spike at the base of the outer branch of the third pair of legs is curved. The fourth pair of legs is, here, more slender and elongated in the male than in the female, its end branch two-jointed and equipped with only four thin and long, slightly curved tufts, of which the last is only slightly longer than the rest. The egg-strings are not much longer than the total length of the animal itself. — Several specimens are still attached by a frontal string of quite different types, and among these Chalimus-like individuals are even males of 3 mm. length. These probably still have not genital segments of full size, but are fully developed in other respects, f. inst., equipped with both lunulae, furca, hamuli, etc.

In "Histoire naturelle des Crustacés" Vol III, page 452 (no. 4) one Diodon has a description, 2 lines long of a C. Kröyeri Edw.; but, however short the description may be, the expression "tronqué postérieurement" about the genital segment seems to exclude the possibility that it could be the variety described here.

3. *Caligus productus* Dana (?)

Table III - Ill. 6

United States Exploring Expedition, Crustacea Vol. II,
pg. 1354, Table 94, Ill. 4.

We have found a few specimens of this species on the inside of the gill-cover of a barracuda *) that Captain Hygom had caught at 30° N. Lat. and 76° W. Long.***) (Danas were from 27°N. Lat. and 19° W. Long), and of which some parts had been preserved. They were all females (Dana does not know the male either) and have a length of only 4-5 mm. The tufts at the end of the first pair of antennae are short; the second pair has the customary slender shape. The "palpi" at the base of the first pair of maxilliped are slender and undivided. Second pair of maxilliped is quite tiny, the branches of the fork are long, slender and undivided. The first pair of legs has no feather-tufts at all as Dana has already mentioned. It has, however, three hook-tufts, decreasing in length from the uppermost to the lowest, and a somewhat longer and straighter tuft. The spike located at the base of the third pair of legs is curved. The end-branch of the fourth pair of legs is only two-jointed; it is, however, equipped with five smooth hook-tufts of which the outermost is not much longer than the others. The abdominal segment to which it is attached is small but distinct. The genital segment is of medium size, elliptic, narrowing towards the front, deeply indented at the rear or extended into two

*) A large mackerel fish of the *Thynnus* group is, by the seafarer called "Barracuda".

**) It should be unnecessary to state that all longitudes in this treatise are counted from Greenwich.

lobes, between which the tail protrudes. We have looked for groups of tufts in vain, even though Dana in his illustrations pictures one at the point of each of the lobes of the genital segment. The tail is long — about as long as the genital segment — more or less distinctly two-jointed, so that the articulation falls about in the middle, wider at the rear than at the root. The tail-blades — between which the anus is not extended — each carry 3 feather-tufts besides some smaller tufts. Some specimens have short egg-strings, about as long as the tail, others have them approximately twice as long. Dana shows them even longer in his illustrations. The eggs are very thick and therefore relatively few.

The differences one may be able to point out between Dana's description of this species and ours, appears to us to be, all together, too insignificant to provoke any doubt about the identity of ours and his varieties. The name is rather unfortunate as it may cause a confusion with O.F. Müllers Caligus productus, in spite of this now being a Dinematura, but we have not wanted to change it as this might cause even greater confusion.

4. Caligus isonyx Stp. & Ltk (♀)

Table III - Ill. 5

Regrettably only one specimen of this species exists. It is $4\frac{1}{2}$ mm. long and without doubt a female,

although it lacks egg-strings. It is taken from a Sphyræna barracuda from the West Indies.

The front edge does not, as in most of the other species, form an even arch with a small indentation in the middle, but an obtuse angle turned inward between the "lunulae". The genital segment is quite large, nearly inversely heart-shaped or bottle-shaped, wider at the rear where it has a straight (only very slightly concave) rear edge and rounded corners and narrowing from there with regular curved outline until it reaches the free abdominal segment. The tail is quite long and unjointed. The end joint of the first pair of antennae is slender, the second pair is equipped with auxiliary hooks. The palpi appears to have a small thorn^y point at the base on their inner side. Second pair of maxilliped is quite slender. The spike at the base of the third pair of legs is curved. Fourth pair of legs is short and powerful, the end branch three-jointed and equipped with five slightly curved tufts, all quite short and of about the same length, the uppermost a little larger than the others. A fifth pair of legs is possibly indicated by the groups of two or three small tufts located not very far from the rear corners and in these themselves in the side-edges of the genital segment. Attached to its rear edge the tail carries two small wide tail-blades, each with three longer feather tufts and one smaller located some distance from the others on the side of the blade.

5. Caligus rapax M. Edw. (♂ ♂)

Table II - Ill. 4

? C. elongatus Nordmann, Mikrographische Beitrage
Vol. II - page 24 (German)

C. rapax M. Edwards, Histoire des Crustacés III
page 453 Table 38 - Ill. 9-12.

C. rapax Baird, History of British Entomostraca
page 270, Table 32, Ill. 2-3.

? C. leptochilus Leuckart, in Frey und Leuckart,
Beitrage zur Kenntniss wirbelloser Thiere, page 165.

Lieutenant Koch of the Marine Department has submitted 6 specimens of this species to the museum — 2 male and 4 female —. These were taken from a shark which he caught in the Atlantic on a trip to South America and the West Indies. Captain Hygom has also collected a few specimens for the museum, but they are all females taken from a cod at 57° N. Lat. and 7° W. Long., that is, close to the Hebrides islands, also curator Malm has submitted some specimens (female) to us, taken from the mouth of a cod (Gadus morhua) in Bohuslän (Sweden). Lastly, we must also refer to this species some small specimens (4½ - 6 mm.) taken from the skin of a cyclopterus lumpus which also have been submitted to us from Mr. Malm, and some similarly quite small specimens taken from Gurnards in the Christianiafjord (now Oslo-fjord), and which we owe to a teacher, Mr. Koch. There can be no doubt that it is the same species Baird has had before him and which, according to his statements may be encountered on quite

different species of fish. The circumstance that some of our specimens were taken from a shark, just like Milne Edwards, also seems to indicate that it actually is this author's *C. rapax*. The differences one may find between our description and Milne Edwards' are probably sufficiently explained by the last mentioned obviously being incomplete and quite superficial. Whether the mentioned species from Leuckart and Nordmann belong here which seems quite plausible at least as far as the first is concerned, is a thing we will let remain undecided.

The female attain a length of $6\frac{1}{2}$ mm. They vary quite a bit — even specimens taken at the same time from the same fish — in regards to the shield being more or less elongated and ~~is~~ the free abdominal segment and the genital segment ^{being} ~~are~~ more or less developed. But in most of them the shape of the body gives the impression of being quite elongated. The genital segment is quite large, almost equally wide in front and rear, rounded in front, straight across or slightly concave at the rear with rounded rear corners. The small tufts on its edge which are indicated in our illustration do not always seem to be present. The tail is quite wide, unjointed, shorter than the genital segment, about twice as long as it is wide, or a little longer. The feather-tufts on the tail-blades are quite long. The antennae, maxilliped and leg-pairs do not offer any particular characteristics. There is a distinct thorn inside at the base of the second pair of antennae. The "palpi" and "the fork" are undivided. The hook or spike located at the base of the third pair

of legs is slightly curved. The fourth pair of legs is small, its end-branch two-jointed and equipped with five tufts of which the uppermost is almost straight and cone-shaped, the next three slightly curved but of about the same length. The fifth is longer, as a rule more than twice as long. None of them are serrated. The egg-string may be as long as the body of the animal, but is often also relatively short. They contain numerous, very flat eggs.

The male attains a length of 9mm. It appears, according to the few specimens in evidence, that also in this there is a not insignificant difference regarding the width of the shield and the development of the genital segments. It is noticeably different from the female by a much smaller, oval genital segment and by a comparatively longer two-jointed tail *), the second joint of which is considerably longer than the first. Also by the narrower tail-blades and the longer feather-tufts of these and by the massive development of the base-joint and shaft of the second pair of maxilliped.

6. Caligus Coryphaenae Stp. & Ltk (♂ ♀)

Table IV - Ill. 7)

At 27° N. Lat. and 19° 30' W. Long. Dana found a Caligus species (C. Thynni D.) on the body of the same "Bonito" under the gill covers of which he found the just mentioned C. productus. From a related type of

*) That the tail is two-jointed is not indicated in Baird's illustration, but is mentioned in the description

fish, the so-called "Dolphin" (*Coryphaena*), Capt. Hygom has in the same waters (30° N. Lat., 38°W. Long.) taken a couple of specimens of a species that undeniably is very close to *Danas C. Thynni*; but which, however, according to our opinion it is not possible to refer to this species, as certain differences that will be difficult to explain away are evident. Later on, ship's surgeon Mr. Stybe has submitted to the museum 3 males of the same species, taken at 23° 31' N. Lat. and 22° 4' W. Long.

The male, of which we have had the opportunity to study 5 specimens, has a length of 7 mm. of which the shield take up 4, with a width of about 3½ mm. The free body segment is quite large and wide. Its outline looking like the cross-section of a lens. The genital segment is short and wide and widest between the sharply protruding rear corners **) from which two long, thin feather-tufts and one very short tuft extend. Within this tuft-group, about midway between it and the first tail-joint, a similar group weaker feather-tufts *) may be seen on each side. The tail is approximately as long as the genital segment and distinctly two-jointed. The tail blades are not as usual situated freely in the rear edge of the last tail joint, but fill in cut-outs in its rear corners, so that the anal section extends out between both tail blades.

**) That the genital segment otherwise may vary considerably in shape is evident from Ill. 7 ♂ and 7 ♀ in Table IV.

*) These tuft groups, of which traces may be found also in other species, are without doubt rudiments of a fifth pair of legs (Compare pg. 344).

They each carry 3 very wide, but not noticeably long feather-tufts situated close together and on both sides of these a few (4 at the most) smaller ones, the presence and number of which does not seem to be constant. The short end joint of the first pair of antennae is partly equipped with some bent, shorter or longer tufts, partly with some long string-like feather-tufts. Some such also occur among the other trimming of short feather-tufts of the base joint. The hook of the second pair of antennae has a strong cone-shaped tooth in the middle of the inside edge; the so-called auxiliary hooks seem to be missing. the "palpi" **) between the proboscis and the first pair of maxilliped are wide and pointed. Second pair of maxilliped has a powerful base joint and medium end hook, but otherwise the usual regular shape. The first pair of legs has three wide, slightly bent end tufts of which the outer is serrated along the inner edge, the others feathered; the fourth, which is located between them and the actual feather tufts is quite slender. The next two pairs of

**) Even though we have retained this designation for lack of something better, we do believe that when one traces this organ further than the Caligus-group, in the Pandarini, one will find that it actually is only an appendix, a growth from the base of the second pair of maxilliped. (Compare pg. 350, first footnote).

legs have the ordinary number of feather-tufts ***); the spike, located at the base of the outer branch of the third pair of legs is straight and surrounded by a flat brim, thereby giving it a blunt shape. The fourth pair of legs is quite big and powerful, a fine feather-tuft may be found at the end of the base-joint. The leg branch is clearly three-jointed, the two other joints carry at the point of their outer edge a spike, somewhat bent at the point and serrated at both edges. This spike is a little longer than the corresponding joint. The end joint has three such spikes of which the second is longer than the first and the third again somewhat longer than the second, although, not twice as long.

The female, of which we have been able to study only one specimen, attains a length of 8 mm., of which the shield takes up 3.5 mm., with a width of 3 mm. Although it, then, definitely is larger than the male, its cephalothorax shield is both absolutely smaller and relatively narrower. (Studies of a number of specimens of other species have, however, taught us that this condition, if the shield is wider or longer, may vary not only with the sex, but also within this and that it, therefore, should not be included in a species diagnosis. Also, the shape of the genital segment may vary somewhat in the same sex of the same species.)

***) Regarding these details we refer to the illustrations. We must, however, remark that in spite of the inner branch of the third pair of legs usually is described as unjointed, we have been made to believe that the uppermost feather-tuft extends from a short upper joint.

The free body segment and its pair of legs are somewhat smaller than in the male. The genital segment, on the other hand, is thicker and much longer and it extends backwards into two thick, somewhat outward-turned flaps or extensions, in the outer edge of which we have noticed a small group of two short and two longer feather-tufts. The tail is longer than in the male — also in this case about as long as the genital segment —, and according to our opinion definitely four-jointed. In all other details — even to the shape of the second pair of maxilliped — we have not been able to discover any difference between male and female, with the exception that in the female the inner tooth on the end hook of the second pair of antennae is missing, but there is a protruding edge or spike outside at its base, which, however, must not be regarded as corresponding to the otherwise always occurring auxiliary hook.

If we compare this type with Danas description and illustration of C. Thynni, of which both sexes also are known, we will find — besides differences in the shape of the tail and genital segments in both sexes — that C. Thynni has much longer and thinner tail-tufts, but lack the long feather-tufts on the genital segment and the antennae. In several other more important characteristics one will, however, find a quite accurate conformity and perhaps the future will prove that we should not have separated them. Our C. Coryphaenae also seems closely related to C. scutatus M. Edw. (Hist. de Crust. Vol III page 453 No. 7) but as this is from the

Indian Ocea, it does not seem probable to us that it is the same species.

7. Caligus branchialis Malm (mscr.) (♀)

Table II. Ill. 3

C. gracilis van Beneden, Annales des sciences naturelles, Vol. XVI (1851) pg. 90 - Table 2

Curator Malm has under the above name submitted to us some specimens (all females), taken from the gills of a Rhombus maximus from Bohuslän (Sweden). It is without doubt van Benedens C. gracilis, which also has been taken from flounder species, but the name can hardly be retained if Danas similar name for an other species, as we suppose *), will take precedence. It is probably this type also, that Kröyer has encountered on the gills of Rhombus maximus and which he mentions as a still undiagnosed type **) that has some resemblance to C. pectoralis Müll.

The available specimens had a length of 8 mm. and are then a little larger than van Benedens. In habits, in regards to the shape of the shield, the size of the fourth pair of legs and the shape of the genital segment, they come very close to C. pectoralis Müll.; just like this, they lack the lunulae and have divided "palpi" and an ordinary furca, but the tail, that is slender and elongated,

*) Danas species seems to have been made known in 1850, van Benedens in 1851.

**) Fishes of Denmark 2nd Vol. pg. 444.

immediately, at first glance distinguish them from Müllers type. The tail-blades are small and their feather-tufts quite long. The end branch of the fourth pair of legs is three-jointed, but equipped with only 4 spikes, three of them short and almost straight, the fourth 3 to 4 times as long. The egg-strings are long and contain numerous flat eggs. The spike located at the base of the third pair of legs is quite straight — in its outer part in any case — just like in C. pectoralis. Otherwise we refer to our detailed illustration in Table II, which we thought necessary to submit, as van Benedens illustrations are quite faulty.

II. GLOIOPOTES Stp. & Ltk. (♀)

The Gloiopotes nob. is distinguished (female) from the genus Caligus, although they also have the first two abdominal segments contained in the cephalothorax and similarly shaped abdominal maxillipeds; they have two very large dorsal blades (elytrum) almost rectangular in shape, which are covering the genital segment as far as the base of the tail, the rear of the genital segments extending backwards in two slender protuberances even with the end of the tail. The tail blades are cylindrical, with one stylet, without feather-tuft.

Typical Sp. G. Hygomianus nob.

Habitat: the equatorial regions of the Atlantic Ocean.

8. Gloiopotes Hygomianus Stp. & Ltk (♀)

Table V - Ill. 9

Of this distinguished and peculiar type one specimen has been brought to us by Capt. Hygom from one of his trips across the Atlantic Ocean, but regrettably, we are unable to state from what fish it was taken.

It is 14 mm. long, quite wide and flat. A sharp line across the approximate middle divides it in two halves of which one consists of the cephalothorax shield, the second of the dorsal blades, the genital segment and the tail. The shield is oval and quite flat. The front plates are divided by a slight incision in the middle. The side pieces of the shield are separated from the middle piece and again by curved cross-stripes each divided in three pieces. The foremost of these cross-stripes continue right across the middle piece and in doing so pass a dark double-spot, the pigment-mass *) of the eye. At the rear of the shield — which, similar to the Caligus shield has assimilated the two first abdominal segments — there are as usual two deep, but narrow incisions. The genital segment is considerably narrower than the shield and not very plump. It extends backwards in the shape of two somewhat flat, tapering and at the end rounded extensions that are just as long as the narrow, unjointed tail located

*) How it actually is with the eyes, has not become quite clear to us, but it almost seems as if they have a somewhat similar development and build as in the Saphirini.

between them and which continues into two (slightly converging) nearly cylindrical tail-blades, each ending in a quite long and strong tuft without hair. Under the microscope one will notice a row of fine spikes along the outer edges of the extensions of the genital segment. This row is terminated by a large and peculiar, knife-shaped tool that is blade-like with a thicker, straight edge turned outward and forward and a thin, sharp, serrated and curved edge towards the rear. The genital segment is otherwise almost completely covered — not including those extensions — by two large, flat dorsal-blades, the shapes of which are nearly rectangular. They do, however, taper slightly towards the rear and are at the sides bordered by curved lines. As they diverge a little and reach a little beyond the sides of the genital segment, the body here attains almost the same width as the shield. The antennae and the maxilliped do not present anything extraordinary. The second pair of maxilliped is very large and quite slender, the "palpi" narrow and pointed. Auxiliary hooks and lunulae are missing but there is a fork. The abdominal legs mainly present a similar structure as in the Caligus species; the branches of the third pair of legs are small compared to the size of the animal. One single and two forked, quite short spikes are located at the end of the first pair of legs. The spike at the base of the outer branch of the third pair of legs is short, thick and bent *). The fourth

*) The number of feather-tufts: Second pair of legs outer branch 8, inner 9.
Third pair of legs outer branch 6, inner 5.

pair of legs has a flat, three-jointed end-branch, that besides the ordinary five tufts which here, however, are quite short, wide and blunt, also is armed with a close row of blunt small spikes of only half the size.

Even though the egg-strings are missing, we take it for granted that specimen in evidence is a female.

III. SYNESTIUS Stp. & Ltk (♀)

Synestius nob. differs (female) from the Caligi. Their identical characteristics with the Caligi are the same mentioned above in the description of the Gloiopotes; they have at the rear of the genital segment four subclavian extensions, as long as the elongated tail.

Typical species: *S. caliginus* nob.

Habitat: In the gills of the *Stromateus paru* (Bl.) Fish Index.

9. Synestius caliginus Stp. & Ltk (♀)

Table VI - Ill. 11

We have found some specimens of this type, all females, on the gills of a Stromateus paru (Bl.) at one time submitted from Dr. König in Trankebar.

The total length of the animal is only $4\frac{1}{2}$ mm. The shield is almost circular, strongly arched and shows the ordinary H-shape. The front plates are equipped with lunulae. The genital segment is thick, in circumference

somewhat larger than the shield and emits at the rear four somewhat club-shaped extensions, two long and two shorter. The tail originates between the two longer, and in regards to length and shape, it corresponds quite well to them, but is flatter and narrower at the base. The hindmost part of it seems to be isolated as a separate small joint. The tail-blades each carry 4 feather-tufts of different length but all quite short. Auxiliary hooks and fork are present. The antennae, maxilliped and legs *) are shaped as in the Caligus-family. The spike located at the base of the outer branch of the third pair of legs is strong and curved. The end branch of the fourth pair of legs is three-jointed and equipped with five slightly curved not very long tufts of even length. About one third of the egg-strings extend past the end of the tail.

*) The number of feather-tufts in:

Synestius caliginus

Second pair of legs outer
br. 5 - 1, inner br. 7-2-1

Third pair of legs outer
br. 4-1, inner br. 6-1.

Parapetalus orientalis

6-1-1 and 4-1-1

3-1 and 6-1

IV. PARAPETALUS Stp. & Ltk (♀)

Parapetalus nob. differs (females) from the Caligi. Their identical characteristics with the Caligi however, are the same mentioned above in the description of the previous genera, with genital segment surrounded by a winglike membrane and with a tail provided with two elongated wings turning backward, fairly simulating a half-moon.

Typical species: P. orientalis nob.

Habitat: In the gills of the Menes maculatae,
Fish Index.

10. Parapetalus orientalis Stp. & Ltk (♀)

Table V - Ill. 10.

Some females of this small type, only 3 mm. long, were found on the gills of a Mene maculata, also at some time sent home from the East Indies by Dr. König.

It is just like many Caligus-species equipped with lunulae and furca. The antennae, maxilliped and abdominal legs are quite Caligus-like. The spike located at the outer branch of the third pair of legs is strong and curved. The end branch of the fourth pair of legs is three-jointed and equipped with five almost straight tufts that increase in length from the upper to the lower. The genital segment is circular and equipped with a thin brim, quite wide at the rear. From each side of the front part of the tail a flat brim or wing extends. It is directed

towards the rear and rounded off, wider at the end.

These two wings together form approximately a crescent with wide rounded horns which extend out past the tail itself, which carry two tail-blades, each equipped with four feather-tufts.

V. EURYPHORUS Nordmann (♀♂)

Table VI - Ill. 12

Until a short while ago, only the female of the genus Euryphorus was known. It was briefly described and illustrated — not quite successfully however — in Milne Edwards Histoire des Crustacés (Vol. III, pg. 462, Table 39, Ill. 1). As the specimens in the Paris Museum were from the "Asiatic Oceans" and as the illustrations would give one the impression that E. Nordmanni has a more developed first pair of antennae than the type that Capt. Hygom repeatedly has taken in large quantities from the gill-caves on "Dolphins" (f. inst. on Lampugus punctulatus Cuv. Val.) between the equator and 30° N. Lat. and 24° and 40° W. Long. *), we considered this to be a new species which we named E. nymphe. By getting acquainted with a treatise by professor Kner "About male and female of Euryphorus Nordmanni Edw." (Of the Vienna Academy's "Sitzungsberichte" for 1859). We, later on, have become very uncertain regarding this. In this treatise the author

*) The individual locations are: 30° N. Lat. and 38° W. Long.; 0° Lat. and 24° W. Long.; 13° N. Lat. and 30° W. Long.; 21° N. Lat. and 40° W. Long.

gives information about the genus according to five specimens from Zanzibar and, although there is very much in prof. Kner's description of the characteristics of this type of animal that is different from what we have noticed we do have a feeling that he has been dealing with the same species as we did, and as the Vienna Museum's specimens were from the Indian Ocean, the same as those in the Paris Museum, it seems to us quite probable that it is the same species that has been encountered in both Oceans **). Regrettably, prof. Kner's material has not been large enough to allow him to make any exhaustive studies; he has certainly not been very fortunate, but does not seem to have had the necessary knowledge beforehand either about the most closely related types. His analysis of the build of the different pairs of legs is unfortunate for both sexes. It is, therefore, not at all out of place to submit a new description and illustration of the animal. It will from this be quite evident — without making any further proof necessary — that the genus belong to the Caligini group and not to the Pandarini group. It has its place beside Caligeri and Elytrophora.

**) Regrettably, there are hardly any precedents for judging whether one should reject the reference of a specimen to a species approved in the literature just because one is from the Atlantic Ocean while the other is from the Indian or Pacific Ocean or vice versa. Are the larger pelagic fish types altogether common for these two large sea-basins or do they each have their characteristic species? So far, so little is known about this that one theory at present is as good as the other. We, however, are most inclined towards the latter and are therefore not ready to assume that the same species of parasitic crustaceans occur in both oceans as long as this has not been established by direct comparison. In this particular instance, however, Milne Edwards' expression: "des mers d'Asie", somewhat, is vague and well suited to cause considerable doubt.

The female is 11-12 mm. long. The shield of the cephalothorax is almost circular, slightly dome-shaped; otherwise, of the shape and build common in the Caligini and particularly it has assimilated the first 2 abdominal segments just as in the Caligus-genus. The location of the eyes is not quite clear to us, as different formations are visible on the dorsal side of the shield that could be assumed to be eyes, but most likely they are just two round spots located close together a little in front of the cross-bar in the H ***). The free abdominal segment carries two such dorsal blades, rounded off at the rear. The genital segment is circular, disc-shaped and is similar in size to the shield of the cephalothorax, but owes its size to a ring-shaped skin-brim which, on either side of the base of the tail also forms a small protruding blade. The tail is almost as long as all of the rest of the body, slim, but for the most part of its length equipped with a quite wide, flat ^{sk} sin-brim that, like a down-hanging drape, extends out past the rearmost free part of the tail, but which otherwise may show some individual variation as regards shape and size. The length of the egg-strings may be somewhat longer than the total length of the animal.

The male is only 6-7 mm. long, the shield and dorsal blades do not appear particularly different from those of the female, but the genital segment is narrow and elongated and lack both the brim and the small blades at the rear. The tail is short and wide and may be described

***) In any case, we take it for decided, that what Prof. Kner considers to be the eyes, are not.

as made up by three joints of which the first, just as in the female, has a wide brim, but this is also so short that it takes on a crescent-shape similar to the Parapetalus (♀). — The antennae, proboscis and mouth parts are similar to those of the Caligini: lunulae and hamuli are missing. There is, however, a fork. The "palpi" are wide. The first pair of legs are similar to those of the genus Trebis and has besides the outer, Caligus-like branch an inner, smaller, with three small feather-tufts. Second and third pair of legs have two well developed three-jointed leg-branches with numerous feather-tufts *). On the fourth pair of legs the outer branch is three-jointed and equipped with five spikes and several feather-tufts, the inner is, however, only two jointed, but also equipped with feather-tufts. The connecting middle-piece is as usual most developed in the third pair of legs, less so in the second and is practically missing in the fourth. All these parts are alike in both sexes. Several males still hold the females embraced by the genital segment as they hold the underside against each other and a spermatophore — of the type known for this genus as well as

*) Outer branch of first pair of legs has 4, its inner branch has 3 feather-tufts
 " " " second " " " 6+1+1 Its inner branch 5)+2+1
 " " " third " " " 5+1+1 its inner branch 3)+(1)+1
 " " " fourth " " " 4+1 its inner branch 4)+1
 " " " " " " " 5)+1

for the Caligeri and Elytrophorae **) — is then often placed on each side between the first pair of legs and the second pair of maxilliped.

Euryphorus. Nordm. differs from the genus Caligus, by two small dorsal blades (elytrum) on the third abdominal segment having two two-jointed branches on the first pair of abdominal legs, with branches of the second and third pair of legs being three-jointed, the fourth pair with branches two-jointed and adapted to swimming supplied with feather-tufts, the inner branch is two-jointed the outer is three-jointed.

The female is distinguished by having disk-like genital segment, surrounded by a winglike membrane from which two small blades extend to the rear. The tail is very long. Most of the tail is covered by a very wide winglike membrane.

The male's genital segment is almost rectangular, no wings or blades are visible. The tail is short, and wide. The first segment is equipped with a short, wide wing fairly simulating a half-moon shape.

The species observed by us, dwells in the gill cavities of Lampugi punctulati and perhaps also of another species named Coryphoenidae, in the equatorial waters of the Atlantic Ocean, always adhering to the clavicular wall of the gill cavity.

**) See Milne Edwards l.c.p. 462, Dana l.c.p. 1361, Tab. 94 F, 8h, Gerstäcker, Archiv. für Naturgeschichte XIX, I (1853) p. 60, Tab. III f 13.

VI. DYSGAMUS Stp. & Ltk (♂)

Dysgamus nob. differs (male) from the genus Caligus by having all abdominal legs, two-branched, with two joints each, adapted for swimming, provided with feather-tufts.

Typical species: Dysgamus atlanticus nob.

Habitat: In the equatorial waters of the Atlantic Ocean.

12. Dysgamus atlanticus Stp. & Ltk (♂)

Table IV, Ill. 8

About half a score of specimens of this species have been available. They have been collected at different location between 8° N. Lat. and 28° N. Lat. and between 21° and 36° W. Long. **) probably swimming free in the water. They are all of about the same size, about 3.5 mm. long (not counting the tail-tufts) and 2 mm. wide across the widest part of the shield. The shape is quite plump, thick and somewhat arched. The abdomen and tail little developed in comparison with the shield which has the shape common to the Caligini. The free abdominal segment is oval. The genital segment is poorly developed and is of a rounded off hexagonal, somewhat drawn out shape. The first tail segment is small and short. The second hexagonal, so that the two wide tail-blades, equipped with four long feather-tufts, are attached to the two sides turning outwards and backwards. The frontal plates are large, but without lunulae. The first pair of antennae are equipped with ca.

**) The separate localities are: 8° 44' N. 27° 53' N. and 25° 03' W.; 22° 04' N. and 24° 40' W; 23° 47' N. and 24° 31' W.; 10° 22' N. and 21° 16' W; 20° N. and 36° W.; 28° N. and 21° W.

6 quite long feather-tufts along the upper edge of its base-joint and its short end-joint carry at its end, besides a few short ones, ca. 4 quite respectable feather-tufts. There are no auxiliary hooks. The proboscis is blunt and short as in the Caligus. The second pair of maxilliped has a thick base-joint with a protruding node or so-called "thumb". There is also a fork. The first pair of legs is as in Euryphorus and Trebius. The next three are equipped with two well developed, two-jointed branches equipped with numerous feather-tufts, ***) the outer branch also, as usual with a number of spikes along the edge. In regard to the development of the middle piece on the different pairs of legs, the usual rule, valid for the Caligini and Pandarini has been followed. A rudiment of a fifth pair of legs may be visible at about the middle of the side edge of the genital segment.

Contrary to the previous group, the Pandarini group distinguish ^{by itself} ~~themselves~~ ^{the} ~~their~~ long, pointed proboscis or trunk and by the branches of the first pair of legs being evenly developed — at least in all types

***)

First pair of legs	has on its outer branch	4,	on its inner branch	3	tufts
Second "	"	"	"	6+1	on its inner branch 8+1 "
Third "	"	"	"	5+1	on its inner branch 5+1 "
Fourth "	"	"	"	5+1	on its inner branch 5+1 "

known to us. Any assimilation in the shield by the first two abdominal segment that carry the second and third pair of legs never occurs; these segments are always free, even though they sometimes are fused together. The females always have from 1 to 3 pairs of dorsal blades which extend from the abdominal segments. They may, however, be missing in the male, and this condition can, therefore, not be used as a general identification characteristic for the group. The females may also have smaller dorsal blades extending from the tail section. Through the whole group — but as far as is known only in the females and disregarding the genera Cecrops and Laemargus (Cecropidae Dana) — there is a certain trend towards a transformation of the legs so that they either become completely rudimentary or are transformed into blade-like, soft, tuftless plates which perhaps directly serve the respiratory process. Sometimes, however, this is not the case with any of the leg pairs (as for instance in the female of Nogagus paradoxus), often only with the last (Dinematura-females), but in other types more or less with them all. The genital segment is in most females of quite a considerable size and the egg-strings are often much longer than those of the Caligini. With the exception of the Cecropidi all Pandarini have so far been found on sharks as far as it has ever been written down on what fish they were found and as far as they have not been found swimming free in the water, which probably is the case with several of the male types.

A very regrettable void in the knowledge about this group is the fact one not counting the Cecropidi, ^{that} ✓ knows both sexes of only one single species, namely of the so-called Nogagus paradoxus (Otto). Of all other described types of the species only either the male or the female *) is known, and the fact is that of the genera noted by Milne Edwards in his "Histoire des Crustacés" 3 of them, namely Dinemura, Phyllophorus and Pandarus include only females (to these however are later added the genera Gangliopus and Lepiclopus), while Nogagus and Specilligus Dana include only male (with the exception of N. paradoxus which only hypothetically is referred to this genus). We are sorry we are not able to fill this gap, but we could, however, not omit to further and discuss the question: Could the types gathered together in the Nogagus genus possibly be the males of the female types referred to in the above-mentioned 5 genera? One will find that all the so-called Nogagi — with the exception of course of N. paradoxus (♀) — are regularly developed types with four well developed pairs of swimming legs, whereas the female types have this particular characteristics in the development of dorsal blades, in a strong and abnormal development of the genital segment and in the more or less complete transformation of the legs. And, if one maintains that a similar, although not always so marked a difference is generally present in the number of types of parasitic copepodae, so that

*) We will in the following explain the occasions where the opposite has been stated and show that it could hardly survive a criticism.

the females are less mobile and more stationary and the males more lively and free moving, there does not seem, from this point of view to be any objections to regarding the Nogagus species as the males, not only of the animals that are like the N. paradoxus (♀), but also to the females of the Dinematura, Pandarus and the other genera mentioned above. We should, however, not deny that there otherwise still usually is a habitual similarity between male and female, as for instance in Euryphorus, Cecrops, Laemargus, Lernanthropus, — a similarity that perhaps mostly is based on a certain conformity in the development of the exterior skeleton, and which here in most cases is lacking. When one, for instance, repeatedly has observed Pandarus Cranchii (♀) together with Nogagus Latreillii (♂) and still is unable to point out other, more corresponding sex-types to these supposed species, it is easy to see the same species in them both, however different they otherwise may be. But even though this is not the only instance where the conformity in the occurrence of the respective types would seem to indicate their specific identity, one must however at the present stage refer this point to further study. One must still classify all male types as species of Nogagus and the female types as species of Dinematura, Pandarus etc., until a direct observation may give a definite answer to the question.

VII. About *Caligus productus* O. Fr. Müller
and the genus *Dinematura* Latreille.

O. Fr. Müller did in his work "Entomostraca seu Insecta testacea, quae etc.," (1785) as may be known, describe 2 species of parasitic copepodae, the "short" and the "long fish-louse", *Caligus curtus* and *C. productus*. This latter, which later became typus for the one by Latreille *) established, genus *Dinemura* (or *Dinematura*, to which Burmeister, probably correctly has changed it), has regrettably never later been recognized by any zoologist, and in this way an uncertainty and confusion has developed, which threatens to be so involved and persistent that we must consider it our duty to give our contribution to the solution of the problem, as circumstances have enabled us, as we think, to acknowledge Müller's species and explain its synonymy.

Dinematura producta has been already described and illustrated no less than five times. The first time in 1780 by Herbst in "Schriften der Berlinischen Gesellschaft naturforschender Freunde" ("Publications of the Berlin Society of naturalist Friends") First Volume: in a treatise "Beschreibung einer sehr sonderbaren Seelaus vom Hemorffische" pg. 56-57 ("Description of a very strange sea-louse from porbeagle"). The copper-plate (Table III)

*) In the 2nd edition of Cuviers "Règne animal" t.4 p.197. Regarding the history of this genus, we otherwise refer to Burmeisters (where stated below) and Kröyers (Journal of Natural History, Vol. 2, pg. 45 and following) remarks about it.

detailed

gives one, considering the time, not bad and quite descriptive of the animal. Herbst got his specimens from pastor Chemnitz here in Copenhagen and he, in turn, got them from the Faroe islands with the information that they had been located on the tail of a specimen of "the fish hemor, three ells long and thick as a bag", which is described as "a very large predatory fish with very sharp teeth that is very seldom caught because it bites off the lines". The "Haemor" from the Faroes is evidently the well known nordic "Haamaer" (Haabrann), by which designation several shark-species are known, but which, however, according to what judge Müller in Thorshavn has told us, is not used for Havkalen (Haaskjaerdingen) (The Greenland Shark), but for a smaller shark-species which he is certain he recognizes as our Sildehai (Herring-shark), *Lamna cornubica* (Porbeagle). The zoological museum of the University has now actually received several specimens (females) of this fish-louse just from the Faroe islands and the sender of these, judge Müller has, on a later request, declared definitely that he is convinced that they have been taken just from the so-called "Haemar" or "Haamaer" and not from the "Havkal" (Greenland Shark). The physiological museum of the University further is in possession of a nice group of *Dinematura producta* sitting close together on a piece of skin from a shark. This is given on the label as being from *Seymnus glacialis*, that is, from Havkalen or Haaskjardingen (the Greenland Shark), but the shape of the scales shows that this is not correct. When a *Lamna cornubica*, a short time ago, was caught in Oresund (Strait

between Denmark and Sweden, leading from Cathegat into the Baltic) and exhibited here in the city and bought by the zoological museum of the University, we had occasion to convince ourselves that the piece of shark-skin in question actually belonged to just this species and also from which part of the body it had been taken. The fish carried numerous marks after fish-lice, but at the time it was exhibited here in the city there remained only one specimen and this was just a *Dinematura producta* *). From this species we have also finally had the opportunity to study a piece that curator Malm has taken from a *Lamna cornubica* himself.

O.F. Müller does not state from where he obtained his specimen, but his book is only 5 years younger than Herbst treatise, it seems quite probable to us that they come from the same shipment from the Faroe islands. Müller's illustrations and the whole of his descriptions are less satisfactory than those by Herbst, he only states that the species first was discovered on a shark, "from this, the name *Femorlans*", and later on the salmon. This last, incorrect statement comes from Müller referring also *Binoculus salmoneus* Fabr. (*Caligus salmonis* Kr.) to his *Caligus productus* on account of Fabricius expression: *cauda tetraptera*.

Under the name of *Pandarus Lamnae* we meet it again in a number of descriptions of British animals (Illustrations in British Zoology), that Johnston published in 1835 in the London "Magazine of natural history (Vol. VIII pg. 203).

*) We owe it to Councillor of Justice Mr. Olrik, who had occasion to examine the fish before any of us, that the Museum got possession of this specimen.

Johnston's specimens were taken from a "Beaumaris Shark" ("Lamna monensis"*), in Berwich Bay. Baird has, under the name of *Dinemoura lamnae* recorded it in his "Natural history of the British Entomostraca" (Ray Society 1850) pg. 286, Tab. 33 f 6-7. He has acknowledged that it was Herbst "Sea-louse from the Hemor fish, but strange enough, without this leading him to acknowledge that it was Müllers Caligus productus he had before him. Baird does not report any other discoveries of this parasitic crustacean than those by Johnstone and it does not appear as if he had the opportunity to examine the specimens of this author; he seems only to have ladled from Johnston's descriptions and limited himself to give an improved copy of his wood-cut print.

And finally, van Beneden in 1857, in a treatise "sur un nouveau Dinemoure provenant du *Scymnus glacialis*" in "Bulletin de l'Académie Royale de Belgique 1857" pg. 226 c Tab., has described and illustrated the same animal under a different designation, namely *Dinemoura elongata*. In case one should be inclined to believe that he was dealing with another species, it will be of importance to learn that van Beneden had obtained his specimens from Councillor of State Eschricht and that they were taken from the piece of skin from the Faeroe islands mentioned

*) English as well as Scandinavian ichthyologists presume that *Lamna monensis* and *cornubica* are not different species, and there is hardly any valid reason to maintain the opposite idea.

above. The incorrect statement in the headline of the article may be caused by the wrong labeling of this piece of skin as being from *Scymnus glaicalis* **).

What may, to some extent, count as an excuse for van Beneden when he believed to have discovered a new species in the animals submitted to him by Counsellor of State Eschricht, is a previous mistake by dr. Gerstächer who in a treatise: "Ueber eine neue und eine weniger gekannte Siphonostomen-Gattung" in "Archiv für Naturgeschichte

**) It is hardly worth-while to engage in any criticism of Herbst and Müller's presentations of this animal, but as they both agree on the division of the underside of the shield by cross-lines into three sections and picture a button or node in front of the base of the proboscis close to the edge of the shield, we must, however, expressly point out that we have not found any such things. They have both described the underside surface of the tail incompletely and Müllers description of the swimming-legs (swimmerets) is even more confusing than Herbst's. We find Kröyers theory (Naturh. Tidsskr. (Journal of Natural history) Vo. 2, pg. 47 in the footnote) that Müller has had a dried specimen from an Insect collection in Copenhagen before him, very plausible; but we can not quite understand how Kröyer has arrived at the conclusion, "that it is because Müller has misunderstood Fabricius that he classes this animal as belonging to the nordic fauna", as Herbst's specimen expressly was stated as coming from the Faeroes.

We will not dwell with Johnstons description either as we have no doubts about the identity of the type in question, although certain points (mainly concerning the construction of the shield and the body segments assimilated in its rearmost incision is inaccurate. In many respects van Benedens description is incomplete and its superficialness is immediately evident when he relates that *Caligus productus* serve as typus for Rafinesques genus *Dinemurus*, which, as known, has nothing to do with Latreille's. Most incomplete is his description of the shield and the free abdominal segments. His illustration does not give one the vaguest idea about their actual condition. The lowest of the three tail cover-blades is not mentioned in the description, although it shows in the illustration. The presentation of side-wings of tail-joints is very unclear and "that the genital segment ("abdomen") is not particularly sharply separated from the segment carrying the dorsal blades" is a very incorrect statement.

XIX Jahrg." p. 63, Tab. 4, " ("About a new and less known Siphonostome-genus" in "Archive for Natural History 19th year) described and illustrated under the name of Nogagus productus — namely because he, in this, believed to recognize Müllers Caligus productus — the species and probably also the identical specimens of this, which at one time had supplied material for the establishment of Ottos Caligus heptapus *), later by the same author rechristened Caligus paradoxus **) and of Nordmanns Binoculus sexcetaceus ***). Trapped in this error dr. Gerstäcker therefore thinks he can reproach Milne Edwards that he has referred Caligus productus to the genus Dinematura, "with which it has only a remote likeness". Mr. Gerstäcker has not been very fortunate here. His Nogagus productus is not the Müller Caligus productus and must then maintain the name Nogagus †) paradoxus (Otto),

*) Description of animals that have not yet been written about part. I (1821) pg. 15. (Quoted after Burmeister l.c.) (from Latin).

**) Description of some new crustaceans discovered in the Mediteranean in 1818 and 1819 (from German). Nova Acta Acad. Caes. Leop. Carol. Nat. Cur. Vol XIV, pg. 352, Table XXII, Ill. 5 - 6.

***) Micrographic contributions to the natural history of invertebrate animals, second installment (1832) pg. 32 (from German).

†) To this we must remark that the typus for the genus Nogagus is N. Latreillii, of which only the male is known, and as long as the female form is unknown, one cannot be certain that C. paradoxus can be placed in the same genus as this, it is even probable. Even if the genus-name Nogagus became vacant by all species, as male-types were distributed over all the other genera established for the females, it would be incorrect to transfer it to Caligus paradoxus Otto (♂ ♀). The most correct would be to establish a new genus for this type.

if one would not go back to the species-name under which it was originally classed and although the author in several places expresses himself with very great certainty about the identity of the types in question, Müller's description of the last pair of legs ought to have convinced him about the opposite. Another case is that Caligus productus Müll. cannot very well remain in the genus with the Edwardian Dinemura (Echthrogaleus nob.) but more about that later. But as Latreille, who has established the genus Dinemura, has based it just on Caligus productus, it is not reasonable to blame Milne Edwards for giving this species a place within the genus. And to the same extent has prof. Kröyer been correct in referring the new species discovered by him (D. ferox) to the genus Dinemura — which has also been stated by Gerstäcker — as D. ferox Kr. just is the only ^{one} of the other so-far described so-called Dinemura, which actually comes so close to the typical species (D. producta) of the genus that one may say there is a true genus-fellowship between them.

Might this condition vary in the females or might prof.

Kroyer's observation in regard to this point perhaps pertain to a male without the author being aware of the difference in sex??

The young dichelestium, depicted by prof. Kroyer in second volume of Naturhistorisk Tidsskrift, table III fig. 8a, is probably a young male. Especially the shape of the third (last) pair of hindlegs seems to indicate this with their width, characteristic for the male. With this assumption, however, prof. Kroyer's interpretation of the indentations and segments of the young dichelestium in question does not appear quite successful when compared with a young male of approx. 4 $\frac{1}{2}$ cm length (incl. the forward stretching second pair of hooks). Undoubtedly d and e on fig. 8a represent the reproductive segment so that f and g together would be the tail on the fully grown animal. The same impression is given when observing the tail and reproductive organ of the available males. The grown male, first described and depicted by Rathke a couple of years afterwards (Noca Acta A. C. M. N. C. t. XIX p. 127 etc., tab. XVII f. 1), was unknown to Kroyer in 1838. It was, therefore, natural for Kroyer to define the young animal on the basis of the female - known to him who has one additional hindbody segment (a fourth) which in the middle is more or less obviously indented.