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I take this opportunity to offer my best thanks to the above mentioned institutions for their having trusted me with these collections of Penaeids; collections which although limited in number, can well be described as unique as they cover the tropical and subtropical regions of all the oceans and include animals which up to the present time are only little known. Especially the larval forms are practically unknown except for *Solenocera membranacea* described by Mme Heldt and in few papers from the previous century.

It is my pleasant duty to render a special thank to my friend and colleague Dr. Erik M. Poulsen for many valuable discussions and support in different ways with this paper.

In presenting this work it is my privilege to thank all those persons and institutions who by different means have rendered me valuable help in connection with this paper:

Dr. Erik Bertelsen, "Dana" Collections and Danmarks Fiskeri- og Havundersøgelser, Charlottenlund.
The British Museum, Nat. Hist. London.
The Carlsberg Foundation, Copenhagen.
Danmarks Fiskeri- og Havundersøgelser, Charlottenlund, Denmark.
Miss Angela Edwards, British Museum Nat. Hist., London.
Dr. Isabella Gordon, British Museum Nat. Hist., London.
Mr. Vagn Hansen, Danmarks Fiskeri- og Havundersøgelser, Charlottenlund.
Mme J. Heldt, Station Oceanographique de Salambo, Tunis.
Mr. R. W. Ingle, British Museum, Nat. Hist., London.
Mr. E. Leenders, Danmarks Fiskeri- og Havundersøgelser, Charlottenlund.
Dr. Henning Lemche, Zoological Museum, University of Copenhagen.
The Library, University of Copenhagen.
Dr. D. Merriman, Bingham Oceanogra. Lab., Yale University, Conn. U.S.A.
Miss Else Poulsen, Copenhagen.
Dr. Erik M. Poulsen, Danmarks Fiskeri- og Havundersøgelser, Charlottenlund.
Dr. A. Racek, University of Sydney, Australia.
The Dr. Johs. Schmidt's Foundation for Oceanographers.
Dr. Torben Wolff, Zoological Museum, University of Copenhagen.
Zoological Museum, University of Copenhagen.

The area investigated and from which the samples for this paper are collected ranges from 50° North to 40° South, the most northern point being south of Ireland to which position larvae of *Solenocera membranacea* have been carried with the Gulf-Stream. The most southern point is the Cape waters of South Africa. But as the Penaeidae is a mainly tropical family most of the catches are from the true tropical areas within the two tropic circles of the Cancer and the Capricorn.

For the pelagic fishery wire-length paid out is given in the list, as far as it has been recorded, stated as m.W. The capital letter before the m.W. indicates gear used; for detailed information see the above-cited papers. The following are the abbreviations for types of gear most commonly used:

E. 300 — open ringtrawl, 300 m in diameter, meshes 24–18–12 mm, mouth to end.
S. 200 — open stramin-net, 200 cm in diameter, about 400–500 strands per one m.
P. 100 — open combined stramin and silk net, 100 cm in diameter, stramin 450 strands per one m, silk 23 strands in 10 mm.

The nets are fished horizontally; the actual fishing depth for wire lengths less than 1000 m is approximately one third of the wire-length paid out, for larger lengths of wire ca. one half of the wire-length.

The material has been preserved in alcohol, most of it for a period of 20–100 years; therefore, no information as to colour of the specimens is given. However, the black and brown pigments—or in cases red pigment turned black during the period of conservation—seem to be well preserved, and notes of such pigment are given. The only species here described, which the author has seen alive is the larvae of *Solenocera membranacea.* These are hyaline, but with very strong, red pigment and a little yellow on the thorax, and especially the tissue of the whole intestine is heavily imbedded with red chromatophores with the result that the intestine shows as a distinct, dark-red string through the whole abdomen.

The figures accompanying the descriptions of the species are all drawn by means of a camera lucida with a scale for measurements drawn together with the figure and placed beneath it, or close to a group of figures all drawn at the same time and with the same magnification.

For the larvae here described for the first time a special nomenclature has been used with "species larva" in between the generic and the specific names, like: *Solenocera* sp. larva *sumatransis.* This is done for not claiming priority with the larval name, when later the adult is known, and is described for the first time, or the larva will be referred to an already known species. The other possibility, only to give the different larvae a number or a letter, is not advisable and can easily cause confusion when the number of newly described larvae are as high as in this paper.

Further the second larva described in this paper has been named *Solenocera membranacea* subspecies *capensis,* because judging from the larva alone, it is a separate species in close relation to *S. membranacea,* but as it only is a larva, and some of the characters to distinguish it are distinctly larval characters, which will change in the adult, I feel with the present knowledge more justified only to make it a subspecies.

GENERAL PART

RATE OF GROWTH

In most groups of invertebrates and in fish growth in weight and in size is continuous throughout life. For the adult it is generally accepted that the rate of growth is decreasing with age and that in very old specimens the growth has nearly ceased, or is extremely slow. In Arthropods of course the growth is discontinuous. It occurs chiefly, but not entirely at intervals corresponding to sheddings of the external chitinous cuticle which in Crustacea occur at intervals till the end of life. But growth does also take place in a smaller scale between the moults in larval forms with a thin cuticle where often at the end of an instar or after one or more very good meals the skin between the segments becomes expanded, adding a small percentage to the total length of the animal.

The especially large growth from instar to instar during the larval life was used by BROOKS (1886) in his "Challenger" Report on the Stomatopods to find out whether his material provided an unbroken series of larval stages or whether some of the intermediate stages were missing. He writes "... the measurements usually enabled me to decide with confidence whether a given larva does or does not belong to a certain series. In a few cases these comparative measurements gave proofs of specific identity which could hardly be made more conclusive by rearing the larvae". In series which he attributed to *Coronis* he found the rate of growth to be constant with an increase from stage to stage of five fourths, or a growth factor of 1.25. From this he further could conclude that "the series (in the material at hand) is consecutive, with the exception of one missing stage before the last".

This numerical relation was termed "BROOKS' law" by FOWLER (1909, p. 224) in his work on the Biscayan Ostracods. He further modified it to read: "During early growth each stage increases at each moult by a fixed percentage of its length which is approximately constant for the species and sex". FOWLER called this percentage the "growth factor". SEYMOUR-SEWELL (1912) with a reference to FOWLER's paper gave growth-factors for several marine Copepodes, and so did SKOGSBERG (1920) and POULSEN (1962) for some species of Ostracods.

RAMMER (1928) studying Cladocera and GURNEY (1929, 1931, 1942) studying mainly fresh-water Copepoda, were impressed by the fluctuations in the intensity of the growth-factor, the differences shown by different individuals, the occurrence in older specimens, especially Cladocera, of moults without change in form and without growth. RAMMER arrived at the conclusion that BROOKS' law of growth has no value for the Cladocera he had examined; the law could therefore not be upheld, and GURNEY concluded, that fresh-water Copepoda showed such great irregularity in the growth-factor that very little reliance could be placed upon it, but in marine Copepoda as well as Decapoda there is a marked tendency for the growth-factor to be about 1.25, but there is much irregularity and the factor tends to decrease with age.

If we after this consider the present material with a series of stages or several different stages, the following will be seen (for *Cerataspis* only the length of the carapace has been given because of the diminutive size of the abdomen placed in a bent position underneath the thorax; all measurements are taken from the basis of rostrum to the cleft in telson):

Solenocera membranacea.

	carapace	growth-factor	total length	growth-factor
III Protozoea	1.3 mm		4 mm	
I Mysis	2.1 —	1.62	5 —	1.25
II —	3.2 —	1.50	5.8 —	1.16

Solenocera sp. larva *danae.*

	carapace	growth-factor	total length	growth-factor
III Protozoea	2 mm		6 mm	
I Mysis	3 —	1.50	12.5 —	2.08
II —	6 —	2.00	22 —	1.76
III —	10 —	1.67	30 —	1.36

Solenocera sp. larva *sumatransis.*

	carapace	growth-factor	total length	growth-factor
I Mysis	2 mm		7 mm	
II —	3 —	1.50	10 —	1.43
III —	5 —	1.67	16.5 —	1.65
IV —	5.5 —	1.10	18.5 —	1.12

Cerataspis longiremis.

	carapace	growth-factor
I Mysis	1.6 mm	
II —	3.2 —	2.00
III —	7.0 —	2.19
IV —	10.0 —	1.43

Cerataspis petiti.

	carapace	growth-factor
I Mysis	4 mm	
II —	4.5 —	1.12
III —	7 —	1.9 (damaged)
IV —	10.5 —	1.50
V —	12.0 —	1.14

Cerataspis monstrosa.

	carapace	growth-factor
II Mysis	5 mm	
V —	11.5 —	1.32 as average growth-factor pr. stage.

This shows for *Solenocera,* when the carapace is measured, first an increase in the growth-factor and then a decrease. The early increase is explained by the fact that the carapace in the younger stages does not nearly cover the thorax and therefore in the following stages grows proportionally much more than the rest of the body. But coming to the second or the third mysis the carapace covers the whole thorax and therefore, from now on, the growth rate measured on the carapace decreases. Measuring the total length there is a decrease through the stages in *S. membranacea* and in *S.* sp. larva *danae,* but *S.* sp. larva *sumatransis* shows first an increase and then a decrease. It must here be remembered that the material at hand is very small in numbers and therefore not absolutely reliable.

When considering the three *Cerataspis* where only the carapace has been measured we observe first an increase and then a decrease as is also the case for the carapace of *Solenocera.*

A larger material including more stages was dealt with in an earlier investigation of *Meganyctiphanes norvegicus* (HEEGAARD, 1948) with results as follows:

Meganyctiphanes norvegicus (after Heegaard, 1948).

		total length	growth-factor	remarks
I	Nauplius	0.45		no mouth opening
II	—	0.40	−0.125	
I	Metanauplius	0.42	1.025	
I	Calytopis	0.85	2.025	strong elongation of abdomen
II	—	1.57	1.85	
III	—	2.13	1.36	
I	Furcilia	2.69	1.26	
II	—	3.26	1.21	
III	—	4.16	1.28	
IV	—	5.42	1.30	

including 98 larvae + nauplii

Further investigations made by Birger Rasmussen (1953) on *Pandalus borealis* along the Norwegian coast show that the growth-factor fluctuates from year to year, as an example is referred to his investigations from the "Torungen Ground" in the years 1942–1946 (pp. 54–55). The growth-factor is larger in 1945 than in 1946, and as a general result of the investigations he concludes in his summary (p. 153): "The growth and maturing change, not only from one locality to another, but also from brood to brood born in different years in one and the same locality". In this connection can be mentioned that the change of sex from male to female in this shrimp takes place at an age of 5 years at Spitzbergen but already in the second year in Skagerrak.

In the paper from which the above growth diagram of *Meganyctiphanes* has been taken (Heegaard, 1948) it is also shown that for the same species taken at the same locality and at the same time there is variation within the stages. We are not able to give a definite description of a certain instar. In Fig. 7 of that paper is shown that if the course of the development of the pereiopods is defined to include nine consecutive groups, we find that Furcilia I is placed in groups 1–3, Furcilia II in groups 2–6, Furcilia III in groups 5–8 and Furcilia IV in groups 7–9. This shows not only a wide spreading in the course of development, but also a considerable overlapping between an instar and the stages preceding as well as following it. This explains the different opinions in the literature of the numbers of instars in certain species and shows, what so often has been overlooked in investigations that an instar of a species can not be described without stating reasonable limits for variation in numbers of setae or even sometimes of joints. Therefore it needs more experience and knowledge in larval development to decide to which instar a certain larva belongs than to determine an adult to a certain species. It also points to the fact that an ecdysis does not only take place when a larva has reached a certain definite stage of development. Time and temperature are also important factors in causing a greater or lesser success for the larva in catching food, thus influencing the degree of development it will reach before moulting.

A further consideration of the growth-factor for *Meganyctiphanes* in the diagram above shows that the factor is negative between the first and second Nauplius, simply due to the fact that the stomodeum and the proctodeum have not broken through in the first Nauplius. Therefore the larva can in this stage only use its own yolk for metabolism as well as for producing new organs. This shrinking is also observed for insects during pupal life, and it is in both cases natural that it must be so. From Metanauplius to Calytopis we found the largest growth-factor, viz. 2,025. This is easy to explain by the fact that the abdomen is more elongate, in fact only a thin string, in the first Calytopis, whereas it is short and more massive in the Metanauplius. The same factor of body change has Poulsen (1962, p. 128) also pointed to when he writes: "Brooks' law is only valid when growth alone is concerned, and not when growth is combined with a change in form". Finally in the later Furcilia stage the growth-factor again has increased a little because the larva now has acquired fully developed mouth appendages and therefore can start to attack bigger prey. A similar increase can be observed when a larva changes from feeding on detritus to being carnivorous, or has grown to a size where it can successfully attack animals which are abundant on the locality, but which up to then have been too big or too fast-swimming for the larva to attack or catch.