

corresponding with its position. The ophthalmus is more orbicular, and it is larger in diameter than the stalk, whereas in *Sergestes cornutus* the ophthalmopod is pear-shaped, gradually lessening from the broadest diameter to the base. The first pair of antennæ, as shown in Kröyer's figure, has the flagellum more than twice the length of the animal, whereas in this specimen it is less than half the length; but it is not improbable that so slender an organ may have been broken off, without any very obvious trace of the accident being apparent.

The rhipidura in *Sergestes cornutus* has the outer margin of the external plate armed with a distinct tooth, whereas in the Challenger specimen it is feeble and not clearly defined.

Sergestes japonicus, Spence Bate (Pl. LXX. figs. 1, 2).

Sergestes japonicus, Sp. B., loc. cit., p. 194.

Anterior surface of the carapace projecting into a short dorsal rostriform crest; the rest of the carapace smooth. Pleon smooth, laterally compressed. The ophthalmopod long and subcylindrical, the ophthalmus being scarcely broader than the stalk.

The first pair of antennæ has the peduncle half as long as the carapace, and terminates in one long and one minute flagellum, the latter being scarcely half as long as the terminal joint of the peduncle. Synhipod of the mandible two-jointed, long and slender, reaching as far forward as the extremity of the peduncle of the second pair of antennæ.

The pereopoda, except the last two, are broken off.

The pleopoda are generic in character, and offer nothing for specific distinction. The rhipidura is long and narrow; the telson is about two-thirds the length of the outer ramus.

Habitat.—Station 232, May 12, 1875; lat $35^{\circ} 11'$ N., long. $139^{\circ} 28'$ E.; off the southern coast of Japan; depth, 345 fathoms; bottom, green mud; bottom temperature, $41^{\circ} \cdot 1$. One specimen. Both trawl and dredge were used.

Length (female), 50 mm. (2 in.).

Station 207, January 16, 1875; lat. $12^{\circ} 21'$ N., long. $122^{\circ} 15'$ E.; off Manila; depth, 700 fathoms; bottom, blue mud; bottom temperature, $51^{\circ} \cdot 6$. Two specimens (females). Trawled.

Length, 27 mm. (1·1 in.).

The texture of this species is soft and membranous, the tissues being exceedingly transparent and reticulate. The dorsal median line is elevated anteriorly into a small laterally compressed crest, which projects forwards to a point.

The ophthalmopod is nearly as long as the first joint of the peduncle of the first pair of antennæ, and supports an ophthalmus that is black in colour, and not broader than

the stalk, which is not furnished with an ophthalmic tubercle. The first pair of antennæ (fig. 1b) has the peduncle about half the dorsal length of the carapace; the first joint is broad, flat, and notched on the outer margin. The second and third are cylindrical, the latter terminating in a long, multiarticulate flagellum, and a short rudimentary one.

The second pair of antennæ (fig. 1c) carries a very transparent scaphocerite, reticulated in appearance and not strengthened by a ridge on the outer margin.

The specimen is much dilapidated, the gnathopoda being the only appendages of the pereion that are perfect, and they present nothing of specific value.

The branchiæ consist of seven plumes, which are well developed, and correspond rather with the second pair of gnathopoda and the first two pairs of pereopoda than with the more posterior appendages. With the exception of the plume which is attached to the small mastigobranchial plate of the first pair of gnathopoda, and which is therefore a podobranchial one, none of the plumes have any connection either with the legs or with their membranous articulations. They are, therefore, pleurobranchial.

Between the somite that supports the first pair of gnathopoda and that which carries the second is a small discoidal plate attached by one extremity; a similar organ exists in the furrow between each pair of somites, as far as the antepenultimate or the one pertaining to the third pair of pereopoda; two branchial plumes, of a somewhat impoverished character, are attached to the next or penultimate somite. The branchial arrangement is tabulated in the following formula:—

Pleurobranchiæ,	.	.	.	...	'1	'1	'1	'1	2	...
Arthrobranchiæ,	.	.	.	...	...	...	...	...	...	...
Podobranchiæ,	.	.	.	1	...	...	...	...	...	...
Mastigobranchiæ,	.	.	.	1	...	...	...	...	...	...
				h	i	k	l	m	n	o

The interstitial foliaceous plate being represented by a comma.

The plumes consist of a central stem supporting lateral branches, on each side of which is a series of small, laterally compressed plates that look like scrolls upon the outer surface of the plume; these diminish posteriorly where the branchiæ are less characteristically developed.

The type specimen was taken off the southern coast of Japan in about 345 fathoms of water, but near a point where it suddenly dips to a thousand.

Sergestes kröyeri, Spence Bate (Pl. LXX. figs. 3, 4).

Sergestes Kröyeri, Sp. B., *loc. cit.*, p. 193.

Rostrum elevated into a short, crest-like tooth. Carapace smooth, having the visceral regions well defined. Pleon laterally compressed. Telson two-thirds the length of the outer ramus of the rhipidura.

Ophthalmopod (fig. 3a) half the length of the first joint of the first pair of antennæ, which is slightly excavated on the upper surface, and is free from any hirsute fringe. Stylocerite reduced to a pointed bulb at the base. Second joint half the length of the first and a little longer than the third (flagella broken off).

Second pair of antennæ furnished with a scaphocerite that reaches to the extremity of the peduncle of the first pair (flagellum wanting).

First pair of pleopoda very long, single, slender; second and succeeding pairs biramose.

Length (female), 63 mm. (2.5 in.).

Habitat.—Station 170, July 14, 1874; lat. 29° 55' S., long. 178° 14' W.; off the Kermadec Islands; depth, 520 fathoms; bottom, volcanic mud; bottom temperature, 43°. One specimen, female. Trawled.

This species closely resembles *Sergestes japonicus*, but is distinguished by the short, stout ophthalmopod and the large ophthalmus, as well as by the structure of the branchiæ, which are represented in the case of each species on the same plate.

Sergestes atlanticus, Milne-Edwards (Pls. LXVIII. and LXIX).

Sergestes atlanticus, Milne-Edwards, Ann. d. Sci. Nat., tom. xix. p. 349, Mars 1830.

" " Milne-Edwards, Hist. Nat. Crust., vol. ii. p. 428, 1834.

Sergestes frisii, Krøyer, Monograph. Fremstilling af Kræbs. *Sergestes*, pp. 19, 60, Tab. i. a-c, 1850.

Sergestes arcticus, Krøyer, Monograph. Fremstilling af Kræbs. *Sergestes*, pp. 24, 60, pl. iii. fig. 7a-g, pl. v. fig. 16.

" " Sidney Smith, Rep. Decapod Crust. "Albatross" Dredgings off East Coast U.S. in 1884, p. 6, pl. xx. figs. 1, 2, 1886.

Rostrum straight, rudimentary. Ophthalmopoda pyriform, much shorter than the first joint of the first pair of antennæ. The ophthalmus is broader than long, without any great distinction from the pedicle, which it does not equal in length, except in the old animals, in which also the ophthalmus becomes very distinct from the pedicle.

The peduncle of the first pair of antennæ is only about one-seventh shorter than the carapace; the third joint is longer than the second, and equal to or a little longer than the first.

The peduncle of the second pair of antennæ has the last joint somewhat clavate and robust; it is about one-third the length of the scaphocerite.

The sixth somite of the pleon is about a sixth of the length of the animal, and about twice as long as deep, much shorter than the fourth and fifth somites combined, and also shorter than the first and second combined, but about four times longer than the telson.

The pleopoda are very large and robust, the basal joint of the fifth pair being nearly twice as long as broad.

The outer branch of the rhipidura is armed with a tooth on the outer posterior margin, at about one-third of the distance from the terminal apex (Kröyer).

Habitat.—North Atlantic, June 18 and 19, 1873; Stations 62 and 63, on the passage from Bermuda to the Azores. Three specimens; one male, two females. Trawled.

Between Tenerife and St. Thomas.

Station 320, February 14, 1876; lat. $37^{\circ} 17' S.$, long. $53^{\circ} 52' W.$; off Monte Video; depth, 600 fathoms; bottom, green sand; bottom temperature, $37^{\circ} \cdot 2$. Trawled.

Length, 38 mm. (1.5 in.).

Station 42, April 30, 1873; lat. $35^{\circ} 58' N.$, long. $70^{\circ} 35' W.$; North Atlantic; 300 miles off the Chesapeake; depth, 2425 fathoms; bottom, blue mud; bottom temperature, $36^{\circ} \cdot 8$.

Length, 25 mm. (1 in.).

Station 232, May 12, 1875; lat. $35^{\circ} 11' N.$, long. $139^{\circ} 28' E.$; off Japan; depth, 345 fathoms; bottom, green mud; bottom temperature, $41^{\circ} \cdot 1$. One specimen; female. Both trawl and dredge used.

Length, 50 mm. (2 in.).

Station 173, July 24, 1874; lat. $19^{\circ} 9' 35'' S.$, long. $179^{\circ} 41' 50'' E.$; off Matuku, Fiji Islands; depth, 315 fathoms; bottom, coral mud. One specimen; male. Dredged.

Length, 24 mm. (1 in.).

Station 159, March 10, 1874; lat. $47^{\circ} 25' S.$, long. $130^{\circ} 22' E.$; south of Australia; depth, 2150 fathoms; bottom, Globigerina ooze; bottom temperature, $34^{\circ} \cdot 5$. Three specimens; one male and two females. Trawled.

Length, 43 mm. (1.7 in.).

On May 6-18, 1876, in lat. $32^{\circ} 41' N.$, long. $36^{\circ} 6' W.$; at the last recorded Station of the voyage, one specimen was taken at the surface; and on the 7th of the same month, near the Azores, the locality whence Milne-Edwards' type of the species was taken by M. Reynaud nearly sixty years ago, two other specimens were taken at the surface. These were about 20 mm. in length and beautifully transparent.

Milne-Edwards records it from the Atlantic Ocean, near the Azores; and Kröyer from Greenland.

The preceding description is that given by Kröyer, and corresponds with the specimens taken by the Challenger in tropical and subtropical parts of the Atlantic.

Milne-Edwards¹ in his description of the species, says—"Third joint of the peduncle of the superior antennæ at least as long as the preceding."

The dorsal surface of the animal is smooth and even, except for a small pointed

¹ Hist. Nat. Crust., vol. ii, p. 428.

rostrum that is elevated rather than projecting forwards. The carapace is about one-third of the length of the animal, excluding the telson, and deepens laterally as it recedes from the frontal margin.

The five anterior somites of the pleon are subequal, but the sixth is about as long as two of the preceding somites, about half as deep as long, and three or four times longer than the telson.

The ophthalmopoda are short, not reaching beyond one-half the length of the first joint of the peduncle of the first pair of antennæ, and support an ophthalmus that is considerably larger in diameter than the stalk.

The first pair of antennæ (Pl. LXVIII., *b* ♂) has the peduncle nearly as long as the carapace, having the first joint broad, flat, and straight on the inner, but arched and furnished with a sharp tooth on the outer margin; both margins are fringed with ciliated hairs, the inner more sparsely. The second joint is nearly as long as the first, and the third is nearly equal to the first and second together. The second and third are narrow, cylindrical, and sparsely fringed with short ciliated hairs. The third joint carries at its distal extremity two flagella; the primary is long and slender, carrying at its base a large bulbous swelling, formed by the coalescence of several annuli; it is larger in the male than in the female, and in both sexes carries a series of closely-planted, membranous cilia, disposed in transverse rows, more numerous in the male than in the female. The rest of the flagellum is made up of numerous small, almost naked, articuli, there being only one very minute hair attached to each articulus near the distal extremity. According to Kröyer, the second pair of antennæ reaches to about the same length as the animal, but according to Milne-Edwards' figure¹ it is twice the length of the animal; in all the specimens in the Challenger collection the flagellum is broken off at various lengths. The outer or secondary branch in the female is short and rudimentary, having the articuli feebly represented, but in the male it is robust at the base, and at the third articulus sends off a short branch that is stout at the base, but rapidly narrowing, and supporting a long, curved spine, which seems capable of acting as a prehensile organ; the main stalk is still robust, and for some distance is apparently uniarticulate, and on the inner side of its distal extremity is developed into a large tubercle, studded at the summit with minute points; the succeeding articuli are narrow and cylindrical, each successively becoming smaller, so that the terminal portion, which measures about the same length as the basal portion, gradually tapers to the extremity.

The second pair of antennæ (Pl. LXVIII., *c*) has a strong peduncle and a small and slender flagellum, which, according to Kröyer, is once, and according to Milne-Edwards more than twice, longer than the animal, and supports a scaphocerite that is not of greater diameter than the last joint of the peduncle, but three times as long and gradually tapering to a point. The inner margin is fringed with long, strong, delicately

¹ *Ann. d. Sci. Nat.*, tom. xix., pl. x.

ciliated hairs, which are articulated at the base on small bulbous prominences; the outer margin is straight, free from hairs, and produced to a short tooth at the distal extremity.

The mandible (*d*) is small but robust; the incisive margin is concave, smooth, and projects anteriorly and posteriorly into a sharp tooth; it carries a two-jointed synaphipod, the basal joint being long and narrow, and the distal one about half the length of the first and somewhat narrow.

The oral appendages exhibit nothing very distinguishable from those of other species; the first pair of siagnopoda or maxillæ (*e*) consists of three plates; the inner is broad, foliaceous and armed with small spine-like hairs; the median is broad, becoming broader at the distal extremity, and is furnished with small robust spines on the inner margin and with a few hairs on the distal; the outer plate is small and rudimentary and tipped with only two hairs.

The second siagnopod (*f*) consists of four foliaceous rami and a broad mastigobranchial plate. The three inner are foliaceous, broad at the distal extremity, and fringed with stiff hairs; the central plate is subfoliaceous, and appears to be homologous with the typical appendage; it is narrow, somewhat robust, shorter than the other plates, and is tipped with three strong teeth or spines. The mastigobranchia is foliaceous and of extreme tenuity; it reaches forwards in advance of or to the same level as the distal extremity of the other plates, and expands posteriorly into a broad and extended plate, fringed all round with cilia that radiate at right angles to the curved margin.

The third siagnopod (*g*) or first maxillipede consists of two foliaceous plates and one triarticulate, cylindrical branch; the inner plate is long, broad, and of nearly the same breadth to the extremity, which is rounded; the inner margin is fringed with hairs and the outer smooth. The outer foliaceous plate appears to spring from the same base as the inner; it is also subequally broad to the rounded extremity, except upon the inner side near the base, where the triarticulate branch originates; this latter branch is cylindrical, or nearly so, and reaches a little beyond the two plates. Attached to the coxal joint by a small pedicle is a broad, smooth-margined, membranous, mastigobranchial appendage.

The first pair of gnathopoda is only six-jointed. The coxa is short and thick, the two succeeding joints are long, cylindrical and subequal, the next two are genuflexed upon the two preceding; all the joints are fringed with small fine hairs on the lower and outer side, and the terminal joint, which is broad, flat, and truncated, has the distal margin fringed with hairs.

The second pair of gnathopoda is much longer than the first, and consists of six joints, which gradually diminish in size as they succeed each other, the distal joint being strongly fringed with hairs.

The first pair of pereiopoda is slender, feeble, and shorter than the second pair of

gnathopoda; it consists of six joints, of which the first three are short and robust, the meros is long and slender, the carpos long and cylindrical, and the propodos or terminal joint is long, much more slender than the preceding, and strongly fringed with hairs. The two succeeding pairs of pereopoda are seven-jointed; they are formed on the same general type as the first, but longer and a little more robust, and terminate in a minute chela of almost microscopic dimensions, which is all but hidden by the surrounding cilia. The fourth pair of pereopoda in Kröyer's specimen is six-jointed, tolerably robust, and furnished with long hairs on the three distal joints. In the Challenger specimen, however, the fourth and fifth pairs of appendages are in only a young or rudimentary condition, which can scarcely be the result of an immature stage, seeing that in the male animal the prosartema is developed and the animal apparently possesses functional power. I can therefore only assume that, after the animal has arrived at maturity, the posterior two pairs of pereopoda increase in value and importance without ever attaining any functional power. The posterior pair is in a more feeble condition than the fourth.

The pleopoda are short and robust. The first pair in the female is single-branched and simple; all the others are biramose. In the male the first (Pl. LXIX., *p, p*) carries on the inner side, near the middle, attached to a pedicle, a large, membranous petasma, that is united in the median line with a corresponding one on the opposite appendage by a series of small cincinnuli. The second pair of pleopoda (*q*) is biramose, and in the male has the anterior or inner branch developed at the base into a strong lobe that is serrate at the free extremity. The third pair is also biramose, and carries a lobe at the base of the inner branch, but is not serrate. The succeeding pairs are biramose, simple, but become shorter and more robust posteriorly.

The sixth pair, which forms the outer plates of the rhipidura, has the outer branch about one-third longer than the inner; the outer margin is armed with a small sharp tooth, distant about one-third from the apex; from this tooth the margin rapidly tapers to the distal extremity, and is fringed with short, soft hairs, that lengthen a little as they approach the apex, which is slightly truncated and furnished with three or four long, ciliated hairs, continued in gradually diminishing size upon the inner margin until they approach the base of the plate. The inner branch or plate is narrower than the outer, and gradually tapers from the base to the distal extremity; the inner and outer margins are fringed with ciliated hairs that gradually increase in length from the base to the apex.

The telson is about half the length of the inner branch; it is lobed on each side near the base, and then gradually tapers to a slightly truncated extremity, the margin being fringed with ciliated hairs that gradually increase in length from the base of the telson to the apex.

Sergestes arcticus, Kröyer, agrees in its general form with *Sergestes atlanticus*,

Milne-Edwards (*Sergestes frisii*, Kröyer), but differs in the relative measurements of several parts. The peduncle of the first pair of antennæ is according to Kröyer nearly a seventh ("septima ferme parte") shorter than the carapace in *Sergestes atlanticus*, and a third shorter ("tertia parte brevior") in *Sergestes arcticus*.

The peduncle of the second pair of antennæ has the terminal joint in *Sergestes atlanticus* scarcely the sixth of the length of the scaphocerite, while in *Sergestes arcticus* it nearly equals the third part.

The sixth somite of the pleon in *Sergestes atlanticus* is "scarcely the sixth of the length of the animal," and much shorter than the length of the fourth and fifth somites united, and about one-fourth longer than the telson. In *Sergestes arcticus* the sixth somite of the pleon is about "one-fifth the length" of the animal, surpassing the length of the fourth and fifth somites united, and nearly twice the length of the telson.

A careful and close analysis of the species named by Milne-Edwards *Sergestes atlanticus* and by Kröyer *Sergestes frisii* and *Sergestes arcticus*, has induced me to place them as synonyms of one and the same species. I have in the preceding paragraph given the points of difference which Kröyer takes to be of sufficient importance to justify their being considered separate species. If one compares Kröyer's figure with that of Milne-Edwards which was published so far back as March 1830, it will be seen the differences are not very important, and I feel certain that I shall receive the approval of future observers for uniting them. Kröyer's specimen, *Sergestes frisii*, was about 13 mm. in length, and Milne-Edwards' specimen of *Sergestes atlanticus* was 30 mm. long.

Mr. Sidney Smith gives a species of *Sergestes arcticus* as being 90 mm. in length.

The largest of the specimens of *Sergestes atlanticus*, from a dozen different places, in the Challenger collection is 50 mm., and the smallest perfectly developed male specimen in the collection is 24 mm.

If the animal so varies in length after it has attained adult sexual features, I think we may also assume that with successive moultings in time a greater or less variation may take place in the proportion of parts in relation to each other, for if the relative value of one part to the others be constant there could scarcely be room for the origination of species.

Sergestes dorsispinalis, n. sp. (Pl. LXXII. fig. 1).

Carapace rather more than one-third of the length of the animal. Rostrum short, sharp-pointed, and horizontal. Cervical suture well developed, and situated halfway between the frontal and posterior margins; just anterior to the suture, in the median dorsal line, is a small, anteriorly directed tooth.

Pleon with the four anterior somites dorsally smooth and subequal in size; the

fifth a little longer; ventral surface with no conspicuous prominence in the median line. Sixth somite equal in length to the four preceding combined, and slightly projecting posteriorly on the dorsal surface.

Telson about half the length of the rhipidura, armed at the extremity with two teeth, one at each angle and one small one on the lateral margin.

Ophthalmopoda quite half the length of the carapace, slender, clavate.

First pair of antennæ having the peduncle quite as long as the carapace, the first joint the same length as the ophthalmopod, and furnished with a short stylocerite and a circular otocyst; the second and third subequal, the two together being about equal in length to the first.

The second pair of antennæ has the terminal joint of the peduncle reaching to two-thirds the length of the ophthalmopod, and the scaphocerite as far as the middle of the third joint of the peduncle of the first pair of antennæ.

The mandible has a two-jointed synhipod, of which the first joint is very long and the second short.

The first pair of gnathopoda is tolerably robust, but the second, though long, is slender. The pereopoda are also long and slender, the chelæ of the third and fourth pairs being rather long. The fourth and fifth pairs are in a rudimentary condition, the fourth being considerably longer than the fifth.

The first pair of pleopoda is long and slender; the others rapidly decrease in length posteriorly. The terminal pair, which forms part of the rhipidura, has the outer margin furnished with a tooth about one-third distant from the extremity, on a level with the end of the inner branch.

Length, 9 mm. (0.3 in.).

Habitat.—South of Australia, March 1874.

This species is thus named because it has a tooth on the dorsal surface of the carapace. That this tooth should be solitary is remarkable, but the closest inspection has failed to show the presence of a second, which not infrequently exists in some species. Neglecting the value of the dorsal tooth, the animal approximates to *Sergestes corniculum*, from which, however, it further differs in the greater length of the ophthalmopoda and antennæ, as compared with Krøyer's figure and description, which more closely resembles the figure of *Sergestes corniculum* given on Pl. LXXV. fig. 1 of this Report.

Sergestes laterodentatus, n. sp.

Carapace one-fourth of the length of the animal, including the telson and excluding the rostrum. Rostrum long, slender, and horizontally straight, half as long as the carapace. Frontal margin armed with a tooth just above the first pair of antennæ, or between it

and the second. Lateral walls armed with a long tooth over the anterior portion of the branchial region.

Pleon with the three anterior somites smooth and subequal; the fourth and fifth of equal length, but dorsally elevated posteriorly, and each bearing a slender tooth. The sixth somite is as long as the three preceding combined, but not so deep, and is armed at the postero-dorsal margin with a long, slender tooth, and a small point exists at the postero-inferior lateral angles.

Telson long and slender, half the length of the sixth somite, and terminating in a sharply pointed fork, flanked by two small teeth.

Ophthalmopoda clavate, about two-thirds the length of the carapace, or a little longer than the first joint of the first pair of antennæ.

First pair of antennæ having the first joint of the peduncle broad at the base to receive the otocyst, and armed with a strong tooth on the outer margin; the second and third joints are subequal, and together of about the same length as the first; the third supporting one long and one short flagellum; the longer is about half the length of the animal, and the smaller about the length of the terminal joint of the peduncle.

The second pair of antennæ has a sharp tooth on the outer distal angle of the penultimate joint of the peduncle, and the terminal joint is about two-thirds the length of the ophthalmopoda (the flagellum is lost). Scaphocerite as long as the peduncle of the first pair of antennæ, armed on the outer margin, near the apex, with a strong tooth, and fringed on the inner margin with a series of hairs.

The first pair of gnathopoda is generic in appearance, and terminates in a small, flat, ovate, spatuliform joint.

The second pair is very long and slender, and terminates in a few long and strong hairs.

The first pair of pereopoda is simple, the second and third long and chelate, and the fourth and fifth rudimentary.

Pleopoda long and slender, slightly shortening posteriorly; ultimate pair with a strong tooth at the outer distal angle of the basal joint; the inner branch as long again as the telson, the outer about one-fifth longer than the inner, and armed with a tooth on the outer margin, about two-fifths distant from the extremity, the intervening space to the apex being concave and fringed with hairs, as is also the inner margin.

Length, 8 mm. (0.33 in.).

Habitat.—South of Australia, March 1874. One specimen.

Observations.—This species was taken associated with *Sergestes dorsispinalis*, from which it materially differs in having no tooth on the dorsal median surface, but one of great length on each side, on the lateral walls of the carapace, just above the apophysis of the mandibles; and in having a tooth at the dorsal extremity of the three posterior somites of the pleon.

The specimen under examination had been evidently approaching a period of moulting. Having been stained, the subjacent new tissue shows the new dorsal tooth of the sixth somite ready to take the place of the previous one, but shorter and less important, while that on the fifth is still less so, and that of the fourth appears to be wanting.

It closely resembles *Sergestes longirostris* (Pl. LXXV. fig. 3), which was taken off Samboangan, from which, however, it differs in the presence of the two very long dorso-lateral teeth.

Sergestes cornutus, Kröyer.

Sergestes cornutus, Kröyer, Monograph. Fremstilling af Kræb. *Sergestes*, pp. 33, 61, Tab. ii. fig. 2, a-l.

“Rostrum very prominent and acute, equal to or exceeding half the length of the ophthalmopod.

“Ophthalmopoda pyriform, much shorter than the first joint of the peduncle of the first pair of antennæ, having the ophthalmus not distinct from the pedicle and broader than long; the breadth being rather more than one-third of the length of the ophthalmopod, but the length not half that of the ophthalmopod.

“First pair of antennæ has the peduncle very slender and about one-seventh shorter than the carapace; third joint longer than the clavate first joint, and much longer than the second.

“Second pair of antennæ having the last joint of the peduncle linear, and nearly half the length of the scaphocerite.

“Sixth somite of the pleon nearly one-sixth of the length of the animal, but shorter than the fourth and fifth somites combined, or the first and second, very little longer than the telson, but twice as long as broad.

“Pleopoda having the branches long and slender, but the basal joint of the fifth pair only twice longer than broad.

“Rhipidura having the outer ramus armed with a tooth one-third distant from the terminal apex.

“*Habitat*.—Greenland” (Kröyer.)

I have not been able to determine any form that wholly corresponds with this species, but that which I have named *Sergestes nasidentatus* differs from it in the length of the ophthalmopoda, which are about four times the length of the rostrum, or subequal to the first joint of the peduncle of the first pair of antennæ. It was taken off the southern coast of South America, near the island of Juan Fernandez.

Sergestes nasidentatus, n. sp. (Pl. LXXII. fig. 2).

Rostrum produced to a sharp point, and armed on the upper surface with a distinct tooth, a little anterior to the frontal margin. Carapace about one-third of the length of the animal; dorsal surface depressed, with a groove over the gastric region.

Pleon with the dorsal margin smooth; the five anterior somites subequal, lateral margins rounded; sixth somite longer than the two preceding and rather deeper than the fifth, and postero-dorsally produced to a small tooth in a line with the dorsal surface.

Telson about one-half the length of the sixth somite.

Ophthalmopoda long, stout, and clavigerous, about two-thirds the length of the carapace. The ophthalmus is scarcely broader than the stalk, and reaches as far as the first joint of the peduncle of the first pair of antennæ.

The first pair of antennæ about as long as the carapace; first joint as long as the ophthalmopod, second about one-third the length of the first, third subequal to the second; the primary flagellum is slender, but as it is partially broken off its length cannot be determined. The base is enlarged to a bulb, which has a prominence at the distal extremity.

The second pair of antennæ has the terminal joint of the peduncle cylindrical, and more than half the length of the first joint of the peduncle of the first pair, and supports a scaphocerite that reaches beyond the extremity of the ophthalmopoda, is armed on the outer margin, at a short distance from the apex, with a small tooth, and has the inner margin fringed with long ciliated hairs.

The first pair of gnathopoda is rather slender, but not to an unusual extent.

The second pair is slender and long, but not so long as the third and fourth pairs of pereopoda; the joints are all subequal, and fringed with rather long hairs, more thickly implanted on the flexible or posterior side than on the anterior.

The first pair of pereopoda is not very much shorter than the second pair of gnathopoda, reaching quite as far as the extremity of the penultimate joint of the latter. The joints are subequal; there is a prehensile apparatus (fig. 2, *k*) near the last articulation, consisting of a fasciculus of short, stiff, distally serrate hairs or spines attached to the ultimate, and another bundle of short, stiff, simple hairs, to the penultimate joint; each set is curved towards the other. Beyond these, a little distance from each fasciculus, are two isolated spines or hairs, that are curved towards each other; these all meet when the limb is flexed, and form a tolerably efficient prehensile apparatus, which may be of a secondary sexual character. The second and third pairs are long, slender, and fringed with long and delicate hairs, implanted in opposite pairs, and perpendicular to the axis of the limb; each of those pereopods terminates in a small chela, the fingers of which are tipped with a small brush of hairs. The fourth pair is short, scarcely

more than one-sixth the length of the preceding, and feeble in character. The fifth pair is about half the length of the fourth, and almost rudimentary.

The pleopoda are long and slender, but gradually shorten in length posteriorly; the first pair is single-jointed, the others biramose.

The sixth pair is long, and forms the lateral plates of the tail-fan, of which the outer plate equals the sixth somite in length, and is armed with a tooth on the outer margin, one-fourth distant from the distal extremity; the outer margin beyond is fringed with hairs, as is also the inner margin and both margins of the inner plate.

Length, 10 mm. (0.4 in.).

Habitat.—The Pacific Ocean (December 16, 1875), between Valparaiso and Juan Fernandez; in the towing net at a depth of 200 fathoms.

Sergestes diapontius, Spence Bate (Pl. LXXII. fig. 3).

Sergestes diapontius, Sp. B., *loc. cit.*, p. 194.

Rostrum short, prominent, sharp-pointed and directed obliquely upwards, and elevated a little above the dorsal surface of the carapace, which is about one-fourth the length of the animal, including the telson.

Pleon with the three anterior somites subequal in length and dorsally smooth. The next two are about the same length, and dorsally armed with a tooth a little within the posterior margin. The sixth somite is shorter than the two preceding combined, dorsally smooth, and less deep than the fifth. Telson nearly as long as the rhipidura. Ophthalmopoda less than half the length of the carapace; ophthalmus not broader than the distal extremity of the stalk, which gradually tapers to the base.

First pair of antennæ with the first joint of the peduncle short, about one-third the length of the ophthalmopod, the second twice as long as the first, and reaching quite to the extremity of the ophthalmopod, and the third nearly as long as the second, but narrower, and supporting a long, slender flagellum that reaches to about one-half the length of the animal. The base of this flagellum is slightly enlarged, and carries a brush of membranous cilia, and a small rudimentary secondary flagellum.

The second pair of antennæ has the terminal joint of the peduncle broad, and longer than the first joint of the first pair, and reaching to nearly half the length of the second joint; scaphocerite nearly as long as the peduncle of the first pair, or reaching at least to half the distance of the third joint; flagellum long and slender, tapering to a fine thread, and nearly once and a half as long as the animal.

First pair of gnathopoda not specifically peculiar.

Second pair long and robust, being nearly as long as the animal; coxa, basis, ischium, and meros long and subcylindrical, carpos long and slender, rather longer than the meros, propodos shorter than the carpos, and divided into three or four articuli

or small joints, armed on the flexor surface with two or three long, strong, distally serrate spines, and several shorter ones (fig. 3, *i*).

The first pair of pereopoda is short, not reaching beyond the distal extremity of the meros; it is five-jointed, slender, and furnished with a prehensile brush (fig. 3, *k*) at the carpal articulation of the meros; the carpos or terminal joint is more slender than the preceding and is straight. The second and third pairs are long and slender, but not so long as the second pair of gnathopoda, and terminate in small chelæ, each finger of which is tipped with a brush of radiating hairs. The fourth pair of pereopoda is short, about half the length of the third pair, reaching to the distal extremity of the meros, and is fringed on the posterior margin with long hairs.

The fifth pair is shorter and more slender than the fourth, reaching to about one-half its length.

The first pair of pleopoda is short and single-branched; the second is equally short but double-branched; the three posterior are subequal in length but more robust; the posterior pair is short and devoid of a tooth on the outer margin of the external plate, which is fringed with a series of small hairs.

Length, 18 mm. (0.7 in.).

Habitat.—The Atlantic Ocean, April 7, 1876.

Observations.—This species bears a resemblance to *Sergestes ancylops*, Kröyer, but differs from it in the length and form of the ophthalmopoda, the length and robust character of the second pair of gnathopoda, the shortness of the sixth somite of the pleon, the absence of a tooth on the outer plate of the rhipidura, and in the length of the telson.

In the middle of the Pacific, north of the Sandwich Islands, several specimens of *Sergestes* in various stages of progressive growth were taken, and among them was one 2.5 mm. in length, which agreed with this species in all details, except that it had a long and slender rostrum. Another specimen, 3 mm. in length, differed only in the length of the rostrum, and a third, 4 mm. in length, corresponds with the *Mastigopus* shown on Pl. LXV. fig. 4, with which the two preceding also agree in all details, except in the dorsal teeth on the pleon and in the length of the rostrum, which in the two smaller specimens has a few denticles or teeth towards the extremity. Whether the larger belong to the same species as the two smaller it is difficult to determine, but the resemblance of the smaller to this species has induced me to draw attention to them in this place. The larger form appears rather to be the young of *Sergestes oculatus*.

Sergestes armatus, Kröyer (Pl. LXXIII. fig. 1).

Sergestes armatus, Kröyer, Monograph. Fremstilling af Kræb. Sergestes, pp. 44, 63, Tab. iii. fig. 6, *a-e*.

"Rostrum distally prominent, acute, fully half the length of the ophthalmopod.

"Ophthalmopoda long, reaching considerably beyond the second joint of the first pair of antenna, broadly clavate or subfungiform, ophthalmus very distinct from and nearly as wide as half the length of the ophthalmopod, and as long as one-third of it.

"First pair of antennæ having the peduncle one-half the length of the carapace, or one-fifth of that of the animal, with the first joint lamellar and nearly equalling the third in length, both being longer than the second.

"Second pair of antennæ with the scaphocerite four times longer than the last joint of the peduncle and extending nearly as far as the extremity of the peduncle of the first pair.

"Second, third, fourth, and fifth somites of the pleon armed each on the dorsal surface with a sharp tooth; sixth somite one-seventh of the length of the animal, longer than the fourth and fifth somites combined, longer than the telson, and equal to the first and second somites united; not quite twice as long as it is broad.

"Pleopoda very slender.

"Rhipidura with the external plate armed with a small tooth on the outer margin, nearer the base than the apex."

Length, 8 mm. (0.3 in.).

Habitat.—September 12, 1875, between Japan and Honolulu, South Pacific Ocean.

Station 256, July 21, 1875; lat. 30° 22' N., long. 154° 56' W.; north of the Sandwich Islands; depth, 2950 fathoms; bottom, red clay; bottom temperature, 35°·2.

"Greenland" (Kröyer).

Port Jackson, Australia, at night.

The rostrum is waved and produced to a length equalling half that of the ophthalmopod; the carapace, without the rostrum, is about one-third the length of the animal.

Pleon with the first five somites subequal, the fifth being rather the shortest; the first is smooth; the second, third, fourth, and fifth are armed with a long slender dorsal tooth, situated in front of the posterior margin; the sixth somite subequal to the two preceding, and about as deep as half its length.

Telson (fig. 1z) about half the length of the sixth somite, broad at the base and gradually tapering to the extremity.

The ophthalmopoda are long, and have the stalk slender, and the ophthalmus broad and reaching to the extremity of the first two joints of the peduncle of the first pair of antennæ.

The first pair of antennæ (fig. 1b) has the peduncle about two-thirds the length of the carapace, and its three joints subequal. The longer flagellum is broken off in all our specimens, but Krøyer states that it is about two-thirds the length of the animal, and is furnished with a small, rudimentary, secondary branch.

The second pair of antennæ is broken off in our specimen at the extremity of the peduncle, and Krøyer gives it as deficient also; it carries a long, narrow scaphocerite, about as long as the peduncle of the first pair of antennæ, and has the margins nearly parallel, the inner being fringed with ciliated hairs and the outer smooth and armed at the distal extremity with a small tooth.

The oral appendages were not specially examined.

The first pair of gnathopoda does not differ from the typical form.

The second pair is long and slender, being about three-fourths the length of the body of the animal; all the joints except the coxa are subequally long and slender, the two distal joints being fringed with long hairs.

The first pair of pereopoda is short, being scarcely more than half the length of the second pair of gnathopoda, and is furnished with a brush of short spine-like hairs on each of the adjacent surfaces of the carpo-propodal or ultimate articulation, which gives the appendage a feeble prehensile power. The dactylos of this pair of appendages is absent. The second and third pairs of pereopoda are slender, about as long as the first pair of gnathopoda, fringed with tolerably long hairs, and terminate in small chelæ. The fourth and fifth pairs are more rudimentary in the Challenger specimens than in Krøyer's figure, the animal probably being younger.

The pleopoda in the female specimen are moderately long and slender, except the sixth pair, which forms the outer plates of the rhipidura; the outer branch is rather more than twice the length of the telson, and is armed with a small tooth on the outer side about one-third from the base; from the tooth the margins gradually taper to the apex, and are fringed with long ciliated hairs.

Observations.—The dorsal surface of the carapace appears to be broader than is generally the case in this genus, but our specimen, from its small size, is probably not a full-grown animal. A specimen that appears to be a younger or *Mastigopus* form of this species was taken about 60° of west longitude of Station 256, but approximately in the same latitude. It is about 4 mm. in length, and differs chiefly in those features that are characteristic of a younger animal. The scaphocerite is longer and has the margins more nearly parallel than in Krøyer's figure, though not more so than in the animal represented in our figure. The telson and the plates of the rhipidura are narrower than in Krøyer's figure or in our type specimen. The dorsal surface of the pleon is armed with only three teeth, one on each of the three posterior somites, whereas *Sergestes armatus* is armed with four, one on the second, third, fourth, and fifth respectively, but none on the sixth. This difference in the dorsal armature is the

only feature that makes me hesitate to pronounce it to be a younger form of the latter species, which it may be and probably is, only just escaping from the *Mastigopus* stage; the second and third pairs of pereopoda are just assuming their chelate condition. The animal from which our figure is taken is scarcely a mature one.

Sergestes edwardsii, Kröyer (Pl. LXXIII. fig. 2).

Sergestes edwardsii, Kröyer, Monograph. Fremstilling af Kræb. *Sergestes*, pp. 30, 61, Tab. iv. fig. 9 a-k.

“Rostrum rudimentary, directed obliquely upwards.

“Ophthalmopoda slender, shorter than the first joint of the peduncle of the first pair of antennæ. Ophthalmi not distinct from the pedicle, nearly as long as broad, and nearly one-third of the length of the ophthalmopod.

“First pair of antennæ having the peduncle about one-fifth shorter than the carapace: the third joint is rather shorter than the first and longer than the second.

“The second pair of antennæ has the terminal joint of the peduncle short, broad, subovate, and in length nearly equal to one-third of the scaphocerite.

“Sixth somite of the pleon about one-sixth of the length of the animal, or as long as the fourth and fifth somites together, or as the first and second united; about twice as long as broad, and scarcely one-third longer than the telson; inferior margin subangular.

“Pleopoda robust.

“Rhipidura having the outer ramus destitute of a tooth.”

Habitat.—North Atlantic, April 1873.

Pacific Ocean, surface, September 1875;

Cape Verde Islands, April 26, 1876.

Greenland (Kröyer).

Length, 9 mm. (0.33 in.).

Rostrum small, pointed, slightly elevated anteriorly. Carapace less than one-third of the length of the animal.

Pleon having the dorsal surface smooth. The first five somites subequal; the sixth about equal to the two preceding.

Telson about as long as the rhipidura.

Ophthalmopoda short, gradually increasing from the base, and not reaching beyond the extremity of the first joint of the first pair of antennæ.

First pair of antennæ about two-thirds the length of the animal; the first joint a little longer than the ophthalmopod, the second shorter than the first, and the third a little longer than the first; the flagellum is about twice the length of the peduncle,

furnished at the base with a small lobe that carries a series of membranous cilia, and a small rudimentary second flagellum.

The second pair of antennæ (fig. 2c) is imperfect; it carries a scaphocerite that reaches nearly to the extremity of the peduncle of the first pair, and is long, narrow, and tapers very gradually to the distal extremity, which is armed laterally at the apex with a sharp tooth, and is fringed on the inner margin with long ciliated hairs.

The first pair of gnathopoda is short, slender, and feeble; it is armed on the upper side near the base of the ischium with a small, curved, or hook-like tooth, and furnished at the carpo-propodal articulation with a series of hairs, that, on flexion of the joint, assist in giving a feeble degree of prehensile power. The second pair is very long, being more than two-thirds of the length of the animal. The basal joints are very robust and long, and the terminal two slender, the ultimate being the shorter, and, like the preceding, fringed with hairs.

The first pair of pereopoda is small and feeble, the second and third are slender, fringed with hairs, and terminate in small chelæ. The fourth is small and feeble, and the fifth rudimentary and inefficient.

The pleopoda are robust, but not very short, the fifth pair is the shortest, and of the greatest diameter. The sixth pair forms the lateral plates of the rhipidura; the outer or longer plate reaches but little beyond the extremity of the telson, and is fringed on the outer as well as on the inner side with a series of ciliated hairs, but does not carry a small tooth.

This species in its general aspect exhibits a close resemblance to *Sergestes atlanticus*, but may readily be distinguished from it by the absence of the tooth on the outer margin of the external plate of the rhipidura, and by the greater length of the telson.

The first pair of gnathopoda in *Sergestes atlanticus* has no armature of any kind, whilst in this species it carries a small tooth near the base on the upper surface, and a brush of prehensile spines at the carpo-propodal articulation. *Sergestes atlanticus* has been found from Greenland in the north to the Equator. *Sergestes edwardsii*, besides having been recorded at Greenland by Krøyer, has been found in the North and South Atlantic as well as in the Pacific Oceans.

Sergestes rinkii, Krøyer (Pl. LXXIII. fig. 3).

Sergestes rinkii, Krøyer, Monograph. Fremstilling af Kræb. *Sergestes*, pp. 49, 64, Tab. ii. fig. 3, a-g.

“Rostrum straight and short.

“Ophthalmopoda very long, reaching to the extremity of the second joint of the first pair of antennæ, but not beyond it, clavate, with the ophthalmus very distinct from the pedicle, its width equalling the third part of the length of the ophthalmopod.

“First pair of antennæ with the peduncle scarcely shorter than the carapace, exceeding

the fourth of the length of the animal, sublinear, slender; second and third joints subequal, but together much shorter than the first.

"Second pair of antennæ having the last joint of the peduncle elongated, linear, equalling in length a third of the scaphocerite, which is a little longer than the ophthalmopoda, very narrow, linear, straight, and ten times as long as broad.

"All the somites of the pleon are armed in the dorsal median line with a short tooth. The first and second somites carry merely small points, but the others are large, though soft and flexible. The sixth somite is elongated, sublinear, and about one-fifth the length of the animal, nearly equalling the combined lengths of the two preceding somites, and nearly four times as long as broad.

"Pleopoda elongated, very slender; the fifth pair shorter than but as slender as the others.

"Rhipidura having the outer branch armed near the middle of the external margin with a short tooth."

Habitat.—New Hebrides, August 23, 1874.

South Pacific, 1875.

Greenland (Kröyer).

Length, 8 mm. (0.3 in.).

The Challenger specimens are unfortunately very imperfect, but they undoubtedly belong to this species, although the localities are evidently distant from that given by Kröyer.

The rostrum is in a line with the dorsal surface of the carapace, small, but tolerably conspicuous. The carapace is about one-third the length of the animal. The pleon has the dorsal surface of the third, fourth, and fifth somites armed with a tooth situated at the posterior margin; the sixth somite is about as long as the united lengths of the two preceding somites. Telson (3z) about half the length of the rhipidura, and terminating in two long spines.

Ophthalmopoda subequal to the first two joints of the first pair of antennæ. The ophthalmus is broader than the stalk, projecting more above than below it.

The first pair of antennæ has the first joint longer than the other two. The longer flagellum is broken off.

The second pair of antennæ is also broken, and carries a scaphocerite that reaches nearly to the extremity of the peduncle of the first pair; it is fringed on the inner side with long ciliated hairs, and on the outer it is armed with a strong tooth, which, in our specimen, is very long, and is situated at some distance from the extremity, whereas Kröyer figures it as being at the extremity and extending beyond it.

Only the first pair of gnathopoda is preserved of all the appendages of the pereion, but it offers no feature of any specific value.

The pleopoda are long and slender; the first pair is single-branched, the others

biramose. The anterior pair is much the longest, while the posterior is the shortest. The outer plates of the rhipidura are armed on the outer margin with a small tooth, distant from the extremity about one-third the length of the plate; the margin beyond gradually tapers to the apex and is fringed with ciliated hairs.

Observations.—There are some points of difference between the Challenger specimen and the description and figure of Kröyer. The rostrum in the former is conspicuous for so small an animal, whereas Kröyer both figures and describes it as rudimentary. The ophthalmopod agrees with Kröyer's description, but differs from his figure in not having the eye symmetrically implanted on the stalk. The sixth somite is shorter than in Kröyer's figure, and although the telson in a general way resembles that given by him, it differs in minute details. Kröyer represents the telson as terminating in two long spine-like horns curving towards one another at the apex, but in the Challenger specimen the telson is cleft at the extremity into two lateral lobes, each of which terminates in a spine that distally curves towards the other, and besides these, there is on the inner side of each another small spine; there are also two others distally situated, one on each side of the telson (3z).

These are points that are not of any great value in specific definition and may be only features of immature growth. They are probably just those details that vary most in specimens from distant localities and lead to greater or less permanent changes of character.

Our specimens were taken in the South Pacific, and those of Kröyer within the Arctic zone.

Sergestes oculatus, Kröyer (Pl. LXXIV. fig. 1).

Sergestes oculatus, Kröyer, Monograph. Fremstilling af Kræb. *Sergestes*, pp. 27, 61, Tab. iii. fig. 5, a-f.

“Rostrum rudimentary.

“Ophthalmopoda longer than the first two joints of the peduncle of the first pair of antennæ, extending to about the extremity of the second, fungiform and supported on a long and slender pedicle. Ophthalmus short, somewhat dilated, and about one-fifth the length of the pedicle.

“First pair of antennæ having the peduncle one-fourth shorter than the carapace; the third joint as long as the first and one-fourth longer than the second.

“Second pair of antennæ having the scaphocerite four times longer than the last thick joint of the peduncle.

“Pereiopoda having the fourth pair scarcely natatorial. Sixth somite of the pleon one-fifth the entire length of the animal, as long as the fourth and fifth or as the first and second somites united; nearly twice as long as broad, and three times longer than the telson.

"Pleopoda very long and slender, except the fifth pair. Outer ramus of the rhipidura destitute of a marginal tooth."

Habitat.—Station 106, August 25, 1873; lat. $1^{\circ} 47'$ N., long. $24^{\circ} 26'$ W.; Mid Atlantic; surface to 40 fathoms. Four specimens.

Station 257, July 23, 1875, lat. $27^{\circ} 33'$ N., long. $154^{\circ} 55'$ W., about five degrees south of the Sandwich Islands. Whether it was obtained, as I am inclined to believe, in the towing-net near the surface, as most of the other specimens were, or at the recorded depth of the station (2875 fathoms), is not mentioned.

North Pacific, near the Sandwich Islands, August 21, 1875.

August 27, 1873. Six male specimens were taken at the surface, off St. Paul's Rock.

September 12, 1875. South Pacific, north of the Low Archipelago; a single specimen.

Station 103, August 22, 1873; lat. $2^{\circ} 52'$ N., long. 17° W.; Atlantic, south-west of Sierra Leone, at 100 fathoms. Recorded depth of Station is 2475 fathoms.

Greenland (Kröyer).

Length, 6 mm. (0.25 in.)

The specimen from which our figure is taken was captured in a tow-net at a depth of about 100 fathoms in the tropical part of the Atlantic, and corresponds closely with Kröyer's description of the species taken off Greenland.

The rostrum is rudimentary and not elevated above the dorsal surface of the carapace.

The pleon is smooth, with the five anterior somites subequal and the sixth a little longer than the two preceding somites combined, and terminating posteriorly in a small tooth.

Telson about half the length of the sixth somite.

Ophthalmopoda long and slender, terminating in a broad eye that reaches to the extremity of the second joint of the peduncle of the first pair of antennæ.

The first pair of antennæ (fig. 1, *b*) with the first two joints subequal, the third joint longer than the second, and the flagellum not enlarged at the base, but supporting a fasciculus of membranous cilia at a little distance from the extremity of the peduncle.

Second pair of antennæ (fig. 1, *c*) having the scaphocerite as long as the peduncle of the first pair of antennæ, furnished with a small tooth on the outer margin near the apex, and having the inner margin fringed with hairs (fig. 1, *c''*).

The first pair of gnathopoda has no peculiar feature.

The second pair of gnathopoda is long and robust, except the two ultimate joints, which are slender and straight.

The first pair of pereopoda is short, about half the length of the second pair of gnathopoda. The second and third pairs are long and slender and terminate in small chelæ. The fourth and fifth pairs are feeble and rudimentary.

The pleopoda are slender but not long, increasing in diameter posteriorly. The sixth pair has the outer branch long, with the external margin straight, unarmed and smooth from base to apex, and the inner margin thickly fringed with long ciliated hairs; the internal ramus is one-third shorter than the outer and furnished with ciliated hairs.

In our specimen the second pair of gnathopoda has a peculiarity that is found in a few other species, in having the coxa largely increased in diameter. The value of this feature I have not been able to determine, but I think it is a character special to young male specimens previous to the development of more distinctly sexual characters.

This species closely approaches the two following.

At the surface of the China Sea a specimen about 7 mm. in length was taken, that corresponds with this species in all essential details, except that there is a little tooth only on the fifth and sixth somites of the pleon, the fourth somite being smooth. This variety differs from *Sergestes ancylops*, Kröyer, in having no tooth on the outer plate of the rhipidura.

Sergestes ovatoculus, n. sp. (Pl. LXXIV. fig. 2).

Rostrum short, slightly elevated above the line of the dorsal surface. Carapace more than one-third the length of the animal. Pleon having the anterior five somites subequal in length, the dorsal surface of the anterior four smooth, the fifth elevated into a strong prominence in front of the posterior margin, the apex of which is crowned with a small posteriorly projecting tooth. The sixth somite is equal to the combined lengths of the two preceding; it projects posteriorly in the dorsal median line to a blunt point, and has the lower margin fringed with ciliated hairs.

The telson is narrow, tapering, has the lateral margins fringed with numerous, long, ciliated hairs, and terminates in two small teeth.

The ophthalmopoda are about half the length of the carapace, or a little longer than the first joint of the peduncle of the first pair of antennæ. The ophthalmus is ovate, much broader than the stalk and abruptly enlarged to a fungiform shape.

The first pair of antennæ has the first joint of the peduncle as long as the stalk of the ophthalmopod, the second joint about half the length of the first, and the third nearly twice as long as the second; the longer flagellum is lost in our specimen.

The second pair of antennæ has the last joint of the peduncle terminating subequally with the first joint of the first pair; the flagellum is lost; the scaphocerite is narrow and nearly twice as long as the ophthalmopod, and is armed with a tooth near the distal extremity.

The first pair of gnathopoda is the only set of appendages of the pereon preserved, and offers no very distinguishing specific character.

The pleopoda are tolerably long, robust, and gradually shorten posteriorly.

The ultimate pair, which helps to form the rhipidura, is longer than the sixth somite of the pleon; the outer plate is narrow and has the external margin armed with a small tooth, about a third from the apex, beyond which it is fringed with ciliated hairs, as is also the inner plate.

Length, 10 mm. (0.4 in.).

Habitat.—The North Atlantic Ocean.

Observations.—This species corresponds very closely with *Sergestes oculatus*, Kröyer; the chief differences are that the outer margin of the rhipidura is armed with a tooth one-third distant from the apex, while in *Sergestes oculatus* it is smooth, and that the fifth somite has a tubercular, small-toothed prominence on the dorsal surface. *Sergestes parvidens* also possesses a close resemblance to this species, and demonstrates the affinity that these species have to one another, although they possess certain differential features that are characteristic of specific distinction.

Sergestes parvidens, n. sp. (Pl. LXXIV. fig. 3).

This species corresponds generally with the preceding; but instead of having only the fifth somite elevated to a dentate protuberance, there is one on the fourth, while the fifth bears a very minute tooth, as does also the sixth, which has the sides proportionately deeper than the preceding somites. The scaphocerite, instead of being rounded at the apex, narrows to a sharp tooth that arms the outer margin at the apex. The second pair of gnathopoda is wanting, but the pereopoda, all of which are preserved, are long and slender, and correspond with those of *Sergestes oculatus*. The first pair (fig. 3, k) is furnished with distinct prehensile hairs situated near the ultimate articulation.

The outer plates of the rhipidura are much longer than the inner, and are fringed on both sides with fine hairs; the outer margin is not armed with a tooth as in *Sergestes ovatoculus*, but it is represented by an obtuse angle, about a fourth of the distance from the base, and defines the limit at which the marginal hairs begin.

Length, 9 mm. (0.36 in.).

Habitat.—The tropical part of the Atlantic; Pacific Ocean, north of the Sandwich Islands; off Sydney and Wellington, Australia.

Observations.—Specimens of this species or variety were taken during the passage from Teneriffe to St. Thomas; *Sergestes ovatoculus* was taken in the North Atlantic, June 14, 1873, and therefore near the same place; and *Sergestes oculatus* was taken among the Gulf-weed, and so far as geographical distribution is concerned, the Atlantic habitats of all these species are within the same region.

Kröyer has made the existence and position of the tooth on the outer margin of the

rhypidura a feature of importance in his description of species, and thus differs from Milne-Edwards, who has not even taken notice either of its presence or its absence in his typical species, *Sergestes atlanticus*. It appears to me that this tooth varies considerably in position according to the age of the specimen, and although in some species it may be either absent or more or less strongly developed in the adult, yet it certainly appears to travel towards the apex with advancing age, a change produced by the relatively greater growth of the appendage taking place at the base with each successive moult, so that with every exuviation the tooth gets more distant, and consequently appears to be nearer the apex.

North of the Sandwich Islands, in Mid Pacific, a specimen, 20 mm. in length, was taken that approaches very closely to this species, but it is much larger. It agrees closely with the figure given in Pl. LXXIV. fig. 3, but there is a very minute denticle on the rostrum which is not present in the typical specimen.

A specimen taken off Sydney, Wellington, Australia, 12 mm. in length, corresponds in almost every detail with the Atlantic form, so that it is impossible to separate them specifically, although the localities are so distant. In this specimen the little tooth which arms the outer plate of the rhypidura, is present on the right side and absent on the left, which consequently diminishes the interval between this form and *Sergestes oculatus*.

The young of this genus are frequently, if not always, tuberculated and spinous, while the adults are more generally smooth than denticulated, a circumstance that might suggest that *Sergestes ovatoculus* and *Sergestes parvidens* were immature forms of some one species; but when we consider their near approach in relative dimensions, I think I am, in the present state of our knowledge of the genus, justified in considering them as specifically distinct.

Sergestes corniculum, Kröyer (Pl. LXXV. fig. 1).

Sergestes corniculum, Kröyer, Monograph. Fremstilling af Kræb. Sergestes, pp. 36, 62, Tab. iii. fig. 4, a-e.

“ Rostrum projecting forwards, very slender and acute.

“ Ophthalmopoda subequal to or a little shorter than the first joint of the peduncle of the first pair of antennæ, clavate; ophthalmus very distinct from the peduncle, and about one-third or one-fourth of it in length; twice as broad as long, but the breadth not reaching one-half the length of the ophthalmopod.

“ First pair of antennæ with the peduncle about one-fifth shorter than the carapace; the first joint is as long as the second and third combined.

“ The second pair of antennæ with the last joint of the peduncle linear, and about one-third the length of the scaphocerite.

"The second pair of gnathopoda¹ at least two-thirds the length of the entire animal.

"Sixth somite of the pleon nearly one-fifth of the length of the animal, equal to the fourth and fifth somites combined, and nearly as long as the three anterior somites united; it is twice as long as broad and not much longer than the telson.

"Pleopoda very long and slender.

"Rhipidura having the external margin of the outer branch armed about midway with a sharp tooth, but rather nearer the base than the apex."

Habitat.—Cape York; north of New Guinea; North-West Pacific; Greenland (Kröyer).

Carapace about one-third the length of the animal. Rostrum horizontal, slender, but not very long, reaching to about one-third the length of the ophthalmopod.

Pleon having the five anterior somites subequal, and the sixth nearly equal to the united length of the three preceding; dorsal surface unarmed, excepting that the posterior margin of the ultimate somite projects posteriorly as a small point. The sixth somite is about half as deep as long, and has the inferior margins fringed with ciliated hairs, which gradually increase in length and thickness posteriorly.

The telson is long, narrow, and tapers slightly to the extremity, which terminates in a small fork; the margins are thickly fringed with long ciliated hairs that are continuous to the extremity.

The ophthalmopoda are about one-half the length of the carapace, reaching as far as the extremity of the first joint of the peduncle of the first pair of antennæ. The ophthalmus is about twice the greatest breadth of the stalk.

The first pair of antennæ has the peduncle about as long as the carapace, and terminates in a slender flagellum that makes the entire organ equal in length to the animal; the first joint is the longest, and about equal to the second and third together; the second is only slightly shorter than the third; the third supports a long and slender flagellum that is enlarged at the base into a strong bulb, which supports a series of membranous cilia, and a small secondary feeble and immature branch.

The second pair of antennæ has the ultimate joint of the peduncle very long, equalling that of the first joint of the peduncle of the first pair, and supports a long and slender flagellum, a large portion of which is broken off, so that its length in the Challenger specimens cannot be determined. The scaphocerite is long and broad, reaching quite to the extremity of the second joint of the peduncle of the first pair of antennæ; the outer margin has a small tooth near the extremity, and the inner margin is fringed with strong ciliated hairs.

The first pair of gnathopoda is rather smaller than usual.

¹ *Pes maxillaris tertius bessem longitudinis totius animalis minime æquans*, in Kröyer's description, is undoubtedly homologous with the second pair of gnathopoda, and not with the third pair of maxillæ (or maxillipedes).

The second pair is long and well developed, being nearly three-fourths the length of the animal, but not especially robust; the terminal two joints are slender and fringed with hairs.

The first pair of pereopoda is two-thirds the length of the second pair of gnathopoda. The upper margin of the ischium is armed with a small tooth, and a fasciculus of small hairs or spines is implanted at the propodal articulation of the carpos; it is fringed with hairs, those on the lower or posterior surface being very long, especially towards the base. The propodos is also ciliated on both sides, but the hairs are not so long. The second and third pairs of pereopoda are long, quite as long as the second pair of gnathopoda, and have the carpos and propodos fringed with long hairs, which are elevated on small prominences that give these appendages a multiarticulate appearance; each terminates in a small rudimentary chela. The posterior two pairs are feeble, the penultimate reaching nearly as far as the extremity of the meros, while the ultimate is small and rudimentary.

The pleopoda are robust and tolerably long, gradually decreasing in length posteriorly, but not increasing in diameter, as they frequently do in various species.

The rhipidura is quite as long as the sixth somite of the pleon; the outer margin near the middle is armed with a very minute tooth, posterior to which it is fringed with strong, ciliated hairs, similar to those on the inner branch.

Length, 12 mm. (0.5 in.).

Observations.—The specimen from which I have taken the preceding description corresponds so closely with that of Kröyer, that I do not hesitate to identify them as being the same, even though the localities are so widely separated; yet under a moderate magnifying power there is a difference that must not be passed over. In Kröyer's figure the rostrum is shown to be horizontal, in the same line as the dorsal surface of the carapace; in that which I have described the rostrum is horizontal but it is elevated slightly on a crest above the dorsal surface, on which, above the orbital margin, a minute point exists which is only observable under 60 diameters magnifying power. So similar are all the other features that I am induced to believe that these details were probably not appreciable under a low magnifying power, and therefore not described as being present in Kröyer's typical specimen.

A specimen taken in the North Atlantic (April 29, 1876) has the rostrum more than half the length of the ophthalmopod, and the chelæ at the extremity of the second and third pairs of pereopoda are not developed, as if the animal were still in an immature condition, which appears to be the state of Kröyer's specimen, if we may judge from his figure. In that which I have figured the chelæ are so minute as only to be determined by a considerable magnifying power, which may be the case with Kröyer's specimens also.

The specimens taken north of New Guinea have the rostrum short, as shown in Kröyer's figure.

Sergestes laciniatus, Kröyer.

Sergestes laciniatus, Kröyer, Monograph. Fremstilling af Kræb. *Sergestes*, pp. 58, 66, Tab. v. fig. 15, a-e.

"Rostrum straight, rudimentary.

"Ophthalmopoda reaching nearly to the extremity of the first joint of the peduncle of the first pair of antennæ, clavate; ophthalmus very distinct from the pedicle, very short, being about the fourth or fifth of the length of the ophthalmopod, and nearly twice as long as broad.

"First pair of antennæ has the peduncle a little shorter than the carapace; first joint subclavate, and nearly as long as the second and third together; the second distinctly longer than the third.

"Second pair of antennæ having the last joint of the peduncle sublinear, reaching to nearly half the length of the linear scaphocerite.

"Second pair of gnathopoda¹ equal in length to nine-tenths of the entire animal.

"Sixth somite of the pleon a fifth of the length of the animal, or equal to the first, second, and third somites united (much longer than that of the fourth and fifth somites together), and twice as long as broad.

"Pleopoda long and slender; basal joint of the fifth pair four times longer than broad. Rhipidura having the external branch furnished with a rudimentary sharp point on the outer margin, situated anterior to the middle."

Habitat.—Greenland (Kröyer).

Observations.—This species does not appear to differ from *Sergestes corniculum* in any marked feature. According to Kröyer the chief distinction lies in the length of the rostrum, which is rudimentary in *Sergestes laciniatus* and well defined in *Sergestes corniculum*, and in the ophthalmus being more distinct from the stalk in the former than in the latter. The author gives no figure of the animal as a whole.

I can recognise no specimen in the collection of the Challenger that corresponds with this description.

Sergestes ancylops, Kröyer (Pl. LXXV. fig. 2).

Sergestes ancylops, Kröyer, Monograph. Fremstilling af Kræb. *Sergestes*, p. 46, Tab. iii. fig. 8, a-e.

"Rostrum small but distinct.

"Ophthalmopoda generally much longer than the first joint of the first pair of antennæ, angular, with the pedicle slender, straight, or nearly so, with long ovate ophthalmus.

¹ *Pes maxillaris tertius longitudine 2/3 totius animalis æquans* (vide note, p. 411).

"First pair of antennæ having the peduncle two-thirds the length of the carapace, and about the fifth part of the length of the animal (or a little longer); third joint longer than the first, distinctly clavate, and much longer than the second.

"Second pair of antennæ having the last joint of the peduncle linear, equalling half the length of the narrow scaphocerite.

"Sixth somite of the pleon exceeding a little the sixth part of the length of the animal, and nearly twice as long as broad, and one-fifth longer than the telson.

"Pleopoda long and slender.

"Rhipidura having the external margin armed with a sharp tooth, about one-third from the apex.

"Length, 4 mm. (0.16 in.)."

Rostrum horizontally continuous with the dorsal surface of the carapace.

Pleon having the five anterior somites subequal, the fourth and fifth being armed with a strong dorsal tooth, a rudiment of another tooth apparently existing on the third also. The sixth somite is about as long as the two preceding, and projects posteriorly at the dorsal margin into a small tooth.

The telson reaches to rather more than half the length of the rhipidura.

The ophthalmopod reaches beyond the extremity of the second joint of the peduncle of the first pair of antennæ. The ophthalmus is ovate and implanted obliquely on the stalk; the inner or extended portion is continuous with the inner or upper margin of the stalk, which causes the latter to appear arched.

The first pair of antennæ is imperfect, being broken off at the extremity of the peduncle. The second pair is also broken, but the scaphocerite is present and reaches to about two-thirds the length of the peduncle of the upper antennæ; it is narrow, with the margins almost parallel, fringed with cilia at the inner margin, and armed with a tooth at the outer angle of the apex.

The first pair of gnathopoda is generic in character. The second pair is long and powerful, but the terminal joint is slender and fringed with cilia.

The first pair of pereopoda is about two-thirds the length of the others, which are a little less in length than the second pair of gnathopoda, feeble in character and fringed with hairs. The last two are rudimentary.

The pleopoda are slender but not extremely long, the fifth pair being the shortest and most robust. The sixth or ultimate pair, which forms the lateral portion of the rhipidura, is armed on the outer margin of the external plate with a feeble hair-like tooth, situated rather more than a third from the apex, beyond which the margin is furnished with hairs fringed with cilia.

Length, 7 mm. (0.3 in.).

Habitat.—New Hebrides; Pacific, July 20, 1875; Greenland (Krøyer).

Observations.—The specimen from the New Hebrides, which I have selected as belonging to this species, differs from Kröyer's description in having a small tooth or tubercle on the dorsal surface of the third somite of the pleon; in all other respects it corresponds very closely, and is probably a young one, or one not yet fully developed.

Sergestes longirostris, n. sp. (Pl. LXXV. fig. 3).

Rostrum long, slender, directed horizontally forwards in a line with the dorsal surface of the carapace, of which it is rather more than one-half the length. Carapace, not including the rostrum, about one-third of the length of the animal.

Pleon having the five anterior somites subequal, the three anterior dorsally smooth, and with the postero-lateral margins round; the succeeding two somites are dorsally armed with a tooth at the posterior margin, and the postero-lateral margin is also produced to a point, of which that of the posterior is the more prominent; the sixth somite is about equal in length to the three preceding somites united, and is dorsally furnished with a tooth at the posterior margin.

The telson is about half the length of the rhipidura, terminates in a forked extremity, and has on each side a small hair or spine.

The ophthalmopoda are long, reaching to the extremity of the second joint of the first pair of antennæ and passing beyond the extremity of the rostrum by the breadth of the ophthalmus, which is broader than the stalk, and gives the organ a clavate appearance.

The first pair of antennæ has the first joint the longest, the second a little shorter than the first, and the third a little shorter than the second. The long flagellum is wanting in our typical specimen, and the secondary branch is very rudimentary.

The second pair of antennæ has the flagellum also wanting, but the scaphocerite is long and narrow, as long as the ophthalmopod, has the margins parallel, and terminates in a rounded extremity, the outer margin being armed with a long tooth that is situated at some little distance from the extremity, and the inner margin fringed with long ciliated hairs.

The oral appendages have not been examined.

The first pair of gnathopoda is the only appendage belonging to the pereion that is preserved, and it exhibits no character of any specific value.

The pleopoda are moderately long and slender; the first pair being the most so, and the fifth pair the stoutest and most robust. The first pair is simple, the second and three following carry a small secondary ramus that becomes smaller in each succeeding pair, and is almost a rudimentary bud on the fifth pair. The sixth pair, forming the outer plates of the rhipidura, has the outer margin armed with a strong tooth near the middle, beyond which it is fringed with ciliated hairs, which are also present on the inner margin and on both margins of the inner plate.

Length, 6 mm. (0.25 in.).

Habitat.—Mid Atlantic, April 1876.

Observations.—The specimen has the appearance of being an immature animal, and but for the form of the ophthalmus and the length of the rostrum I should have thought it related to *Sergestes ancylops*; it is about twice its size, and differs in some other apparently important features.

Sergestes junceus, n. sp. (Pl. LXXVI. fig. 1).

Rostrum small and slightly elevated above the dorsal surface of the carapace, which is a little less than half the length of the animal exclusive of the telson.

Pleon with the first three somites subequal and dorsally smooth. The two succeeding subequal in length, and dorsally armed with an elevated tooth just in front of the posterior margin. Sixth somite rather longer than the three preceding combined, posteriorly produced to a small tooth, and with the lateral walls not deeper than those of the preceding somites.

Telson nearly half the length of the sixth somite.

Ophthalmopoda about one-third the length of the carapace, and reaching a little beyond the distal extremity of the first joint of the first pair of antennæ. The ophthalmus is not very large, and the stalk, which is slender, narrows at first suddenly, and then gradually to the base.

The first pair of antennæ is about half the length of the carapace; the first joint is longer than the other two, and reaches nearly to the extremity of the ophthalmopod; the second is about one-third the length of the first, and the third is shorter than the second, and supports a flagellum, which is broken, and a short rudimentary appendage.

The second pair of antennæ carries a long, narrow scaphocerite, which is armed on the outer margin at a little distance from the extremity with a long and slender tooth; the inner margin is fringed with ciliated hairs.

The oral apparatus is situated anterior to the centre of the carapace.

The first pair of gnathopoda is rather slender, and is only generic in character. The second pair is wanting, but the coxa is larger in diameter than that of the other limbs.

The first pair of pereopoda is long and slender, and devoid of any prehensile apparatus. The second pair is long and slender, and is once and a half as long as the first pair, and terminates in a very minute chela. The third pair is broken off at the basis. The fourth and fifth pairs are merely rudimentary or bud-like.

The pleopoda are long and slender, slightly decreasing in length, and increasing much in diameter posteriorly. The posterior pair, which forms the outer plates of the rhipidura, is long and broad, about as long as the sixth somite of the pleon; the outer margin of

the external plate is armed with a small tooth, one-third distant from the extremity, and beyond that is fringed with hairs.

Length, 6 mm. (0.25 in.).

Habitat.—South Pacific Ocean.

Observations.—This specimen is evidently one of the group that connects *Sergestes* with *Leucifer*. The great length of the cephalon, the distance between the oral apparatus and the frontal margin of the carapace, and the reduction of the two posterior pairs of pereopoda to a rudimentary condition, demonstrate its tendency to depauperisation in the direction of that genus.

Sergestes longispinus, n. sp. (Pl. LXXVI. fig. 2).

Rostrum long, slender, and sharp, dorsally armed with a small denticle a little in advance of the frontal margin, and about one-third the length of the carapace, which is about one-third the length of the animal.

Pleon with the five anterior somites subequal, and dorsally armed with a strong tooth; the two anterior teeth are small and anteriorly directed; the two succeeding long, perpendicular, and spine-like, and the fifth small and directed posteriorly; the sixth somite is equal to the united lengths of the three preceding, but not so deep laterally, and is dorsally armed posteriorly with a tooth that is directed backwards in a line with the dorsal surface, and one also at the postero-inferior angle.

The telson is long and slender, being more than half the length of the outer branch of the rhipidura.

The ophthalmopoda are fungiform and about as long as the carapace; the stalk is long and slender, and the ophthalmus much broader than the stalk.

The first pair of antennæ has the three joints of the peduncle subequal; the terminal flagellum is broken off short.

The second pair of antennæ has the last joint of the peduncle long and cylindrical, and the scaphocerite is long, narrow, and with parallel margins, the outer being smooth and armed near the extremity with a sharp, slender tooth, and the inner fringed with a series of ciliated hairs.

The first pair of gnathopoda is rather short, but not specifically peculiar.

The second pair of gnathopoda is long, with the basal joints robust, and the distal slender and furnished with fine hairs.

The first pair of pereopoda (fig. 2*k*) is short, about half the length of the second pair of gnathopoda; the basis is armed with a small denticle or obtuse point, and the under or posterior margin bears a series of distantly placed hairs, as also does the meros; the terminal joints are furnished with closely placed hairs, and the ultimate is reduced to a

minute size. The second and third pairs are long, slender, and terminate in small chelæ. The fourth and fifth pairs are entirely absent.

The pleopoda are slender, not very long, and gradually become shorter and more robust.

The sixth pair of pleopoda is about as long as the sixth somite of the pleon; the outer margin of the external plate is armed with a small tooth halfway between the basal and distal extremities; the rest are furnished with long ciliated hairs.

Length, 12 mm. (0.5 in.).

Habitat.—Station 106, August 25, 1873; lat. $1^{\circ} 47' N.$, long. $24^{\circ} 26' W.$; Mid Atlantic Ocean, within 40 fathoms of the surface.

Station 354, May 6, 1876; lat. $32^{\circ} 41' N.$, long. $36^{\circ} 6' W.$; North Atlantic Ocean.

Observations.—The specimen from the former station appears to correspond with the genus *Acetes* in the absence of the posterior two pairs of pereopoda, but I am inclined to think, from the presence of these appendages in a rudimentary condition in the specimen from the latter station, that their absence is owing to the early stage of development.

The telson is rather longer in the specimen from the tropical part of the Atlantic than in that from the North Atlantic, which also has the ventral surface produced to large lobes in the median line, the anterior two being each furnished with a short strong tooth.

Sergestes penerinkii, n. sp. (Pl. LXXVI. fig. 3).

Carapace about one-third the length of the animal; rostrum short, about one-fourth the length of the carapace, and projecting horizontally forwards; frontal margin not produced to a tooth at the outer angle of the orbit.

Pleon having the first two somites armed on the ventral surface in the median line with a strong, sharp tooth, broad at the base, and directed forwards; the second being more prominent than the first. The third, fourth, and fifth somites are dorsally armed with a strong tooth in the median line of the posterior margin, and on the ventral surface in the median line with a strongly projecting unarmed lobe. The sixth somite is furnished with a tooth on the posterior dorsal margin, and is about as long as the two preceding somites together.

Telson about half the length of the sixth somite.

The ophthalmopod is very nearly as long as the carapace, the stalk slender, and the ophthalmus broad.

The first pair of antennæ having the extremity of the peduncle reaching scarcely beyond the extremity of the ophthalmopod; the three joints subequal or nearly subequal in length.

Second pair of antennæ with a scaphocerite as long as the peduncle of the first pair, and armed on the outer margin subapically with a small tooth.

The first pair of gnathopoda is generic in character.

The second pair is long; the three proximal joints are long and robust, the next long and slender, and the terminal uniarticulate, slender, and fringed with hairs.

The first pair of pereopoda is short, slender, and carries a small but strong curved process attached to the posterior margin of the ischium. The other pereopoda are missing.

The pleopoda are long and slender, slightly shortening posteriorly.

The outer margin of the external plate of the rhipidura is armed with a tooth one-third from the base, and distally fringed with short hairs; the inner margin is fringed with long hairs, as are also both margins of the inner plate.

Length, 8 mm. (0.3 in.).

Habitat.—North Atlantic Ocean.

Observations.—This species bears a strong resemblance to *Sergestes rinkii*, Kröyer, but differs in the following points:—in having the rostrum one-third the length of the ophthalmopoda, or about one-fourth the length of the carapace, instead of being short and rudimentary; the ophthalmus planted obliquely on the stalk, instead of being symmetrically even (*vide* Kröyer's figure, pl. ii. fig. 3); a sharp, projecting, mesial tooth on the ventral surface of the first and second somites of the pleon, and an obtuse projection on the three following somites; the ophthalmopoda subequal to the peduncle of the first pair of antennæ, instead of not reaching beyond the extremity of the second joint; a small tubercular process attached to the posterior margin of the ischium of the first pair of pereopoda, not present in *Sergestes rinkii* (Kröyer has figured the appendages separately); the terminal pair of pleopoda, which helps to form the rhipidura, armed on the outer margin with a sharp tooth that is nearer the basal articulation than is the extremity of the telson, while that of *Sergestes rinkii* is much nearer the distal extremity.

Sergestes fermerinkii, n. sp. (Pl. LXXVI. fig. 4).

Carapace rather less than a third of the length of the animal. Rostrum smooth, sharp and horizontal, about one-fourth the length of the carapace. Frontal margin produced to a sharp tooth at the outer orbital angle.

First somite of the pleon dorsally smooth and laterally furnished with a short anteriorly directed tooth or tubercle. Second somite subequal and smooth. Third, fourth and fifth dorsally armed near the posterior margin with a strong tooth; as is also

the sixth somite, which is nearly as long as the three preceding somites combined. The infero-lateral distal angle of each is rounded.¹

Telson short, about one-third the length of the last somite.

The ophthalmopod is about three-fourths the length of the carapace; the ophthalmus much larger than the diameter of the stalk.

First pair of antennæ with the peduncle longer than the ophthalmopod; first joint largely developed at the base to receive the otocyst; the second and third joints nearly as long as the first.

The second pair of antennæ carries a scaphocerite that is longer than the peduncle of the first pair, narrow, with parallel margins, and armed on the outer or smooth margin with a long tooth, somewhat distant from the apex.

The first pair of gnathopoda is the only one preserved of the long appendages of the pereion.

The pleopoda are long and slender, and the terminal or sixth pair is armed on the outer margin with a tooth that is nearly a third distant from the basal joint.

Length, 5 mm. (0.2 in.).

Habitat.—Pacific Ocean, lat. 24° S., long. 148° W.

Observations.—This specimen bears a close resemblance to the Challenger specimen of *Sergestes rinkii*, which was also taken in the Pacific, but it differs in having the telson shorter, the tooth on the outer margin of the rhipidura nearer the base, and in having a strong tooth on the frontal margin of the carapace. It also differs from Krøyer's figure of *Sergestes rinkii* in having a longer rostrum, and in the form of the scaphocerite; in both these points it corresponds more with our figure of *Sergestes rinkii* than with Krøyer's. It differs from *Sergestes penerinkii* in having a frontal tooth at the outer canthus of the orbital notch, in not having any tooth or protuberance on the ventral median line of the somites of the pleon; and in the shorter telson.

Sergestes tenuiremis, Krøyer.

Sergestes tenuiremis, Krøyer, Monograph. Fremstilling af Kræb. Sergestes, pp. 39, 62, Tab. iv. fig. 11, a-b.

“Rostrum upright, rudimentary.

“Ophthalmopoda clavate, rather longer than the first joint of the peduncle of the first pair of antennæ, or at least equal to it; the pedicle slender, elongated, distinct from the ophthalmus, and more than twice as long. Ophthalmus nearly four times as broad as long, one-third the length of the pedicle, and in diameter scarcely less than a third.

“First pair of antennæ with the peduncle only a little longer than half the length of

¹ I have unfortunately drawn an extra somite to the pleon; there are only two smooth somites instead of three; the second should have been omitted.

the carapace; the third joint of the peduncle is subequal in length to the second, and the two together are equal in length to the first.

"The second pair of antennæ with the scaphocerite sublinear, and six times as long as broad; the last joint of the peduncle is linear, and three times as long as broad.

"Sixth somite of the pleon scarcely a sixth part of the length of the entire animal, but fully as long as the first and second somites together, scarcely shorter than the fourth and fifth somites together, more than twice as long as broad, and scarcely one-third longer than the telson; it is armed with a sharp point on the posterior dorsal margin.

"Pleopoda very slender, the anterior pair nearly subsetiform.

"Rhipidura having the external branch armed with a sharp point, about one-fourth distant from the apex.

"*Habitat.*—Greenland" (Krøyer).

Observations.—No specimen in the Challenger collection corresponds precisely with the description and figure given by Krøyer, but there are three forms that somewhat closely resemble it. Two were taken in the North Pacific, and one in the North Atlantic.

The one described as *Sergestes præcollus* was taken north of the Sandwich Islands. It corresponds most closely, but differs in having the rostrum reduced to a mere angle, and the ophthalmopoda slightly compressed behind the ophthalmus, the stalk gradually decreasing to the articulation; and carries a very long and outwardly directed tooth on the outer margin of the outer plates of the rhipidura, in the position mentioned by Krøyer.

Sergestes longicollus, n. sp. (Pl. LXXVII. fig. 1).

Rostrum reduced to a small point on the frontal margin. Carapace considerably more than one-third the length of the animal, little less than one-half, exclusive of the telson.

Pleon dorsally smooth; the four anterior somites subequal, the fifth a little longer than the preceding, all with the infero-lateral angles rounded off; sixth about twice as long as the fifth, posteriorly furnished with a small dorsal tooth.

Telson about half the length of the sixth somite.

Ophthalmopod one-fifth as long as the carapace, and reaching as far as the extremity of the first joint of the peduncle of the first pair of antennæ. Ophthalmus a little broader than the stalk, which gradually narrows to the base.

First pair of antennæ with the first joint as long as the ophthalmopod, the second joint about half the length of the first, and the third subequal to, or a trifle longer than, the second; flagellum wanting, secondary branch slender and feeble, and as long as the third joint.

Second pair of antennæ with the terminal joint of the peduncle cylindrical and

as long as the ophthalmopod, and supporting a scaphocerite that reaches beyond the distal extremity of the second joint of the first pair of antennæ; the outer margin is armed with a long, slender tooth, somewhat distant from the rounded apex, which is fringed with a series of fine hairs.

Oral apparatus situated halfway between the frontal and posterior margins of the carapace.

The mandible furnished with a long synalipod, which does not reach to the frontal margin of the carapace.

The first pair of gnathopoda has the ischium and meros reaching but a little in front of the oral apparatus, and the whole of the appendage when extended scarcely reaches to the frontal margin of the carapace.

The second pair of gnathopoda is missing, being broken off at the coxa, which is broad and formed for carrying a powerful organ.

The first pair of pereopoda is short as compared with the second and third, but not much shorter than the first pair of gnathopoda; the ischium and meros are long and robust, and the two terminal joints feeble and ciliated. The second and third pairs are long, slender, fringed with long hairs, and terminate in minute but long, fringed chelæ. The fourth pair is about half the length of the preceding, and fringed with long hairs on the posterior margin of the distal extremity. Fifth pair little more than half the length of the fourth, very slender, and fringed with hairs.

Pleopoda long and slender, gradually decreasing in length and increasing in breadth posteriorly.

Posterior pair having the outer branch nearly twice as long as the telson; outer margin straight and armed with a small tooth one-fourth distant from the extremity, beyond which the margin is fringed with short hairs, as also are the inner margin and both margins of the inner plate.

Habitat.—South Atlantic Ocean, October 5, 1873; near Station 131; lat. $29^{\circ} 35' S$. long. $28^{\circ} 9' W$.

Length, 25 mm. (1 in.).

Station 295, November 5, 1875; lat. $38^{\circ} 7' S$, long. $94^{\circ} 4' W$.; South Pacific Ocean; depth, 1500 fathoms; surface temperature, $52^{\circ} \cdot 5$. Taken at night.

Length, 8 mm. (0.3 in.).

Observations.—This species comes very near to *Sergestes tenuiremis*, Kröyer, but differs from it in the form of the rostrum, which is represented in Kröyer's figure as standing erect on the dorsal surface, but which in our specimen is reduced to a mere point on the frontal margin.

The specimen from the South Pacific is more pronounced than that from the South Atlantic, and the ophthalmopod corresponds more nearly with Kröyer's species.

Sergestes præcollus, n. sp. (Pl. LXXVII. fig. 2).

Very closely resembling *Sergestes longicollus*, but differing in certain details, of which the following are the most important.

The fifth somite of the pleon in *Sergestes præcollus* has the posterior margin dorsally produced to a point; the sixth somite is not produced to a point posteriorly.

The scaphocerite is broad and armed on the anterior margin with a subapical tooth; inner margin sparsely fringed with short hairs. The oral apparatus is a little in advance of the centre of the carapace.

The first pair of gnathopoda is rather more robust than in *Sergestes longicollus*, and is produced to a truncated tubercle at the posterior angle of the coxal joint.

The second pair of gnathopoda is tolerably long and robust; the distal joints are not more slender than the proximal, and are fringed with cilia.

The first pair of pereopoda is two-thirds the length of the second pair of gnathopoda, and is not furnished with a prehensile apparatus at the ultimate articulation.

The third and fourth pairs of pereopoda are subequal and terminate in a short and fringed chela.

The sixth pair of pleopoda has the outer plate furnished with a small tooth nearly halfway from the distal apex; the margin beyond the tooth being slightly excavated and fringed with hairs, also the inner margin and both margins of the inner plate.

The carapace in this, as in the preceding species, has the lower margin closely folded beneath the ventral surface and deepens posteriorly.

Length, 25 mm. (1 in.).

Habitat.—North Pacific Ocean.

Observations.—The specimen is one of those that corresponds closely with *Sergestes tenuiremis*, but differs from it and from *Sergestes longicollus* in the form of the posterior pair of pleopoda, which is armed on the outer margin with a tooth more distant from the distal extremity of the plate, and has the space beyond it slightly concave. These species and *Sergestes juncus* all agree with *Sergestes tenuiremis* in having the distance between the oral appendages and the antennal or frontal region considerably prolonged, and suggest an approximation to the genus *Leucifer*, with which name von Willemoes Suhm has labelled one of the specimens that was mounted for microscopic use.

Sergestes semiarmis, n. sp. (Pl. LXVII. fig. 1).

Rostrum sharp, straight, armed on the upper surface with a small tooth, and reaching to about half the length of the first joint of the peduncle of the first pair of antennæ. Carapace nearly a third of the length of the animal, having the frontal margin furnished with a strong tooth on the outer side of the first pair of antennæ.

Pleon having the five anterior somites subequal. The first two dorsally smooth; the three succeeding armed with a strong tooth on the posterior dorsal region. Sixth somite about the length of the two preceding combined, and with the postero-dorsal angle produced to an obtuse point.

Telson about half the length of the sixth somite.

Ophthalmopoda about two-thirds the length of the carapace, fungiform in appearance; ophthalmus broad, stalk narrow.

First pair of antennæ having the peduncle a little longer than the ophthalmopoda; first joint longest, second and third subequal, supporting a long and slender flagellum that is quite the length of the animal, and has a bulbous enlargement at the base, from which there usually springs a fasciculus of membranous cilia.

The second pair of antennæ support a similarly formed but rather longer, flagellum, and a scaphocerite that is equal in length to the peduncle of the first pair. It has the inner and outer margins subparallel, the outer being smooth and armed with a strong tooth near the distal extremity; the inner margin foliaceous and fringed with a thick row of ciliated hairs.

The first pair of gnathopoda possesses no specific character.

The second is long, robust at the base and slender towards the distal extremity, where it is fringed with hairs disposed in pairs, one on each side, the hairs supported on strong prominences, each alternately larger and smaller; the distal extremity is tipped with three long, strong, simple hairs.

The first pair of pereopoda is about half the length of the second pair of gnathopoda; it is slender and feeble and carries a small prehensile organ. The second and third pairs are long and slender, and terminate in a small chela, the extremity of each digit being tipped with a small brush of hairs; the third pair has the fingers longer and more slender than the second. The fourth pair is short and very slender, reaching nearly to the distal extremity of the ischium of the third pair. The fifth or terminal pair is very much shorter than the fourth, and is rudimentary in character.

The pleopoda are slender but not long. The first pair is the most slender, and is single-branched; the others are biramose and become gradually shorter posteriorly; the posterior pair, which helps to form the rhipidura, has the outer and longer plate armed on the external margin with a strong tooth about midway between the base and the distal extremity, and the margin beyond is fringed with long ciliated hairs, as also is the inner plate.

Length, 12 mm. (0.5 in.).

Habitat.—West Pacific Ocean.

Station 354, May 6, 1876; lat. 32° 41' N., long. 36° 6' W.; Mid North Atlantic; surface temperature, 70° 0.

Observations.—A specimen (Pl. LXVII. fig. 2) very similar to the type was taken in

the Atlantic, the differences being so slight that they would not justify its separate notice from *Sergestes semiarmis*, but for the distance between their habitats.

This specimen has the scaphocerite long and narrow, the sides parallel, the outer smooth and armed with a long tooth at a point equal to its length from the extremity.

The first pair of pereopoda is slender and exhibits no trace of a prehensile apparatus. The chela of the second pair of pereopoda is minute and rudimentary, the pollex particularly so. The fourth and fifth pairs of pereopoda are minute and bud-like, as if they were only commencing to be developed.

The sixth somite of the pleon terminates dorsally in a prominent tooth instead of in a blunt point as in the typical specimen, and the telson terminates in a minutely-forked extremity.

These two forms are, I believe, early stages of a much larger specimen, but their matured shape compels us to accept them as specific forms until the life-history of the species be made clear.

Sergestes læviventralis, n. sp. (Pl. LXVII. fig. 3).

Carapace more than one-third the length of the animal. Rostrum as long as the ophthalmopod, armed with a tooth immediately over the frontal margin.

Pleon armed with a tooth at the posterior dorsal surface of each somite, those on the anterior three somites being vertical, and on the posterior three directed backwards. The median ventral line of the pleon is free from spinous processes.

Telson about half the length of the sixth somite.

Ophthalmopoda clavate, not longer than the rostrum, robust; the ophthalmus but little larger than the diameter of the distal portion of the stalk.

The first pair of antennæ has the first joint of the peduncle rather longer than the ophthalmopod; second and third short, subequal, and together about the same length as the first.

The second pair of antennæ has the terminal joint of the peduncle reaching nearly to the extremity of the ophthalmopod, and carries a scaphocerite that reaches as far as the distal extremity of the peduncle of the first pair of antennæ.

The mandible is at a considerable distance from the antennæ, and is, I believe, furnished with a small two-jointed synnhipod, although in the present condition of the mounted specimen I could not positively determine it.

The first pair of gnathopoda terminates in a short spatuliform dactylos.

The second pair is long and slender, having the coxa larger than in any of the other appendages of the pereion.

The first pair of pereopoda is slender and about half the length of the second

pair of gnathopoda. The second and third pairs of pereopoda are long, slender and chelate. The fourth and fifth pairs are in a rudimentary or bud-like condition.

The pleopoda are long and slender, gradually becoming shorter posteriorly; the terminal pair, which forms the outer rami of the rhipidura, is armed with a strong tooth at about two-fifths from the distal extremity; the distal division is slightly curved inwards and furnished with many hairs similar to those on the inner margin.

Telson about half the length of the outer branch of the rhipidura and armed with two short, sharp teeth at the distal extremity, and with three similarly formed articulating spines on the lateral margin, of which the anterior is intra-marginal and separated considerably from the posterior two.

Length, 7 mm. (0.28 in.).

Habitat.—North of New Guinea (label VI. in Suhm's series).

Observations.—This species somewhat resembles *Sergestes spiniventralis*, but differs from it in having no large teeth on the median lobes of the ventral surface of the pleon; the outer ramus of the rhipidura is broader and armed with a strong lateral tooth, and the telson is longer and armed with lateral spines; but the most important structural difference appears to me to lie in the distance of the oral apparatus from the cephalic appendages, which is much greater in *Sergestes læviventralis* than in *Sergestes spiniventralis*.

Two specimens that correspond with Krøyer's description of *Sergestes corniculum* were taken associated with it; they are both 7 mm. in length.

Sergestes spiniventralis, n. sp. (Pl. LXVII. fig. 5).

Carapace about one-third the length of the animal. Rostrum long and slender, armed with a slight tooth above and slightly anterior to the frontal margin, which carries a well-developed tooth above the orbit; antero-lateral angle rounded and smooth. Carapace smooth except for a very small lobe above the mandible and a well-defined tooth in the median line at the posterior margin.

The first somite of the pleon is dorsally smooth except for a very minute tooth on the posterior margin, and ventrally produced in the median line to a large lobe, that is surmounted by a strong anteriorly directed tooth. The second somite is dorsally armed with a minute tooth on the posterior margin, and ventrally furnished with a strong lobe, surmounted by a strong tooth as in the first somite, but directed downwards. The third somite is dorsally armed with a strong tooth, perpendicular in direction, and ventrally furnished with a large lobe without being surmounted by any tooth. The fourth and fifth somites are similarly armed, but the teeth on the dorsal surface are directed backwards; and the ventral lobes are less prominent.

The sixth somite is as long as the three preceding combined, and is armed dorsally on the posterior margin with a horizontal tooth and with a small tooth at the postero-lateral angles, while the median ventral lobe is unarmed and reduced in size, and has the nerve-ganglion belonging to this somite lodged in it.

Telson about one third the length of the sixth somite, deep at the antero-lateral margin and narrow at the distal extremity, where it is armed with two sharp teeth.

Ophthalmopoda fungiform (fig. 5a), and nearly four times longer than the rostrum.

First pair of antennæ having the first joint of the peduncle a little shorter than the ophthalmopoda; the second joint about one third the length of the first, and the third about half the length of the second.

The second pair of antennæ has the last joint of the peduncle reaching to one third the length of the ophthalmopod, and the scaphocerite, which is narrow, with the margins parallel, and armed near the extremity with a sharp tooth, reaches as far as the distal extremity of the peduncle of the first pair of antennæ.

The epistoma is largely developed and projects anteriorly to near the posterior extremity of the antennæ.

The mandibles are strong, but I cannot detect a synhipod attached.

The first pair of gnathopoda is similar to that in other species.

The second pair is attached to a large coxa and is robust as far as the fourth joint, the distal two being slender and fringed with hairs, and subequal in length with the animal.

The first pair of pereopoda is short, slender, and is not furnished with a small tubercle on the anterior margin of the ischium. The second pair of pereopoda is long and slender, and has the ischium furnished with a small tubercle. This pair terminates in a rudimentary or scarcely determinable chela furnished with long hairs. The third pair resembles the second in length and proportion, but has the ischium smooth and the terminal extremity without a trace of a chela, and is furnished with long hairs.

The fourth and fifth pairs are apparently missing.

The pleopoda are slender and decrease in length posteriorly.

The sixth pair, which forms the outer plates of the rhipidura, is long, narrow and pointed; the outer plate is longer than the inner, and nearly four times the length of the telson, it has no tooth on the lateral margin, and is slightly curved, and fringed with hairs that increase in length posteriorly.

Length, 3.5 mm. (0.14 in.).

Habitat.—North Pacific Ocean.

This species should be compared with *Mastigopus spiniventralis* (p. 379; Pl. LXVII. fig. 4), the specimen of which, with three others on the same slide, is labelled by Dr. v.

Willemoes Suhm as being the young of *Sergestes tenuis*, but what that species is I am not prepared to determine, as there is no adult in the collection thus named.

With it was taken the *Acanthosoma* form represented on Pl. LXIV. fig. 2 (*Acanthosoma tynitelsonis*), in which figure a large median lobe ought to be added to the ventral surface of the five anterior somites of the pleon, of which the three anterior are armed with a small tooth. A younger *Acanthosoma* that corresponds in certain details with *Acanthosoma macrotelsonis* (Pl. LXVI. fig. 1) suggests that they belong to separate species. The length of our type specimen is about 4 mm. The carapace has four lateral spinous teeth, but instead of being situated as in *Acanthosoma macrotelsonis* they are all close together and implanted nearer the fronto-lateral margin; the two anterior are small, close together, and correspond with the fronto-lateral angle of the carapace; the next is long, slender, and not remarkably spinous, and the next is somewhat similar and situated in a line a little posterior to the oral appendages. Behind this the rest of the carapace is smooth, as in figs. 1 and 3 on the same plate, from which it differs in having a long, slender, forked, and spinous telson. It corresponds with fig. 3, which Dr. Suhm considers to be a younger stage, in the form of the scaphocerite as well as in the outer branch of the rhipidura.

The specimen figured as *Mastigopus tenuis* on Pl. LXV. fig. 4, was also taken associated with *Mastigopus spiniventralis*; its length is about 5 mm. It was labelled by Dr. Suhm, whose name I have retained, as being the young of *Sergestes tenuis*; it is an older form, and has assumed the *Mastigopus* features, but they cannot belong to the same species, for in this one the rostrum is short and rudimentary, without a dorsal tooth; it is unarmed on the dorsal surface of the pleon, destitute of teeth on the median lobes of the ventral surface, and the outer branch of the rhipidura is not armed with a lateral tooth. These four forms were taken together, mounted and labelled by Dr. Suhm as the young of one species. Except for the large diameter of the eye, the specimen corresponds more closely with the description of *Sergestes edwardsii* than with any other species known to me.

Sergestes profundus, n. sp.

Carapace about one-third the length of the animal, anteriorly produced to a sharply pointed rostrum, and armed on the crest with one small tooth. Dorsal surface divided near the middle by the cervical fossa. First four somites of the pleon subequal in length, the fifth rather shorter than the preceding, the sixth as long as the fourth and fifth together.

The antennæ, gnathopoda, pereopoda are lost, and the rhipidura is broken.

Length, 21 mm. (0.84 in.).

Habitat.—Station 137, October 23, 1873; lat. $35^{\circ} 59'$ S., long. $1^{\circ} 34'$ E.; depth, 2550 fathoms; bottom, red clay; bottom temperature, $34^{\circ} \cdot 5$. One female (?). Dredged.

Station 300, December 17, 1875; lat. $33^{\circ} 42'$ S., long. $78^{\circ} 18'$ W.; west of Valparaiso; depth, 1375 fathoms; bottom, Globigerina ooze; bottom temperature, $35^{\circ} \cdot 5$. Female (?). Trawled.

The specimen unfortunately is very imperfect, but the form of the rostrum is not unlike that of *Sergestes spiniventralis* (Pl. LXVII. fig. 5). It consists of a short fine point projecting horizontally for about one-fourth the length of the ophthalmopod, and is dorsally furnished on the crest with a small tooth. The carapace generally is soft and flexible, particularly on the lateral walls.

The pereion has the pleural walls of each somite longitudinally divided as in *Sergestes prehensilis*.

The pleon is dorsally smooth, the first three somites are subequal in length, while the fourth is rather shorter than the third, and the sixth is subequal in length to the fourth and fifth together, and is laterally compressed and deeper than the preceding somites; on the dorsal surface it is armed posteriorly with a small projecting tooth.

The telson is about one-half the length of the sixth somite, laterally depressed near the base and tapers to the extremity, which terminates in three points, the middle being the longest.

All the appendages are lost or broken off short, excepting the pleopoda and the ophthalmopoda which are about one-fourth the length of the carapace, and have the ophthalmus not of larger diameter than the stalk.

The antennæ are broken off just beyond the extremity of the ophthalmopoda.

The mandibles carry a slender biarticulate synhipod that reaches to the extremity of the ophthalmopoda, and has the inferior margins fringed with long hairs; the margin of the psalistoma is smooth. The metastomata are well developed and of a bat-shaped form, and the succeeding oral appendages correspond with those of *Sergestes prehensilis*.

The gnathopoda and pereopoda are all lost, being broken off short at the coxal joint.

The pleopoda are perfect, the first pair being single-branched as in females, and the others biramous. The posterior pair, which forms the lateral rami of the rhipidura, is broken off at half its length, so that the form cannot be determined.

Observations.—The species of this genus mostly live within a hundred fathoms of the surface, but there is every reason to believe that this one resides near the bottom, it having been taken in the same haul together with the rhipidura of a specimen of *Gnathophausia ingens* and one of *Gennadas intermedius*.

The branchiæ, as well as could be observed, consist of a series of nearly circular discs attached to a common stalk, somewhat like those figured on Pl. LXV. fig. 3.

The structure of the external tissue is reticulate throughout, which is especially noticeable in the rhipidura and dorsal crest.

The rostrum corresponds somewhat to that of *Sergestes spiniventralis*, but the ventral surface is not armed with a series of projecting teeth.

North-east of the island of Juan Fernandez and about five hundred miles due west of Valparaiso, another specimen of *Sergestes* was trawled at a depth of more than a mile and a half, associated with specimens of *Willemæsia*, *Pentacheles*, and *Glyphocrangon*. It is a mutilated specimen, but the existing parts correspond with those preserved of *Sergestes profundus*, and as they are the only specimens in the collection that are recorded from so considerable a depth, they are probably of the same species, and the description of one may interpret the form of the other. The portion of the animal preserved is as far back as the extremity of the second somite of the pleon with the appendages, but the body is too compressed and disfigured to say more than that it is generally free from external adornment.

The rostrum is similar to that of the specimen from Station 137, and corresponds in form, but in a less pronounced degree, with that of *Sergestes spiniventralis*.

The ophthalmopoda are about one-fourth of the dorsal length of the carapace, and somewhat clavate, but the ophthalmus is not of greater diameter than the stalk.

The first pair of antennæ has the first joint of the peduncle longer than the ophthalmus, and the second and third joints subequal in length, and together as long as the first joint; the flagella are broken off.

The second pair of antennæ has the flagellum also wanting; the scaphocerite is as long as the peduncle of the first pair, moderately broad, and armed with a small tooth at the outer distal extremity.

The mandible is furnished with a long and slender synhipod that reaches beyond the frontal margins of the carapace and as far as half the length of the terminal joint of the second pair of antennæ.

The oral appendages, so far as I have been able to examine them without dissection, appear to correspond with those of *Sergestes prehensilis*.

The first pair of gnathopoda is well developed and of generic value only; the three anterior free joints are fringed on the posterior margin, and the three distal joints on the anterior margin, with long hairs.

The second pair of gnathopoda are broken off at the coxal joint, which is broad and robust.

The first pair of pereopoda is moderately long, and furnished with a prehensile apparatus at the ultimate articulation. The second pair of pereopoda is long and stout, probably as long as the animal, the distal joints being fringed with long hairs. The third pair of pereopoda is similar to, but rather longer than the second. The fourth pair is very nearly as long as the third, reaching beyond the carpal joints of the propodos;

the dactylos is wanting. The posterior margin of the several joints are anteriorly smooth, posteriorly semiserrate, and fringed with very long delicately ciliated hairs. The fifth pair is broken off at the coxa.

The first two pairs of pleopoda are long and rather powerful organs; the first is single and smooth, as in females, and the second is two-branched.

Length of part preserved 18 mm., probable length of the entire animal 24 mm. (0.98 in.).

Sergestes ventridentatus, n. sp.

Carapace one-third the length of the animal not including telson nor rostrum. Rostrum short, sharp, horizontal, and armed with a small tooth on the dorsal surface anterior to the frontal margin.

Five anterior somites of the pleon subequal and dorsally smooth; three anterior ventrally produced in the median line to a plate that is armed with a strong and sharp tooth; the two posterior lobed and unarmed. Sixth somite equal in length to the two preceding combined, but narrower and produced to a point only at the posterior dorsal angle. Telson one-third the length of the sixth somite, anterior portion deep at the margins, posterior suddenly narrowed.

Ophthalmopoda rather more than half the length of the carapace, fungiform, stalk suddenly narrowed, ophthalmus broad.

First pair of antennæ having the first joint of the peduncle widened at the base to receive the otocyst, but not armed with a tooth on the outer margin. The three joints are subequal in length and the first two reach as far as the distal extremity of the ophthalmopod; the flagellum is slender and as long as the peduncle, the secondary appendage is merely a single-jointed, bud-like organ.

The second pair of antennæ has the scaphocerite long and narrow, reaching to the extremity of the peduncle of the first pair, and subapically armed with a small acute tooth. The terminal joint of the peduncle reaches to half the length of the ophthalmopod, but the flagellum is lost.

The first pair of gnathopoda appears to have the terminal joint shorter and more discoid than usual, and much narrower than the preceding joint.

The second pair is long and powerful, reaching considerably beyond the distal extremity of the flagellum of the first pair of antennæ; it has the four basal joints broad and stout, and the two terminal narrow and slender, the extremity being fringed with three fasciculi of hairs on the posterior and distal surfaces.

The first pair of pereopoda is furnished with a small hook-like process on the anterior surface at the base of the ischium. The second pair of pereopoda is not fully chelate, but only rudimentarily so; while the ischium is armed on the posterior margin

near the base with a strong sharp tooth. The third pair of pereopoda is minutely chelate. The fourth and fifth pairs are rudimentary, the anterior being slightly jointed and the posterior in a state of gemmation.

The pleopoda are long and fairly robust, and have both branches far advanced in development. The posterior pair has the inner plate twice as long as the telson, and the outer three times as long, fringed on each side with hairs, those on the inner side long, on the outer short; it is not armed with a tooth at any point.

Length, 7 mm. (0.28 in.).

Habitat.—North of the Sandwich Islands.

Observations.—This species corresponds very closely with *Sergestes nasidentatus*, from which it differs in having the eyes much larger in diameter and more fungiform, but especially in having the median ventral surface of the three anterior somites produced to prominent lobes, surmounted by a strong tooth directed obliquely forwards. It differs also from *Sergestes spiniventralis*, which has the five anterior somites of the pleon similarly armed ventrally, but has every somite except the first dorsally furnished with a strong tooth, while in this species the dorsal surface is smooth throughout, excepting for a small point at the posterior extremity of the sixth somite, as in *Sergestes nasidentatus*, and it has the posterior pair of pleopoda smooth, whereas in *Sergestes nasidentatus* the outer margin is armed with a strong tooth. *Sergestes ventridentatus* was taken in Mid-Pacific, north of the Sandwich Islands, while *Sergestes spiniventralis* was found in the western part of the same ocean, and *Sergestes nasidentatus* was taken about 800 miles off the coast of Chili, at a depth of 200 fathoms.

Sergestes brachyorrhos, Kröyer.

Sergestes brachyorrhos, Kröyer, Monograph. Frematilling af Kræb. Sergestes, pp. 56, 65, Tab. v. fig. 13, a, b.

“Rostrum distinctly prominent, very acute, and reaching to half the length of the ophthalmopoda. Ophthalmopoda very large, reaching to the extremity of the second joint of the peduncle of the first pair of antennæ, broadly clavate or subfungiform; ophthalmus very distinct from the peduncle, in breadth equalling half the length of the ophthalmopod, and in length scarcely a third of it.

“First pair of antennæ having the peduncle nearly one-fourth of the length of the animal, or more than two-thirds of that of the carapace. The first joint nearly equals the second and third combined, and is twice as long as the third.

“Second pair of antennæ having the scaphocerite more than four times longer than the last joint of the peduncle, and reaching to the extremity of the peduncle of the first pair of antennæ.

"Pleon having the fourth, fifth, and sixth somites armed with a small sharp tooth on the posterior margin of each. The first to the fifth somites also furnished with a sharp tooth on each side, especially distinguishable on the fourth and fifth.

"Sixth somite of the pleon exceeding the fifth part of the length of the animal, or equalling that of the third, fourth, and fifth somites combined, and three times as long as the telson, linear, and three times as long as broad.

"Pleopoda very slender.

"Rhipidura having no tooth on the outer margin of the outer branch.

"*Habitat*.—Greenland," (Kröyer).

I can recognise no form corresponding exactly with this species, but the next, *Sergestes utrinquedens*, differs from it in having a longer and more slender rostrum and a longer telson, and in having no teeth on the dorsal surface of the pleon.

Sergestes longirostris (p. 415, Pl. LXXV. fig. 3), differs from it in having a tooth on the outer plate of the rhipidura.

Sergestes utrinquedens, n. sp.

Carapace more than one-third the length of the animal not including the rostrum, which is straight, slender, and nearly as long as the ophthalmopoda. The frontal margin is rounded and smooth, but just beyond the fronto-lateral angle is a small anteriorly directed tooth. The rest of the carapace is free from ornamentation.

The pleon has the four anterior somites subequal, and all ventrally smooth and dorsally unarmed; the fifth is slightly longer than the preceding, and all these five somites have the lateral or coxal margins pointed and tipped with a strong sharp tooth, the first which is the largest has the smallest tooth, and the fourth which is the smallest has the largest tooth. The first somite is, moreover, furnished on each side with a small projecting process that corresponds to the pleocleis in other genera. The sixth somite is as long as the two preceding and is dorsally armed on the posterior margin with a small and slender tooth, and the postero-lateral angles are produced to a very minute point.

The telson is about as long as the last somite, and is produced into two sharp terminal points, flanked on each side with two small teeth or spines.

The ophthalmopoda are about half the length of the carapace; the ophthalmi broader than the stalk, which gradually tapers to the base.

The first pair of antennæ has the three joints of the peduncle subequal; the first joint is rather the longer, it is enlarged at the base to receive the otocyst, and is armed on the outer margin with a sharp tooth; the two succeeding joints are cylindrical and support flagella that are broken off.

The second pair of antennæ, which is broken at the extremity of the peduncle, has the basal joint armed on the outer and lower angle with a strong tooth, and carries a scaphocerite that is as long as the peduncle of the first pair of antennæ; it is narrow and has the margins parallel, the outer being armed with a long tooth near the distal extremity, and the inner fringed with long, slender, and distantly planted hairs.

The metastoma has no tooth at the anterior margin, but is produced to a blunt point.

The mandibles carry a strong two-jointed synnhipod.

The first pair of gnathopoda terminates in a long, ovate, spatuliform joint.

The second pair of gnathopoda is not remarkable for its length, and the terminal joint is only in an incipient stage of development.

The first pair of pereopoda is wanting, being apparently broken off at the coxal joint. The second and third pairs are moderately long and terminate in incipient chelæ. The last two pairs are wanting and appear to be in an early stage of gemination, and the two somites which support them are not appreciably distinct, and support on each side two small branchial plumes in an incipient stage of development.

The first pair of pleopoda is long, slender, and single-branched; the four succeeding pairs resemble the first, but carry a small secondary branch attached to the anterior angle of the distal extremity of the basal joint, which is more robust in the anterior and foliaceous in the following pairs, each successively increasing in length posteriorly.

The posterior or terminal pair is very long, being twice the length of the telson or quite equal to two-thirds of the length of the pleon. The plates are narrow and slightly curved; the outer is armed with a strong tooth near the middle of the margin, and is fringed with cilia on the inner and distal margins.

Length, 3.5 mm. (0.14 in.).

Habitat.—North Pacific Ocean.

Observations.—This species bears so close a resemblance to *Sergestes brachyorrhos*, Kröyer, that I was at first induced to believe it might be a younger form of that species, an opinion that received support from the form of the rhipidura and scaphocerite. It differs, however, from that species in the length of the telson, the shortness of which in Kröyer's species having probably suggested the specific name. The outer plates of the rhipidura are furnished with a strong tooth on the outer margin, and the narrow form of this appendage and of the scaphocerite is strong evidence of incomplete development. The absence of the fourth and fifth pairs of pereopoda, or at least their presence only in a stage of incipient budding, is suggestive of this animal being the young of the genus *Acetes*—a genus that I have not had the opportunity of studying with care, as there does not appear to be a specimen of it in the extensive collection of the Challenger. But since Professor Brooks is inclined to believe that up to a certain

stage the posterior pair is wanting in most of the young of *Sergestes*, I prefer to reserve my opinion until I have had an opportunity of examining an adult form; I am the more inclined to do so on account of a specimen having been taken in the West Pacific, which, though evidently in a younger stage, corresponds with it in almost every important detail, having the posterior two pairs of pereopoda more advanced in development, although still in a saccular condition. It is in the *Mastigopus* stage and is described at page 376.

Sergestes serrulatus, Kröyer.

Sergestes serrulatus, Kröyer, Monograph. Fremstilling af Kræb. *Sergestes*, pp. 52, 65, Tab. iv. fig. 12, a-g.

"Rostrum straight, rudimentary; furnished with three or four distinct teeth on the upper margin.

"Ophthalmopoda reaching to the extremity of the first joint of the peduncle of the first pair of antennæ, clavate, three times longer than broad.

"First pair of antennæ having the peduncle equal in length to the carapace, or even exceeding it, being a fourth of the length of the animal; first joint broad, deeply excavated, and furnished with a strongly pointed tooth.

"Second pair of antennæ having the scaphocerite narrow, sublinear, three times longer than the last thick joint of the peduncle, and nearly reaching to the distal extremity of the second joint of the first pair of antennæ.

"Sixth somite of the pleon nearly equalling the fifth part of the animal in length; twice as long as broad, equalling at least the length of the fourth and fifth somites combined, and exceeding that of the first and second together; nearly twice as long as the telson.

"Pleopoda moderate.

"Rhipidura armed with a tooth on the outer margin about one-third from the apex.

"*Habitat*.—Greenland" (Kröyer).

Sergestes caudatus, Kröyer.

Sergestes caudatus, Kröyer, Monograph. Fremstilling af Kræb. *Sergestes*, pp. 54, 68, Tab. v. fig. 14, a-d.

"Rostrum large, equalling one-fourth (?) part of the carapace in length, and furnished on the upper surface with six or seven small teeth.

"Ophthalmopoda very short, stoutly pyriform, scarcely reaching to the extremity of the first joint of the peduncle of the first pair of antennæ, having the ophthalmus slightly distinct from the pedicle, and nearly half the length of the ophthalmopod.

"First pair of antennæ having the peduncle about two-thirds the length of the carapace, and equal to a fifth part of the entire length of the animal. First joint very long, longer than the second and third combined; third very short.

" Second pair of antennæ having the scaphocerite linear, reaching a little beyond the extremity of the peduncle of the first pair of antennæ, eight times as long as broad, and nearly nine times longer than the last joint of the peduncle.

" Sixth somite of the pleon considerably elongated, sublinear, exceeding one-fifth of the entire length of the animal, longer than the three preceding somites together, and three times as long as broad.

" Pleopoda very slender.

" Telson but little shorter than the outer plates of the rhipidura, the outer margin of which is furnished with a sharp tooth, situated not far from the distal extremity.

" *Habitat*.—Greenland" (Krøyer).

Sergestes arcticus, Krøyer.

Sergestes arcticus, Krøyer, Monograph. Fremstilling af Kræb. *Sergestes*, pp. 24, 60, Tab. iii. fig. 7, a-g; Tab. v. fig. 16.

" Rostrum rudimentary.

" Ophthalmopoda pyriform, much shorter than the first joint of the peduncle of the first pair of antennæ; ophthalmus very distinct from the pedicle, broader than long, the diameter being equal to half the length of the ophthalmopod.

" The peduncle of the first pair of antennæ about one-third shorter than the carapace. The second and third joints nearly equal in length, and together but little longer than the first.

" The last joint of the peduncle of the second pair of antennæ three times as long as broad, and about the third of the length of the scaphocerite.

" Sixth somite of the pleon about the fifth part of the length of the animal, and equalling that of the first, second, and third somites combined, but surpassing in length that of the fourth and fifth somites combined; twice as long as broad, and nearly twice as long as the telson.

" Pleopoda long and slender; the basal joint of the fifth pair twice as long as broad.

" The outer branch of the rhipidura armed with a tooth on the outer margin, one-third from the terminal apex.

" *Habitat*.—Greenland" (Krøyer).

Sergestes obesus, Krøyer.

Sergestes obesus, Krøyer, Monograph. Fremstilling af Kræb. *Sergestes*, pp. 41, 62, Tab. iv. fig. 10, a-f.

" Rostrum upright, rudimentary.

" Ophthalmopoda pyriform, scarcely reaching to the extremity of the peduncle of the first pair of antennæ, but quite to the extremity of the second.

"The ophthalmus not very distinct from the pedicle, the breadth scarcely equalling half the length of the ophthalmopod, but certainly more than a third.

"The first pair of antennæ has the peduncle scarcely half the length of the carapace; the first joint subclavate and distinctly longer than the second and third.

"The second pair of antennæ having the last joint of the peduncle very short, robust, subquadrate, nearly equalling in length one-fifth of the sublinear scaphocerite.

"Sixth somite of the pleon scarcely longer than broad, and in length nearly one-seventh of the animal; shorter than the fourth and fifth somites united, and also than the united lengths of the first and second; nearly a third longer than the telson.

"Pleopoda very short and stout.

"Rhipidura having the outer branch armed on the external margin near the extremity with a small point.

"*Habitat*.—Greenland" (Kröyer).

Sergestes dissimilis, n. sp.

Animal slender. Carapace about one-third the length of the entire animal. Rostrum slender, armed on the dorsal crest, slightly posterior to the frontal margin, with a small tooth, and on the gastric region with a small dorsal cusp.

Pleon having the five anterior somites subequal in length, the sixth being longer than the preceding two united. The anterior three are dorsally smooth, the posterior three being furnished with a small tooth at the posterior margin.

Telson long and tapering, not reaching quite as far as the extremity of the inner plates of the rhipidura, but nearly equal with the lateral tooth on the margin of the outer plate, terminating in two strong teeth, and laterally furnished with two small spines on each side.

The ophthalmopoda are about one-third the length of the carapace, and reach a little beyond the distal extremity of the first joint of the peduncle of the first pair of antennæ; they are clavate, gradually increasing in size from the base to the extremity, where the ophthalmus is of greater but not of suddenly increased diameter.

The first pair of antennæ has the first joint subequal in length to the ophthalmopoda, and the two succeeding joints are subequal in length to each other, and together about as long as the first. The flagella are broken, but judging from the portions left, the smaller is longer than usual.

The second pair of antennæ carries a narrow scaphocerite that reaches beyond the distal extremity of the second joint of the first pair of antennæ, and terminates in a rounded extremity, armed on the outer margin with a strong tooth.

The gnathopoda and pereiopoda offer no very decided features of specific variation. The second pair of gnathopoda is wanting, and the first pair of pereiopoda is broken off

at the meros. The second pair is long and slender, fringed with long hairs, and terminates in a small but well-formed chela. The third pair is wanting, being broken off at the basis. The fourth pair is broken off at the middle of the carpos, but, judging from the portion left, it is a longer appendage than usual; the fifth pair is short, cylindrical, and saccular, and within the sac three articulating divisions are apparent.

The pleopoda are long and slender, the first pair being single-branched, the others unequally biramose, and becoming slightly more robust posteriorly. Those of the sixth pair help to form the rhipidura, and are longer than the telson, the outer branch being furnished with a tooth that is one-third distant from the distal extremity.

Length, 10 mm. (0.4 in.).

Habitat.—April 26, 1876; St. Vincent, Cape Verde Islands; at the surface.

Observations.—This species differs from *Sergestes nasidentatus* in having the small tooth on the dorsal crest a little posterior to the frontal margin, a cusp on the gastric region, and a small tooth at the posterior dorsal extremity of each of the three posterior somites of the pleon.¹

Sciacaris,² n. gen.

Like *Sergestes*, but having the telson terminating in two lateral uniarticulate appendages.

This genus, if genus it be, is founded on three specimens in three different stages. The youngest is in the Acanthosoma stage, the second in the Mastigopus condition, and the third in that of the young adult. They appear to be different stages of two species, and as such I shall describe them.

The several specimens were taken off New Guinea, and in the North Pacific Ocean.

Sciacaris telsonis, n. sp. (Pl. LXXVIII. fig. 1).

Carapace nearly half the length of the animal, not including the rostrum or telson. Rostrum long, slender, and nearly half the length of the carapace. Frontal margin armed with a slender tooth on the outer side of the first pair of antennæ. Dorsal surface and lateral margins smooth.

Pleon having the first five somites subequal, and the sixth about as long as the three preceding united.

Telson (fig. 12) about half the length of the sixth somite, bifurcate at the extremity, each process supporting a small articulating joint of considerable tenuity, armed at the apex and outer margin with one or two articulated spines.

The ophthalmopoda are clavigerous and about as long as the rostrum.

¹ Since the foregoing was in type I have discovered that the genus *Podopsis*, established in 1829 by Vaughan Thomson, is synonymous with *Sergestes*. But as the former name was used in 1819 for a genus of Mollusca by Lamarck, Milne-Edwards' appellation must stand.

² From *scia*, shadow, and *caris*, shrimp.

The first pair of antennæ has the peduncle rather longer than the rostrum, having the first joint long and the two following short, terminating in two flagella, of which the inner is short and uniarticulate, and the outer stout, but in the specimen it is broken at the first articulus. The base of the first joint of the peduncle is broad and flat, furnished on the outer margin with a strongly projecting point; within this space is an otocyst containing a spherical otolith.

The second pair of antennæ is broken off at the extremity of the peduncle, which is short, stout, and carries a scaphocerite that is long, narrow at the base, and increasing in width towards the extremity, armed with a tooth on the outer side and foliaceous on the inner, which is furnished with cilia.

The mandibles are not furnished with a synhipod.

The first pair of gnathopoda is like that of *Sergestes*, but the terminal joint is rather cylindrical than spatuliform, but this may be the result of its immature condition.

The other appendages of the pereion are broken off, so that I cannot determine their form, nor can I determine the presence of the last two pairs of pereopoda. The first somite of the pleon is furnished on each side with a projecting process that is homologous to the pleocleis of larger species.

The pleopoda are all long and single-branched, all but the first pair having a small bud-like process, which is the rudiment of the inner ramus, at the distal extremity of the basal joint; these are small on the second pair, and gradually increase in size posteriorly. The sixth or terminal pair, which forms the outer plates of the rhipidura, has the basal joint armed on the outer distal angle with a short robust tooth. The outer plate is a little longer than the telson, and is armed on the outer margin with a long tooth about one-third distant from the apical extremity; the inner branch is narrow and tapering, about the length of the telson, and fringed on both sides with long delicate hairs.

Length, 4 mm. (0.17 in.).

Habitat.—North of New Guinea.

Observations.—The absence of the posterior two pairs of pereopoda is suggestive of its relation to the genus *Acetes*; but the specimen is undoubtedly that of an animal not fully grown. The ocellus is still visible as a small longitudinal black streak. The rostrum is slender, and has a deciduous appearance from its delicate, thin, dermal covering. This is also the condition of the terminal appendages of the telson, and the general structure is that of an animal that has not arrived at its mature condition, but is approaching it, although its dimensions are still small.

The second stage represented on Pl. LXXVIII. fig. 2, is in the *Mastigopus* condition, and is more perfectly preserved than the preceding.

The carapace is nearly as long as the pleon, excluding the telson. Rostrum broken. Dorsal surface armed with a tooth on each side corresponding with the extremity of the

apophysis of the mandible; the rest of the carapace is smooth both at the margin and on the dorsal surface.

Pleon having the anterior five somites subequal; the first and second are dorsally armed with a small tooth, anteriorly to the posterior margin, so also are the third, fourth and fifth somites, but on these each tooth is twice as long, and nearer to the posterior margin. Fifth somite with a small tooth above the infero-posterior angle. Sixth somite as long as the four preceding combined, and armed at the posterior dorsal margin with a slender tooth.

The ophthalmopoda are long and clavigerous.

The first pair of antennæ has the peduncle rather longer than the ophthalmopoda, and has the first joint long and the two following short, of which the third is shorter than the second, and terminates in one long and robust flagellum (broken), and one short and uniarticulate; the base of the first joint is enlarged, armed with a tooth on the outer margin, and contains an otolith.

The second pair of antennæ has the flagellum broken off at the extremity of the peduncle, which carries a long, narrow scaphocerite, armed on the outer margin with a long tooth (2c) that commences at some distance from the extremity and passes beyond it.

The appendages are all in an immature condition, but the second and third pairs of pereopoda exhibit signs of an incipient chelate character. The fourth and fifth pairs are present in a budding condition; the fourth is larger than the fifth.

The pleopoda are long, slender and single-branched, having the bud of the second branch present on the last two pairs only.

Terminal or lateral branch of the rhipidura long and narrow; the outer longer than the telson, and furnished with a tooth near the middle of the outer margin, beyond which it is fringed with long hairs as is also the inner plate.

Length, 4 mm. (0.17 in.).

Habitat.—North of New Guinea.

Observations.—This specimen was taken associated with the preceding, to which it bears considerable resemblance, but differs from it in several details which I believe to be dependent upon development.

The dorsal teeth on the pleon and that on the lateral margin of the fifth somite probably disappear with growth; the form of the scaphocerite becomes broader and the subapical tooth smaller, the rostrum shorter, and the terminal appendages of the telson probably disappear in the adult animal. But the two last pairs of pereopoda, which are now in a budding condition, probably become developed into rudimentary or imperfect appendages, as seen in *Sergestes*; and the lateral dorsal teeth on the hepatic region of the carapace probably continue as a more or less important feature, and therefore suggest that this specimen when mature is specifically distinct from the preceding.

The next, which is the youngest known stage (Pl. LXXVIII. fig. 3), is in the Acanthosoma condition, and as such approaches others in its generic value.

The carapace is short, or about half the length of the pleon, exclusive of the telson.

The rostrum is long, slender, and fringed with teeth; the lateral margin of the carapace corresponding with the antero-lateral angle is armed with a tooth of extreme tenuity and fringed with small spines.

Pleon armed with ornate spines or teeth on the lateral margins, and dorsally on the posterior four somites.

Telson (fig. 3z) bifurcate and terminating in two uniarticulate appendages, tipped with one or two small hairs.

The ophthalmopoda are large, broad, and fungiform.

The first pair of antennæ has a three-jointed peduncle, of which the first joint is long and the two succeeding short, supporting two flagella, one short and uniarticulate, the other scarcely half the length of the peduncle and biarticulate. The basal extremity of the first joint is not enlarged to receive an otolith.

Second pair of antennæ carries a flagellum that reaches but little beyond the ophthalmopod, and a scaphocerite that nearly equals it in length, and which is furnished on the outer margin, near the extremity, with a long tooth fringed with marginal teeth (not properly represented in the figure).

There are seven pairs of appendages that represent the gnathopoda and five pairs of pereiopoda, of which the last two are feeble and the others tolerably robust.

The pleopoda are all single-branched, and exhibit no signs of an inner ramus, except the posterior pair, which goes to form the rhipidura. The plates of this pair are long, narrow, and reach beyond the extremity of the telson; the outer is armed with a strong tooth one-third distant from the extremity.

Length, 3 mm. (0.12 in.).

Habitat.—North Pacific Ocean.

Observations.—This is a younger form and may develop into either *Sergestes* or *Acetes*, as it possesses no feature that might not become modified in the course of its progressive growth.

Acetes, Milne-Edwards.

Acetes, Milne-Edwards, Ann. d. Sci. Nat., t. xix. p. 350, 1830.

„ „ Hist. Nat. des Crust., t. ii. p. 429.

There is no specimen in the extensive collection of species of this family that I can recognise as belonging to this genus.

Professor Brooks¹ figures a specimen as a young *Acetes*, $\frac{80}{1000}$ th of an inch long

¹ *Phil. Trans.*, pl. x. fig. 85, 1882.

(2 mm.), and also figures¹ an older specimen, $\frac{15}{100}$ th of an inch (4 mm.) long, in which, besides the characteristic absence of the posterior two pairs of pereopoda, the anterior three pairs, unlike *Sergestes*, resemble those of *Penæus* in all three being chelate.

On Pl. LXVII. of this Report, fig. 4 represents an animal 7 mm. long (described as *Mastigopus spiniventralis*, at page 379), that is almost identical in form with that given by Brooks in his fig. 85 above referred to, excepting that neither pair of pereopoda possesses any trace of a chelate character. Believing this to be a young *Sergestes* in the *Mastigopus* stage, I have named it so accordingly, assuming, that as in every specimen analytically examined I found the posterior pair of pereopoda in a budding condition, but more or less developed, that they were present in this also, although it corresponded closely with Milne-Edwards' description of the genus *Acetes* in having the pereopoda filiform and terminated by a single point (sont filiformes et terminées par un article pointu).² To see it figured with three pairs of chelate appendages similar to *Penæus*, as shown by Professor Brooks in his plates, and confirmed by his description, suggests that the specimens examined were not the young of *Acetes*.

I am aware that Professor Milne-Edwards originally described *Sergestes* as having the pereopoda filiform and monodactyle, and that we are indebted to Professor Krøyer for first pointing out that two pairs of these appendages terminated in minute chelæ, but Krøyer did not make this character a feature of the genus as has been done in this Report, inasmuch as several of the species that he has described in his Monograph on this genus have the pereopoda terminating in a monodactyle extremity, a condition which, throughout this Report, I have attributed to the immature stage of *Mastigopus*.

So far as my knowledge goes the genus *Acetes* has never been fully described or noticed at all from independent observation, since it was first published by Professor Milne-Edwards nearly sixty years ago, nor am I aware of any specimens having been observed, excepting those from which Milne-Edwards drew his description, and which are still preserved in the Museum of the Jardin des Plantes at Paris. These type specimens are recorded as inhabiting the Ganges, in which river, or in the sea near its mouth, they must be very abundant, for among the specimens of Crustacea collected by Sir Walter Elliot, S. I., there were several specimens of *Acetes indicus* (Pl. LXXXV. fig. 1), and with them was a note stating that they were taken in 1852 from a large fish "21 feet in length and 25 broad" (*Dicerobates eroogoodoo*); its stomach was filled with myriads of these little Crustaceans, which were carried away in bucketfuls by the fishermen, and thousands were left scattered about the shore.

Milne-Edwards says this genus ought to be placed very near the Schizopoda.

¹ *Loc. cit.*, pl. xi. fig. 90.

² *Ann. d. Sci. Nat.*, t. xix. p. 350, 1830.

Subfamily LUCIFERINÆ.

This subfamily is formed to receive those Sergestidæ that have no branchiæ attached to the pereion; in which the two anterior pairs of pereiopoda are not chelate, and the third pair has the chelæ reduced to a more or less imperfect condition; in which the ova are carried beneath the pereion, but appear not to have any special means of attachment, and in which the brephalos is hatched in the Nauplius form. Of this subfamily there is known to exist only a single genus.

Lucifer, Vaughan Thompson.

Lucifer, Vaughan Thompson, Zool. Researches, p. 58, pl. vii. fig. 2, 1829.

Leucifer, Milne-Edwards, Hist. Nat. Crust., tom. ii. p. 469.

Lucifer, Dana U.S. Explor. Exped., Crust., p. 668.

Animal long, slender, and laterally compressed. Cephalon cylindrical, and produced to a great length anteriorly to the mandibles, so that the antennæ and ophthalmopoda are removed considerably from the oral and other appendages. The pereion is short and dorsally covered with a small receding carapace. The pleon is very long, being about two-thirds the length of the animal, and has the five anterior somites subequal, whereas the sixth is about twice or thrice the length of either of the preceding.

The telson is narrow, compressed and tapering, differing more in sexual than in specific form.

The ophthalmopoda are long, narrow, and terminate in round, bulbous ophthalmi.

The first pair of antennæ (Pl. LXXIX., *b*) has a three-jointed peduncle and a single slender flagellum, and carries within the basal portion of the first joint a well-defined acoustic organ (or otolith).

The second pair (*c*) has the joints of the peduncle closely united; the first supports a long, slender phymacerite, and the second a long, slender, somewhat styliform scaphocerite; and the terminal joint is long, robust, and supports a long, slender flagellum.

The distance from the second pair of antennæ to the epistoma is greater than from that to the posterior extremity of the pereion, and these together form about one-third the length of the animal.

The mandibles do not carry any synhipod, and have the margin of the psalisiform blades serrate.

The first pair of siagnopoda (*e*) is three-lobed, two lobes being on the inner side, one of which is broad and fringed with several strong spines, the other narrow and furnished with a few slender spines or hairs; and one on the distal surface that is narrow, cylindrical, and free from ornamentation.

The second pair (*f*) consists of four foliaceous lobes; the two basal are produced inwards,

and each is crowned with four strong spinous teeth, or spines; the third is broad, of great tenuity, and fringed on the inner margin with a row of closely planted, simple, stiff hairs or smooth spines; the fourth lobe is posteriorly attached to the base of the preceding, and is produced anteriorly and fringed with seven or eight long, ciliated hairs; it is also produced considerably posteriorly, and fringed at the extremity with five long, ciliated hairs, the margins between the two extremities being naked and free from hairs or cilia. This plate is the homologue of the mastigobranchia, which Dana calls the "fouet," and which he has observed playing with constant motion beneath the carapace in the living animal.

The third pair of *siagnopoda* (*g*), or first maxillipedes, is only two-jointed; the basal joint is broad, foliaceous, and fringed on the inner margin with long, robust, simple hairs; the second is narrower, of similar construction, and furnished with a double row of similar hairs; these appendages are short but larger than the preceding, and generally lie like an operculum protecting the organs of the mouth, which are protruded and much exposed.

The first pair of *gnathopoda* (*h*) is tolerably robust and six-jointed; the basis and ischium forming a curve, articulate with the meros at a right angle, which causes the three succeeding joints to be directed posteriorly; all the joints bear strong ciliated hairs, and the terminal joint ends in a blunt round extremity.

The second pair of *gnathopoda* (*i*) is more slender, and corresponds in length with the first; it is only five-jointed, and terminates in an obtuse point.

The first pair of *pereiopoda* (*k*) is shorter than the *gnathopoda*, but much resembles the second pair in its feebleness of character. The second pair of *pereiopoda* (*l*) is very much longer than the first and much more robust. It is six-jointed, and terminates in an obtuse extremity sparsely ciliated with fine hairs. The third pair (*m*) resembles the second in size and general aspect, but terminates in a minute dactylos that gives to the extremity when magnified the appearance of being chelate and furnished with long hairs. The fourth and fifth pairs of *pereiopoda* are not developed.

The first pair of *pleopoda* is attached near the middle of the ventral surface of the first somite of the pleon, and has a long basal joint and terminates in a single branch. The four succeeding pairs gradually shorten posteriorly and support two rami each; those of the sixth pair differ from the others and form the lateral plates of the rhipidura. The basal joint is short and the outer plate long and terminates subapically in a sharp tooth, whereas the inner plate is shorter, more tapering and slender than the outer, and fringed with cilia on both margins.

Organs of Generation.—The reproductive organs of the male animal were first figured by Vaughan Thompson¹ and again by Dana,² but without either of them having a full appreciation of the character and importance of their observations; a circumstance that probably accounts for their not having been noticed by other writers.

In 1861 Dr. Semper described, without any illustration, the form of these structures,

¹ *Loc. cit.*, pl. vii. fig. 2.

² U.S. Explor. Exped., Crust., Atlas, pl. xlv. fig. 94.

both in the male and female, from specimens procured at Samboangan, one of the Philippine Islands, and in 1872 he gave a second memoir with illustrations on the same subject. In these he stated that the vas deferens has but one opening, and that in the median line on the ventral surface. This was confirmed by Anton Dohrn in 1871, who also demonstrated that the form of the adult animal corresponds with that of Vaughan Thompson's figure.¹

The fact of there being a single opening of the vas deferens, and that in the median line, is contested by Professor Brooks in his memoir on *Lucifer*,² where he asserts³ it has "two external openings; they are not on the median line, and their position in the body does not correspond to that of the female orifice; but in other respects my own observations show the correctness of" Semper's "description."

Professor Brooks appears to have had "an abundant supply of adult specimens of both sexes," and was consequently enabled to give a more complete account of the structure and relations of the reproductive organs. He says⁴:—"The body of the animal is so thin (narrow) that it is almost impossible to get a good dorsal view without crushing the specimen; but a very careful examination of the side view seems to show that there is only a single organ on the median line of the body, as Semper states. On each side of the intestine, along the line where the testis joins its wall, a small tubular vas deferens arises, and runs backwards along the side of the intestine nearly to the end of the first abdominal" (pleonic) "somite, to which it seems to be attached by a ligament. It then bends outwards and forwards upon itself to form a second much larger portion, which is parallel to and outside of the first portion, and reaches nearly to the anterior edge of the first abdominal somite. The third or terminal portion has a large cavity, thick walls, and it runs down to an external opening which is situated on the outer edge of the sternal surface of the thoracic" (perionic) "region, behind the basal joint of the third pereopod, and therefore in the position which would be occupied by the basal joints of the fourth or fifth pereopods if they were present.

"There is a vas deferens, made up of these three portions, on each side of the body, and the ventral nerve-chain passes between their external openings.

"The more anterior follicles of the testis are almost perfectly transparent, but the development of the male cells in the posterior ones gives to them a faint granulation. The first division of the vas deferens has a small cavity, thin walls, and as it usually seems to be entirely empty it is probable that the passage of the male cells from the testis through it to the second division takes place quickly. The second division has a very large cavity, and in it the male cells become arranged in a single layer around the surface of a central core, which is formed of some dense transparent adhesive substance.

"The spermatophore appears to pass into the third chamber before it is completely

¹ Zoological Researches, 1829.

² Loc. cit., p. 58.

³ Phil. Trans., p. 57, 1882.

⁴ Loc. cit., p. 59, et seq.

formed, as all those which were seen in the second chamber consisted only of a central core and a layer of male cells, while those which were contained in the thick-walled third chamber had an outer enveloping capsule.

"I have found several specimens with a fully-developed spermatophore on one side of the body and none on the other side, and was thus enabled to thoroughly satisfy myself of the presence of two vasa deferentia, and two external openings.

"I was unable to discover how the spermatophore is transported to the body of the female, or what part the clasping organ upon the first pleopod of the male performs during the act of copulation.

"Upon several occasions I observed a male clinging to the basal joints of the first antennæ of a female, but as I never succeeded in getting the pair under a lens without separating them, I made no careful examination. Copulation usually takes place during the daytime, or at least this was the case in every instance which I observed. In several cases I found female specimens with a simple fresh spermatophore attached to the opening of the seminal receptacle. This opening is situated between and a little anterior to the basal joints of the third pair of thoracic limbs. As the spermatophore gradually discharged its contents, it was easy to see that both the central core and the investing layer of spermatozoa escaped from the outer sheath and passed into the seminal receptacle. In all the breeding females which I have observed the spermatozoa filled the posterior, and the transparent core of the spermatophore the anterior half of the spermatoc receptacle. The ovary is very long, and it lies under the intestine, reaching from the fifth abdominal (pleonic) somite to the posterior edge of the carapace, where it bends upon itself at right angles and runs down to its external opening, which is upon or close to the median line of the ventral surface, a little in front of the third pair of pereopods. The wall of the ovary is so very thin and delicate that I was not able to detect it at all except when it is filled with ripe ova. These are very much elongated, granular, and slightly opaque; and there does not seem to be any shell around them. They are very elastic, and undergo great changes of shape as they pass through the small oviduct.

"Oviposition occurs between 9 and 10 o'clock in the evening, and occupies only a few minutes.

"After the eggs are laid they are spherical, transparent, and each one has a rather thick shell. They are attached, in a loose bunch of twenty or more, to the last pair of thoracic limbs, and in order to save space I have shown them in fig. 74, although the specimen from which the figure was drawn had not laid any of its eggs.

"As I obtained very few ripe females, I was not able to sacrifice one of them to study the reproductive organs under pressure, and I am therefore unable to decide whether any parts of this system are double; but I feel confident that there is only one spermatoc receptacle, and the opening of the oviduct seems to be upon the median line." I have been induced to quote Professor Brooks' memoir on this subject very fully because of its

variance from the observations of preceding writers, and the greater advantages at his disposal in the quantity of living specimens at his command.

Those in the Challenger collection, although numerous and obtained from all parts of the Atlantic and Pacific Oceans within tropical and subtropical regions, are few in comparison, especially those in which the reproductive parts in either sex are in a condition for analytical examination, and these from their long retention in an alcoholic fluid, are less transparent than those that were at the command of Professor Brooks.

In our male specimens the testes are numerous and suspended in bunches from a continuous cord apparently traversing the median line immediately beneath the alimentary canal, extending anteriorly as far as the second pair of gnathopoda, and posteriorly to the first somite of the pleon, where it appears to me to be connected with a large chamber that extends posteriorly in the form of a gradually narrowing and pointed *cul de sac*, in which the spermatophores are developed, and from the anterior extremity of this cavity an opening on each side anteriorly passes into a vas deferens that descends almost vertically, or at most but slightly forwards to the posterior ventral extremity of the pereion, one on each side of the neural cord that traverses the ventral surface of the pereion. It is probable that in the same animal only one duct is in use, *inasmuch as two spermatophores are never equally developed at one time or proceed simultaneously*, and when they succeed each other with rapidity, they, according to the figures given by Dana and Professor Brooks, traverse the same channel in succession. Undoubtedly in the specimens that I have studied, the vas deferens sometimes passes down on the left side, as shown on Pl. LXXX. fig. 1, while in another specimen it is on the right side; in the latter the vas deferens appears to be empty, as if a spermatophore had recently been extruded, while the nuclei of three others appear to be in a state of formation. In the former specimen a spermatophore appears to be approaching the period of extrusion, and another in an earlier condition within the chamber.

The spermatophore when ready to be discharged is quite equal to, and in some instances longer than, half the depth of the animal, the large end in advance, the sharp or pointed extremity following; when the stouter end reaches the external extremity of the passage through which it travels, it presses against a thin membrane that appears to close the orifice of the vas deferens and retain the spermatophore in position until circumstances require its extrusion; it is then in all likelihood caught by the petasma, where it is retained until it is required for the impregnation of the ovum.

That the petasma is capable of so holding it may, I think, be accepted from an examination of its structure, which I have illustrated on Pl. LXXX., *ptm*, showing it in lateral aspect, with the anterior central portion, which is considerably advanced, detached and more highly magnified to show the inner surface corrugated in the median line as if it were formed for grasping and holding the spermatophore, which it probably does, by the latter being dropped with the thick end into the grasping process of the petasma, the

pointed and narrow extremity falling forwards ready for insertion when the opportunity occurs.

The second pair of pleopoda carries, attached to the base of the inner of the two rami, a rigid branch that is about a third of the length of the one to which it is attached. The object of this, which is only present in male animals, is not very obvious, and it is only a conjecture, when I say that it may be useful in adding power to retain the preceding pair in position during copulation.

When the spermatophore is liberated from the influence of the male animal, the smaller extremity is inserted into the oviduct and there retained, the ova being fertilised as they pass through the seminal receptacle, which opens on the inner side of the third pair of pereopoda (Pl. LXXXI. figs. 1♀, 2♀).

This latter organ I have not been able in the specimens at my command to determine to be of the inverted bottle-shaped form as figured by Professor Brooks; nor does it appear to open anterior to the third pair of pereopoda, but according to my observation it is only a slight enlargement with a constriction, or rather a series of constrictions, that forms a series of chambers in the oviduct.

Professor Brooks says that there is only one opening, and his opportunity and power of observation are so great that they demand assent, but I can only state, according to the opportunities of my own observation, that the neural cord, which consists of an elongated mass with bulbs increasing in size from the oral appendages to the third pair of pereopoda, whence it continues as a fine thread until it reaches the first pair of pleopoda, passes behind or rather on one side of the ovisac, and therefore the neural cord being in the median line the ovisac must be on one side; that on the opposite side, as in the males, is probably obsolete or only periodically in use.

The ovaries are very long, and in some specimens reach as far back as nearly to the middle of the sixth somite of the pleon (fig. 1♀), where they terminate in a gradually narrowing point; the posterior portion is full of simple granules, and the anterior with gradually ripening ova.

Observations.—So far as I can determine, there are only two species of *Lucifer*, and these are probably the same as recorded by Milne-Edwards in his short description. All other forms, of which I give several figures, are, I believe, only dependent upon variation in the progress of development. Even the two recognised species differ but little in important characters. The ophthalmopoda of one are longer than those of the other, and the form of the teeth on the lateral margins of the sixth somite of the pleon in the males varies but little. The other external features of difference are not very considerable. The last mentioned difference only exists in the male animals, whereas the females closely resemble one another in both species, except in the relative length of the ophthalmopoda.

Dana, in his Report on the Crustacea of the U.S. Exploring Expedition, describes

three new species, but from comparison with those I have figured I am convinced that they are only immature forms of the already known species.

Professor Brooks¹ says:—"We found a few adult specimens out at sea, but, while I was able to learn little about their habits, I think that they are not strictly pelagic, but that their proper home is the salt marshes close to the ocean.

"They were met with in the greatest abundance about half a mile inside Old Topsail Inlet, near a large marsh, during the first hour of the ebb tide, on calm evenings when the tide turned between 7 and 8 P.M.; and I infer that they leave the marshes at this time to breed in the ocean. All the mature females which we found, with one exception, were captured under these peculiar conditions; and we never failed to find them at this spot when the tide turned about sunset and the water was calm."

DEVELOPMENT OF LUCIFER.

The interest in the study of this genus has been maintained ever since its first discovery was made by Vaughan Thompson. This has been largely owing to the anomalous appearance of the animal, arising chiefly from the enormous longitudinal development of the regions between the anterior lip and the second pair of antennæ; the reduction of the pereopoda to three pairs, and the greater comparative development of the pleon and its appendages, herein exhibiting features the very opposite to those of the aberrant Amphipoda, where the pereion is increased in proportion and the pleon reduced to a rudimentary condition.

The difficulty of studying the history of the animal has been increased by the fact that the female does not carry the ova attached to the pleopoda, as among the Prawns, or in an ovisac as in other Crustacea. No one before Professor W. K. Brooks,² so far as I am aware, ever observed the female bearing ova at all, and he found them in the anomalous condition of being attached to the posterior pair of pereopoda instead of to the pleopods, and they appear to be retained in position by some adhesive property of the ovum instead of being linked together like a bunch of grapes by a tissue developed for the purpose. According to Professor Brooks the deposition of the ova takes place between nine and ten in the evening and occupies only a few minutes. After deposition, they are spherical, transparent, and have rather a thick case, and are loosely attached in a bunch of about twenty to the third or posterior existing pair of pereopoda, and so feeble is their attachment, that "even when great numbers of mature specimens are captured in the breeding season, with the greatest care and delicacy, very few of them, much less than one per cent., are found to have eggs attached to their limbs." About thirty hours after oviposition, the ocellus and appendages of the embryo become visible inside the outer envelope, and after thirty-six hours the brephalos is hatched in the

¹ *Loc. cit.*, p. 60.

² *Loc. cit.*, p. 64.

form of a Nauplius, $\frac{8}{1000}$ of an inch in length, and, according to Professor Brooks' figure, nearly as much in its broadest diameter. The brephalos is ovate in form and carries three pairs of free appendages, of which the anterior is single-branched and the two succeeding biramose. The anterior labrum is large and prominent; posterior to it is a double row of four pairs of bud-like eminences, arranged in longitudinal series. The three free appendages have hairs projecting from their extremities, which lengthen considerably within a few minutes after the embryo is extruded from the egg. These three appendages are organs of locomotion, and by their agency the animal is propelled through the water. The motions of the brephalos are very erratic and violent, and consist of a series of quick leaps produced by vigorous strokes of the appendages, much like those of a young Copepod or Cirriped.¹

The outline of the body (Professor Brooks says) is pear-shaped, with the broad end at the posterior extremity, when the second maxillæ are in the centre of the field of view; but when the metastoma is in the centre this is reversed, and the broad end is in front. This difference is due to the fact that the dorsal region is much wider than the labrum and to the series of buds, which together form a ridge along the ventral surface.

The dorsal portion of the posterior region of the body is swollen and rounded, and near its lateral margins there is a pair of small but very conspicuous dark pigment-spots, which might easily be taken at this stage for ocelli, since they are nearly of the same size and colour. These two pigment-spots are very conspicuous during all the early stages of the metamorphosis, and their position during the later stages shows that the portion of the Nauplius body which bears them becomes the pereion and not the pleon in the maturer form.

When the brephalos is just hatched it is, as in this stage of all these animals, enclosed within a delicate cuticle, which, however, is soon torn off, probably through the forcible extension of the hairs of the appendages. In this early stage Professor Brooks had no difficulty in keeping it alive, and was thus enabled to contribute largely to our knowledge of the life history and morphology of this curious and interesting little creature.

In about twelve or fourteen hours the Nauplius sheds its skin, and increases in length from $\frac{8}{1000}$ (0.2 mm.) to $\frac{9}{1000}$ (0.225 mm.) of an inch, and the extremity of the pleon is posteriorly projected, showing the telson in a forked condition, and furnished with two pairs of short stout spines, the inner pair being longer than the outer. A well-marked fold of the surface of the body now distinguishes the posterior and lateral margins of the carapace, but this line is not continued on to the anterior end of the body, and the posterior edge is not yet raised or separated from the hind body as it is, according to Metschnikoff, in the Nauplius stage of *Euphausia*.

The two small pigment-spots that were noticed in the earlier stage are in this drawn out in such a way as to surround a large rectangular area at the posterior end of the carapace, and in the region where the heart becomes visible in the next stage.

¹ *Loc cit.*, p. 73 et seq.

The digestive tract has become visible; the œsophagus, which commences immediately behind the labrum, rising upwards and backwards to open into the floor of the stomach. The intestine is small, with thin walls, and it follows the dorsal curvature of the body to the anus, which is placed just in front of the spines of the telson.

The nervous system is present in the form of a cerebral ganglion and a neural mass that is obscurely divided into segments, which passes beneath the stomach.

Within twelve hours the animal moults, and increases from $\frac{9}{1000}$ (0.225 mm.) to $\frac{200}{1000}$ (0.5 mm.) of an inch, or to rather more than twice its length, and changes its form from that of a Nauplius to that of a Zoea—a change chiefly due to the development of the carapace and the great increase in the length of the pleon.

The great increase in size, more than twice, and the remarkable variation in form are such, that nothing less than the exactitude shown in the observations made by Professor Brooks would have precluded critical discussion, but he, having placed the Nauplius which has just been described, alone in a watch-glass of sea-water, at 9 P.M. on September 28, found on the 29th at 9 A.M. that it had changed into the Zoea form.

This Zoea has the carapace developed in a horse-shoe form, much like that of the king-crab, *Limulus*, and it forms about one-half of the entire length of the animal. The frontal margin is produced anteriorly in the median line to a strong and pointed rostrum, about one-third of the length of the carapace. The posterior margin is concave and produced in the median line into a short tooth that is obliquely elevated, and the postero-lateral angles are produced to long, posteriorly directed teeth. The walls of the carapace are folded down, and laterally compressed, so that all the appendages except the antennæ are almost completely enclosed and protected.

Dana¹ described and figured two specimens of this form under the name of *Erichthina demissa*; the earliest stage had no eyes visible, only the central ocellus, but in the older one the eye was present in a more advanced stage than that shown in either of Brooks' figures.

This is as far as Professor Brooks was able to trace the development of one specimen, but he has shown from others taken at a similar period that there are three forms that correspond with this Zoea moult.

This stage corresponds with the accompanying figure (fig. 54), taken from Willemoes Suhm's drawings, which he defines, as—

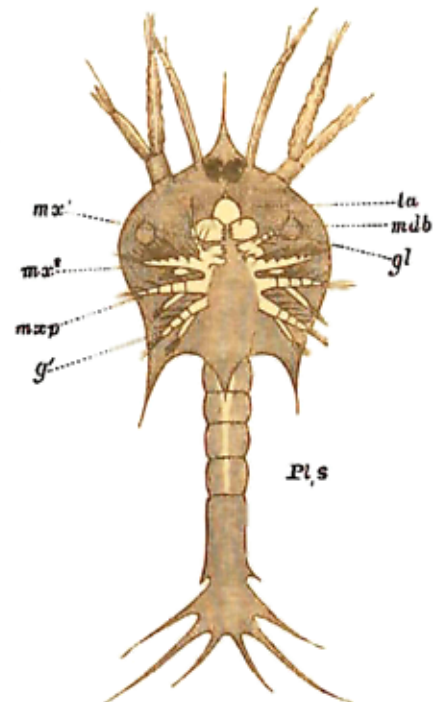


FIG. 54.—Zoea of *Lucifer reynaudii*. *gl*, gland in the carapace; *Pl.s*, provisional segments of the pleon; *la*, labrum; *mdb*, mandible; *mx¹*, first maxilla; *mx²*, second maxilla; *mxp*, maxilliped; *g¹*, gnathopod.

¹ U.S. Explor. Exped. Crust., p. 634, pl. xlii. figs. 3a-d.

"A. The youngest Zoea stage without eyes in the development of *Leucifer reynaudii*. Taken north of New Guinea, off Mariannes, March 1875."

"Specimens in this stage were also taken north of Japan."

The second stage differs from the first in having increased from $\frac{29}{1000}$ (0.5 mm.) to $\frac{37}{1000}$ (0.67 mm.) of an inch, measured from the apex of the rostrum to the base of the hairs on the telson. The appendages are similar to those of the first Zoea, but the carapace is elongated, and a pigment-spot represents the future compound eye which is now appearing.

The Zoea previous to maturity loses the caudal spines by shedding the skin.

The third stage Professor Brooks has observed in several specimens, more than fifty having passed through it in the laboratory. The form now corresponds in character with our figure on Pl. LXXIX. fig. 1, which is 1 mm. in length, and was taken in September 1875, in lat. 2° 34' N.

Claus in his Crustacean System (Taf. ii. fig. 1) has also figured this stage as an *Erichthina* from a specimen that was taken in the Gulf of Messina, and which he says corresponds with the "larva of *Leucifer* by Willemoes Suhm," but which differs from Suhm's specimen as well as from that figured in this Report, on Pl. LXXIX., which was stained and mounted in Canada balsam by Willemoes Suhm, and is probably that from which he made his drawing, in having the lateral extremities of the carapace rounded as in the young of *Penæus*, instead of being produced to points, as in Suhm's drawings and our figure.

The description agrees with the figure given by Professor Brooks,¹ except in such points as may be attributed to the treatment our preserved specimen received in mounting, or in such details as will be pointed out.

The ocellus is present in our specimen in the form of a circular transparent lens.

The eye is represented by a pigment-spot, which Professor Brooks figures as being on the outer side of the second pair of antennæ, and posterior to the cerebral ganglion, whereas in our specimen it is on the inner side of the antennæ and in contact with the cerebral ganglion, and is much larger and more conspicuous than in Professor Brooks' figures.

The first pair of antennæ consists of a long cylindrical basal joint and a slender terminal one, which ends in two rather long sensory cilia. The second pair is made up of a short, stout, semi-articulate peduncle that supports two branches, one of which, the scaphocerite, is single-jointed and the other biarticulate, each being tipped with several long hairs. The scaphocerite in Brooks' and Suhm's figures is multiarticulate. These are the chief organs of locomotion at this period.

The mandibles cannot be easily determined in our sole specimen, but Professor Brooks describes them as being "cutting blades which are visible in a dorsal view."

"During the first Protozoa stage it (the mandible), has only one denticle, which is

¹ *Loc. cit.*, pl. iv. fig. 42.

large, pointed, and situated at the posterior angle of the cutting edge, but at the second Protozoa stage a number of small denticles have appeared in front of the long one. The mandibles are never quite symmetrical, but the outline of the left always differs a little from that of the right," as shown in the following illustration from Willemoes Suhm's drawings.



FIG. 55.—Mandibles of *Lucifer*.

The first pair of maxillæ consists of a basal portion made up of two joints with "cutting hairs," an inner ramus of two joints terminating in three slender hairs, and an outer ramus with three. In the first stage the hairs of the latter are simple, but on the second they are plumose.

The second maxilla consists of a multiarticulate basal portion, a small biarticulate inner ramus, and a uniarticulate outer branch. The entire inner margin of the appendage carries short stout hairs; the extremity of the inner ramus carries a few somewhat longer, and the outer branch three slender plumose hairs, which are much longer in the second than in the first stage.

The next succeeding appendages, which Professor Brooks calls the first and second pairs of maxillipedes, but which are homologous with the last or third pair of siagnopoda and the first pair of gnathopoda according to the nomenclature in this Report, resemble each other and consist of a two-jointed basal portion, a four-jointed inner, and a single-jointed outer ramus, the former supporting four long slender hairs which are simple in the first pair but regularly ciliated in the second. The second pair is smaller than the first, and apparently of little functional importance. Professor Brooks here notices "a small convoluted shell-gland which appears to open at the base of the first maxilla."

In Suhm's figure of the earlier stage of this Zoea there is represented a small gland (fig. 54, *gl.*) of a similar character, but situated on the outer side in a line with the mandibles, whereas Professor Brooks describes it as being at the base of either the first or second maxilla, he is not sure which, because "the constant and violent movements of the limbs renders it difficult to decide with confidence exactly what its relation to them is."

After the next moult, which Professor Brooks has observed in a great number of specimens, the Zoea passes into a form that is directly comparable, so far as the appendages are concerned, with the *Elaphocaris*-stage of *Sergestes*,¹ although the most conspicuous features, the long compound spines, are not present in the young of *Lucifer*. It is now about $\frac{1}{8}$ of an inch (or 1.25 mm) long; the appendages are the same, but the four pairs of pereopoda and the appendages of the sixth somite of the pleon are present as rudimentary buds. The permanent eye is now well advanced in development, although there is yet no trace of a peduncle, the cornea being simply a modified portion of the

¹ It should be remembered that *Elaphocaris suhmii* has yet no trace of the permanent eye, and Suhm asserts, and his drawing confirms the opinion, that the specimen when he captured it still contained in abundance the cells of the embryonic yolk-mass, a circumstance that strongly suggests that the youngest form of *Sergestes* is a Nauplius in the form of a blind *Elaphocaris*, and therefore earlier in development than the Protozoa of *Lucifer*.

integument of the carapace. The carapace is longer, narrower and more rectangular in a dorsal view than it was at the last stage, and it makes only about one-third of the total length of the body.

Up to this time, Professor Brooks says the mode of motion has been short, jerking Nauplius-like leaps, and the two pairs of antennæ have been, as they were when the larva left the egg, the chief organs of locomotion. The structure of these appendages has remained extremely constant through all the moults, but they now entirely change their character and lose their locomotive function.

The change which is undergone by the larva at the end of the Zoca series is very much greater than at any preceding moult, except that between the Nauplius and the first Protozoëa, and in some respects it is even greater than it was at that time. After the moult it is about $\frac{1}{1000}$ of an inch (or 1.75 mm.) long, with seven pairs of long-jointed, biramose, swimming feet, fringed with long slender hairs. The swimmerets are also present as functional appendages with long fringing hairs.¹

Professor Brooks' figure was drawn from a Zoca which was captured at the surface of the ocean, carefully examined, and compared with one previously examined (*loc. cit.*, fig. 43), and found to agree with it exactly. It was then placed alone in a small beaker of sea-water. The next day it was found to be moulting, and a drawing was made from it

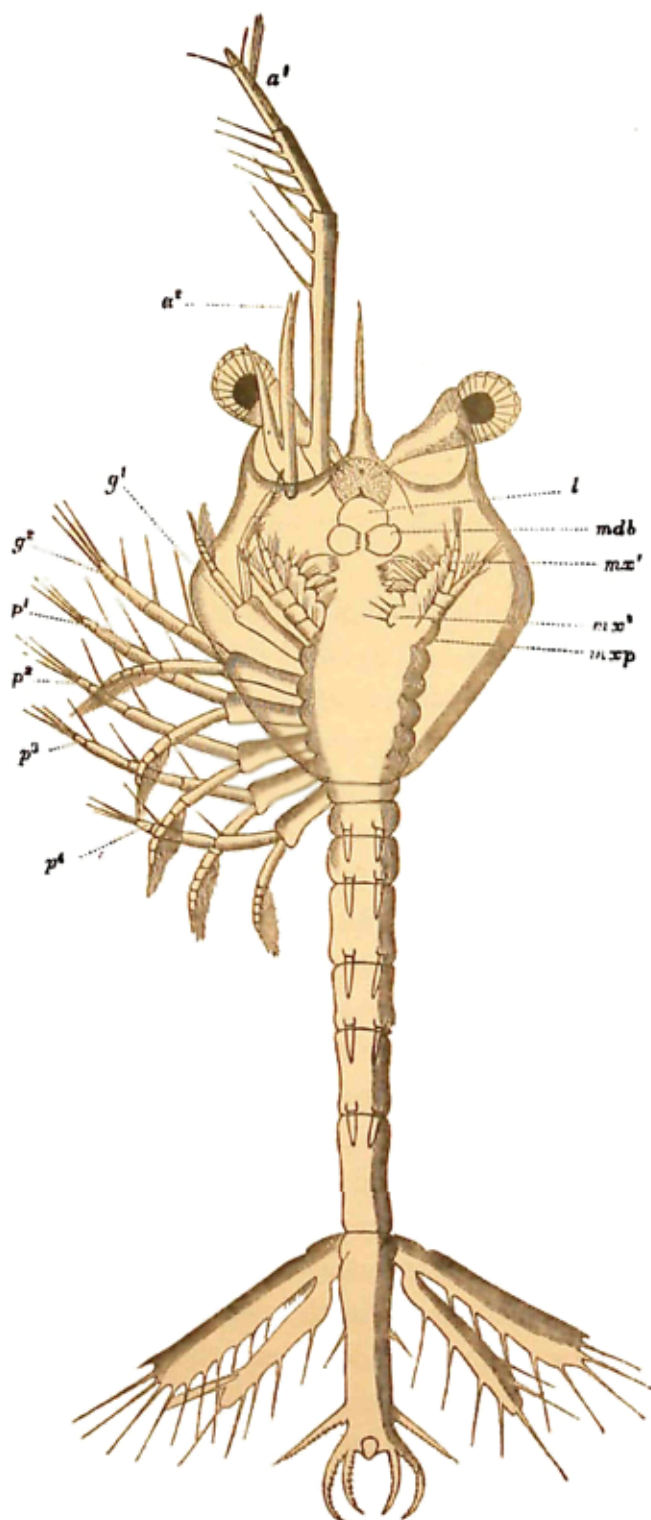


FIG. 56.—*Lucifer* in the *Acanthosoma* stage, from a drawing by Willemoes Suhm. *a*¹, first antenna; *a*², second antenna; *l*, labrum; *mdb*, mandibles; *mx*¹, first maxilla; *mx*², second maxilla; *mxp*, maxilliped; *g*¹, first gnathopod; *g*², second gnathopod; *p*¹⁻⁴, pereopoda.

¹ It should be here noticed that by swimmerets and swimming feet Professor Brooks does not mean the pleopoda that are so named in Crustacea generally, but the immature pereopoda and their accompanying branches.