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PENEIDES AND STENOPIDES

BY

OSCAR SUND

WITH 2 PLATES, 49 FIGURES IN THE TEXT, AND CHARTS

REPRINTED FROM

REPORT OF THE SCIENTIFIC RESULTS OF THE "MICHAEL SARS" NORTH ATLANT. DEEP SEA EXPED. 1910

CARRIED OUT UNDER THE AUSPICES OF THE NORWEGIAN GOVERNMENT AND THE SUPERINTENDENCE OF

SIR JOHN MURRAY, K. C. B. and DR. JOHAN HJORT

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PENEIDES AND STENOPIDES

FROM THE

HAEL SARS' NORTH ATLANTIC DEEP-SEA EXPEDITION 1910

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OSCAR SUND

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Introduction.

This paper, dealing with the Penæids and Stenopids, forms the first part of the memoir upon the decapod Crustaceans taken during the "Michael Sars" North Atlantic Deep-Sea Expedition in 1910. Subsequent papers will treat of the other prawns and of the Reptantia in a similar manner, and will contain a general account of the decapod fauna of the Atlantic from the geographical and biological points of view, based upon the material collected by the Expedition.

The technical terms used are those generally employed in modern works. In stating the size of a specimen I have made a departure from the usage hitherto common, giving the lateral length of the carapace (measured from the ocular sinus to the hinder edge of the carapace) where not otherwise stated. I have introduced this innovation because the total length is often very difficult to determine accurately and, when the rostrum is included, this measurement may give a false idea regarding the dimensions of the animal, as the relative length of the rostrum differs exceedingly, not only in the different species of decapoda, but also in different individuals of the same species.

For most species tables are inserted indicating (1) the dimensions, i. e. length of carapace, (2) the bathymetrical distribution, and (3) the number of specimens taken. The depths are estimated as equal to half the length of wire paid out (m. w.), and in the opinion of Mr. Thor Iversen, the captain of the "Michael Sars" during the Expedition, this estimate is generally not far from the truth.¹⁾ But even if one knew the actual depth at which the appli-

ances were towed, it must be borne in mind that an animal may occasionally be caught while hauling in. The influence of this source of error is however considerably lessened in the case of species taken in great numbers, as the number of specimens caught during the short time required to haul will always be small compared with the number taken during the long time devoted to towing horizontally. The following abbreviations are made use of:—

- mxp.³ = third maxilliped
trl³ = " pereiopod (trunkleg) } after HANSEN 1896.
1 sn. = silknet, 1 metre in diameter.
y. = young-fish trawl (with an opening of four square metres).
3 ln. = large net, 3 metres diameter.
m. w. = metres of wire paid out.

In the tables indicating the catches, each specimen is represented by a figure denoting its size, following the sign for sex., e. g. ♂ 5 = a male with carapace 5 millimetres long; ♀ 6.7 ♂ 5.7 = two females and two males, the length of carapace being respectively 6 and 7, and 5 and 7 mm. The sign ⊙ is used to indicate immature specimens, the sex of which could not be determined.

I take the opportunity of offering my thanks to Dr. HJORT for placing in my hands for examination the rich collections from the Expedition he so successfully carried through.

The printing of this paper, which was ready in manuscript in 1915, has been delayed by the fire in Jan. 1916 and by war-time difficulties. Literature appeared since 1915 has consequently not been considered.

Bergen, Jan. 1920.

¹⁾ Subsequent scrutiny of the records has, however, shown that the depth attained may go up to two thirds of the length of wire paid out. The steepness of the wire is apparently greater when a great length is out, on account of the lesser speed caused by the greater resistance from the great number of nets which were attached to the single wire. See also J. GRIEG: Brachiopoda etc. (in the present volume), p. 5.

PENEIDES.

Sergestidæ.

This family contains the genera *Sergestes*, *Leucifer*, *Stomatocaris* and *Petalidium*, of which the two last-named are represented in the "Michael Sars" collections.

For information regarding the species not treated of in this paper, readers are, above all, referred to Hansen's (1896 and 1903).

Leucifer Reynaudii, H. Milne Edwards.

This tiny transparent animal, which looks so little like a shrimp, seems to belong exclusively to the surface of the sea. It was taken in the S. E. portion of the Atlantic.

We have not had access to Milne Edwards' original description; but have determined the specimens by means of Hansen's drawings and description in the "Challenger"

Table of catches.

St.	Gear	m. w.	Number	Sex
29	1 sn	0	1	1 ♂
45	1 sn	200	1	1 ♂
.	1 sn	100	9	4 ♀ 5 ♂
46	1 sn	0	2	1 ♀ 1 ♂
47	1/2 sn	40	13	8 ♀ 5 ♂
48	1/2 sn	7800	1	1 ♂
49	y	370	1	1 ♀
51	1 sn	0	113	43 ♀ 70 ♂
52	1 sn	0	43	22 ♀ 21 ♂
8	9		184	105 ♂ 79 ♀

Sergestes.

For the synonymy of this genus I refer to HANSEN (1896).

Ever since the first *Sergestes* was captured the genus has been a source of difficulty, and even now, I believe, there is still much to be added to our knowledge of it, especially concerning the rôle which *Sergestes* plays as a component of the oceanic plankton. Two circumstances have obscured our knowledge regarding *Sergestes* (and this applies also to many other oceanic animals): (1) the adults live generally at some distance from the surface and are consequently more difficult to capture than the small larvæ, usually found in the upper-waterlayers; (2) the adults seem to be powerful

swimmers and hence were not so easily captured before the introduction of steamships in marine investigations allowed of the deep-sea appliances being towed at a greater speed than was formerly practicable.

During the "Michael Sars" Expedition in 1910 the Atlantic watermasses were investigated by means of effective tow-nets, etc., and the captures of presumably swiftly swimming animals like fish and prawns were considerable, not to be compared to anything brought home by former expeditions. Our knowledge of the genus *Sergestes* has been much extended by an examination of the rich material collected.

Firstly I should like to point out that *Sergestes* and some other prawns (Hoplophoridae and Pasiphaidae) form an essential part of the oceanic mesoplankton, and probably play an important rôle as food for fishes, whales and other large aquatic animals.

Not only are the "Michael Sars" plankton samples rich in quantity, but they also contain many new forms, and have led to a better understanding of the relationship of the forms previously described. Thus of *Sergestes* four new-species are described in this paper, viz: *S. grandis*, *S. splendens*, *S. tropicus* and *S. pectinatus* and the adults of two species formerly known only as larvæ were found in great numbers in the Atlantic, viz.: *S. armatus*, *Kr.* and *S. corniculum*, *Kr.*

Since Hansen's two important papers on *Sergestes* were published (1896 and 1903) our knowledge of the genus cannot be said to have been greatly extended. Explorations in the Mediterranean have proved the existence in that sea of a good number of the Atlantic forms (Pesta 1913, u, f).

The following key is in its main features similar to that given by Hansen in 1896, though synonyms and names applying only to larvæ are not included, while some slight alterations are introduced. *S. corniculum* *Kr.* is transferred to group B II, as made necessary by a study of the adult. The same is done with *S. rubroguttatus* Wood Mason which undoubtedly is nearly related to it.

A number of species not captured by the expedition, and of which our knowledge is rather incomplete, are not included, e. g. *S. hamifer* Wood Mason, etc.

The species taken by the "Michael Sars" are printed in heavy type and the letters after each name denote the main facts about their distribution, *A* signifying the Atlantic Ocean, *P* the Pacific, *I* the Indian and *N* the Norwegian Sea, *M* the Mediterranean.

Sergestes tenuiremis Krøyer.

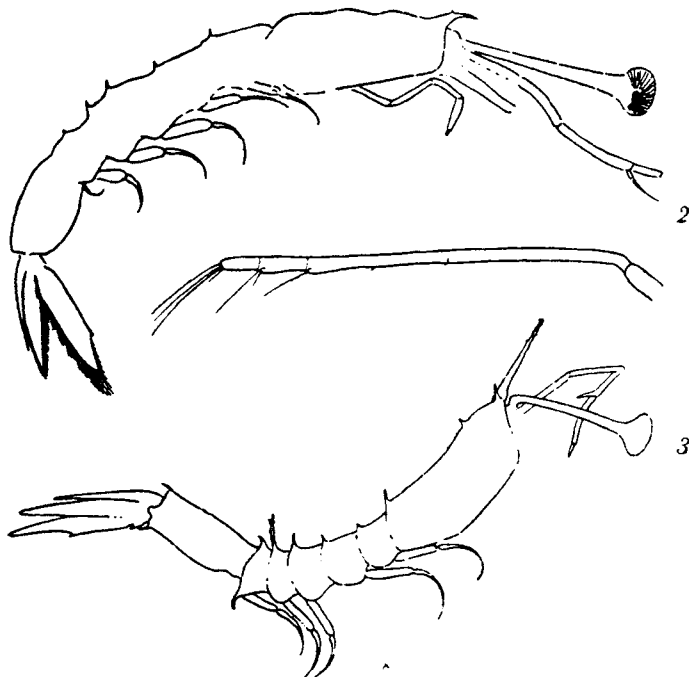
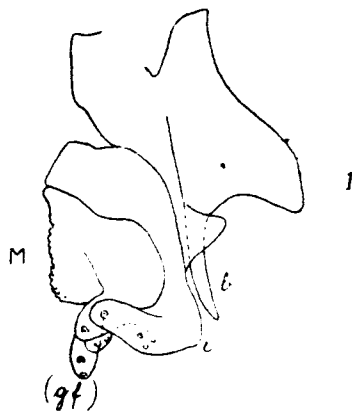
- S. longicollus* BATE 1888.
- S. junceus* BATE 1888.
- S. tenuiremis* HANSEN 1896.

Only a single young specimen was taken during the expedition, C=7 (total length about 17 mm.), at st. 64. sn, 100 m.w. The eyes are not black, and the sex cannot be determined.

According to HANSEN (1896) *S. tenuiremis* is known from all three oceans, though only from their warmer seas, the most northerly record being lat. 32° 16' in the Atlantic. St. 64 lies in lat. 34° 44' N.

Sergestes cornutus Krøyer.

- S. cornutus* KRÖYER 1855.
- S. longispinus* BATE 1888.
- S. cornutus* HANSEN 1896.



Figs. 1—3. *Sergestes cornutus*. 1) ♂ 5, st. 45, y 2000. Petasma, (50/1). 2) ♂ 2.5, st. 64, y 300, (10/1). 3) ♂ 1.7, st. 49, y 300, (10/1).

A few specimens of this species were taken in the southern part of the area explored by the "Michael Sars". Previously it was known from the central Atlantic as far north as the latitude of Florida, and, according to ORTMANN (1893), from the central Pacific.

Fig. 1 is a drawing of the petasma. The specimen is possibly not fully developed, as it is difficult to form an idea about the homology of the part compared with the structure found in other species. The process marked *b* certainly corresponds to *b* in the petasma of *S. robustus*.

HANSEN, in his description of the mastigopus states that the fourth segment of the abdomen does not carry any spine, but in nearly all the "Michael Sars" a dorsal spine is found, even up to a size of C = 4 (L = about 14 mm.) and where it is lacking it seems to have been broken off. Fig. 2 is a drawing of a specimen 7.5 mm. long (C = 2.5). Fig. 3 is the smallest specimen in the collection (C = 1.4 mm.), taken at st. 49.

St.	Gear	m. w.	Number	Sex, size
45	y	2000	1	♂ 5
48	1 sn	0	2	♂ 4 ♀ 4
49	y	370	2	♀ 4 ♂ 1.4
53	1 sn	200	1	♂ 3.5
64	1 sn	200	3	♂ 2.6, 2.2, 2.1
.	y	300	4	♂ 2.5, 2.1, 2.0, 1.9
.	3/4 sn	600	1	♂ 2.9
67	3/4 sn	800	1	♂ 3.3
(6)	(8)		15	

Sergestes atlanticus H. Milne Edwards.

- S. atlanticus*, H. MILNE EDWARDS 1830
- S. frisi*, KRÖYER 1855.
- S. ancyllops*, KRÖYER 1855.
- S. pacificus*, STIMPSON 1860 (fide HANSEN 1896).
- S. ovatoculus*, BATE 1888.
- S. atlanticus*, do. (partim).
- S. atlanticus*, H. I. HANSEN 1896 and 1903.

H. I. HANSEN in his papers of 1896 and 1903 has fully discussed the synonymy, and traced the development, of this species, which proves to have a world-wide distribution in the warmer seas. During the "Michael Sars" Expedition it was taken only along the southern section, and mostly in the upper waterlayers, though the adults seem to descend to intermediate depths.

Table of batymetrical distribution.

Depth ¹⁾	trawls	Size (C)		Total
		2—4	5—7	
0—200	18	53	36	89
200—500	3	4	4	8
over 500	13	6	22	28
Total . . .	34	63	62	125

¹⁾ The depth is estimated as half the length of rope ("m. w.").

Table of sizes. (C in mm.)

Size.....	1½	2	2½	3	3½	4	5	6	7
Males.....							7	5	3
Females ..							5	15	7
Young ... } Indet. }	3	22	1	18	3	16	10	6	4



Fig. 4. *S. atlanticus*, ♂ 7, st. 48, ½ sn 7800, petasma, (15/1).

In this species, the length of the carapace (C) seems not to exceed 7 mm. corresponding to a total length of about 20 mm. A figure is given of the petasma (fig. 4).

Table of catches. (Hauls made during night marked *)

St.	Gear	m. v.	Number	Sex, size
19	4 ln	900	1	♀ 2.
25*	½ sn	3400	1	♀ 6
29	y	400	5	♀ 7, ♂ 6, 5, 5, 5
.	y	2000	2	♀ 6, ♂ 7
34*	y	400	1	♀ 7
42*	y	900	1	♀ 6
45*	1 sn	200	2	♀ 3, 3
.	y	300	3	♀ (?) 7, 6, 6
.	y	2000	2	♀ 7, 7
48	1 sn	0	1	♀ 4
.	½ sn	7800	1	♂ 7
49*	y	2000	1	♀ 3
51*	1 sn	0	4	♂ 7, ♀ 3, 3, 2
52	1 sn	0	15	7, 7, 7, 6, 6, 6, 6, 5, 5, 5, 5, 4, 4, 2 1½
.	½ sn	100	1	♀ 1½ (dubious)
.	3 sn	1200	1	7
53*	1 sn	0	9	6, 5, 5, 5, 5, 4, 4, 4, 3
.	1 sn	100	11	♀ 6, 6, ♂ 6, 6, 6, 5, 5, 5, ♀ 3½, 1½
.	y	300	2	♀ 6, 6
.	y	1600	1	♀ 3
.	3 ln	2600	2	♀ 6, 5
56*	1 sn	0	2	♀ 3½, 3½
.	1 sn	100	1	♀ 3
.	y	2000	1	♀ 4
.	3 ln	3000	2	♀ 7, 6
62*	1 sn	0	2	♀ 4, 2½
64	1 sn	200	11	♀ 4, 3, 2, 2, 2, 2, 2, 2, 2, 2, 2
.	y	300	15	♀ 4, 4, 4, 3, 3, 3, 3, 3, 2, 2, 2, 2, 2, 2
.	¾ sn	600	1	♀ 2
.	y	1000	2	♀ 5, 4, 2
.	y	2000	4	6, 5, 5, 3
.	¾ sn	2500	3	♀ 5, ♂ 6, 5
67	y	200	5	♀ 4, 3, 3, 3, 3
.	y	1200	6	♀ 7, 6, 6, 6, ♀ 4, 4
69	1 sn	200	1	♀ 2
80	¾ sn	600	2	♀ 5, 5
17	36		125	

Sergestes arcticus Krøyer.

- S. arcticus*, KRØYER 1855.
- S. atlanticus*, BATE 1888 (partim).
- S. arcticus*, HANSEN 1906.
- S. arcticus*, WASSERLOOS 1908.

This species seems to be the commonest of the genus, and was indeed captured by the "Michael Sars" Expedition in all regions of the North Atlantic. Its anatomy is so well known that it is unnecessary to add anything but a drawing of the petasma (fig. 5), to show the homologies with *S. robustus*, the petasma of which I have taken as the standard of comparison (see fig. 11). It will be seen that the part *d* is not found in *S. arcticus*, while the part *c*, which in most species is unarmed, is in this species armed with a row of spine clusters. This structure is figured by KEMP (1910) pl. III.

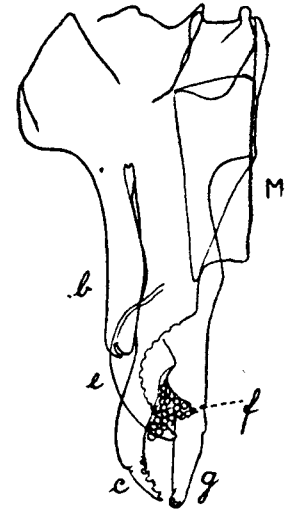


Fig. 5. *S. arcticus*, ♂ 16, st. 102, 3 ln 1500, Petasma, (15/1).

The "Michael Sars" specimens are arranged according to size in the following table:

	Sizes (C in mm.)																										
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19								
Males.....																		3	5	1	1						
Females.....																				2	2	4	5	5	4	3	2
Young.....	18	23	2	8	19	26	20	6	9	1	2																

The vertical distribution differs for the larvæ and for the adults, and is correlated with the fact that the latter possess a fair amount of red pigment (see KEMP 1910, p. 32), while the larvae are nearly colourless. (Compare this with the table of vertical distribution of the different sizes).

Depth m.	Hauls	Size (C in mm.)			Total
		1-9	10-15	16-19	
0-200	12	55	1		56
201-500	14	48	5		53
over 500	17	27	18	15	60
Total.....	44 1)	100	24	15	170

It appears that the grown up individuals do not ascend much beyond 500 m. from the surface, the species resembling in this respect *Acanthephyra purpurea* and other prawns, the horizontal distribution of which it also shares, being found all over the Atlantic, as far north as 65° N. lat. between Iceland and Greenland. It has also been taken in the Norwegian Sea on several occasions both by Danish

1) One haul from unknown depth.

and Norse Expeditions, on the Norwegian Coast as far north as in the Trondhjem-fiord. In May 1911 it was taken in the Sogne-fiord along with *Pasiphaea principalis* and *P. multidentata* (SUND 1913). Generally it may be stated that *Sergestes arcticus* in the Northern Atlantic has nearly the same distribution as the genus *Pasiphaea*.

Table of catches. (Hauls during night marked *)

St.	Gear	m. w.	Number	Sex, size
10	y	300	1	♀ 11
.	?	?	1	♀ 12
19	4 ln	900	5	♀ 12, 11, 10, ♂ 6, 5
23*	y	400	1	♂ 7
42*	1 sn	200	1	♀ 8
53*	y	1600	1	♂ 5
62*	1 sn	0	2	♂ 5, 4
.	y	1000	4	♂ 6, 6, 6, 5
64	1 sn	100		1 mast.
66	3/4 sn	1500	9	♂ 7, 7, 7, 7, 6, 6, 6, 6, 4
.	3/4 sn	1000	2	♂ 6, 6
.	y	1500	4	♂ 7, 7, 6, 6
70	3/4 sn	70	3	♂ 8, 7, 5
.	y	1700	19	♀ 19, 18, 18, 17, 17, 17, 16, 16, 15, ♂ 14, 13, 13, 13, 13, 12, 12, 12, ♂ 7
80	y	1000	5	♀ 15, 14, ♂ 5, 5, 5
.	3/4 sn	1500	1	♂ 6
.	y	2000	1	♀ 16
.	3 ln	3000	2	♀ 18, 16
81	1 sn	100	7	4 mast., 3 acanthosoma
.	3/4 sn	600	1	♂ 3
82	1 sn	100	20	5 mast., 15 acanthosoma
.	1 sn	200	13	mastigopus
84	3/4 sn	600	1	♂ 4
.	3/4 sn	1500	2	♂ 5, 4
87	y	1000	12	♂ 8, 7, 7, 7, 7, 6, 6, 6, 5, 5, 5, 5
88	1 sn	100	2	♂ 8, 7
.	y	300	2	♂ 7, 7
.	y	1000	4	♂ 9, 9, 6, 6
90	3/4 sn	600	2	♂ 5, 4
.	y	1000	3	♂ 9, 9, 6, 6
92*	1 sn	100	2	♂ 6, 4
.	y	300	2	♂ 9, 9
.	y	2000	1	♂ 4
94	3 ln	2000	1	♀ 14
98	1 sn	200	2	♂ 5, 5
.	y	600	3	♂ 9, 8, 7
.	y	1000	5	♂ 9, 9, 6, 6, 6
.	3/4 sn	1450	1	♂ 6
.	3 ln	1500	10	♀ 19, 16, 15, 15, 14, 13, ♂ 9, 8, 7, 7
101	y	600	4	♂ 7, 5, 5, 5
.	3/4 sn	1500	2	♂ 6, 4
.	y	2000	2	♀ 17, ♂ 5
.	3 ln	2500	3	♀ 15, 14, 13
102*	y	600	3	♂ 6, 3, 3
.	3 ln	1500	1	♂ 16
21	45		170	♂ 10, ♀ 27, ♂ 133

Sergestes corniculum (Krøyer).

- S. corniculum*, KRÖYER 1860 (larvæ).
- S. corniculum*, BATE 1888 (do.)
- S. corniculum*, HANSEN 1896 (do.)
- S. corniculum*, HANSEN 1903 (do.)
- ? *S. rubroguttatus*, LO BIANCO 1904 (adult).
- ? *S. rubroguttatus*, PESTA 1913 (adult).
- S. vigilax*, STEPHENSEN 1913 (do.)

Young specimens of this species were described by Krøyer in 1860, and later on HANSEN (1896) gave further particulars, and added a description of stage still younger than that described by Krøyer. The adult was captured in the Mediterranean by the "Puritan" and a drawing of it was published by LO BIANCO (1904).—It was subsequently examined by Pesta and Stephensen, who gave drawings of the petasma. I am not quite sure that the Mediterranean species is identical with the Atlantic one; there seems to be a very slight difference in the form of the petasma but it may be accidental.

This fine large species is closely related to *S. rubroguttatus*, Wood Mason.

That I am right in referring the adult form to the species described from larval specimens by Krøyer is proved by a study of the outer maxillipeds. Fig. 6 shows the 6th joint in an adult and in a mastigopus; in the lastnamed the four distal subjoints are not yet distinctly divided from each other, and in neither can the subdivision of the two long proximal subjoints, mentioned by Hansen, be seen with certainty.

The branchial apparatus agrees closely with the description given by HANSEN (1896, p. 957). In the adult the relative lengths of the four posterior branchiæ (those above the 3rd and 4th pereiopods) are about as follows: 9—3—6—4.

The mxp.³ do not differ very much from the pereiopods, and only the proximal two-fifths of the external uropods are devoid of setæ on the outer edge. Nor does this edge carry any spine (see fig. 7). The rostrum (Pl. II, fig. 1) is small, ending in a blunt tooth, directed forward. Ocular and hepatic spines present. Cervical groove distinct; so are also the branchiocardiac groove and ridge, which run backwards to the edge of the carapace. The pleon is smooth, the pleuræ rounded, and the sixth somite is very powerful, being nearly twice as long and one-half deeper than the fifth.

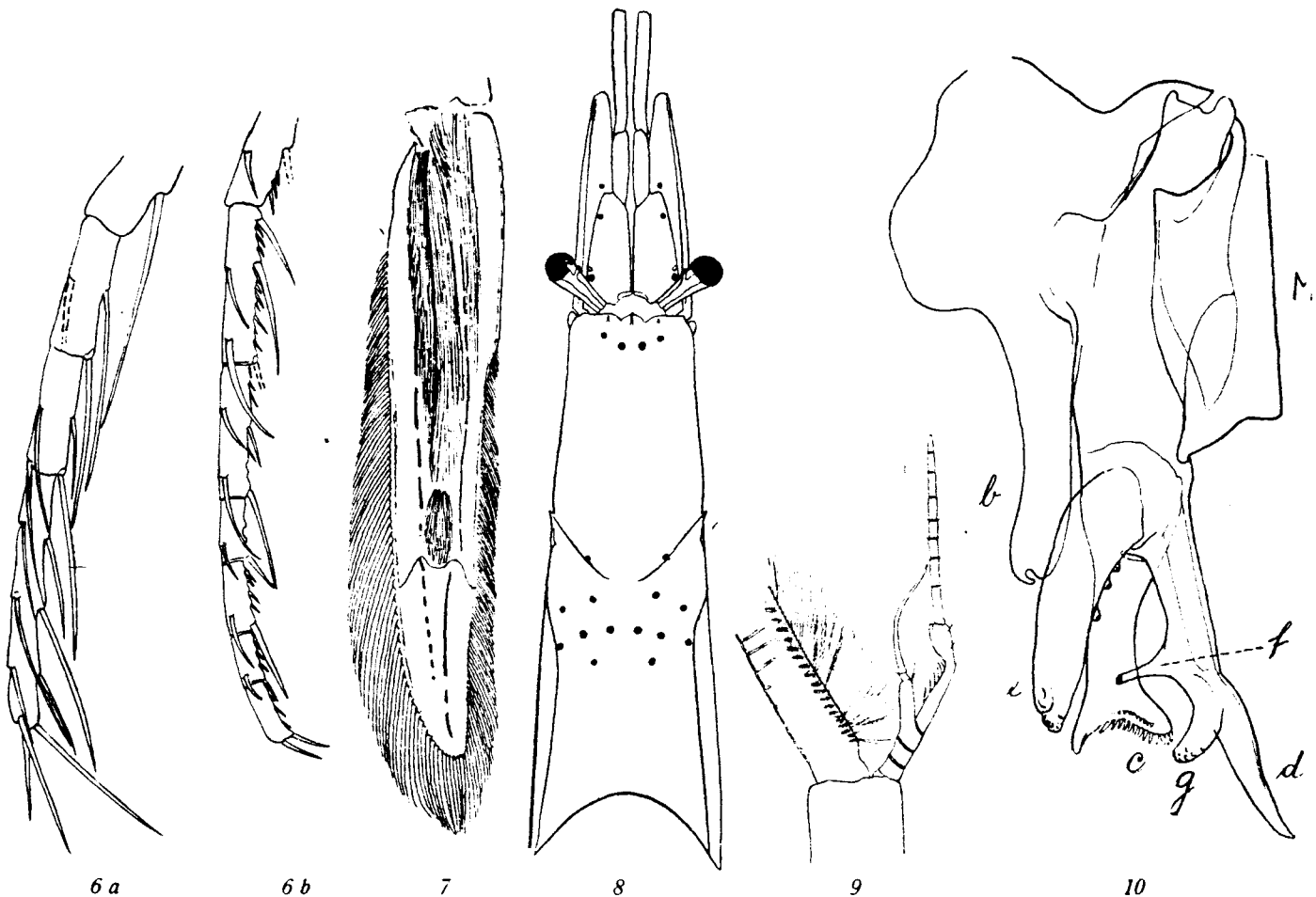
The integument is transparent (but not soft) save for some red spots on the fore part of the body (see fig. 8).—The pleon also probably carries such patches, but they are not visible in the preserved material. The stomach is of a bright red colour, clearly visible through the transparent body. *S. rubroguttatus* Wood-Mason is the only other species of this type of colouring.

The eyes reach about to the middle of the 1st segment of the antennular peduncles, the diameter of the cornea being about half the length of the ocular peduncles, which carry on their inner side and near the edge of the cornea a low colourless tubercle, which is seen to receive a branch of the optic nerve.

The antennular peduncle is slender, about two-thirds the length of the carapace. The first joint is slightly

shorter than the third, which is about one half longer than the second. The internal flagetulum in the male differs slightly from that in *S. rubroguttatus*, figured by WOOD-MASON 1892. Compare his figure with fig. 9.

The scaphocerite reaches about to the middle of the third joint of the antennular peduncles. Its outer edge is gently curved from base to tip, and more strongly in the outer half. The terminal spine is short and stout.



Figs. 6—10. *Sergestes corniculum*. 6 a) Outer end of third maxilliped, ♂ 3-2, st. 67, y 200. 6 b) The same, ♀ 17, st. 62, 3 in 3000. 7) Outer uropod, ♀ 15, st. 51, y 300, (¹⁰/₁). 8) Forepart of ♂ 15, st. 51, y 300, (⁵/₁). 9) First antenna, ♂ 17, st. 51, y 300, (¹⁰/₁). 10) Petasma, ♂ 15, st. 51, y 300, (³⁰/₁).

The petasma is strongly and very characteristically developed. In general plan it resembles that of *S. robustus*, but the processes *c* and *d* are much more developed, while the processes *g* and *f* are reduced both in size and armature. Thus the process *f* in *S. corniculum* has only a single hook, situated on the tip, while the end of *c* is broadened and terminates with a row of "claws". Parallel with the terminal row is another, consisting of smaller claws.

The largest individual is a female, 55 mm. in total length, corresponding to a length of carapace of 19 mm.

Table of sizes.

Sizes (C)	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	Total
Males										1	1	1	2	3				8
Females										1	3	2	5	7	7	4	1	30
Young	1	2			2	5	3	3	1									17

This beautiful species was taken at most stations, except those situated in the NE quadrant of the area investigated, 55 specimens being procured.

The bathymetrical distribution is shown in the following table. Although the catches are not numerous it

appears that the species mostly lives in the intermediate waterlayers, and rises some hundred metres nearer to the surface during the dark hours.

Table of vertical distribution.

Depth (metres)	Hauls		Size (C in mm.)						
			3-10		11-19				
	D	N	D	N	D	N	D	N	
0-100	1	5	2	7		6	2	13	15
150-200	1	7	1	1	1	22	2	23	25
300-1700	4	6	4	2	2	7	6	9	15
Total	9	18	7	10	3	35	10	45	55 ¹⁾
Gr. tot. . .		27		17		38		55 ¹⁾	

Table of catches. (Hauls during night marked *)

St.	Gear	m. w.	Number	Sex, size
23*	1 sn	200	2	♀ 16, ♂ 13
"	y	400	3	♀ 17, 16, ♂ 17
25	1/2 sn	3400	1	♀ 10
29	y	400	2	♀ 12, ♀ 9
34*	y	400	1	♀ 16
45*	y	300	2	♀ 9, 11
49*	4 ln	1000-0	2	♀ 17, 17 (vertical haul)
"	4 ln	3000	2	♀ 19, 17
51*	1 sn	200	1	♀ 15
"	y	300	6	♀ 17, 16, 15, 14, ♂ 17, 15
"	y	2000	1	♀ 18
52	y	600	1	♂ 14
"	3 ln	1200	1	♀ 7
53*	1 sn	100	4	♀ 10, 8, 8, 4
"	1 sn	200	2	♀ 10, 8
"	y	300	6	♀ 17, 16, 16, 15, 14, ♂ 15
"	3 ln	2600	2	♀ 18, ♀ 8
56*	y	300	1	♀ 18
"	3 ln	3000	2	♀ 17, 15
58*	y	300	7	♀ 16, 15, 13, 13, 13, ♂ 17, 12
62*	1 sn	0	1	♀ 4.2 (mast.)
"	y	2000	1	♀ 7
"	3 ln	3000	1	♀ 15
64	1 sn	100	1	♀ 3.0 (mast.)
"	1 sn	600	2	♀ 4, 4
"	3 ln	3000	1	♀ 9
67	y	200	1	♀ 4.0
88	y	1000	1	♀ 18
15	27		57	8 ♂, 31 ♀, 18 ♀

¹⁾ Two specimens from vertical haul not considered.

Sergestes robustus Smith 1882.

S. dissimilis, BATE 1888.

S. mediterraneus, HANSEN 1896.

S. dissimilis, HANSEN 1903(1, 2).

S. inermis, HANSEN 1903(2).

S. robustus, HANSEN 1908.

—, — KEMP. 1910.

Small individuals of this species were caught at nearly all the stations during the expedition, as well as a few fine adult specimens. The identification of this species proved to be very easy from Smith's description, especially as he has given a good drawing of the petasma, that appendage which should be used as the "ear-mark" in the genus *Sergestes*. Several doubtful species are in my opinion rendered "good" on the evidence furnished by the petasma. I have tried to use Smith's designations of the different parts of this appendage when dealing with other species, but in many cases the homology is rather doubtful, especially in very distantly related species, for instance *S. robustus* and *S. pectinatus*.

For the sake of a clearer understanding of the petasma I reproduce here Smith's drawing (fig. 11) and an additional figure of the outer portion, seen from behind, Smith's figure being seen from before. The "fingers" *f* and *g* seen from before look like separate members, but in fact form one piece, bent in two planes (see fig. 12).

The smallest individual in which I could detect a petasma was only 23 mm long ($C=7$), and among the individuals of $C=8$ I found three with petasma buds. Fig. 13 is drawn from a male of this size. There were twelve individuals with $C=8$, in which no petasma could be seen, but I dare not conclude that they are all females. When C exceeds 9 I believe that the petasma should be easily seen, and I have therefore classed as females all the specimens above 9 mm (C) without petasma. The only adult female specimen is very like the male in appearance, except that the eyes are slightly smaller.

I cannot dismiss this opportunity of mentioning what I believe to be the luminous organs of *Sergestes robustus*. The structures in question are small opaque patches on the scaphocerite and on the outer uropods, arranged in a similar manner to that found in *S. challengerii*, *S. gloriois* and *S. splendens*. In *S. robustus* there is a row of 14 patches on the scaphocerite: 7 along the outer edge of the muscle and 7 beyond the termination of it. On the outer uropod there are 12 patches, six situated in an irregular longitudinal row beyond the muscle, and six near the inner setose edge, in a row occupying the second fourth from the base of that edge. I have not been able to find such patches on other parts of the body

or appendages. On the outer uropods there are fine dotted lines, just as in *S. splendens*, which may also be luminous organs.

As the name denotes, *S. robustus* is one of the largest species in the genus. It should be mentioned that the abdomen in *S. robustus* is considerably longer than in *S. mollis*. The following table shows the number of specimens of each size and sex:

Length (total)	20	30	40	50	60	70	80	Total												
L. of carap. (mm)	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22		
Males			1	4	7	2	2							1	1	1		1	1	21
Females					12	12	16	5						1						46
Young	10	26	44	4																84

(The figures given for total length are only approximate).

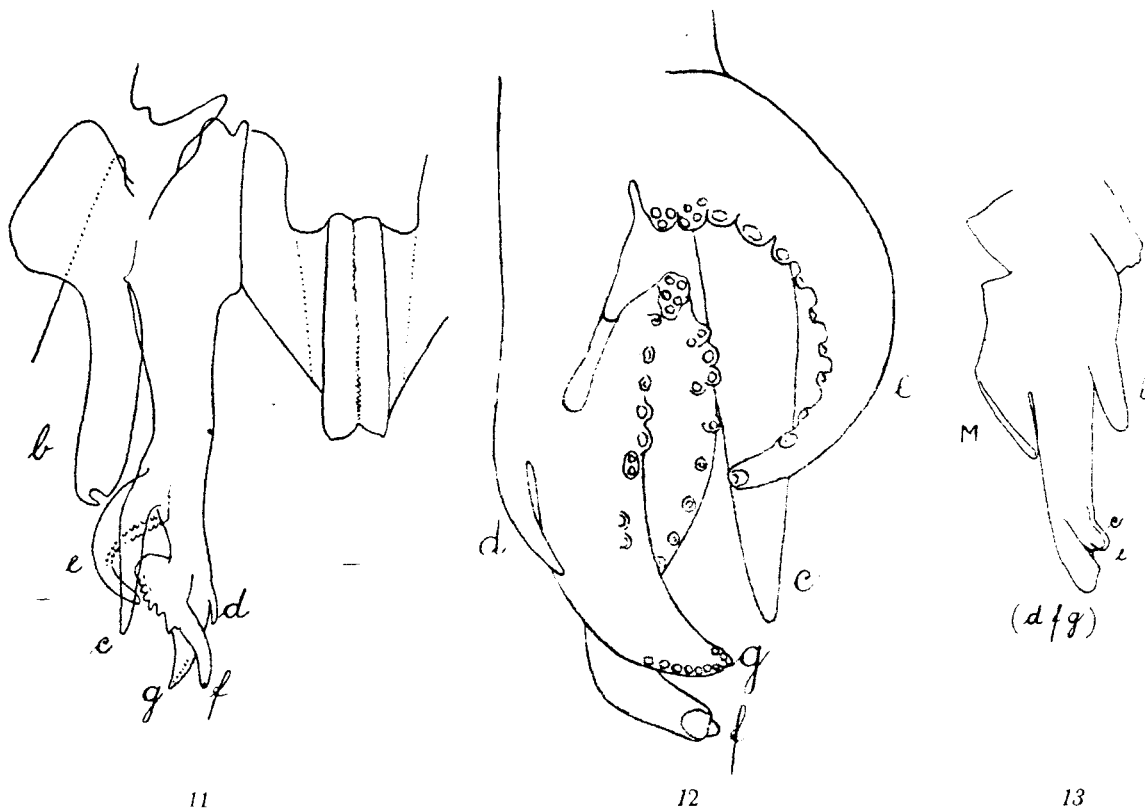


Fig. 11—13. *Sergestes robustus*. 11) Petasma, after SMITH (1884), (ca. $\frac{1}{2}$). 12) Tip of Petasma, ♂ 18, st. 53, 3 in 2600, ($\frac{50}{1}$). 13) Petasma, ♂ 8, st. 67, y 1200, ($\frac{50}{0}$).

The peculiar feature of this table is that no specimens between 11 and 17 mm C. were caught. Is this to be interpreted as indicating that the material comprises two (or three?) yearclasses?

S. robustus was taken at 19 stations, on the northern and southern sections, to the W. of the British Isles, and, what is most remarkable, at st. 102 to the SE. of the Faeroes, in the part of the Faroe-Shetland Channel belonging to the Norwegian Sea, as well as in the Spanish Gulf and near the Canaries, but not on the route between the Canaries and the Azores.

It had previously been captured by „Blake” and the “Albatross” off the New England coast (Smith), in the Bay of Biscay by the “Caudan” (CAULLERY), in the Mediterranean near Crete (ADENSAMER) and near Sicily (LO BIANCO and RIGGIO). It has been taken at a number

of localities to the W. of Ireland, and by Danish and Norwegian expeditions to the SW. of the Faeroes. Generally it may be said that it is as yet known only from the Gulf Stream and from Mediterranean watermasses, inside and outside Gibraltar. Its apparent absence between the Canaries and the Azores may be accidental.

Vertical distribution of sizes.

Depth (metres)	Hauls	Size (C in mm)			Total
		5—8	9—12	17—22	
50—250	10	12	12		24
251—500	11	33	10		43
501—1000	14	36	5	1	42
> 1000	8	19	14	5	38
Total	43	100	41	6	147

From the vertical distribution as evidenced by the "Michael Sars" catches it appears that *S. robustus* is a deep-sea prawn, only the younger stages occurring in the upper strata, but never at the surface. There is a marked difference in the colouring of the adult and the young, the latter being almost transparent, only the purplish blue stomach shining through the carapace. The exceedingly beautiful colouring of the adult (scarlet lake with crimson spots, golden feather-bristles and blue reflections) is well described by Kemp (1910).

4 and 7 mm. (C = 1.7—2.5 mm.) and they agree perfectly with BATES' (1888), ORTMANN'S (1893) and HANSEN'S (1903) descriptions of *S. dissimilis*, which HANSEN later (1908) cancelled as being the young of *S. robustus*¹⁾.

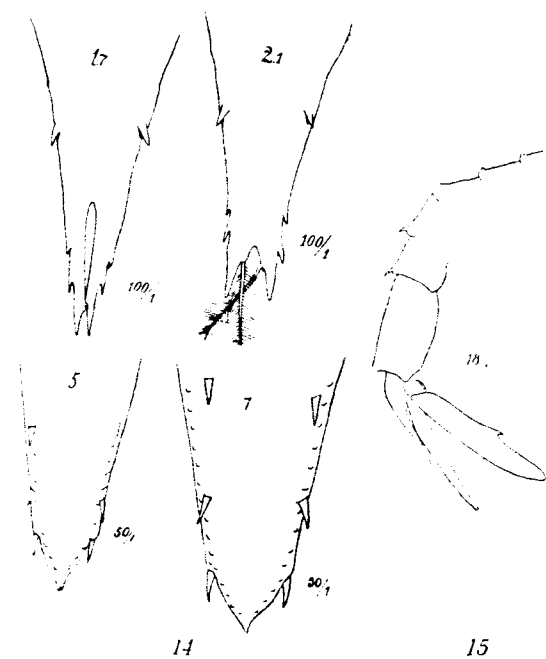
A study of the telson in these larvæ and in the subadult *S. robustus* and its nearest allies makes Hansen's statement probable, though some transitional stages (C = 3-4 mm.) are needed to make the series complete. Fig. 2 and 3, pl. I, are photographs of the head and tail-fan of a specimen 4.7 mm. long (C = 2.1), and in textfig. 14 outline drawings of telson of the same specimen and of

Table of catches. (Hauls made during neight marked *)

St.	Gear	m. w.	Number	Sex, size
23*	1 sn	200	5	♀ 11, 10, 9, 9, ♂ 7
..*	y	400	2	♂ 10, ♀ 8
..*	T	(1215)	1	9
34*	y	400	1	9
..*	1/2 sn	600	2	9, 9
35	4 sn	2400-0	3	11, ♀ 11, 10
..*	1/2 sn	4200	1	10
42*	y	900	4	11, 11, 10, 10
53*	y	300	2	♂ 10, ♀ 8
..*	y	600	2	♂ 6, 6
..*	1/2 sn	2100	1	7
..*	3 ln	2600	4	♂ 18, 17, ♂ 7, 7
56*	1 sn	100	1	7
..*	1 sn	200	1	6
..*	y	300	5	♂ 7, 7, 7, 7, 7
..*	y	1000	3	7, 7, 7
..*	y	2000	2	10, 6
..*	3 ln	3000	13	♂ 10, 10, 10, 9, 9, 8, 8, ♂ 7, 7, 7, 7, 6, 6
58*	y	300	3	♂ 10, ♀ 8, 7
62	1 sn	200	2	9, ♀ 11
..*	y	1000	2	9, ♀ 6
..*	y	2000	2	7, 5
..*	3 ln	3000	2	♂ 19, 11
63	4 sn	1350-450	1	8
64	y	2000	9	♂ 17, 10, 10, 10, 10, 10, ♀ 9, 7, 7
..*	3/4 sn	2500	2	♂ 8, ♀ 8
..*	3 ln	3000	5	♂ 21, ♀ 8, 8, 8, ♂ 7
66	y	1500	3	9, 7, ♀ 8
67	y	1200	14	♂ 8, ♀ 7, 7, 6, 6, 6, 6, 5, 5, 5, 5, 5, 5
81	y	2000	1	8
87	3/4 sn	1500	1	9
..*	y	2000	2	8, ♀ 7
88	y	1000	3	9, 8, ♀ 7
..*	3/4 sn	1500	1	9
..*	y	2000	1	10
90	y	1000	4	9, 9, ♀ 7, 7
92*	y	300	2	9, ♀ 9
..*	3/4 sn	600	2	8, ♀ 6
..*	y	1000	1	8
98	y	1000	18	♂ 8 a 7, 9 a 6, 1 a 5 mm.
..*	3/1 sn	1450	1	♂ 6
..*	3 ln	1500	10	♂ 22, ♀ 8, 8, 7, 7, 7, 7, 7, 7, 7
101	3/4 sn	1500	2	♂ 6, 5
..*	y	2000	2	♂ 6, 6
102	y	1000	2	♂ 7, 6
20	45		151	♂ 21, ♀ 46, ♀ 84

Larvæ.

At the stations 51, 52, 53 and 64 a number of mastigopus stages were taken which I believe may be referred to *Sergestes robustus*. Their length is between



S. robustus (juv.). Fig. 14. Tip of telson in 4 young specimens. Size (C) inscribed in each drawing. The two smallest from st. 64 y 300, the others from s. 98, y 1000. Fig. 15. Abdomen of ♂ 1.7 in fig. 14.

a smaller one (but subadult specimens of *S. robustus*) are given. I will be noted that the larvæ and the subadults possess the same number of lateral spines. In the smallest of the subadults (C = 5) the tip is still cleft while in the largest it has become simple. In one specimen with forked tip, not figured, a single tip was observed ready to take its place after moulting.

In the smallest larvae (C = 1.5—1.7) there were also spines on the 2nd and 3rd abdominal somites, in the very smallest (1.5) even on the first, while the specimens described by Bate (L = 10 mm.), by Ortmann (10--12 mm.) by Hansen (9.5 mm.) and the others taken

¹⁾ H. I. HANSEN writes (1908): "It appears now that *S. dissimilis* is the mastigopus stage of *S. robustus*, so that intermediate stages have been described as *S. incertus* H. I. H. and as "the subadult stage of *S. mediterraneus* H. I. H." I presume that "*S. incertus*" in the passage cited is a misquotation for *S. inermis*.

by the "Michael Sars" (4.7—7.0 mm.) had spines on the 4th, 5th and 6th only, see fig. 15.

Larval examples of *Sergestes robustus* were taken on the following occasions:

- St. 51, 0 m.w. one, C = 2.4 mm.
- 52, 0 " one, C = 1.5 "
- 53, 60 " one, C = 2.0 "
- 64, 100 " ten, C = 1.9—2.5 mm., one 1.5 mm.
- " 300 " two, C = 1.7, 2.1.

Sergestes splendens n. sp.

This handsome species is a near relative of *S. robustus* which it resembles in the form of its powerful body (see fig. 16) though of much smaller size, the adult females not reaching a total length of 40 mm. The males are smaller. Though of such moderate size *S. splendens* has a stout and more muscular body than perhaps any other

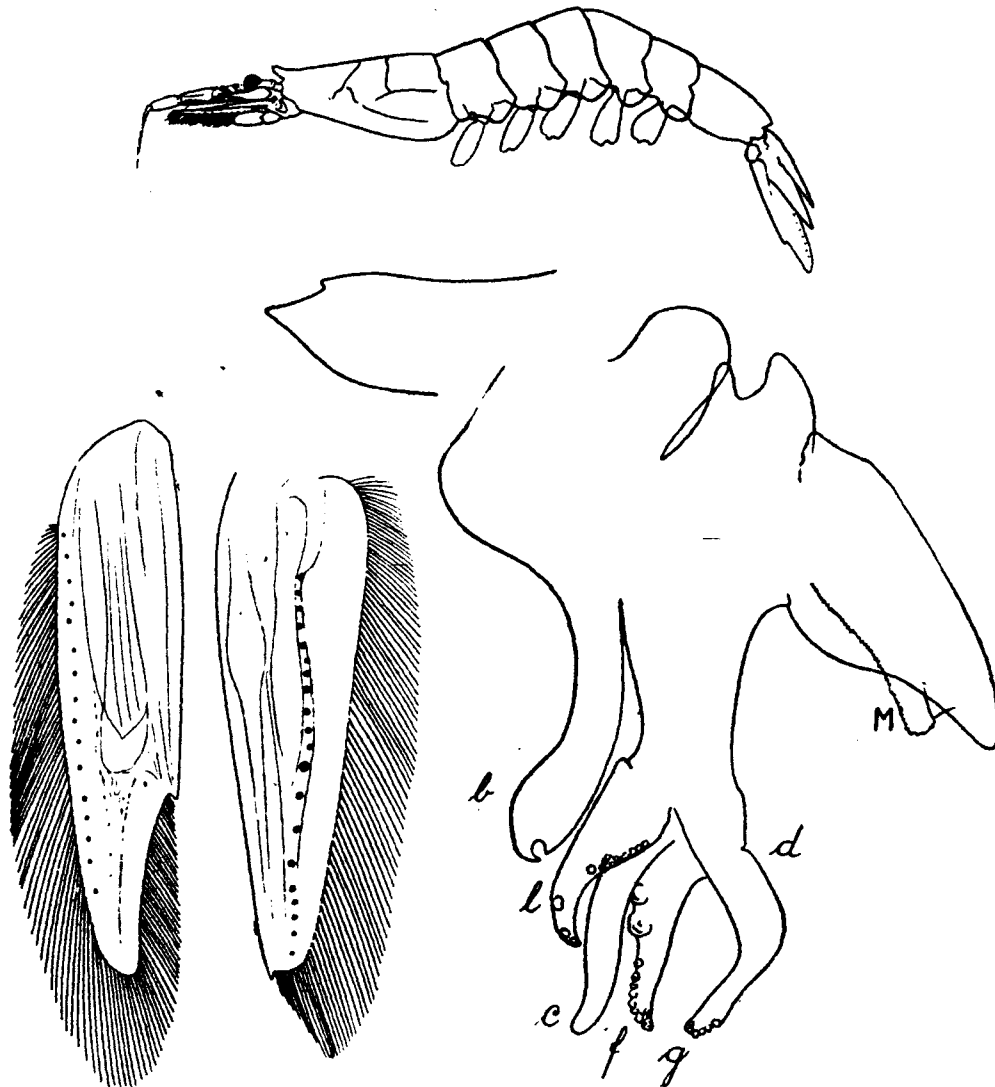


Fig. 16—18. *Sergestes splendens*, ♂ 10, st. 49, 3000. Outline of body (²/₁), rostrum (⁹⁰/₁), ext. uropod and scaphocerite (¹⁰/₁) and petasma (⁹⁰/₁).

Sergestes. The sizes of the specimens taken are given in the following table:

Number of	Length of carapace (mm.)										Total
	4	5	6	7	8	9	10	11	12		
Males.....	4	4	12	21	5	3	6				51
Females.....		14	5	22	3	3	6	1	1		55
Young.....	5										5

The rostrum is in most specimens of the form represented in fig. 16, though it is subject to some variation as will be seen from fig. 19.

The carapace has distinct grooves but no ocular spine, and the hepatic spine is represented only by a bluntly rounded lobe. The eyes are larger than those of *S. robustus*, and spherical. On the inner and upper side of the stalks there is the rudiment of an ocular tubercle.

The branchiæ are as in *S. robustus*, differing only in the relative size of the posterior branchia above the third pereopod, this branchia being only two thirds as long as the anterior, while in *S. robustus* it is nearly as large. The posterior branchia above the fourth pereopod is $\frac{4}{5}$ as long as the preceding one.

The first joint of the antennular peduncles is slightly shorter than the second and the third together. The second is about one fourth longer than the third, which is not much more than two times longer than broad.

The form of the scaphocerite and the outer uropod may be seen from fig. 17. On both appendages is noticed even in the smallest specimens a row of peculiar patches which I believe to be luminous organs, their position being analogous to that of the light organs of *S. gloriosus* Stebbing and *S. Challengeri* Hansen. In the young specimens the patches are fewer in number, while in the young of *S. robustus* no patches are visible till the animal has reached a size of a full-grown *S. splendens*.

The colouring of newly preserved formaline specimens consists of an intense scarlet on the fore part of the back, fading gradually into the transparent abdomen and legs. In the alcoholic specimens the colour is persistent only along the grooves of the carapace.

The nearest relative of *S. splendens* is undoubtedly *S. Gardineri* Kemp (KEMP 1913) which is proved by the petasma in these species, (see fig. 18) that of *S. splendens* carrying however only one process (*e* in the figure) were *S. Gardineri* has two. Other points of distinction may be derived from the relative length of the branchiæ, and of the joints of the antennular stalk; the presence in *S. splendens* of patches believed to be luminous organs, etc.

Also from the species described by STEBBING (1908) as *S. bisulcatus* *S. splendens* is easily distinguished by the presence of the lastnamed character and by its size (C. never exceeding 12 mm. in the 111 specimens, while Stebbings specimen measured 24, the total length being 76 mm). From *S. gloriosus* and *S. bisulcatus* Wood Mason our species is distinguished by its characteristic petasma which resembles only that of *S. Gardineri* as stated above.

Table of bathymetrical distribution.¹⁾

Depth (m.)	Hauls		Size (C in mm.)						Total	
			< 7		7-9		> 9			
	D	N	D	N	D	N	D	N	D	N
50-100	2	5	3			10		3	3	13
101-250	1	5		10	1	40		5	1	55
> 250	5	6	25	1	3	3	4	3	32	7
Total	24	28	11	4	53	4	11	36	75	

¹⁾ Heavy figures denote the number of specimens taken during the night.

Horizontally *S. splendens* is apparently limited to the southern part of the area explored. The accompanying table of batymetrical distribution seems to indicate that the species avoids the upper waterlayers during the day, but ascends during the night, though it has not been taken at the very surface of the sea.

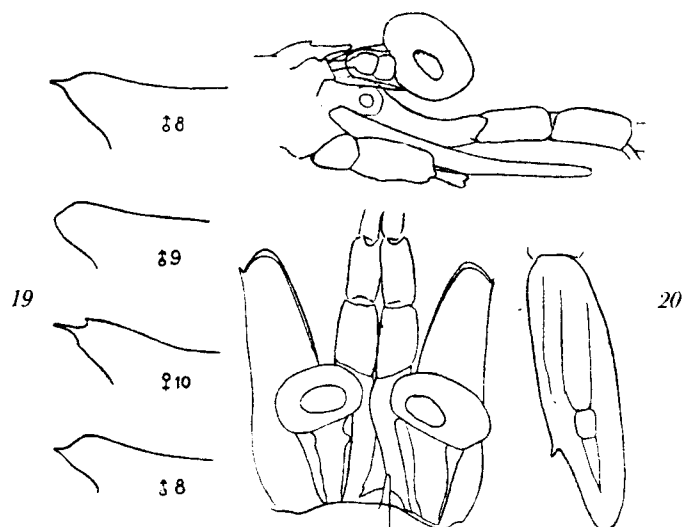
Table of catches.

St.	Gear	m. w	Number	Sex, size
29	y	400	1	♀ 9
42	y	300	1	♀ 8
45	1 sn	100	1	♂ 7
.	1 sn	200	6	♀ 7, 7, ♂ 7, 7, 7, 7
.	y	300	50	♀: 1 à 10, 2 à 8, 16 à 7, 1 à 6 and 4 à 5 mm. ♂: 1 à 10, 2 à 8, 18 à 7 and 5 à 6 mm.
.	y	2000	1	♀ 10
.	4 ln	3000	1	♀ 9
49	4 ln	3000	4	♀ 10, 7, ♂ 10, 6
51	1 sn	200	1	♂ 10
.	y	300	2	♂ 10, 9
.	1/2 sn	1000	1	♂ 6
52	1/2 sn	100	2	♂ 6, ♀ 5
53	1 sn	100	4	♀ 10, ♂ 9, 9, 8
.	y	300	1	♂ 10
.	y	600	2	♀ 9, 7
.	3 ln	2600	1	♂ 8
56	1 sn	200	1	♀ 11
.	y	300	1	♀ 10
62	y	2000	1	♀ 10
64	1 sn	100	1	♂ 4
.	y	2000	3	♂ 10, ♀ 4, 4
66	3/4 sn	1000	1	♀ 5
67	3 ln	2000	2	♂ 8 (L = 29), ♀ 12 (L = 39)
.	y	1200	22	♂: 4 à 6 and 4 à 5 mm, ♀: 4 à 6 and 8 à 5 mm, ♂ 2 à 4 mm.
12	24		111	

Larvæ.

At stations 64 and 67 some larvæ were taken which I believe may be referred to *S. splendens*. They resemble this species very much in the form of the cephalic appendages, even the rudiment of the ocular tubercle being visible as a protrusion from the nerve (see fig. 20, which also shows the form of uropod typical of *S. splendens*). It is true that an ocular tubercle is present in many species of *Sergestes*, but none of these species were taken in the same area with the larvæ in question.

An examination of the telson points also to *S. splendens*. Fig. 21 shows the outlines of the telson in the three larvæ, and in a nearly adult *S. splendens*. It will be noted that the three pairs of dorsolateral spines found in the smallest larvæ, have disappeared in the two larger larvæ, but the form of the tip convinces one of the specific identity of the three larvæ, neither could any other differences be found than those connected with



Figs. 19—20. *S. splendens*. 19) Rostrum of 4 specimens, the sizes (C) of which are inscribed, from st. 53, 1 sn 100. 20) Head and uropod of ♂ 3.15 from st. 67, 1 sn 50.

size. Now both *S. splendens* and *S. grandis* carry only one pair of spines on the telson, as does the larger of the larvæ in question. But these spines in *S. grandis* are situated very far from the tip, whereas in *S. splendens* they are found close to it (see fig. 21).

The larvæ referred to *S. splendens*, were taken on the following occasions:

St. 64, 1 sn 100 m.w, one, C = 2.6, L = 6.15,
 Urop. = 1.25 mm.
 " " y 2000 " one, C = 2.9, L = 7.0,
 Urop. = 1.50 "
 " 67, 1 sn 50 " one, C = 3.15 L = 8.7,
 Urop. = 1.70 "

Pl. II, figs. 2 and 3, are photos of the head parts and tail-fan in the smallest of the specimens.

Sergestes grandis n. sp.

This species is very nearly related to the species described by FAXON (1895) from the Pacific under the name of *S. bisculatus* Wood-Mason. In 1893 Faxon had mentioned his species under the name of *S. phorcus*, which was withdrawn by himself as a synonym. Now after the publication of a more detailed account with illustrations of *S. bisculatus* by ALCOCK in 1901 it appears beyond doubt that Faxon's species is not identical with that of Wood-Mason, so that the former must retain the original name of *S. phorcus*. In describing *S. grandis* I shall try to indicate the points in which it differs from the species mentioned.

Figs. 22 and 23 show two females, one adult and one young. The relative length of carapace and abdomen is nearly as in Faxon's species, the abdomen, telson excluded, equalling about twice the length of the carapace, while in Wood-Mason's species, according to Alcock's figure (Illustr. . . . Investigator, pl. L), the carapace is half the length of the abdomen, telson included.

The rostrum, as in Faxon's species, is small, inclined about 30° from the back. Both edges are parallel, and the tip is excavated as in *S. splendens*.

Both transverse grooves are well defined, as are also the gastrohepatic and the branchiocardial, the last running nearly to the edge of the carapace, accompanied by a marked keel.

The branchial formula is the same as in Faxon's species; the second lamella above the third leg is not however concealed beneath the first, but plainly visible, and it is about $\frac{2}{3}$ as long as the first.

The eyes are as in *S. phorcus*. In the smaller specimens the lateral length of the cornea is less than half that of the stalk, while in the adult it is about two-thirds,

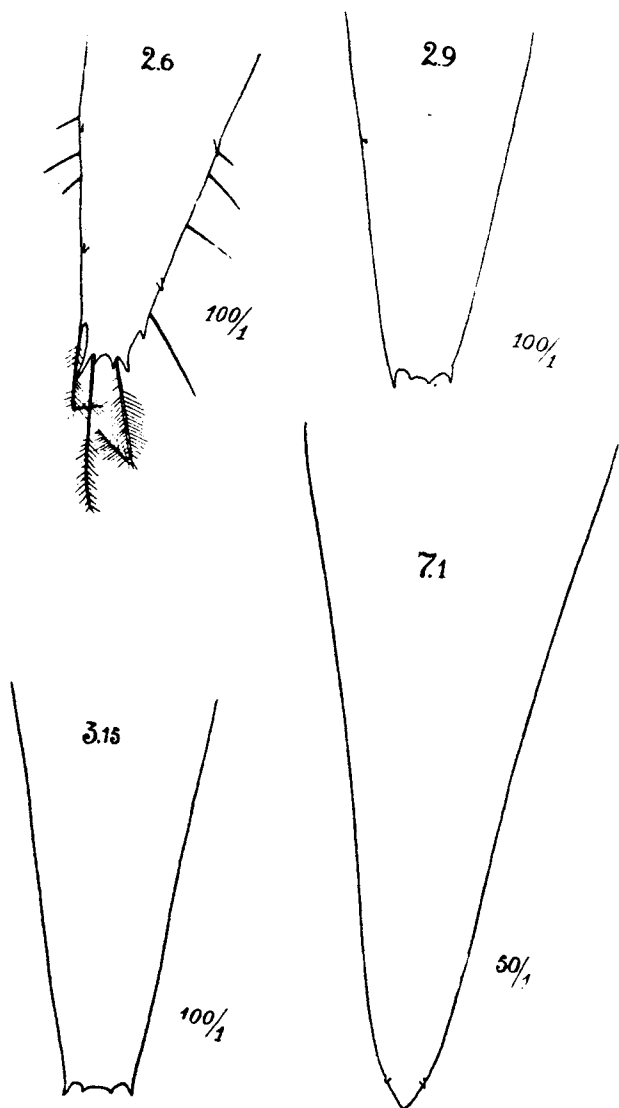
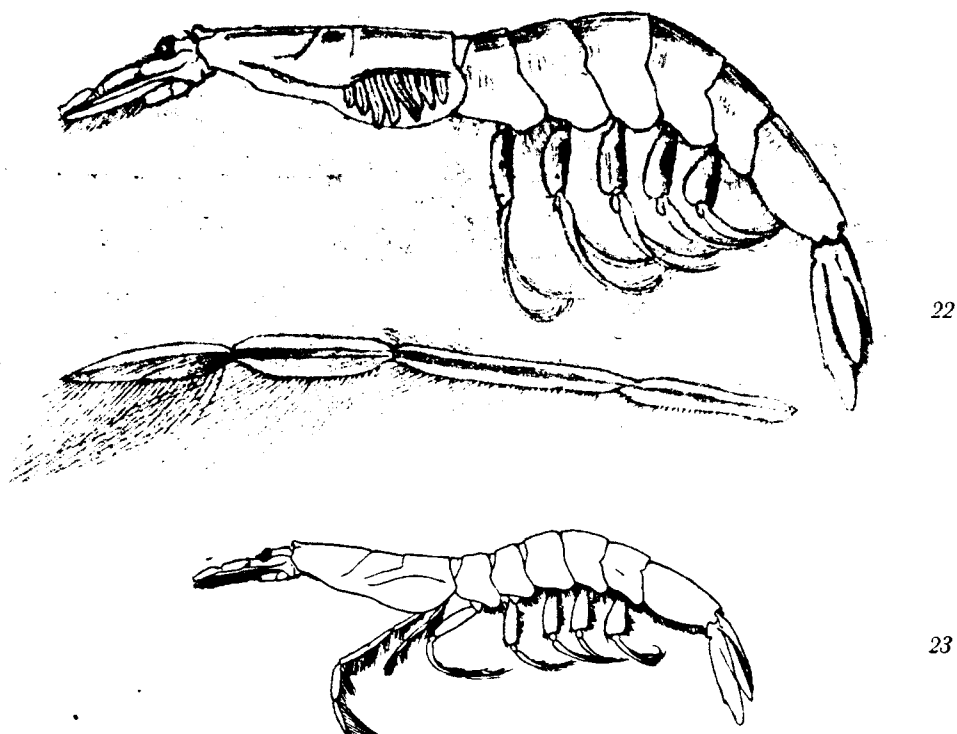
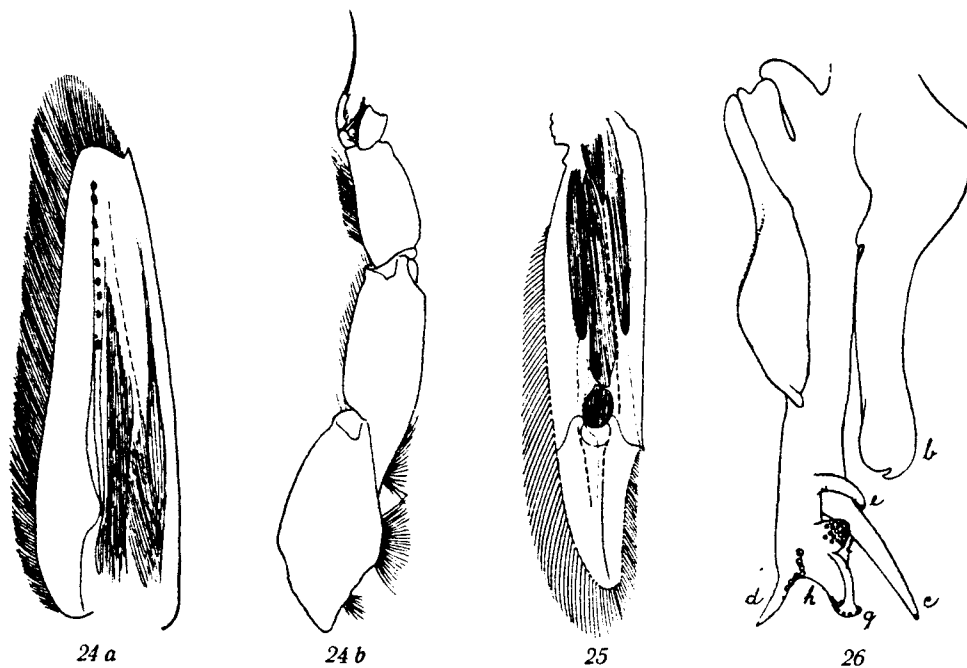


Fig. 21. *S. splendens*. Tip of telson of 4 specimens (the size of which are inscribed) from st. 64 and 67.



Figs. 22—23. *Sergestes grandis*. 22) ♀ 17, st. 52, y 600 ($\frac{2}{1}$). Below is shown the fourth pereiopod more enlarged.
23) ♀ 10, st. 34, y 400 ($\frac{2}{1}$).



Figs. 24—26. *Sergestes grandis*, ♂ 20, st. 51, 3 ln 4000. 24 a) scaphocerite ($\frac{5}{1}$). 24 b) antennular peduncle ($\frac{5}{1}$). 25) outer uropod ($\frac{5}{1}$).
26) petasma ($\frac{10}{1}$).

The antennular peduncles are of the same type as those of *S. robustus*, though the 2nd joint is relatively lightly longer, resembling that of *S. phorcus* (see fig. 24).

The scaphocerite (fig. 24) differs from that of *S. phorcus*, the outer edge being less curved, and the inner being lightly concave in its outer two-thirds. Its under side carries more feather bristles than in any other *Sergestes* known to me. These bristles are sparsely implanted in a longitudinal bed along the middle of the scaphocerite, and their length equals about one-third of the breadth of the appendage. The scaphocerite carries a row of 1—10 luminous (?) patches.

The fourth pair of pereopods differs from those both of *S. phorcus* and of *S. bisulcatus* in having the two last joints broader, the greatest breadth of the penultimate joint being more than one-fourth of its length.

The exopodite of the outer uropod is shown in fig. 25. The spine is situated slightly more than two-thirds from the base (in *S. phorcus* slightly less), the breadth is contained about $4\frac{1}{2}$ times in the length (in *S. phorcus* about 5 times). The general form recalls that found in *S. splendens*. In *S. bisulcatus* the uropod is of quite another type.

The telson has dorsally a broad shallow groove, the limits of which bend slightly together just before the middle and form the dorsolateral edges of the telson in its posterior part.

Male. The only male (from st. 51) differs from the females in the larger size of its eyes, a sexual difference also found in *S. robustus*. The grooves and keels on the carapace are less distinct, and the integument on the whole is stiffer than in the females, perhaps depending upon difference in time since the last moult.

The petasma (fig. 26) possesses one process more than in that of *S. robustus*, thus strikingly resembling the petasma of *S. phorcus*, from which it differs however in the following points:—(1) the process *b* ends in a strongly curved hook, (2) the process *e* is much shorter. Compare the drawing in FAXON, 1895, pl. LII).

Sergestes grandis, like *S. phorcus*, has been captured on a few occasions only, and apparently does not inhabit the superficial waterlayers. Some of the specimens showed traces of red pigment (*S. phorcus* is reported to be deep red). During the "Michael Sars" expedition it was taken as follows:—

St. 34, y,	400 m. wire,	one,	♀	10
" 49, 4 ln,	3000 -	"	one,	♀ 12
" 51, 3 ln,	4000 -	"	one,	♂ 20
" 52, y,	600 -	"	one,	♀ 17
" " y,	1200 -	"	two,	♀ 18, 12.5

STEBBING (1908) also describes a "*S. bisulcatus*" from S. Africa taken at 250—300 fathoms, 29 miles E^bN. of Cape Point. He says that his specimens "agree so closely with Faxon's description that it would be rash to base a specific separation on the one or two minute differences which I have noticed". A glance of his figure however shows at once that his species has nothing to do with Faxon's. The form of the carapace is different in many respects, and it is not easy to understand how Stebbing could arrive at such a conclusion.

Neither is his species identical with that described here as *S. splendens*, with which it seems to have the nearest relations, as mentioned under that species.

Sergestes tropicus n. sp.

This species shares with *S. phorcus* Faxon (described as *S. bisulcatus*, FAXON 1895¹⁾), and *S. Kröyeri* Bates, and *S. gardineri* Kemp, the character of having a conspicuous tubercle on the eyestalk. Faxon does not mention it in the text but it is seen in his figure. *S. tropicus* is easily distinguished from *S. phorcus* by the form of the petasma, compare fig. 27 with Faxon's figure (1895, pl. 52, fig. 1 h), and from *S. Kröyeri* by the form of the rostrum (compare fig. 28 and fig. 29, the last being taken from HANSEN 1903).

The uropods (fig. 33) are narrower (breadth contained $4\frac{1}{2}$ —5 times in length) than in *S. Kröyeri*, the uropods of which are "at most four times longer than broad".

From *S. gardineri* Kemp the present species is easily distinguished by the form of the petasma, of which KEMP (1913) gives an excellent drawing (pl. 7, fig. 4).

The third pair of maxillipeds are considerably shorter than the third pereopods, the length of the joints (beginning with the second) being in a ♂ 21 from st. 64: 6.5, 6.0, 7.0, 6.7, 6.0 mm. The fifth joint is subdivided into three subjoints the relative length of which are as 36:11:20. The sixth joint is subdivided into 8 subjoints, the relative length of which are as 17:20:14:13:13:15:14:13.

The scaphocerite, which does not reach beyond the middle of the third joint of the antennular peduncles²⁾

The telson ends in a point and carries three pairs of spines along the dorsolateral edges and three other pairs is broad and the lamellar portion is much in advance of the triangular tooth. (See fig 30 and 31 where also the ocular tubercle is visible).

¹⁾ As regards the name *S. bisulcatus*, see under *S. grandis*.

²⁾ According to BATE (1888, p. 388) it reaches, in *S. Kröyeri* to the tip of the antennular peduncles.

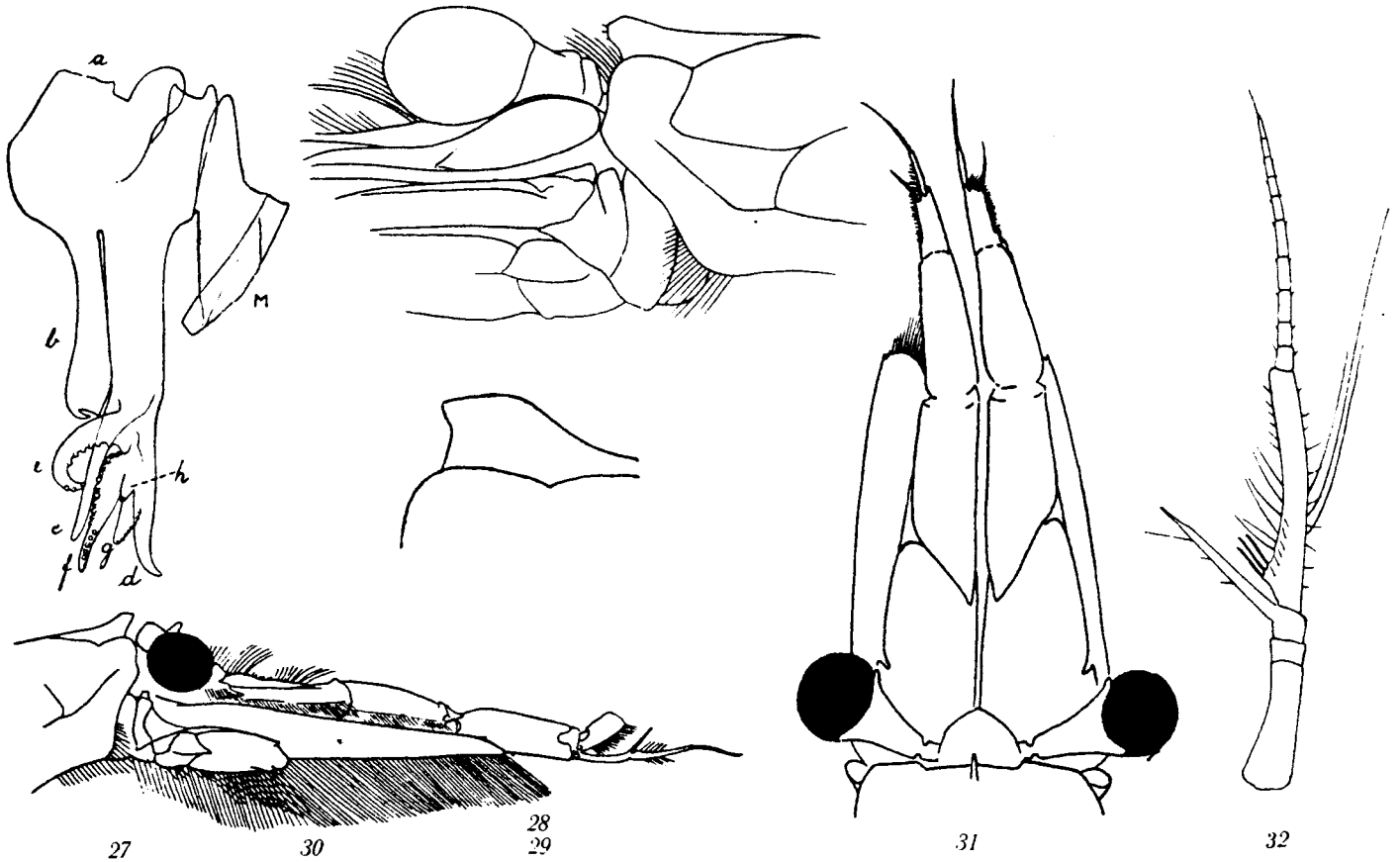


Fig. 27. Petasma of *Sergestes tropicus*, ♂ 18, st. 53, 3 in 2600 ($10/1$). Fig. 28. Rostrum and eye of *S. tropicus*, ♂ 19, st. 49, 4 in 3000 ($10/1$).
 Fig. 29. Rostrum of *S. krøyeri*, (after HANSEN, 1903). Fig. 30. Fore-end of *S. tropicus*, ♂ 18, st. 56, 3 in 3000 ($6/1$). Fig. 31. The same ($6/1$).
 Fig. 32. Outer flagellum of antennular of the same specimen ($20/1$).



Fig. 33. *Sergestes tropicus*, ♂ 21, st. 64, 3 in 3000. Right eye from above, petasma, end of 4. leg, telson and outer uropod. (Enlargements inscribed in the drawings).

between those edges. This feature together with others in a large male from st. 64 is shown in fig. 33.

Both the uropods and the scaphocerite show a reticular or cellular pattern, also found in *S. mollis*. The integument is soft as in that species and supraocular and hepatic spines are absent.

The branchiæ are feeble compared with those of *S. robustus*, though not in such a state of reduction as found in *S. mollis* (see SMITH 1887). Relative length of four posterior branchiæ 6—2—4—3, the second branchia above trl.³ being very small and onesided.

The form of the secondary antennular flagellum in the male is seen in fig. 32.

S. tropicus is one of the larger *Sergestes*, one female and one male measuring about 70 mm. (C = 21). It was found only in the southern part of the area examined, in all 18 specimens having been taken. It seems to be a deep-water species, as all the large specimens were taken at a depth of 1000 metres or more, even though most of the hauls were made during the night.

Colour orange, except mouthparts which are reddish-brown. The dark stomach can be seen through the body. The eyes are large and black, the tubercle is of the same colour as the stalk.

Table of catches.

St.	Gear	m. w.	Number	Sex, size
29	y	2000	2	♀ 19, ♂ 18
45	y	2000	1	♀ 13
49	4 ln	3000	4	♂ 21, 19, 12, ♀ 12
51	1/2 sn	700	1	♂ 7, (def.)
"	1/2 sn	1000	1	♀ 9
"	y	3000	1	♀ 9
"	4 ln	4000	1	♀ 10
52	3 ln	1200	1	♀ 10
53	3 ln	2600	4	♂ 19, 18, 18, ♀ 11
56	3 ln	3000	1	♂ 18
64	3 ln	3000	1	♂ 21
8	11		18	9 ♂, 8 ♀, 1 ♂

***Sergestes mollis* Smith.**

S. mollis, SMITH 1884.

S. mollis, SMITH 1887.

S. japonicus, HANSEN 1896.

S. japonicus, HANSEN 1903(2).

I have been somewhat in doubt as to what name should be adopted for the numerous "Michael Sars" specimens which agree in every particular with SMITH's descriptions and figures, but have decided not to follow HANSEN in regarding *S. mollis* as a synonym of *S. ja-*

pionicus Bate (BATE 1881, 1888). The evidence given by Hansen in support of his view seems too scanty. He has compared the three 30 years old and mutilated "Challenger" specimens with Smith's description, and found no difference. He says:—"It should be specially mentioned that an examination of the branchiæ showed the most complete agreement with Smith's description and drawing". Still, he has not seen any Atlantic specimens, or he would have noticed that the form of the rostrum differs greatly from that of the specimen figured by BATE (1888, pl. 70), and until it can be shown that this difference is due to inaccurate drawing by Bate, it is safest to regard *S. mollis* and *S. japonicus* as distinct species.



Fig. 34. *Sergestes mollis* ♂ 17, st. 81, 3 ln 3000. Petasma (25/1).

The petasma (fig. 34) is remarkable for the rudimentary stage of the small hooks and tubercles on the processes. It is possible, though not very probable, that even the largest of our male specimens are not fully developed.

S. mollis is undoubtedly a deep-sea species, as will be seen from the following table of bathymetrical distribution (3 ind. from vertical hauls not consid.):—

Depth (metres)	Nr. of hauls		Sizes (C. in mm.)								Grand total
			4—10		11—17		18—26		Total		
	D	N	D	N	D	N	D	N	D	N	
350—800	6	5	13	14	5	2			18	16	34
1000—1300	4	5	12	25	3	11	2	1	18	37	55
1500—2100	5	7		16	16	3	7	2	22	20	43
Total	15	17	25	55	24	16	9	3	58	74	132
Grand total	32		80		40		12		132		

This table affords no evidence of a diurnal vertical migration, like that found e. g. in the case of *S. splendens*. A similar difference regarding this habit is found in the peneid genus *Amalopenæus*, the large-eyed species of which have a marked diurnal movement, while nothing of that kind could be inferred from the data regarding the species which lives deepest and has the smallest eyes, viz. *A. Alicei*. The same rule holds good in the genus *Sergestes*, *S. mollis* having very small, *S. splen-*

dens very large eyes. It will be noted that the large specimens were all taken at a depth of 1000 metres or deeper.

S. mollis was formerly known only from deep water along the Atlantic coast of the United States (Smith 84, 87). During the "Michael Sars" Expedition it proved to be fairly common, as it was taken nearly every time the deep-sea plankton appliances were towed, even as far north as between Scotland and Rockall (st. 101), but it has

Table of sizes.

Size	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	Total	
Males											3	2	2	2		1									10
Females											2	4	4	4	2	3	3	1		2				1	26
Young	1	16	16	18	7	13	12	4	7	5															99

Table of catches.

St.	Gear	m. w.	Number	Sex, size
19	4 ln	900	1	♂ 5
25	1/2 sn	3400	2	♂ 10, 8
29	y	2000	2	♂ 10, 8
35	1/2 sn	4200	1	♂ 12
42	y	900	8	♂ 9, 7, 7, 7, 7, 6, 6, 6
45	y	2000	12	♀ 16, 16, ♂ 11, 10, 9, 9, 8, 7, 7, 6, 6, 5
.	4 ln	3000	5	♂ 10, 9, 7, 7, 7
49	y	2000	6	♂ 10, 10, 10, 9, 9, 7
.	4 ln	3000	3	♂ 9, 9, 7
51	1/2 sn	700	1	♂ 4
.	y	2000	5	♂ 19, ♂ 13, 8, 7, 5
.	4 ln	4000	2	♂ 13, 7
53	y	1600	2	♂ 12, 12
.	3 ln	2600	12	♀ 17, 15, ♂ 15, 14, ♂ 12, 9, 9, 8, 7, 6, 5
56	y	1000	3	♂ 5, 5, 5
.	3 ln	3000	1	♂ 8
62	y	1000	2	♂ 6, 6
.	y	2000	2	♂ 11, 6
.	3 ln	3000	7	♂ 23, ♂ 13, 12, 10, 10, 10, 9
63	4 sn	4500	1	♀ 18
.	4 sn	1800	2	♀ 17, ♂ 10
64	y	2000	13	♀ 18, ♂ 15, ♂ 13, 7, 7, 6, 6, 6, 5, 5, 5, 5, 5
.	3 ln	3000	9	♀ 20, 19, 19, 14, ♂ 17, 16, 14, ♂ 12, 11
66	y	1500	1	♂ 14
67	y	1200	9	♂ 10, 8, 6, 6, 6, 6, 5, 5, 5
80	3 ln	3000	3	♀ 17, 15, 15
81	3 ln	3000	7	♀ 23 (L = 71), 21 (L = 64), 17, 16, 15, 14
82	y	1000	3	♂ 17
84	y	1000	1	♂ 13, 12, 11
.	3 ln	3000	2	♂ 5
87	3/4 sn	1500	3	♀ 20, 19
.	y	2000	1	♂ 12, 7, 5
92	y	3000	1	♂ 16
101	3 ln	2500	2	♀ 20
22	34		135	♀ 26, 16

not been captured in the Norwegian Sea, where it probably does not occur, as we may infer from the non-occurrence there of other Atlantic deep-sea species, such as *Hymenodora gracilis* Smith, which is indeed replaced in the Norwegian Sea by a near relative: *H. glacialis* Bucholz.

Sergestes vigilax Stimpson, H. I. Hanseu

S. vigilax, STIMPSON 1860 (*mastigopus*).

S. vigilax, HANSEN 1896.

HANSEN has described the adult very carefully, and there can be no doubt as to the specific identity of Stimpson's young specimens and the adult described by Hansen. In the material from the "Michael Sars" expedition all stages from the very smallest are present, and the development of the characteristic rostrum and maxillipeds can be followed without interruption until they assume their final shape, (see fig. 35 and 36). The number of spines on the 6th joints of the maxillipeds I have found to vary between 20 and 22, or rather less than stated by Hansen (22—25). The 5th joint is subdivided into two subjoints, the distal one being about one-fourth the length of the entire joint.

The petasma (fig. 38) is of quite another type from that found in *S. robustus*, and shows the closest resemblance to that of *S. atlanticus*.

S. vigilax is a small species, as seen from the following table:—(specimens of 2 1/2 mm. are entered as being 3 mm., etc.)

Size (C. in mm.)	1	2	3	4	5	6	7	8	Total
Males					2	13	4		19
Females					11	20	9	2	42
Young	1	39	50	26	11				127

S. vigilax is probably limited to the tropical Atlantic¹⁾. It was taken only on the southern section, from Africa to the Sargasso Sea. The catches were too few to allow any definite conclusions regarding the bathymetrical distribution to be drawn, but the table seems to indicate that (1) the adults prefer deeper water than the young, (2) that the adults sink during the night.

Depth (metres)	Number of hauls		Size				Total		Grand total
			< 4.9		> 4.9				
	D	N	D	N	D	N	D	N	
0—50	5	5	43	64	4	14	47	78	125
100—200	4	9	8	6	2	21	10	27	37
300—	5	6	5	3	11	6	16	9	25
Total	14	22	56	73	17	41	73	114	187
Gr. total....	36 ²⁾		129		58		187		

Table of catches.

St.	Gear	m. w.	Number	Sex, size
23	y	400	1	♀ 7
.	T	(1215 m)	1	♀ 7
20	y	400	3	♂ 7, 5.5, ♀ 4.5
42	y	300	1	♂ 7
45	1 sn	100	15	♂ 7, ♀ 6, 5, 5, ⊙ 4, 4, 4, 3.5, 3.5, 3, 3, 2, 2, 2, 2
.	y	300	6	♀ 7, 7, 6, ♂ 6, 6, 6
.	y	2000	1	♂ 6
47	1/2 sn	40	4	⊙ 3, 3, 3, 3
49	y	370	6	⊙ 5, 3, 2.3, 2.2, 2.2, 2.0
.	4 ln	1000-0	1	♂ 7
.	y	2000	2	⊙ 2.6, 2
51	1 sn	0	27	♀ 7, ⊙ 6 à 1.5, 5 à 2, 9 à 2.5, 2 à 3, 3 à 3.5, 1 à 4 mm.
.	y	300	2	♀ 6, 6 (def.)
.	y	2000	1	♀ 6
.	y	3000	2	♀ 6, ⊙ 3.5
.	4 ln	4000	1	♀ 6
52	1 sn	0	22	♀ 6, 5, ⊙ 1 à 3.5, 1 à 3, 6 à 2.5, 6 à 2, 5 à 1.5, 1 à 1 mm.
.	1/2 sn	100	3	♀ 5, 5, ⊙ 4
.	3 ln	1200	2	♀ 6, ♂ 6
53	1 sn	0	1	⊙ 4
.	1 sn	60	22	⊙ 2 à 4.5, 2 à 4, 5 à 3.5, 5 à 3, 6 à 2.5, 2 à 2 mm.
.	1 sn	100	11	♀ 7, 6, 6, 6, 6, 6, 5, 5, ⊙ 4.5, 4.5, 4
.	1 sn	200	5	♀ 8, ♂ 6, 6, 6, 6
.	y	300	5	♀ 7, 7, 6, 6, 5
.	y	600	1	♀ 6
58	1 sn	100	1	♂ 6
.	y	300	1	♀ 7
62	1 sn	200	1	♂ 7
64	1 sn	100	12	⊙ 4 à 4.5, 1 à 4, 3 à 3.5, 1 à 3, 3 à 2.5
.	1 sn	200	2	⊙ 2.5, 2.3
.	y	300	3	⊙ 3.0, 2.8, 1.5
.	3/4 sn	600	1	⊙ 2.6
.	y	1000	8	♀ 6, ♂ 6, 5, 5 ⊙ 4.5, 4.5, 4, 3
.	y	2000	1	♀ 6
67	1 sn	50	6	⊙ 3.2, 2.8, 2.7, 2.3, 2.2, 1.7
.	y	200	2	⊙ 3, 2
.	y	1200	4	♀ 7.5 (L = 24) 6, 5, 5

²⁾ One vertical haul (one specimen) not considered.



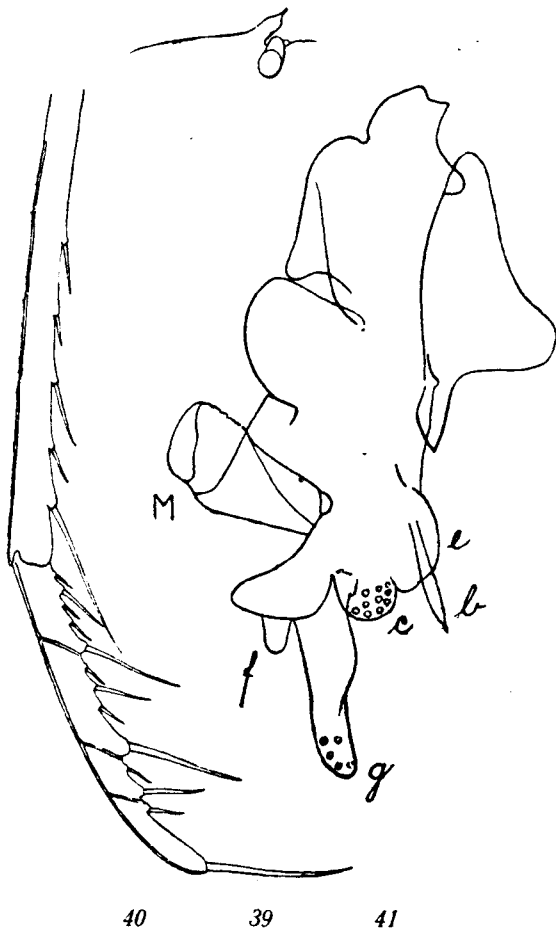
Fig. 35—38 *Sergestes vigilax*, 35) ♀ 7, st. 67, y 1200, rostrum (40%). 36) ♂ 6, st. 29, y 400, end of 3. mxp. (20/1). 37) ♂ 6, st. 29 y 400, outer uropod (10/1). 38) ♂ 6, st. 29, y 400, petasma (30/1).

¹⁾ HANSEN'S opinion (1896) that Bates' *S. parvidens*, which was taken both in the Atlantic and the Pacific, is the young of *S. vigilax* is certainly wrong. The eyestalks are, as represented by Bate, much too short. In a specimen of *S. vigilax* of the same size they are much more than half the length of the carapace. It is equally certain that *S. macrophthalmus*, Stimps. is not the mastigopus of *S. vigilax*. The "Michael Sars" specimens of young *S. vigilax* agree fairly well with STIMPSON'S description, but they seem to have more numerous dorsal spines, which are found not only, as in *S. macrophthalmus*, on the hinder edge of the carapace and on the fourth and fifth abdominal joint, but also on the third and sixth joints up to a size of 7—8 mm. (C = 2.5 mm.). The size given by Stimpson (0,7 inch = 17 mm.) suggests that *S. macrophthalmus* is not identical with *S. vigilax*, as this species has lost all its dorsal spines before it attains a total length of about 13 mm.

Sergestes armatus Kröyer

S. armatus KRÖYER 1855 (mastigopus)
S. armatus HANSEN 1896 (—, —)

This species has hitherto been known only from its mastigopus stage, but during the "Michael Sars" expedition many adults were captured, which I shall briefly describe.



Figs. 39—41. *Sergestes armatus*. 39) ♀ 14, St. 23, y 400, rostrum (5/i). 40) ♀ 14, St. 23, y 400, end of 3. mxp. (10/i). 41) ♂ 10, St. 51, y 300, petasma (30/i).

Rostrum adscendent, its outer third tapering to an acute point (see fig. 39). Supraocular and hepatic spines present, the latter situated upon a marked keel running from the base of the antenna and disappearing behind the spine. The branchiocardial keel and furrow are also distinct and reach the hinder edge of the carapace.

In the antennular peduncles, the aggregate length of which is about 85 % of the length of the carapace, the first and the second joints are nearly equal, the third being about one-third longer than either.

The very long third maxillipeds have the sixth joint divided into four subjoints, the relative lengths of which

are as 21:30:16:33. All four subjoints carry strong spines arranged as shown in fig. 40. In all the specimens the distal subjoint is strongly curved.

The outer uropods are fringed with setæ along 2/3—3/4 of their external edge, and a spine is present only in some of the young specimens.

The petasma (fig. 41) recalls to some extent that of *S. vigilax*.

As far as can be judged from material preserved in formaline pigment is absent, except in the stomach, which is purplish.

S. armatus is a large species, compared with the others in Hansen's group II, as will be seen from this table:

Size (C in mm.)	3	4	5	6	7	8	9	10	11	12	13	14	Total
Males				1	1		1	1					4
Females				1	3	3	1	4	1		1	1	15
Young	5	4	2										11

The nearest relative of *S. armatus* Kr. is *S. diapon-tius* Bate H. J. H. (= *S. penerinki* Bate H. J. H.), but is distinguished from it by the form of the antennular peduncles and the relative length of the hairfringed portion of the outer uropods.

S. armatus has been identified with certainty only in the Atlantic. Bate's specimens from the Pacific and from Australian waters, are not, according to HANSEN (1903), correctly determined.

Regarding the bathymetrical distribution not much is known, and the "Michael Sars" material is too scanty to allow of any definite conclusions being drawn. (See table of catches).

Table of catches.

St.	Gear	m. w.	Number	Sex, size
23	y	400	1	♀ 14
45	y	300	5	♀ 10, 10, 8, 8, 7
.	4 ln	3000	1	♀ 10,
51	1 sn	0	2	⊙ 3, 3
.	1 sn	200	1	♂ 6
.	y	300	2	♀ 10, ♂ 10
53	y	300	2	♀ 9, 7
.	y	600	1	♀ 7
64	1 sn	100	3	⊙ 3 1/2, 3, 3
.	1 sn	200	2	⊙ 4 1/2, 4
.	y	300	3	⊙ 4, 4, 3
.	y	1000	2	♀ 8, ♂ 7
.	y	2000	1	♀ 6
67	1 sn	50	1	♀ 11
.	3/4 sn	600	1	⊙ 4 1/2
.	y	1200	2	♀ 13 (L = 36), ♂ 9 (L = 31)
6	17		30	15 ♀, 4 ♂, 11 ⊙