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UNDER THE COMMAND OF

CHARLES WILKES, U.S.N.

VOL. ¹⁴ ~~XIII~~.

CRUSTACEA.

BY

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GEOLOGICAL SOCIETY OF LONDON; THE AMERICAN ACADEMY OF ARTS AND SCIENCES
AT BOSTON; THE ACADEMY OF NATURAL SCIENCES OF PHILADELPHIA, ETC.

WITH A FOLIO ATLAS OF NINETY-SIX PLATES.

PART II.

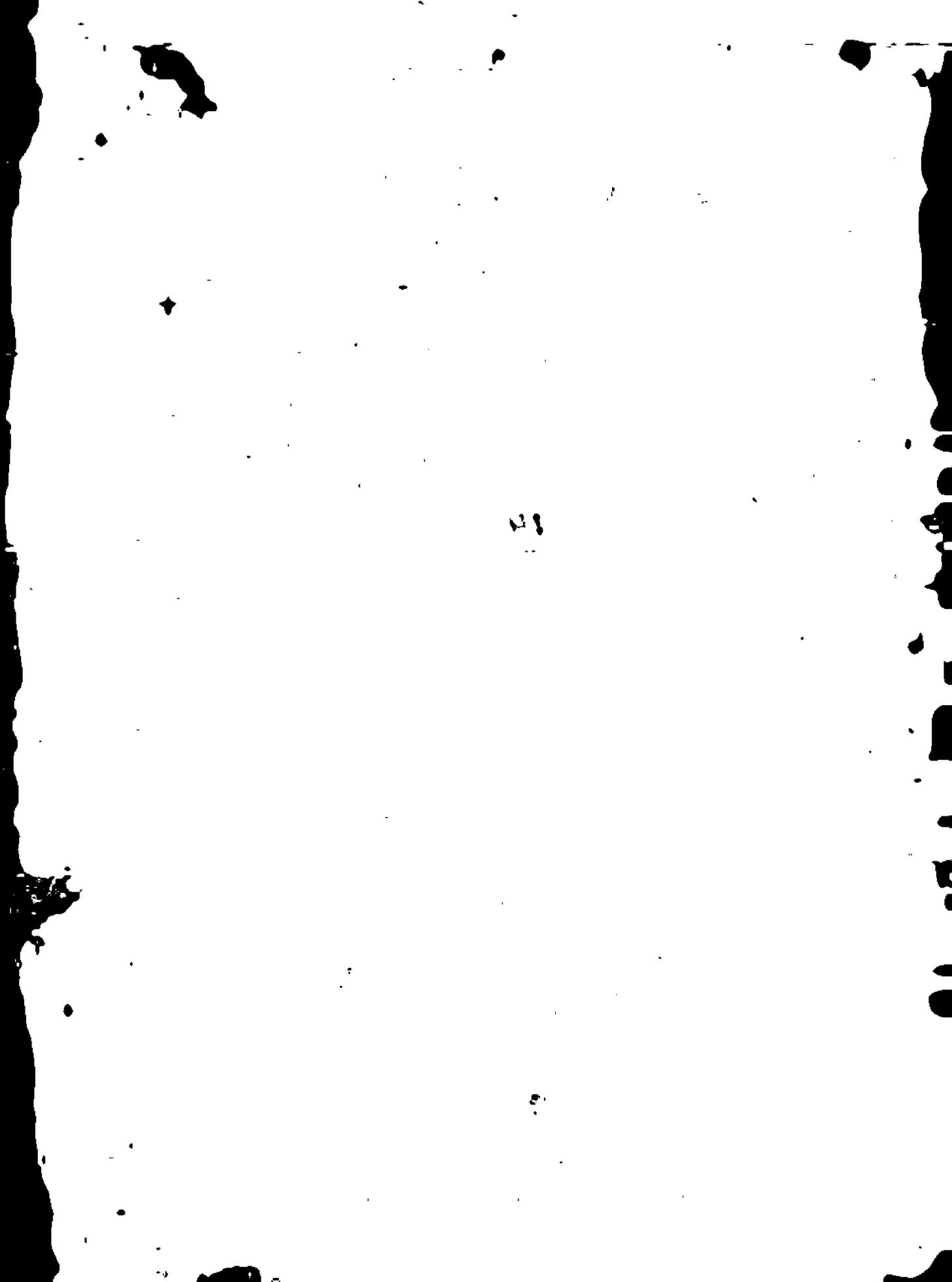
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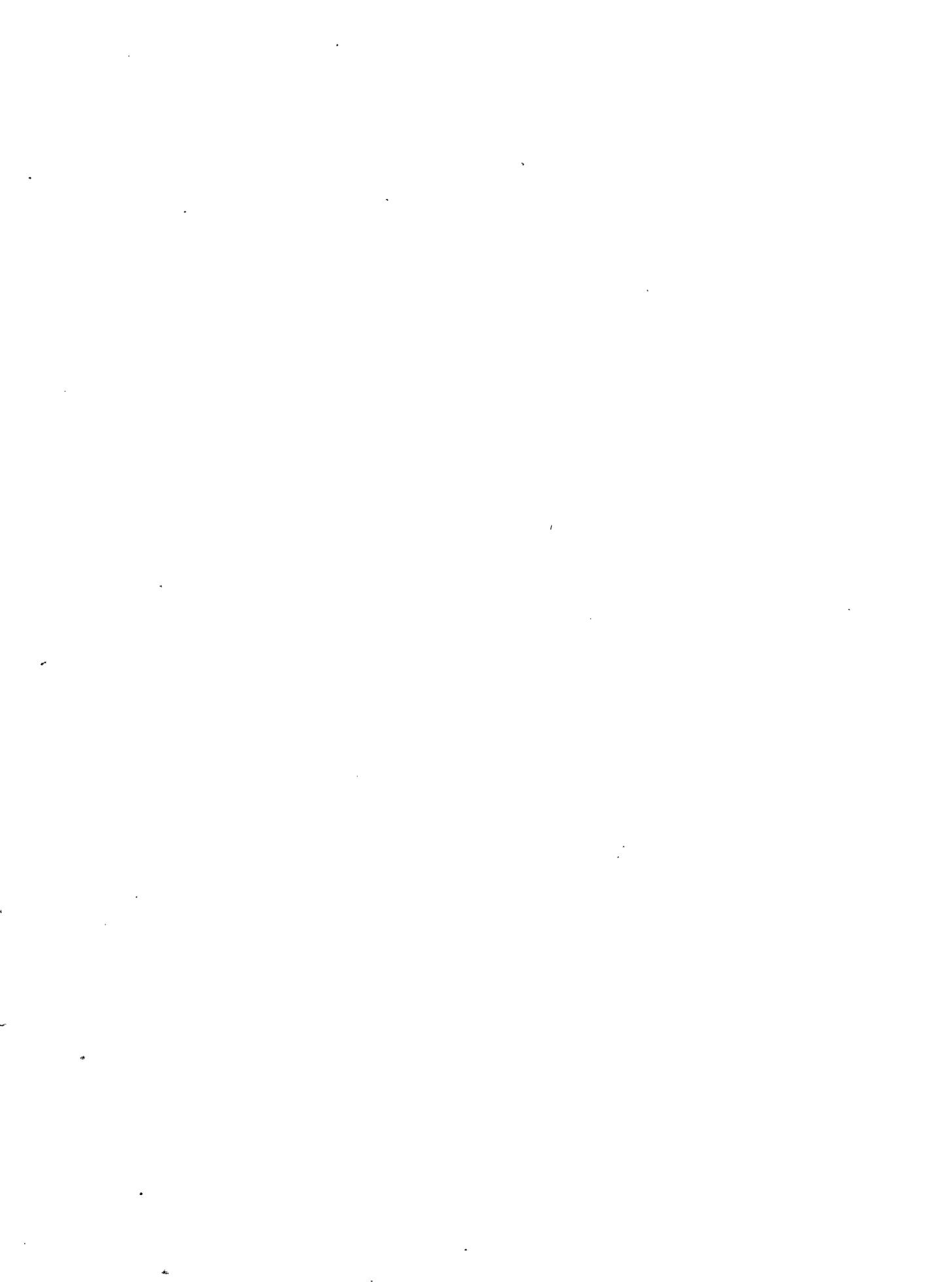


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CRUSTACEA.

PART II.



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SUBCLASS II.

CRUSTACEA EDRIOPHTHALMIA.

ON pages 8 to 12 of this volume, the prominent points in the classification of the Edriophthalmia have been considered, and the grand divisions laid down. These divisions or ORDERS are as follows:—

Ordo I. CHORISTOPODA. — Cephalothorax multi-annulatus, segmentis thoracis numero septem, pare pedum utroque ad segmentum singulum pertinente, segmento anteriore cephalico brevi. Pedes thoracis pediformes, sæpissime unguiculati. Abdomen paribus appendicum pluribus infra instructum. Appendices branchiales sive thoracici sive abdominales.

Ordo II. TRILOBITA. — Cephalothorax multi-annulatus, numero segmentorum thoracis et abdominis sæpe valde multiplicato. Pedes thoracis foliacei et non unguiculati (?). Abdomen cum paribus appendicum pluribus seriatis instructum (?).

Ordo III. ENTOMOSTRACA. — Cephalothorax sæpissime parce annulatus, segmento utroque par singulum pedum thoracicorum tantum rarissimè gerente. Pedes sive prehensiles, sive natatorii. Abdomen paribus appendicum seriatis carens. Appendices branchiales nulli.

Ordo IV. ROTATORIA. — Corpus parce annulatum, minutum, a ciliis non pedibus motum, pedibus et appendicibus branchialibus omnino carens.

ORDER I.

CHORISTOPODA, OR TETRADECAPODA.

THE three divisions of the Choristopoda, the AMPHIPODA, ANISOPODA, and ISOPODA, are pointed out on pages 10 and 11 of this Report, and the reasons are there stated for rejecting the subdivision of *Lœmipoda*, introduced by Latreille.

The Amphipoda are uniformly characterized by having—

1. The three posterior pairs of thoracic legs in one series, and the four anterior pairs in two other series of two pairs each. The branchiæ are thoracic.
2. The abdominal members in two sets, the three anterior pairs subnatatory, the three posterior styliform.

The Isopoda through all the typical groups have

1. The four posterior pairs of thoracic legs in one series, and the three anterior in another series. The branchiæ are abdominal.
2. The abdominal members in two sets, the five anterior pairs branchial (the first or exterior sometimes an operculum), the sixth pair more or less styliform.

Expressing these distinctions in figures, and numbering the pairs of appendages 1 to 7 for the thorax, and 1 to 6 for the abdomen, we have for the series in the

	Thorax.	Abdomen.
AMPHIPODA,	4 (or 2+2) : 3	3 : 3.
ISOPODA,	3 (or 1+2) : 4	5 : 1.

In these particulars we observe two distinct types of structure of fundamental character; and any species which do not partake of these peculiarities, or such as are intermediate forms, partly having the characteristics of the Isopoda and partly those of the Amphipoda, may be arranged in a distinct group.

Of these intermediate forms, the group Anisopoda consists. They have

1. *Like Amphipoda*, the three posterior pairs of thoracic legs in one series, and the four anterior in a different series.
2. *Like Isopoda*, the three posterior pairs of abdominal members are not styliiform, only the last having this character.

These are constant characters, distinguishing the whole group. But there are various degrees of divergence from either the Amphipoda or Isopoda, or of convergence towards one or the other tribe, which mark out their affiliations, and show the true transition character of this section of Choristopods.

In some species (Arcturi) all the abdominal appendages are precisely as in the Isopods, although Amphipodan in the thoracic appendages, and at the same time the abdomen has the joints hardly flexible, instead of allowing free motion, as in the Amphipods.

In others, not far remote (species of Tanais, male Bopyri, etc.), the abdomen is more elongated; the joints have some free motion; the appendages are but imperfectly branchial, the branches being elongated and long ciliated, as in the Amphipods, and moving freely beneath the somewhat elongated abdomen. Yet although so much like Amphipods, as, in the case of one or two genera, to have been referred to the Amphipoda rather than the Isopoda, the fourth and fifth pairs of abdominal appendages are not styliiform like the sixth, as in the Amphipods; the sixth, on the contrary, is Isopodan in character, and the fourth and fifth, in Isopod style, hardly differ from the second and third. Thus, while these appendages are nearly Amphipodan in structure (excepting the sixth), instead of there being only three pairs subnatatory, all five pairs have a similar character, so that the members in the two series have the Isopod number, 5 : 1, and not 3 : 3.

In other species, the abdomen diverges from the Isopod form in another manner. It gives the Amphipod ratio, 3 : 3; and the three anterior pairs have nearly the Amphipod form, being elongated and

ciliated. Yet the fourth and fifth pairs, instead of being styliform, as in Amphipods, are branchial, as in Isopods. Such are the species of the *Serolis* group. This is a divergence from the Isopod type of structure of a very wide and important character; and still the general habit of the species is Isopodan.

From these observations, it is obvious that there is a group of Choristopods which has not hitherto been recognised. Till now, they have been mostly placed with the Isopods; and it is of much interest to observe, that nearly all of the larger groups in Edwards's system, are divided by him into two parts, one part including the true Isopoda, the other, the species here classed as Anisopoda. In his more recent paper on the *Serolis* group, he recognises the great difference between the species and other Isopoda, but still continues them with that tribe, referring them to its lower grades, or as the link between the Isopoda and Trilobita.

The characters of the tribes are as follows :—

Tribus I. ISOPODA.—Appendices branchiales pedes sunt abdominales, foliaceæ. Pedes thoracici seriei anticæ antrorsum porrecti numero sex. Pedes abdominales decem antiqui foliacei, duo postici sæpe styliformes. Abdomen breve.

Tribus II. ANISOPODA.—Appendices branchiales pedes sunt abdominales, foliaceæ. Pedes thoracici seriei anticæ antrorsum porrecti numero octo (ac in *Amphipodis*). Pedes abdominales decem antiqui foliacei, interdum subnatorii, duo postici sæpe styliformes. Abdomen breve vel breviusculum.

Tribus III. AMPHIPODA. — Appendices branchiales pedibus thoracis appendiculatæ. Pedes thoracici seriei anticæ antrorsum porrecti numero octo. Pedes abdominales sex antiqui elongati, natorii, reliqui sex plus minusve styliformes. Abdomen elongatum, raro obsoletum.

It is obvious that the Anisopoda constitute a type intermediate between the Isopoda and Amphipoda; but not so apparent, whether the Amphipoda or Isopoda should rank first in order.

The position of the branchiæ in the Amphipoda, as appendages to

the thorax, while in the Isopoda they are abdominal, might seem to settle the question in favour of the former, as thoracic branchiæ characterize all the higher Crustacea. But, as we have observed in other places, general structure in the body takes precedence of characters of the above kind. The position of the branchial appendages may confirm the conclusions from structure, but cannot set them aside. The main facts upon which we rest, are those pertaining to the appendages, and these appear to show that the Isopoda and Amphipoda have a relation to one another, analogous to that of the Brachyura and Macroura.

a. In the first place, the Isopoda have the abdomen quite short, with no proper feet, and instead, only branchial leaflets, besides a single pair of stylets, which last are sometimes wanting.

b. Again, the antennæ are commonly very short, as in the Brachyura.

c. Again, the anterior set of legs includes three pairs instead of four, the addition of the fourth pair to the anterior three, where it occurs, being an evidence of a less concentration of force in the cephalic ganglions, precisely as the addition of the third pair to the series of chelate legs, places the Penæi below the Palæmons.

In each of these points the Amphipods show inferiority.

1. They have an elongated abdomen, with natatory appendages below, and are thus analogous to the Macroura.

2. The antennæ are usually quite long, also a Macroural characteristic.

3. The anterior set of legs includes four pairs.

In addition, we observe, that the body in the Isopoda has in every part a more compact aspect. Moreover, the species are often terrestrial, a fact, as Prof. Agassiz has shown, marking the higher grades among classes or groups of species.

A significant fact of still higher moment is presented by the nervous system. The Amphipods have often the two dorsal cords distinct between the ganglia, while in the Isopods, there is but a single cord. The Amphipods have thus their less concentration of nervous influence and general force exhibited prominently in the nervous system itself. This double cord is seen in none of the higher Crustacea, and as we descend in the scale, first makes its appearance in the Amphipoda.

The Caprellidæ among the Amphipods, appear to militate with the

above conclusion, inasmuch as the abdomen in these species is nearly or quite obsolete. These are, however, aberrant forms, bearing a resemblance in essential points of structure to the Amphipoda. They have the long antennæ of the Amphipods; and whenever the abdomen is partly developed, as in some of the species, it has rudiments of the same members that are observed in that tribe.

These species—the Caprellidæ—are also peculiar in often wanting the third and fourth pairs of legs, so that the cephalothorax consists of two distinct divisions. This tendency to abortion in the legs at the middle of the thorax, is also presented by some of the Macrourea, as in certain Crangonidæ. The posterior part of the thorax in such cases appears to be in some sense separate from the anterior in its developments, as if pertaining to a different centre.

TRIBE I. ISOPODA.

THE tribe Isopoda, as here adopted, corresponds to that of other authors so called, except that the groups named by Milne Edwards “*Idoteides Arpenteurs*,” “*Asellotes Heteropodes*,” “*Praniziens*,” “*Bopyriens*,” and the *Serolis* group, are excluded, as they are properly Anisopoda. There are three subtribes.

- I. IDOTÆIDEA.—Appendices abdominales duæ posticæ bene operculiformes, appendices alias optimè tegentes.
- II. ONISCOIDEA.—Appendices abdominales duæ posticæ styliformes et non operculiformes, fere terminales, raro obsolete.
- III. CYMOTHOIDEA.—Appendices abdominales duæ posticæ lamellatæ, apud abdominis latera dispositæ.

SUBTRIBE I. IDOTÆIDEA.

THIS division contains, as far as known, two families, which, with their genera, are characterized as follows:—

FAM. I. IDOTÆIDÆ.

Pedes fere consimiles, plus minusve ambulatorii.

- G. 1. IDOTÆA, *Fabr.*—Antennæ externæ internis longiores, flagello multiarticulato confectæ.
- G. 2. EDOTEA, *Guerin.*—Antennæ externæ internis parce longiores, flagello pauciarticulato confectæ, basi paululo longiore quam basis internarum.
- G. 3. ERICHSONIA, *Dana.*—Antennæ externæ multo longiores, geniculatæ, 6-articulatæ, flagello carentes. Pedes subæqui, consimiles.
- G. 4. CLEANTIS, *Dana.*—Antennæ externæ multo longiores, 5–6-articulatæ, non geniculatæ, flagello carentes. Pedes 4ti 3tiis valde breviores, et 4ti 5ti 6ti 7mi longitudine sensim increscentes. Abdominis opercula laminam appendiculatam parvam ad articulationem gerentia.
- G. 5. EPELYS, *Dana.*—Antennæ breves, subæquæ, externæ flagello carentes non geniculatæ. Pedes subæqui, 4ti 3tiique non valde inæqui. Oculi minuti, remoti.

FAM. II. CHÆTILIDÆ.

Pedum 6 posticorum duo vel plures longissimi setiformes et multiarticulati.

- G. CHÆTILIA, *Dana.*—Antennæ 1mæ longiores, superiores, 2dæ flagello multiarticulato confectæ. Pedes 7mi breves, non unguiculati; 6ti longissimi, setiformes. Abdominis opercula laminam appendiculatam ad articulationem gerentia.

The genera *Arcturus* and *Anthura* belong with the Anisopoda.

FAMILY IDOTÆIDÆ.

GENUS IDOTÆA.

THE flagellum of the outer antennæ distinguishes *Idotæa* from the following groups. Moreover, the exterior plates of the abdomen are destitute of the inner lamina that characterizes the genus *Cleantis*. The body is oblong, varying in form between linear and oblong oval. The young of species that are oblong-oval when mature, are often broadest in front and narrow backward. The outer antennæ have a five-jointed base, and the flagellum is five to twenty-one-jointed. The legs are approximately equal in length; the posterior pairs sometimes exceed a little the fifth or fourth pairs in length; but again, they are often shorter than these. The feet are all subprehensile.

The abdomen consists of one to five segments; and it appears that the first normal segment is sometimes obsolescent, or is concealed beneath the extremity of the thorax.

1. *Abdomen 3-articulatum, articulis duobus anticis simplicissimis, ultimo suturâ utrinque notato. Corpus sat latum.*

IDOTÆA ARGENTEA.

Elongatè subelliptica, anticè truncata vel obsoletè excavata, superficie æquâ et lævi, epimeris latiusculis, integris. Abdomen latè oblongum postice paululo angustius, truncato-rotundatum. Oculi prominuli, ad capitis angulos insiti. Antennæ internæ dimidio basis externarum vix longiores, articulo ultimo longiore, extus parce subtilissimè setuloso. Antennæ externæ fere dimidii corporis longitudine, flagello 7-articulato et breviorè quam basis, articulis 2 ultimis minutis, setulis minutis paucis.

Long subelliptical, truncate or slightly excavate in front; surface even and smooth; epimerals rather broad, entire. Abdomen broad oblong, a little narrower behind, and broad truncato-rotund at apex.

Eyes prominent, situated on the angles of the head. Inner antennæ hardly half as long as base of outer, last joint as long as two preceding, very minutely setulose on the outer side. Outer antennæ nearly half as long as the body, flagellum seven-jointed and shorter than the base, setæ minute and rather few.

Plate 46, fig. 1 *a*, animal, enlarged; *b*, *c*, antennæ more enlarged; *d*, under view of mouth; *e*, one of the legs; *f*, abdominal plates.

Taken from a Porpita, July 27, 1839; latitude 16° 50' south, longitude 107° 45' east.

Length, five lines. Colour, silvery, with a bluish shade, which is deeper towards the sides.

The body is broadest at the fourth thoracic segment, which segment is the longest in the thorax. The outline is long elliptical, as far as the abdomen; but from the abdomen, the curving line is less convergent, though the narrowing of the body continues slightly. The lateral margins of the thoracic segments bear a few very short hairs, visible under a high magnifier, and there are also others on the last joint of the abdomen. The abdomen is rather longer than half the rest of the body, and the last segment is nearly one-third the length of the whole body. The *facets* of the eyes are *square*. The inner antennæ are a little longer than first three basal joints of outer pair, the first and second joints are very short, the third is longer than the second. The outer antennæ have the first three joints quite short, and the fourth oblong, but shorter than the fifth; the last two joints of the flagellum are minute. Anterior legs shortest; the pairs gradually increase backward. The seventh pair is much more slender than the preceding. The claw of each has a few spinules especially on the inner side, and the preceding joint has spinules on the sides and at apex; these spinules are bearded.

The maxillipeds have a granulose surface; last joint subovate; basal joint and lamella attached to its outer side of nearly equal size.

Fig. 1 *g*, represents a young individual, probably of this species. It was found on a Porpita, at the same time with the above. Length, one-

ninth of an inch. The body is broadest anteriorly. There are only six thoracic segments, the normal first being probably concealed by the following. The abdomen has three segments, besides an appearance of another, anterior to these, situated mostly beneath the last thoracic segment. Of the three segments alluded to, the first two are very short; the last is oblong, narrows behind, and is regularly rounded at its extremity, with a few short ciliations. Only six pairs of legs were distinguished, three posterior and three anterior. The eyes were situated on the angles of the head, and were a little prominent.

The outer antennæ have basal joints, and a terminal portion consisting of three joints; the first four basal joints are short; the fifth oblong. The inner antennæ are quite short; the third joint is longer than the fourth.

Figures 1 *h* and 1 *i*, are from a specimen six lines long, collected near New Zealand, and probably identical with *I. argentea*. The abdomen is very similar. The outer antennæ have the flagellum about as long as the base, and eight-jointed; surface minutely scabrous, under a high magnifier.

IDOTÆA MARGARITACEA.

Plate 46, fig. 2 *a*, animal, enlarged; *b*, caudal extremity; *c*, outer antennæ; *d*, extremity of flagellum of another specimen.

Length, five lines. Colour, bluish, with the back pearly white. Differs from the preceding somewhat in its antennæ and front of head; and the body is not quite as much narrowed behind. The three teeth of the front are very low; one occupies either angle, and the third, which is less distinct, the middle of the front; the outer are subacute; the spaces between are low concave. The inner antennæ extend to apex of antepenult joint of base of outer antennæ, and there are a few short setæ at apex on outer side. The outer antennæ have the third joint two-thirds the following, and the fifth four-thirds the fourth, but this may not be constant; the flagellum has but four or five joints, the number being five through a subdivision of the first of the four when four-jointed. The surface of the

joints is very minutely scabrous, as seen under a high magnifier. Length, four to five lines.

Obtained between New Holland and Northern New Zealand, five hundred miles from Port Jackson, N. S. W.

IDOTÆA ANNULATA.

Elongata, parce elliptica; fronte truncato, obsoletè arcuato; superficie annulatâ, segmentis prominentibus; epimeris latiusculis. Abdomen latè oblongum, lateribus fere parallelis, apice truncato angulis rotundatis. Oculi prominentes, ad angulos insiti. Antennæ internæ dimidio basis externarum non longiores, articulo ultimo longiore, obtuso. Antennæ externæ fermè dimidii corporis longitudine, flagello breviorè quam basis, 7-articulato, articulis duobus ultimis non breviores; setulis paucis brevissimis. Pedes nudiusculi.

Elongate, sparingly elliptical, front truncate or slightly arcuate; surface annulate, the segments being prominent; epimerals rather broad. Abdomen broad oblong, sides nearly parallel, apex truncate, with the angles rounded. Eyes prominent, situated on the angles. Inner antennæ not longer than half the base of the outer, last joint longest, obtuse. Outer pair about as long as half the body; flagellum shorter than the base, seven-jointed, last two joints not shorter than the preceding; setæ few and very short. Feet nearly naked.

Plate 46, fig. 3 *a*, animal, enlarged; *b*, *c*, antennæ, more enlarged; *d*, first pair of legs; *e*, third pair.

Taken in the Antarctic Seas, south of New Holland, in 1840. Collected by Mr. John Dyes.

Length, three-fourths of an inch; greatest breadth, one-fourth of an inch. The abdomen is more than half as long as the rest of the body; the segments of the thorax are prominent between the articulations. The outer antennæ have the last joint of the base about one-third the length of the preceding. The joints of the flagellum

are oblong, nearly naked, there being a few very minute setules at apex; on the joints, the most prominent setules are at the outer apex of the penult joint at base. Legs very nearly naked; the fourth joint very short; first pair shortest and stoutest, and well adapted for prehension; third pair longer than second.

IDOTÆA BREVICAUDA.

Angustè ovato-elliptica, fronte truncato. Abdomen latè oblongum, posticè paululo angustius et truncatum, angulis prominulis medioque postico apiculato. Oculi laterales, oblongi, vix prominentes. Antennæ internæ parvulæ, dimidio basis externarum non longiores. Antennæ externæ dimidium corporis longitudine non superantes, flagello 9-10-articulato, paulo longiore quam basis, articulis brevibus, fere nudis. Pedes longitudine posticè sensim paululo incrementes, nudiusculi.

Narrow ovato-elliptic, truncate in front. Abdomen broad oblong, posteriorly a little narrower and truncate behind, angles rounded and a little prominent, at middle of posterior margin apiculate. Eyes lateral, oblong, hardly prominent. Inner antennæ small, not longer than half the base of outer; outer pair scarcely longer than half the body, second joint short, with outer apex prominent, flagellum nine to ten-jointed, rather longer than base, joints short, nearly naked. Feet increase slightly from the first pair to the last, nearly naked.

Plate 46, fig. 4 *a*, animal, enlarged; 4 *b*, part of flagellum of outer antennæ.

Abundant in the harbour of Rio Janeiro. Taken, December 25, 1838.

Length, one-half to three-fourths of an inch. Colour, brownish gray. Body broadest at the third thoracic segment. The first thoracic segment is very short, except laterally, and receives the head; the third is a little the longest; the sixth and seventh have the posterior angles subacute, which in the others are rounded. The abdomen narrows posteriorly, very exactly in conformity with the thorax

just anterior to it, so that the outline of the body either side is convex throughout. Like the front, the centre of the caudal margin is apiculate. The outer antennæ have the first two joints shortest; the second broadest, with the outer apex elongated; the fifth joint little longer than fourth. The whole length of the inner antennæ scarcely exceeds first three joints of outer. The claws of the legs have a minute spine under the apex. The external plates of the abdomen beneath are truncate behind.

Figure 5 *a*, Plate 46, represents an animal found at the same time with the preceding, and supposed to be a young individual of some other species. It is broadest anteriorly, and has rather large eyes situated on the lateral margin and containing about fifteen facets. The head is transverse, and is not embraced behind by the following segment; it is subtruncate in front, with the centre slightly projecting, and the sides rounded. Anterior thoracic segment very short, or only partly visible. The thoracic segments increase in length from the first to the last; the three posterior are sublunate in an upper view, the posterior margins being concave, and the angles prolonged but obtuse, or nearly so. Abdomen five-jointed, the first four transverse, and subequal in length; the first abruptly narrower than the following or preceding thoracic segment; the fifth oblong, shield-shape, the sides curving and meeting behind in an angle. The exterior plates of the abdomen have a triangular subobtuse termination. Inner antennæ less than half the length of the outer; the third joint smaller than the second. The outer antennæ consist of seven joints, the first five of which correspond to the basal portion; the first three joints are quite short; the second has the outer apex prolonged the length of the third joint; the fourth and fifth joints are a little oblong, but shorter than the sixth and seventh; the last is pointed. A few short hairs on the joints. Legs subequal; increase from the first pair to the last. The claw nearly straight, has a largish subconical base. 5 *b*, represents the leg of the fifth pair; 5 *c*, the plate covering the branchial leaflets.

Length, one line. Colour, brownish gray.

Several specimens were taken December 23, 1838, in the harbour of Rio, near the city.

IDOTÆA HIRTIPES.

Sat lata, fronte truncato, vix excavato. Epimeræ latiusculæ, posteriore equilateraliter triangulatâ. Abdomen latè oblongum, postice parce angustius, apice paulo truncatum, angulis posticis rotundatis medioque postico paulum apiculato. Pedes infra plus minusve hirti. Antennæ internæ articulum penultimum basalem externarum attingentes. Antennæ externæ dimidio corporis non longiores, flagello 16-18-articulato, nudo.

Rather broad, front truncate, hardly excavate. Epimerals somewhat broad, the posterior equilaterally triangular. Abdomen broad oblong, a little narrower behind and subtruncate, posterior angles rounded and having a small, prominent, apical point. Feet rough, and rather close hairy below. Inner antennæ reach to penultimate basal joint of outer pair; outer antennæ not half as long as body, flagellum sixteen to eighteen-jointed, naked.

Plate 46, fig. 6 *a*, animal, natural size; *b*, first antennæ, enlarged; *c*, posterior pair of legs, *ibid*.

Puget's Sound, Oregon.

Length of body, 1.45 inches; breadth, 0.42 inch; ratio, 3.5:1. This large species, when of full growth has the under side of the legs quite thick and rough hairy. The last pair has the fourth joint transverse, and the third hardly oblong, and the margins as well as the surface below, are short hairy.

2. *Abdomen 1-articulatum, versus basin suturâ utrinque notatum.*

IDOTÆA STRICTA.

Sat angusta, fronte excavato, capite paulo transverso. Epimeræ parvulæ. Antennæ externæ fere dimidii corporis longitudine, flagello brevior quam basis, 10-articulato, nudo. Antennæ internæ penulti-

mum articulum basalem externarum vix attingentes. Abdomen angustè oblongum (plus duplo longius quam latum) extremitate triangulatum et subacutum, marginibus lateralibus paulo excavatis. Pedes infra parce hirsuti.

Narrow, front excavate, head a little transverse. Epimerals very small. Outer antennæ about half as long as body, flagellum shorter than the base, ten-jointed, naked. Inner antennæ hardly reaching to penultimate basal joint of outer pair. Abdomen narrow oblong (length more than twice the breadth), triangulate at extremity and subacute, lateral margins a little excavate or concave. Feet sparingly hirsute below.

Plate 46, fig. 7 *a*, animal, enlarged two diameters; *b*, part of leg of seventh pair.

New South Wales, Australia.

Length of body, 0·86 inch; breadth, 0·17 inch; ratio, 5:1. This narrow species has the epimerals occupying only part of the margin of each segment. The abdomen is longer than half the cephalothorax. The surface is not distinctly granulate.

GENUS EPELYS, Dana.

Antennæ breves, subæquæ; externæ non geniculatæ, flagello non confectæ. Pedes subæquales, quarti tertiis vix breviores. Oculi minuti, remoti.

Antennæ short, subequal, outer not geniculate and without a flagellum. Feet subequal, the fourth pair differing little in size from the third. Eyes minute, remote.

The only species of this genus seen by the author was of very small size, and occurred upon the upper surface and imbedded among the tentacles of an *Asterias*. From its form and the minute eyes, it was evidently not the young of an *Idotæa*, as might have been inferred from the tentacles; and even the tentacles are peculiar, since in young *Idotææ* they are still very unequal in length, as in adults,

though of less inequality. These differences and its parasitic habit require the institution of a new genus.

The *legs* are all similar in form and terminate in a small claw; the first pair is the shortest. The *mandibles* have a number of corneous spines at apex; and also below the apex, a second prominence, placed obliquely, and having a truncate extremity, edged or set with minute spines; this prominence is much stouter than the terminal process of the mandible. The inner maxillæ differ little from the same organs in other *Idotæidæ*.

The maxillipeds are five-jointed; the first joint is very short beneath the second, but is broadly enlarged and prolonged on the outer side, and bears a large lamella or palpus; the second joint is stout, and a little oblong, and its apex is prolonged in the form of a lamella, which reaches to the last articulation; the third very short; the fourth and fifth together nearly obovate, flattened on the inner side; the fifth joint largish and having a short ciliate or pubescent margin.

The name of the genus is from *επηλυς*, a stranger.

EPELYS ANNULATUS.

Angusto-subellipticus. Caput transversum, medio fronte apiculato, angulis rotundatis. Segmenta thoracis prominentia, transversa, longitudine subæqua, tribus posticis sublunatis. Abdomen 2-articulatum, segmento primo brevissimo, fere obsoleto, valde angustiore quam secundum; secundo scutellato, posticè triangulato, obtuso, lateribus fere parallelis. Antennæ breves, latitudine capitis non longiores; internæ parce breviores, 4-articulatæ, articulo tertio paulo longiore; externæ 5-articulatæ, articulis brevibus, tribus ultimis paululo longioribus.

Narrow subelliptic. Head transverse, front margin apiculate at middle, angles rounded. Segments of thorax prominent, transverse, nearly equal in length, the three posterior sublunate (seen from above). Abdomen two-jointed; first segment very short, nearly obsolete, much narrower than following; the second scutellate, triangular behind, the sides towards base about parallel. Antennæ short, not longer than the breadth of the head; inner sparingly the shorter, four-jointed; third joint a little longer than the others; outer five-jointed; joints short, the last three a little the longest.

Plate 46, figure 8 *a*, animal, enlarged; *b*, inner antennæ; *c*, outer antennæ; *d*, mandible, in one view; *d'*, extremity of the same, in another view; *e*, inner maxilla; *f*, maxilliped; *g*, leg of fourth pair.

From near Viña del Mar, three leagues north of Valparaiso, Chili; found on an Asterias.

Length, one-fifth of an inch. Colour, yellowish-white. The head is rather longer than the first thoracic segment; the front margin is a little concave either side of the prominence that forms its centre, and from beneath this part the tentacles proceed. The thoracic segments are all short, and the last four are a little separated on either side. There is a slight pubescence and a few very short hairs at the extremity of the abdomen. The exterior plates cover completely the abdomen below; margins of the plates hirsute. The antennæ are stoutish, and bear a few short hairs. The legs are all rather short.

GENUS CLEANTIS, *Dana*.

Antennæ externæ valde longiores, non geniculatæ, 5-6-articulatæ, flagello articulo non confectæ, articulo ultimo oblongo. Pedes quarti tertiis valde breviores; parium quatuor ultimorum sensim longitudine increscentes. Abdominis opercula laminam internam parvulam ad articulationem gerentia.

Outer antennæ much the longer, not geniculate, five to six-jointed, without a flagellum. Feet of fourth pair very much shorter than third; last four pairs gradually increase in length. Outer abdominal plates or opercula having a small lamina attached inside at the articulation.

The body of the species of Cleantis collected is slender linear, and the legs increase from the first to the third pair, and again from the fourth to the seventh, the third and seventh pairs being the longest, and the fourth very short. The outer antennæ have a single joint in place of a flagellum, and are very much longer than the inner.

The mandibles have two processes besides the terminal; the terminal is rather slender and imperfectly dentated at apex; the second, just below, is equally slender and alike dentated; the third, corre-

sponding to the usual molar prominence of this division of Crustacea, is stouter, a little reflexed, with a truncate apex, and short hairs or spinules just below the apex. The exact character of its surface was not observed. The maxillæ are nearly as usual (see figures); the maxillipeds have five joints, and the two are in close contact along the medial line. The first or basal joint is very short, and projecting laterally, but diminishing nearly to a point; it bears a triangular lamella or palpus; the second joint is oblong, and has its inner apex lamellarly prolonged; the third is short; the fourth and fifth together elliptical in outline. The outline of the whole pair is nearly an equilateral triangle. The mandibles are to a great extent visible in an under view, just exterior to the maxillipeds.

The first and second pairs of abdominal appendages are furnished with very long plumose setæ, and the second bears from the base of the inner plate, a slender spiculiform process, as long as the rest of the organ, obtuse at apex. These two pairs are attached to the free abdominal segments. The outer pair has a small oval plate inside, attached at the articulation.

CLEANTIS LINEARIS.

Angusto-linearis, fronte truncato, parce excavato, capite parce transverso, per segmentum proximum partim amplexo. Oculi mediocres, reniformes, remoti. Segmenta thoracis paulo transversa. Abdomen 3-articulatum, segmentis duobus brevissimè transversis; tertio valde oblongo, prope basin suturâ notato, lateribus fere parallelis, angulis posticis truncatis, apice truncato aut obsolete excavato. Antennæ internæ parvulæ, dimidio externarum valde breviores. Antennæ externæ crassiusculæ, articulo ultimo brevior quam precedens, longè ovato, pubescente. Pedes tertii primis duplo longiores.

Very narrow linear, front truncate or a little excavate, eyes situated near its angles. Head subtriangular behind and obtuse, being set into the following segment. Thoracic segments somewhat transverse. Abdomen three-jointed, first two segments very short transverse, the third twice as long as broad, having a suture near base, sides nearly parallel, posterior angles truncate, apex truncate or slightly excavate. Inner antennæ very small, not half the length

of the outer. Outer antennæ rather stout, last joint shorter than preceding, long ovate, pubescent. Third pair of feet twice longer than the first.

Plate 46, fig. 9 *a*, animal, enlarged; *b*, inner antenna; *c*, extremity of outer; *d*, view of mouth, in position showing maxillipeds and part of mandibles; *e*, mandible; *f*, first maxilla; *g*, second maxilla; *h*, first pair of abdominal appendages; *i*, second pair; *k*, outer pair; *l*, tarsus.

Rio Negro, Northern Patagonia. Taken from the stomach of a *Silurus*.

Length, nine or ten lines. Colourless when obtained. Length of body full six times its width. The head and first thoracic segment together longer than broad; fourth, fifth, sixth thoracic segments longest, the fourth nearly quadrate. Outer antennæ shorter than half the body; last four joints each oblong. Basal joint of inner antennæ stoutish, third shortest, obconical; the fourth as long as second and third together.

Legs compressed; last joint longest. Claw with a short spine beneath the apex. The three anterior pairs were thrown forward, and reached alike just beyond the front of the head; the others were spread laterally. Inner oval lamina of exterior abdominal plates ciliated, much shorter than the other plate with which it is associated.

GENUS ERICHSONIA, Dana.

Antennæ externæ valde longiores, geniculatæ, 6-articulatæ, flagello nullo, sed articulo obtuso confectæ, subclavatæ. Pedes subæqui, quarti tertii-que non valde inæqui. Oculi mediocres, remoti.

Outer antennæ much longer than inner, geniculate, six-jointed, ending in an obtuse joint and no flagellum, subclavate. Feet subequal, the third and fourth pairs but little different in size. Eyes of moderate size, remote.

The single species of this genus discovered, has an angular outline to its segments, and a row of small tubercles along the back. The club-shaped outer antennæ are geniculate at the antepenult articulation; the last joint is clavate and pubescent. The inner pair is not one-third as long as the outer. The thorax has seven segments; the abdomen only one. The legs are similar and subequal, and all in their natural position were spread more or less laterally, as in the true *Idotææ*.

This genus is named in honour of Erichson, successor of Wiegman as editor of the *Archiv für Naturgeschichte*.

It is near *Eidotia* of Guèrin; but in that genus, the inner and outer antennæ differ but little in length, and the outer have a flagellum of three or four joints.

ERICHSONIA ANGULATA.

Elongato-elliptica, fronte excavato, capite et segmentis thoracis angulatis, transversis. Segmenta thoracis quatuor antica medio tuberculum gerentia. Abdomen uni-articulatum, oblongum, subscutellatum, ad latera sinuosum, versus apicem latius, extremitate triangulatum, obtusum. Antennæ internæ fere quadruplo breviores, 4-articulatæ; externæ dimidio corporis longiores, 6-articulatæ, articulis tribus ultimis subæquis, penultimo brevioribus, ultimo obtuso, breviter hirsuto. Pedes subæqui, duobus posticis et anticis brevioribus; articulo basali crasso, plerumque tuberculato.

Long elliptic, front excavate, head and thoracic segments angulate, transverse; four anterior segments of thorax with a tubercle at middle. Abdomen one-jointed, oblong, subscutellate, margin sinuous, broadest near apex, extremity triangulate, obtuse. Inner antennæ nearly four times the shorter, four-jointed. Outer longer than half the body, six-jointed, last three joints subequal, the penult shortest, the last obtuse and short hirsute. Feet subequal, two posterior and two anterior shortest; basal joint stout and generally tuberculate.

Plate 46, fig. 10, animal, enlarged.

Among sea-weed, harbour of Rio Janeiro; December, 1838. Found along with Caprellas.

Length, half an inch. Colour, brown or yellowish brown; penult joint of legs, with a black or brownish transverse band. Body a little convex. Head excavate in front, and having on each side two crenations, in the posterior of which the eyes are situated. There are two tubercles on the centre of the anterior margin; in the specimen examined, these tubercles were a little to the left of the centre. The fourth thoracic segment is broadest and longest. The first and second are triangular in outline on either side, the third and fourth polygonal. The epimerals are also angular, and may be seen from above excepting the third and fourth pairs, and the third is sometimes apparent in an upper view. The basal joints of the legs bear three or four tubercles; none were observed on the anterior pair. The right of the outer antennæ was a little larger than the left.

FAMILY CHÆTILIDÆ.

THE sixth pair of legs, in the only species of this family discovered, terminates in a very long, bristle-like extremity, which consists of numerous joints; it is twice as long as the body. The seventh pair is similar in being without the usual claw, and has a multiarticulate extremity, but is quite short. The antennæ of the first pair are situated over (and not inside of) those of the second pair.

The Chætiliæ belong to quite a distinct group from the preceding Idotæidea. It is doubtful, however, whether the group may not rest for its distinctions more properly on other characters than those mentioned. This cannot be fully known until other related genera are discovered.

GENUS CHÆTILIA.

Antennæ 1mæ super 2das insitæ et longiores; inferiores (2dæ) flagello

multiarticulato confectæ. Opercula abdominis lamellam parvulam internam ad articulationem gerentia. Pedes 8 antici tarso tenui confecti et subprehensiles.

First pair of antennæ situated above the second and longest, four-jointed. Inferior (second) pair ending in a multiarticulate flagellum. Outer abdominal plates having an inner lamella at the articulation. Eight anterior feet terminating in a slender tarsus, which closes on the preceding joint.

Both pairs of antennæ are moderately long and are reflexed either side of the body; the second pair is here the shorter, and is situated beneath the first pair.

CHÆTILIA OVATA.

Ovata, posticè acuminata. Caput postice arcuatum, fronte paulo excavatum. Oculi remoti, rotundati, mediocres. Thorax 7-articulatus, segmento septimo valde angustiore quam sextum et partim celato, sexto utrinque posticè acuto. Abdomen 4-articulatum, 3 segmentis transversis, quarto perangusto, longoe acuminato, subacuto, apice ciliato, prope basin suturâ notato. Antennæ superiores fere dimidii corporis longitudine, 4-articulatæ, articulis tribus ultimis tenuibus longis, ultimo extus subtiliter setuloso. Antennæ inferiores valde breviores, flagello fermè 10-articulato, articulis basis duobus ultimis anticè setulosis. Pedes sexti corpore fere duplo longiores.

Ovate, acuminate posteriorly. Head arcuate behind, front a little excavate. Eyes remote, round, of moderate size. Thorax seven-jointed, seventh segment much narrower than sixth and partly concealed by it, sixth on either side acute. Abdomen four-jointed, three segments transverse, fourth long and narrow triangular, subacute and ciliate at extremity, having a suture near base. Superior antennæ nearly half as long as body, four-jointed, the last three joints long and slender; the terminal one setulose on outer side. Inferior antennæ one-fourth shorter, flagellum about ten-jointed, last two joints of base setulose on anterior margin, and hairy on the posterior. Sixth pair of feet almost twice as long as the body.

Plate 46, fig. 11 *a*, animal, enlarged; *b*, part of head, with antennæ; *c*, one of three anterior pairs of legs; *d*, fourth pair; *e*, fifth pair; *f*, outer abdominal plates.

Rio Negro, Patagonia. Taken from the stomach of a *Silurus*.

Length, nine lines. The cephalothorax is oval and broad, and there is an abrupt diminishing of the breadth where the abdomen begins. The last abdominal segment is narrow elongate, with the sides very slightly arcuate, and the apex pointed. The superior antennæ, thrown back either side of the body, reach to the second articulation in the thorax, or the third thoracic segment; the first of the slender joints is the longest, and the third the shortest. The setæ in the last increase in length towards the apex. The inferior antennæ were flexed backward, like the superior; only four basal joints were observed, and these about equal the flagellum in length. Outer abdominal plates broadest at base; inner lamella oblong ovate, plumosely ciliate.

The organs of the mouth have a general resemblance to those of the *Cleantis*.

SUBTRIBE II. ONISCOIDEA.

THE Oniscoidea are distinguished from the other Isopoda by having the posterior pair of abdominal appendages, which are either styliform or small lamellar, appended as a caudal pair to the extremity of the abdomen. They may be suboperculiform, and cover the ventral surface of the last abdominal segment, as in *Tylus*; but they never form a pair of valves covering the other abdominal appendages, as in *Idotæa*.

The families included are as follows:—

Fam. I. ARMADILLIDÆ.—Corpus bene convexum, strictè articulatum. Abdomen multiarticulatum, segmento ultimo parvo. Appendices

caudales ultra abdomen non exsertæ, lamellatæ. Mandibulæ non palpigeræ. Antennæ internæ inconspicuæ.

Fam. II. ONISCIDÆ.—Corpus sæpius minus convexum, vel strictè vel laxè articulatam. Abdomen multiarticulatum, segmento ultimo parvo. Appendices caudales bene exsertæ, styliformes. Mandibulæ non palpigeræ. Antennæ internæ inconspicuæ.

Fam. III. ASELLIDÆ.—Corpus sæpius valde depressum et laxè articulatam. Abdomen 1-6-articulatum, segmento ultimo magno, scutellato. Appendices caudales styliformes, raro obsoletæ. Mandibulæ palpigeræ. Antennæ internæ conspicuæ.

The Asellidæ correspond to the "Isopodes Asellotes" of Edwards, excepting that we exclude his "Asellotes Heteropodes," which are Anisopoda. The Oniscidæ include the "Cloportides Maritimes" of this distinguished author, together with part of the "Cloportides terrestres," viz., the "Porcellioniens;" while the Armadillidæ comprise the remainder of the "Cloportides terrestres."

The Armadillidæ and Oniscidæ appear to rank before the Asellidæ. This is to be inferred from the fact, that the former are mostly terrestrial, while the latter are aquatic; for the principle which Agassiz has brought forward appears to be of very general application, that in a given group, the terrestrial species are highest in organization. Moreover, the loose structure of the Asellidæ seems to be proof of inferiority to the well-formed, compact, and symmetrical Armadillo and Oniscus. The antennæ of the Asellidæ also are more largely developed, and the caudal stylets are usually longer and more projecting than in the Armadillidæ and most Oniscidæ, giving farther evidence of vegetative elongation in either direction, at the expense of concentration. These reasons may not be of great weight, yet they seem, in the doubtful state of the case, to point to the conclusion here adopted.

The following are the known genera of living species, and the sub-families into which they are naturally grouped.

FAM. I. ARMADILLIDÆ.

SUBFAM. 1. TYLINÆ.*—Appendices caudales infra abdominis segmentum posticum celatæ et operculiformes.

G. 1. TYLUS, *Latr.*

SUBFAM. 2. ARMADILLINÆ.† — Appendices caudales inter abdominis segmenta duo postica partim visæ.

G. 1. ARMADILLO, *Latr.* partim, *Brandt, Edwards.*‡—Basis appendicum caudalium magnus, ramo interno parvulo, altero obsoleto.

G. 2. SPHERILLO, *Dana.* — Basis appendicum caudalium grandis, ramo interno parvulo, externo parvulo, laterali, in latere basis interiore versus apicem insito.

G. 3. ARMADILLIDIUM, *Brandt.*§ — Basis appendicum caudalium brevis, ramo externo lato, terminali, interno parvulo.

G. 4. DIPLOEXOCHUS, *Brandt.* — *Armadilloni* appendicibus caudalibus similis. Segmenta thoracis processu horizontali utrinque armata.

FAM. II. ONISCIDÆ.

SUBFAM. 1. ONISCINÆ.||—Maxillipedes 3-articulati, articulis duobus ultimis brevibus et parvulis. Antennæ externæ ad articulationem 5tam bene geniculatæ. Basis appendicum caudalium perbrevis, duos stylos multum inæquos gerens, stylo interno sub abdomine sæpissimè partim celato.

G. 1. ONISCUS, *Linn.*—Antennæ externæ subcylindricæ, ad basin fronte partim tectæ. Flagellum 1-3-articulatum, articulo precedente vix brevius vel longius.

Subgen. 1. TRICHONISCUS, *Brandt.*—Antennæ externæ 6-articulatæ.

Subgen. 2. PORCELLIO, *Latr.*—Antennæ externæ 7-articulatæ.

Subgen. 3. ONISCUS, *Latr.*—Antennæ externæ 8-articulatæ.

* *Tylosiens*, Edwards. The Greek τυλος, would make Tylus in Latin; and from the genitive comes, according to rule, the derivative, *Tylinæ*.

† *Armadilliens*, Edwards.

‡ *Pentheus*, Koch.

§ *Armadillo* of Koch, and in part of other authors.

|| *Porcellioniens*, Edwards. *Porcellionidæ*, Cat. Brit. Crust., Brit. Mus., 1850. We derive the family name from the name of the old Linnæan genus, believing this more correct and even more significant.

G. 2. PHILOSCIA. — Onisci subgeneri *Porcellioni* antennæ externis 7-articulatis affinis. Antennæ externæ usque ad basin apertæ.

G. 3. PLATYARTHRUS, *Brandt.* — Antennæ externæ quoad articulum 5tum latæ, latere externo dilatatæ.

G. 4. DETO, *Guérin.* — Flagellum antennarum externarum perbreve, 4-articulatum, articulo precedente multo brevius; articulus 5tus cylindricus.

SUBFAM. 2. SCYPHACINÆ. — Maxillipedes 2-articulati, articulo 2do lamellato. Antennæ externæ ad articulationem 5tam non geniculatæ. Styli caudales fere ac in *Oniscinis*; basis vel brevis vel oblongus, ramo interno interdum omnino aperto.

G. 1. SCYPHAX, *Dana.* — Flagellum antennarum 1-3-articulatum.

G. 2. STYLONISCUS, *Dana.* — Flagellum antennarum tenue, multi-articulatum.

SUBFAM. 3. LYGINÆ. — Maxillipedes 4-articulati, elongati. Antennæ externæ ad articulationem 5tam non bene geniculatæ. Styli caudales longi, basi longe exserto, stylis setiformibus subæquis et æque apertis.

G. 1. LYGIA, *Fabr.* — Basis appendicum caudalium apice simplex, ramosque duos simul gerens.

G. 2. LYGIDIUM, *Brandt.** — Basis appendicum caudalium apice furcatus, brachio utroque ramum gerente.

FAM. III. ASELLIDÆ.

SUBFAM. 1. LIMNORINÆ. — Abdomen 5-6-articulatum.

G. 1. LIMNORIA. — Segmenta abdominis duo postica grandia, simul sumta scutellata.

SUBFAM. 2. ASELLINÆ. — Abdomen 1-2-articulatum.

1. *Pedes thoracici quatuordecim subæqui.*

G. 1. JÆRA, *Leach.* — Appendices caudales perbreves, branchiales laminâ impari tectæ.

G. 2. JÆRIDINA, *Edw.* — Appendices caudales perbreves, branchiales apertæ.

G. 3. ASELLUS, *Geoffroy.* — Appendices caudales elongatæ. Pedes antici subchelati.

G. 4. JANIRA, *Leach* (*Oniscoda*, *Latr.*) — *Asello* affinis. Pedes toti unguiculati, ungue bifido.

* *Zia*, *Koch.*

2. *Pedes posteriores valde elongati.*

- G. 5. HENOPOMUS, *Kröyer*.*—Pedes 1mi subchelati, digito 2-articulato; reliqui ambulatorii, articulo 6to subrudimentario. Appendices branchiales laminâ unicâ permagnâ tectæ. Thoracis segmenta latere incisa et dentata.
- G. 6. MUNNA, *Kroyer*.†—Appendices caudales rudimentariæ. Pedes antici crassiores, subchelati. Pedes posteriores corpore multo longiores.

FAMILY ARMADILLIDÆ.

SUBFAMILY TYLINÆ.

TYLUS SPINULOSUS.

Corpus antennæque spinulosæ, spinulis brevissimis et sæpe subclavatis. Caput processibus truncatis prominentibus sub oculis ornatum. Antennæ fere ad segmentum thoracis 2dum attingentes, articulo 2do antice salienter angulato, flagello 3-articulato, articulo 1mo parce brevior quam articulus precedens, et duplo longiore quam sequens.

Body and antennæ spinulous, spinules very short and often subclavate. Head below either eye having a prominent process which is truncate at extremity. Antennæ reaching barely to second segment of thorax, second joint having a salient angle on anterior side near base, flagellum three-jointed, the first joint but little shorter than the preceding joint, and twice as long as the following.

Plate 47, fig. 1 *a*, body, enlarged four diameters, the head thrown outward; *b*, part of antenna, enlarged twenty-four diameters; *c*, caudal lamellæ.

Nassau Bay, Fuegia.

* *Ibid.* [2], ii. 1847. Both this genus and *Munna*, are stated by *Kröyer* to be related to *Asellus* and *Jæra*.

† *Nat. Tidsskr.*, ii. 1838, 1839, p. 612, and [2], ii. 1847.

Length, four lines ; breadth, half the length. The so-called spinules are not acute, and might perhaps be more properly called setules. The processes on the head below the eyes are not in view, unless the head is placed out horizontally, as it would be carried by the animal when walking. The epistome is spinulous like the back. The caudal lamellæ have a small joint at the extremity, as described by Krauss in his South African species (Südaf. Crust., p. 63, pl. 4, f. 5, 6) ; and as he suggests, there are differences between the specimens and the figures of Savigny's species, in this and other respects, which may require the institution of a new genus. The animal rolls up into a ball, like the Spheromæ.

SUBFAMILY II. ARMADILLINÆ.

ARMADILLO SPECIOSUS.

Corpus valde convexum, subtiliter granulosum. Caput anticè fere truncatum. Segmenta thoracis lateraliter non acuta, anticum majus. Abdominis segmenta strictè conjuncta, ultimum apice arcuatum et valde latius, lateribus excavatis. Appendices caudales angustæ, ad apicem truncatæ, marginibus parallelis integris et nudis. Antennæ tenues, flagello plane breviorè quam articulus quintus.

Body much convex, finely granulate. Head nearly truncate in front. Segments of thorax laterally not acute, anterior largest. Segments of abdomen with their margins closely in contact throughout, the last much broadest at apex, and with the sides excavate. Caudal appendages narrow, apex truncate, margins entire, nearly parallel, naked, basal portion rectangular, produced inward. Antennæ slender, flagellum distinctly shorter than fifth joint.

Plate 47, fig. 2 *a*, animal, natural size ; *b*, under view of abdomen ; *c*, caudal stylets, separated and much enlarged ; *d*, antenna, much enlarged.

From moist soil, among leaves, in the crater of Taiaimmai, New Zealand, in the vicinity of the Bay of Islands. Collected, March, 1840.

Length, nearly seven-eighths of an inch. Colour, dark brown, with a few small yellow spots on several of the joints; segments, laterally a little reddish; also, margin of abdomen the same. Head about half the width of next segment, and rather less than half as long, somewhat narrower in front. Eyes with few facets, situated near middle of lateral margin of head. First thoracic segment very large. None of the segments properly acute at the latero-posterior angles. The last abdominal segment has a faint suture across it, which appears to show the outline of a seventh normal segment. Third and fourth joints of antennæ equal, fifth about as long as third and fourth together, flagellum about two-thirds the fifth; penult shorter than last.

The caudal appendages have an oblong rectangular form, and the outer basal angle of the base is a little prominent. The other abdominal appendages scarcely occupy more than one-third of the width of the abdomen.

GENUS SPHERILLO.

Armadillini affinis. Appendices caudales ramis duobus instructæ, utroque laterali, parvulo, breviter styliformi.

Near *Armadillo*. Caudal appendages having two branches, both lateral and small and short styliform.

The two branches of the caudal appendage are both situated on the inner margin of the base, one near the medial line of the abdomen, and the other on the inner side of the base, not far from the apex. The species are intermediate between those of *Armadillo* and *Armadillidium*. The outer branch is visible, in a dorsal view, between the last abdominal segment and the base of the caudal appendage, and sometimes it is not distinguished at all in a ventral view, when distinct in a dorsal.

SPHERILLO MONOLINUS.

Caput anticè arcuatum. Segmenta thoracis ad latera truncata, supernè lineâ elevatâ monilinâ transversim ornata, primo majore et lineis

duabus monilinis notato. Abdomen semicirculare, segmentis tertio quarto quintoque ad latera obtusis, ultimo ad apicem quadrato, ad basin valde latiore. Appendices caudales subtriangulatae, latitudine breviores, margine interno latè excavato. Antennæ fere nudæ, flagello vix breviorè quam articulus precedens.

Head arcuate in front. Segments of thorax transversely marked with a beaded ridge and laterally truncate, anterior segment longest and marked with two beaded ridges. Abdomen semicircular, third, fourth, and fifth segments laterally obtuse, the last with a nearly subquadrate apex and much broader at base. Caudal appendages subtriangular, shorter than breadth at base, inner margin broadly excavate. Antennæ nearly naked, flagellum hardly shorter than preceding joint.

Plate 47, fig. 3 *a*, animal, enlarged; *b*, antennæ; *c*, posterior leg; *d*, extremity of abdomen, under view, showing caudal appendages.

From under rotten wood, up the Wykare River, near Bay of Islands, New Zealand. Collected by Dr. C. Pickering.

Length, four lines. Segments of thorax, towards the lateral margin, not in contact; sixth and seventh longer than either of three preceding; their posterior margin nearly straight across the back, but bending backward either side. Width of head about half that of thorax, and its length much less than half its width. The outer side of the triangular caudal appendage is arcuate, the inner deeply concave, with a small cylindrical branch near its centre. The transverse ridge on the thoracic segments is minutely beaded. The legs are short spinulous; tarsus very slender. The antennæ have the fourth joint a little longer than the third, and shorter than the fifth, but hardly longer than the second; the flagellum is about as long as preceding joint.

The figure (fig. 3 *d*) represents the outer branch of the caudal appendages, and not the inner; and as the specimen is not in our collections, the author is doubtful whether the inner are obsolete or not.

SPHERILLO VITIENSIS.

Caput subrectangulatum, anticè truncatum. Segmenta thoracis nuda, lævia, margine postico concavo. Abdomen extremitate rotundatum, segmento ultimo ad apicem fere truncato, ad basin angustiore, utrinque excavato. Appendices caudales latitudine valde longiores, apice plus duplo angustiore, truncato, margine externo recto, interno rectangulatè emarginato. Antennæ latitudinis corporis longitudine, fere nudæ, flagello articulum quintum longitudine æquante.

Head subrectangular, truncate in front. Segments of thorax naked, smooth, posterior margin concave. Abdomen rounded at extremity, last segment almost truncate at apex, narrower at base and sides excavate. Caudal appendages much longer than broad, apex truncate and more than twice as narrow as base, outer margin straight, inner having a rectangular notch near apex. Antennæ as long as breadth of thorax, nearly naked, flagellum as long as fifth joint.

Plate 47, fig. 4 *a*, animal, enlarged; *b*, antenna; *c*, leg of fifth or sixth pair; *d*, caudal appendage.

Feejees, island of Vanua Lebu.

Length, two lines. Head nearly half the breadth of the thorax, with the eyes on the *posterior* angles. The caudal appendages are oblong, and subrectangular in form, except that a rectangular piece is taken out from the inner angle. The inner branch is not more than half as long as the base of the organ, and is attached very near the inner angle of base, which inner angle is but little widened or prolonged inward. Fourth joint of antennæ little longer than third joint, and shorter than fifth or second; the hairs are extremely minute, so that the organ appears nearly naked; they are more numerous on the joints of the flagellum. Hairs of legs extremely short, mostly shorter than diameter of joints. Claw of sixth pair about half the length of the tarsus.

SPHERILLO HAWAIIENSIS.

Corpus minutissimè confertim granulatum et pubescens, valde convexum, segmentis thoracis margine postico plerumque concavis, segmento antico juxta marginem postero-lateralem fisso, reliquis longitudine subæquis. Antennæ subtiliter hirsutæ, pilis dimidio latitudinis articuli paulo brevioribus, articulis flagelli subæquis. Appendices caudales subquadratæ, viæ longiores quam latitudo apicalis, margine interno superne viso emarginato articulumque minutum gerente.

Body very minutely close granulate and pubescent, much convex, segments of thorax having posterior margin mostly concave, anterior segment with a fissure in the postero-lateral margin; following segments about equal in length. Antennæ very short hirsute, the hairs not half as long as breadth of joints, the two joints of the flagellum subequal. Caudal appendages subquadrate, hardly longer than the apical breadth, inner margin (as seen from above) having an emargination, whence proceeds a minute joint.

Plate 47, fig. 5 *a*, animal, enlarged three diameters; *b*, antennæ; *c*, leg of fifth pair; *d*, under view of abdomen; *e*, caudal appendage, upper view, showing the outer of the branches of the appendage, a minute joint.

Hawaiian Islands.

Length of body, six lines. The small joint, which is properly the outer branch of the caudal stylets, and the emargination in which it lies, is not seen, except in an upper view; and the breadth at the extremity below the emargination, is as great as that anterior to it. The pubescence and granulation of the body are only distinguishable with a high magnifying power. The fifth pair of legs has the fourth joint rather crowdedly spinous, there being about twelve pairs of spines (often serrated, or divided at top), none longer than greatest diameter of the joint. The fifth joint has about six pairs of spines, some a little longer than those of the fourth joint.

SPHERILLO SPINOSUS.

Corpus spinis subacutis omnino echinatum, marginibus parce productis; segmentis ad latera truncatis. Caput trapeziale, anticè arcuatum et paulo latius. Segmentum thoracis anticum majus. Segmenta abdominis lateraliter obtusa, ultimum subquadratum, ad basin non latius, et apicem truncatum.

Body bristled throughout with subacute spines, margin either side a little produced and segments laterally truncate. Head nearly trapezial, arcuate in front and a little broader than behind. First segment of thorax largest; segments of abdomen laterally obtuse, the last subquadrate, not broader at base, truncate at apex.

Plate 47, fig. 6 *a, b*, animal, enlarged; *c*, under view of head; *d*, spine, much enlarged; *e*, upper view of extremity of abdomen; *f*, under view of same, showing caudal stylets; *g*, part of antennæ, much enlarged.

New Zealand, near Bay of Islands; from under the bark of pine trees. Collected by Dr. Pickering, March, 1840.

Length, three lines. Colour, chestnut brown, with brownish yellow along margin, and irregularly spotted along the back. The spines cover closely the head, thorax, and abdomen, but not the margin of the body. These spines are minutely pubescent. The margin is a little flattened out or recurved, so as not to be in the same curvature with the back. The joints laterally are not in contact; they are narrow, rectangular, and obtuse. Surface of segments below and lateral portions pubescent like the spines. Eyes situated near centre of lateral margin of head. Posterior angles of first thoracic segment obtuse. The antennæ in a dead specimen were folded under the head, as in figure 6 *c*. The flagellum is about as long as the fifth joint.

FAMILY ONISCIDÆ.

SUBFAMILY ONISCINÆ.

THE *Oniscinæ* are the "Porcellionides" of Edwards. The distinctions of this group have been well drawn out by this author. We add only a few remarks on the antennæ. A characteristic feature of these organs, as regards position, is the fact, that they are geniculated at the fifth articulation as well as near the head, which gives them two abrupt flexures, somewhat like the form of the letter Z. The flagellum consists of one to three oblong joints, besides (as appears not to have been noticed) two or three small apical joints. Of the former there are commonly but two; and when there are three, it arises from a subdivision of the first of these two. This was evident to us in a species of *Scyphax*, which, though not correctly one of the *Oniscinæ*, is similar in its antennæ: in specimens three to three and a half lines long, the flagellum was two-jointed, with the first joint the longer; while, in specimens four to four and a half lines long, the flagellum was three-jointed, and the first articulation was fainter than the second, and plainly cut across the first of the two joints in the two-jointed flagellum. The joints at the extremity are either two or three in number; the last is slender and somewhat spiniform or subcylindrical, with a few setules at apex; the other one or two are quite short, and the articulations sometimes are not very distinct. These parts are illustrated in our figures on Plates 47 and 48. The surface of the antennary joints is usually thick set with very short hairs, or more sparsely with spines. In the genus *Deto*, the flagellum of the antennæ is said to have four joints; whether this includes the last of these small terminal joints or not, we cannot say from observation. It is possibly so, as all the joints of the flagellum are very short.

From the occurrence of both two and three-jointed flagella, in different specimens of the same species that are so nearly of the same size, as in the *Scyphax*, alluded to above, it is apparent that the distinction as to number of joints cannot be a generic characteristic, and at the most would separate only subgenera. It is on this account, added to other points of identity, that we have not retained *Porcellio*, *Oniscus*,

and *Trichoniscus*, as distinct genera, but as subgenera of the genus *Oniscus*. *Deto*, in having the flagellum so remarkably short, diverges more from the *Oniscus* type; and *Platyarthrus*, in the broad, flattened fifth joint of the antennæ is also sufficiently distinct; but we make this flattened joint the characteristic of the genus, without adding to it the number of joints in the flagellum, except so far as to say, that the number is small (one to three or four), as in *Oniscus*.

PORCELLIO GEMMULATUS.

Abdomen thorace non subito angustius. Capitis processus antero-lateralis valde prominens, subtruncatus, fronte triangulatus. Segmenta thoracis abdominisve granulis ornata, granulis juxta marginem segmentorum posticum bene seriatis, alioque partim seriatis; segmenta abdominis 3tio 4to 5toque lateribus expansa et salientia, ultimum triangulatum et subacutum, latere excavatum, latitudine basali vix longius, basi stylorum vix longius ramos internos non superans. Antennæ subtiliter hirsutæ, articulo tertio spinâ non armato, flagello biarticulato paulo brevior quam articulus precedens.

Abdomen not abruptly narrower than thorax; antero-lateral process of the head very prominent, subtruncate, front triangular. Segments of both thorax and abdomen with granules, a row along posterior margin of each, and others partly seriate; third, fourth, and fifth of abdomen laterally expanded and salient; last segment triangular and subacute, hardly longer than breadth at base, but slightly longer than base of caudal stylets, and hardly projecting as far as apex of inner branch of the stylets. Antennæ very finely hirsute, third joint without a spine, two-jointed flagellum shorter than preceding joint.

Plate 47, fig. 7 *a*, animal, enlarged four diameters; *b*, extremity of antenna, much more enlarged; *c*, apex still more enlarged; *d*, leg of second pair, enlarged; *e*, *f*, *g*, spines of under surface of same leg, from fourth joint.

California, near San Francisco; also, Puget's Sound.

Length, half an inch. The joints of the thorax have the segments flexed backward on either side. The last abdominal segment is not narrow oblong, as in the *scaber*. The stylets are about half as long as the abdomen. The under surface of the anterior legs of the first and second pairs especially, are thickly set with spines, which are partly laminated, and have a ragged edge. The extremity of the flagellum of the antennæ consists of two or three small joints, the last of which is slender and setulose at extremity.

PORCELLIO? FUEGIENSIS.

Abdomen thorace subito paulo angustius. Caput antice bene præruptum, processu antero-laterali parvulo, subrectangulato, fronte saliente fere recte transverso. Segmenta thoracis partim rugato-granulata, abdominis subtilissimè granulata, 3tium, 4tum, 5tumque latere paulo expansa et salientia, ultimum triangulatum, paulo transversum, paulo concavum, basin stylorum vix superans; ramo stylorum interno longè saliente et hirsutiusculo, externo dimidii abdominis longitudine.

Abdomen abruptly a little narrower than thorax. Head anteriorly with an abrupt vertical surface and acute edge above, antero-lateral process very small and subrectangular, front salient, nearly straight transverse. Segments of thorax in part rugato-granulate; segments of abdomen very finely granulate, third, fourth, and fifth laterally expanded and salient, last triangular, somewhat transverse, and above concave, hardly projecting beyond base of stylets; inner branch of stylets long salient, and short hirsute; outer branch half as long as abdomen.

Plate 47, fig. 8 *a*, animal, enlarged; *b*, part of body, with the posterior abdominal segments bent on either side as in some preserved specimens; *c*, extremity of abdomen; *d*, extremity of posterior legs.

Near Nassau Bay, Tierra del Fuego.

Length of body, four lines. The projection of the inner branches of the stylets is a striking character, since they are in sight from above nearly their whole length, and extend one-third of the distance to the

apex of the longer stylets. The antennæ of the specimens were mutilated, and we are, therefore, in some doubt as to the number of joints of the flagellum. The granules of the surface are hardly granules, they appearing partly like wrinkles though raised, ranging longitudinally across the segments of the thorax near their middle.

PORCELLIO CHILENSIS.

Levissimè granulatus. Caput bene transversum, a segmento sequente non amplexum, processibus antero-lateralibus minutis, rectangulatis, fronte parce arcuato. Antennæ subtiliter hirsutiusculæ, flagello vix brevior quam articulus precedens, articulo flagelli 1mo fere duplo longiore quam 2dus. Thoracis articulationes 5tæ anticæ fere recte transversæ. Abdomen breve, non longius quam latum, segmentis 3tio 4to 5toque lateribus salientibus et acutis, ultimo triangulato, subacuto, lateribus excavato, latitudinem basalem longitudine fere æquante. Styli caudales hirsutiusculi, abdominis longitudine, basi extremitatem abdominis non attingente, ramo interno bene exserto, crassiusculo, subulato, apicem 3-setigero, externo crasso acuminato plus triplo longiore.

Very faintly granulate. Head much transverse, not imbedded in following segment, antero-lateral processes minute, rectangular, front sparingly arcuate. Antennæ very minutely hirsute, flagellum slightly shorter than preceding joint, its first joint nearly twice as long as the second. Five anterior articulations of thorax nearly straight transverse. Abdomen short, not longer than broad, third, fourth, and fifth segments laterally salient and acute, last triangular, subacute, sides excavate, breadth at base a little greater than its length. Caudal stylets as long as abdomen, the base hardly reaching to apex of abdomen, shorter branch exsert, a little stout, subulate, having three setæ at apex, outer branch stout, acuminate, more than three times as long as the other.

Plate 47, fig. 9 *a*, animal, enlarged; *b*, base of antenna; *c*, extremity of antenna; *d*, extremity of leg of first pair in outline; *e*, caudal stylets.

Valparaiso, Chili.

Length, six to eight lines. There is a resemblance in this species to the *fuegiensis*; yet it is much larger and lighter-coloured. The shorter branch of the stylets is not slender linear, as in the *fuegiensis*, and has three setæ at apex; the front is much less projecting. The granules of the surface are quite small, and there is some pubescence.

PORCELLIO? HAWAIIENSIS.

Corpus læve. Frons arcuatus, non prominens, processu antero-laterali rotundato, prominulo. Segmentum abdominis ultimum fere T-formis, parte posticâ anguste triangulatâ, subacutâ, stylis caudalibus oblongis, basi et ramo interno extremitatem abdominis non superantibus.

Body smooth. Front arcuate, not prominent, antero-lateral process rounded, not very prominent. Last segment of abdomen nearly T-shape, the posterior part very narrow triangular, subacute; caudal stylets oblong, neither the base nor the inner branch extending beyond the extremity of the abdomen.

Plate 47, fig. 10, animal, enlarged three diameters.

Island of Maui, Hawaiian Islands.

The basal part of the last abdominal segment is very short, or transverse linear, and the rest of the segment is narrow and quite prominent; the longer branch of the caudal stylets projects beyond the abdomen, two-thirds the length of the abdomen or more. The articulations of the thorax are but slightly arcuated, excepting the two posterior, and these are not very much so. The antennæ of the specimen were mutilated.

ONISCUS NIGRESCENS.

Corpus nitidum, anticè vix angustius, rotundatum. Abdomen thorace subito valde angustius, breve, paulo oblongum, parce pubescens, margine laterali recto, vix interrupto, segmento ultimo breviter transverso, transversim triangulato, segmentis aliis latere brevissime acutis. Caput

paulo transversum, anticè subtruncatum, a segmento proximo partim amplexum. Segmentum thoracis primum majus, ultimum angulis productum et acutum. Styli caudales abdomine parce longiores, ramo majore triplo longiore quam minor, reverso-scabriculo.

Body somewhat shining, scarcely narrower in front, rounded. Abdomen suddenly much narrower than thorax, short, a little oblong, sparingly pubescent, last segment very short, transverse triangular. Head somewhat transverse, subtruncate in front, and setting deeply into next joint. First joint of thorax largest; last with the angles produced and acute. Caudal stylets scarcely longer than the abdomen, branches very unequal, one three times longer than the other, the longer finely reversed scabrous.

Plate 48, fig. 1 *a*, animal, enlarged; *b*, under view of abdomen of male; *c*, outer maxilliped.

Found under stones, near Rio Janeiro, December, 1838.

Length of male, six lines; of female, eight lines. Colour, black, or nearly black, with some irregular lighter spots (sometimes nearly white) along the anterior portion of the thoracic segments, and also along the median line of the abdomen, at times giving the animal a dark grayish aspect. The head is not wider than half the next segment, and is nearly two-thirds encircled by it. Last abdominal segment slightly longer than preceding, low pointed behind; the three preceding segments laterally produced backward and acute. Eyes, black, situated obliquely on the latero-anterior angles of the head. Legs scabrous, the last pair spinous; claw very short, on last pair not longer than one-sixth the preceding joint. Abdominal lamellæ, five pairs; the anterior smallest, bidentate at apex, the inner tooth longer. The following pairs of lamellæ elongate and acute near the median line. A broad oblong oval plate between first and second pairs, which terminates behind in two oblong styliform organs (in male) acute and curved a little outward.

Another specimen, mutilated in its antennæ, resembled the above, except that the abdominal plates were obtuse, instead of acute, and the organ between the first and second pairs was wanting, indicating that it was a female.

ONISCUS PUBESCENS.

Corpus pubescens, subellipticum. Abdomen thorace subito valde angustius, breve, latitudine non longius, segmento ultimo breviter transverso, et postice non producto. Caput transversum, segmento proximo paulo brevius et angustius. Segmenta thoracis subæqua, ultimum utrinque posticè acutum sed vix productum. Styli caudales parvuli, abdomine breviores, ramis valde inæquis, tenuissimis, acutis. Antennæ subtiliter hirsutæ.

Body pubescent, subelliptic. Abdomen abruptly much narrower than thorax, short, not longer than broad, last segment very short transverse, and not produced backward. Head transverse, a little shorter and narrower than next segment. Thoracic segments nearly equal in length, last on either side acute, but hardly prolonged. Caudal stylets quite small, shorter than abdomen, branches very unequal, very slender, acute. Antennæ finely hirsute.

Plate 48, fig. 2 *a*, animal, enlarged; *b*, antennæ; *c*, sixth pair of legs; *d*, stylets.

Under rotten wood, in forests, ten miles from the Bay of Islands, New Zealand, up the Whykare River.

Length, three lines. Colour, brown and brownish white, with irregular bands and spots of deeper brown. The articulation between the head and first thoracic segment is nearly straight. The abdomen is shorter than breadth of thorax, and hardly longer than its own breadth at base. Antennæ eight-jointed; third and fourth joints together about equalling the fifth; so also, the three last together exclusive of the terminal spine. Legs minutely hirsute or pubescent. Tarsus scarcely longer than preceding joint. Inner branch of stylet scarcely half the length of the outer; both minutely pubescent.

ONISCUS? ANGUSTUS.

Corpus angustum, læve. Caput prominens, processibus antero-lateralibus non exsertis, fronte paulo arcuato. Abdomen thorace subito paulo angustius, lateribus rectis et integris, segmentis latere non salientibus, ultimo breviter transverso, triangulato.

Body narrow, smooth. Head not embedded in following joint, but prominent, the antero-lateral processes absent, and front a little arcuate. Abdomen abruptly a little narrower than thorax, sides straight and entire, the segments not being salient either side; last segment short transverse, triangular.

Plate 48, fig. 3 *a*, animal, enlarged; *b*, outer maxilliped; *c*, first pair of legs; *d*, extremity of last pair.

Near Nassau Bay, Tierra del Fuego.

Length, four lines. The antennæ and stylets are both wanting in our specimens, and the subgenus to which they belong is, therefore, undetermined. The habit of the body is somewhat like that of a *Styloniscus*; but the character of the maxillipeds shows that they are not related to that group. The fifth joint of the last pair of legs is very slender, and the short setæ on the under side are not longer than the breadth of the joint; the fourth joint of the first pair bears below a few long, slender spines, longer than half the next joint; the fifth joint is very nearly naked.

ONISCUS? MACULATUS.

Caput suborbiculare, fronte arcuatum, processibus antero-lateralibus salientibus non instructum. Corpus nitidum, non granulatum. Segmenta thoracis 5 antica fere rectè transversa. Abdomen thorace subito multo angustius, vix longius quam latum, lateribus integris et rectis (segmentis utrinque non salientibus), segmento ultimo valde transverso, margine postico latè triangulato, stylis abdomine parce brevioribus, ramis am-

bobus omnino exsertis, minore dimidio brevior, basi brevi. Articulus pedum posteriorum 5tus infra spinulis longiusculis et crassiusculis armatus.

Head suborbicular, front arcuate, no antero-lateral processes prominent. Body shining, not granulate. Five anterior segments of thorax nearly straight transverse. Abdomen abruptly much narrower than the thorax, hardly longer than broad, sides entire, the segments not projecting either side, last segment very transverse, the posterior margin broad triangular; stylets a little shorter than the abdomen, both branches exsert, the inner half shorter than the outer, base short. Fifth joint of posterior legs armed below with longish spinules.

Plate 48, fig. 4 *a*, animal, enlarged, mutilated in its antennæ; *b*, outer maxilliped; *c*, extremity of posterior leg, upper view; *d*, same, lateral view; *e*, tarsus of same, more enlarged; *f*, caudal stylets.

Sandwich Islands.

Length, three to four lines. Strongly marbled with brownish black, and often a black spot below on the bases of the legs. The last abdominal segment does not cover the bases of either branch of the stylets, the base of the shorter being nearly in the same line with that of the longer. The species is broader than the *angustus*, and the fifth joint of the last pair of legs in that species is furnished only with short setules, not longer than the diameter of the joint.

PHILOSOCIA — ?

Plate 47, fig. 11 *a*, animal, enlarged; *b*, extremity of antennæ; *c*, apex of second joint of flagellum.

Madeira.

The recognised species of *Philoscia* are so imperfectly characterized, that we forbear referring our specimen to any species, especially as the caudal stylets are wanting, these being the organs particularly

referred to in the descriptions. The surface of the segments of the thorax is corrugate, except a smooth medial surface, and a band across adjoining the posterior margin; the articulations are nearly straight across, the postero-lateral angles being little prolonged backward, except for the last thoracic segment. The head is granulate. The antennæ have the same kind of extremity as in other Oniscinæ. Length, four lines.

SUBFAMILY SCYPHACINÆ.

This subfamily embraces two genera, as present known. Although the general form of the body and structure of the caudal appendages are nearly as in the Oniscinæ, there is a wide difference in the outer maxillipeds, the extremity consisting only of a single lamellar joint, which in one genus is half as long as the preceding joint. One of the genera includes species found in a sand-beach bordering the sea, while the other belongs, like the Onisci, to damp places about the land, remote from the sea.

The head is not set into a concavity in the anterior thoracic segment, and is broad transverse, with large reniform eyes in one genus. The mandibles are rather slender, without palpi.

GENUS SCYPHAX, Dana.

Oculi grandes. Antennæ pediformes, ad articulationem 5tam non geniculatæ, flagello 1-3-articulato articulis apicalibus minutis exclusis. Articulus maxillipedis terminalis latus et margine lobatus. Styli caudales ac in Oniscinis. Pedes septimi valde minores, debiles.

Eyes quite large. Antennæ pediform, not geniculate at the fifth articulation, flagellum 1-3-jointed, the minute apical excluded. Terminal joint of maxillipeds broad and serrately lobed. Stylets as in the *Oniscinæ*. Feet of seventh pair much smaller than the others, weak.

The sides of the head are occupied by the oblong reniform eyes. The antennæ are eight-jointed, and bend outward at the articulation between

the fourth and fifth joints; they have at apex, like those of the *Oniscinae*, two or three very short joints, the last of which is slender and somewhat spiniform, with short setules at the extremity. The legs are all similar, or nearly so, and subequal, excepting that the seventh pair is shorter and smaller, and unarmed with spinules. The last thoracic segment is correspondingly much shorter than the preceding. The mandibles have a denticulate apex, and plumose setæ beneath. The first pair of abdominal appendages in the male consists of a small branchial plate, and a jointed pediform organ, consisting of five joints and a small claw at apex. The other abdominal appendages to the fifth inclusive are nearly circular lamellæ. The stylets have a stout but very short base, and two styliform branches.

SCYPHAX ORNATUS.

Corpus ellipticum, abdomine non abrupto angustiore quam thorax. Caput segmento proximo non brevius, transversim ellipticum, oculis latera capitis tegentibus. Segmenta thoracis subœqua. Abdomen 6-articulatum, segmentis duobus anticis thorace partim tectis, ultimum valde angustius, ad basin latius. Styli caudales fere abdominis longitudine, basi perbrevis, ramis paulo inœquis, hirsutiusculis. Antennæ dimidio corporis paulo longiores. Antennæ pedesque minute hirsuti.

Body elliptic, abdomen not abruptly narrower than thorax. Head not shorter than following segment, transversely elliptical, eyes occupying the whole of the lateral margin. Segments of thorax subequal. Abdomen six-jointed, two anterior segments partly concealed by thorax, last segment very much narrower than preceding and widest at base. Caudal stylets as long as abdomen, branches little unequal, minutely hirsute. Antennæ a little longer than half the body. Antennæ and feet minutely hirsute.

Plate 48, fig. 5 *a*, animal, enlarged; *b*, *b'*, antenna; *c*, *c'*, mandible, in different positions; *d*, *e*, maxillæ; *f*, maxillipeds; *g*, *g'*, languette; *h*, *h'*, part of last pair of thoracic feet, from different specimens; *i*, second pair of abdominal appendages; *k*, *l*, third and fourth pairs; *m*, fifth pair; *n*, sixth pair or caudal stylets much enlarged; *o*, part of sixth pair of legs; *p*, part of seventh.

New Zealand, Bay of Islands; abundant on beach of Parua Harbour, and found in the sand by turning it over for a depth of a few inches; often seen running on the beach.

Length, 6–10 lines. Colour, variegated; irregularly spotted with bright yellow, red, brownish red, and jet black, producing a beautiful appearance; antennæ, colourless, or nearly so. Body quite evenly elliptical, and surface indistinctly a little spinulose. Posterior angles of thorax acute. Last abdominal segment subtriangular, with apex truncate, not more than half the width of the preceding. Caudal stylets have the branches straight; the base fills up the interval between the last two abdominal segments. Legs have second, third, fourth, and fifth joints subequal. Antennæ have last three joints together (corresponding to a flagellum) but little longer than the preceding one, and this a little longer than the next preceding; the first three about equal in length to last three.

Plate 48, fig. 6, represents a smaller animal, found in and upon the same beach, which we suspect to be young of the above. Still, the differences are so great, that we are not sure that it may not be a distinct species. The general form was that of an adult. The reasons for supposing it young, are the resemblance between the two in the outer maxillipeds, a general similarity in colouring, and their occurrence together in the same locality. All the specimens found were of the same size, being about two lines long. In the caudal extremity, the differences are very considerable. The last segment of the abdomen does not project at all between the stylets, so as to separate the bases of the stylets; on the contrary, these stylets are close alongside of one another from their bases; moreover, they project but very little beyond the outline of the abdomen, the large branch being very short and obtuse, and not long and subulate, as in the adult *ornatus*; and the smaller branch quite slender, and arising from a point far anterior to the base of the larger branch. The head is short transverse. The eyes are rather large and prominent. The antennæ are short and curve outward; they consist of five basal joints, and a terminal flagellum, which is indistinctly five or six-jointed; the surface is minutely spinulose. The last thoracic segment is not shorter than the preceding, and the last pair of thoracic legs is also of the usual size and character. The abdomen fills the concavity below the last

thoracic segment, and forms a semicircle beyond it. Last abdominal segment smallest; third, fourth, and fifth segments much produced backward on either side. Surface of thorax and abdomen with a few very short scattered spinules.

If this is a distinct species, it is also a new genus, the seventh pair of legs being of full size; and it may be named the *Actæcia euchroa*, the name by which it was designated by the author in his earlier manuscripts.

Plate 48, fig. 6 *a*, animal, enlarged three diameters; *b*, outline of back; *c*, outline of front of head; *d*, abdomen in outline, upper view; *e*, antenna, enlarged; *f*, outer maxilliped; *g*, extremity of one of the legs; *h*, caudal appendages, under view.

GENUS STYLONISCUS, Dana.

Oculi mediocres. Antennæ ad articulationem 5tam geniculatæ, flagello multiarticulato, elongato. Styli caudales ac in Oniscinis. Pedes septimi vix minores, non debiles.

Eyes of moderate size. Antennæ geniculate at the fifth articulation, flagellum multiarticulate, elongate. Caudal stylets as in the *Oniscinæ*. Feet of seventh pair of full size.

The species of this genus approach the *Lygiæ* in form, and one of the two here described has the base of the stylets oblong and projecting much behind the abdomen. The last abdominal segment does not project backward between the caudal appendages. The head is not set deeply into the next segment, as in the *Porcellios*, and has the posterior margin little arcuate.

STYLONISCUS MAGELLANICUS.

Corpus nitidum, angustè ellipticum, anticè rotundatum. Abdomen thorace subito paulo angustius, oblongum, segmento secundo brevissimo, ultimo non longiore quam penultimum. Caput segmento proximo paulo brevius et paulo angustius. Styli caudales divaricati, fere abdo-

minis longitudine, ramo majore fere duplo longiore quam minor. Antennarum flagellum subulatum, 7-10-articulatum.

Body shining, narrow elliptical, rounded in front. Abdomen abruptly a little narrower than thorax, oblong, second segment very short, last not longer than penult. Head a little shorter and narrower than next segment. Caudal stylets divaricate, nearly as long as abdomen, longer branch nearly twice the length of the other. Flagellum of antennæ subulate, seven to ten-jointed.

Plate 48, fig. 7 *a*, animal, enlarged; *b*, antenna; *c*, extremity of antenna; *d*, maxilliped; *e*, maxilla of second pair; *f*, extremity of leg of seventh pair; *g*, caudal stylets.

In damp woods, under rotten stumps and trunks of trees, near Nassau Bay, Tierra del Fuego.

Length, four lines. Colour, dirty brown, a little clouded. The head is transverse, and arcuate less behind than before. The first three thoracic articulations are convex backward; the last two convex forwards. Lateral margins of thoracic segments finely serrulate, with a few minute spinules at intervals. Last joint of base of antennæ longer than preceding and a little shorter than flagellum; posterior margin very minutely and evenly spinulose; anterior margin with four or five short spines. Claw of legs short and more or less spinous. In the posterior pair, the outer or superior margin of the fifth joint is finely pectinated for a part of its extent; on the inner side, adjoining the base, the joint is enlarged and villose, and there are a few short spinules beyond. The pectination on the dorsal margin of the joint is seen only with a high magnifier, and is often not visible in dried specimens.

STYLONISCUS LONGISTYLIS.

Corpus angusto-ellipticum, anticè rotundatum. Abdomen thorace subito angustius, subquadratum, latitudine parce longius, articulis sex subæquis. Segmenta thoracis subæqua, anticum parce longius. Styli caudales elongati, basi oblongo (dimidio abdominis longiore) crasso,

ramo majore abdominis longitudine, crassè subulato. Antennæ longæ, flagello fermè 16-articulato, subtiliter spinuloso.

Body narrow elliptic, rounded in front. Abdomen abruptly narrower than thorax, subquadrate, a little longer than broad; segments six, subequal. Segments of thorax subequal, the first slightly the longest. Head transverse. Caudal stylets elongate, base oblong (longer than half the abdomen), longer branch as long as abdomen, stout subulate. Antennæ long, flagellum about sixteen-jointed, minutely spinulous.

Plate 48, fig. 8 *a*, animal, enlarged; 8 *b*, part of flagellum, more enlarged.

Island of Tongatabu, Friendly Islands.

Length, about three lines. The articulation behind the head is but little arcuate. The abdomen has the last segment but slightly longer than preceding, and obtuse behind. The stylets are peculiar in having an oblong base; the bases of the two are parallel, but the longer branch diverges widely from the medial line. The flagellum of the antennæ is longer than the preceding joint, and that is but little longer than the next preceding. The joints of the flagellum are somewhat oblong, and have a circle of minute setules at apex. The legs are minutely spinulous.

SUBFAMILY LYGINÆ.

LYGIA EHRENBERGII?

Plate 49, fig. 1 *a*, animal, enlarged; *b*, abdomen, more enlarged; *c* to *g*, abdominal appendages of the five pairs in succession.

Island of Madeira.

Length, eight to nine lines. Colour, grayish, or dotted with black on a light ground. Length of body, excluding stylets, to breadth, as 17 to 7. Eyes large, black. Abdomen narrow, abruptly much nar-

rower than thorax, the first abdominal segment being about two-thirds as broad as the last thoracic. Caudal stylets slender, the base as long as the abdomen, a little incurved; setæ about equal, fully as long as whole body (the stylets excluded). Antennæ as long as the body; last basal joint nearly twice as long as preceding; flagellum about twenty-three-jointed.

LYGIA NOVI-ZEALANDIÆ.

Latiior, elliptica, dorso scabriculo. Abdomen thorace non subito angustius, segmento postico longiore, posticè paulo arcuato, angulis breviter acutis. Styli caudales basi fere abdominis longitudine, ramis scabriculis, multo inæquis, thorace non longioribus. Antennæ corporis longitudine, flagello 18-21-articulato, scabriculo.

Elliptical, broader than preceding species. Surface of thorax and abdomen covered with very short hairs. Abdomen not suddenly narrower than thorax; last segment arcuate behind, and angles short acute. Base of caudal stylets nearly as long as abdomen; branches quite unequal, scabrous, the longer hardly as long as thorax. Antennæ as long as the body, finely scabrous; flagellum 18-21-jointed.

Plate 49, fig. 2 *a*, animal, enlarged; *b*, view of flagellum, more enlarged; *c*, outline of extremity of abdomen; *d*, part of larger seta of stylet.

Along shores of Bay of Islands, New Zealand, under kelp, &c.

Length, six lines; width of the head, about half that of the thorax; longer caudal seta, stouter than the other; last joint of base of antennæ, about four-fifths the preceding; penult joint of all the legs, excepting anterior pair, very slender and styliform; in fourth pair, about five-fourths the length of the fourth joint; third, fourth, and fifth segments of the abdomen much prolonged backward on either side, the prolonged sides of the penult segment reaching nearly as far as the angles of the last segment.

Lygia australiensis.—(Pl. 49, f. 3.) We thus indicate a species which was collected by us in New South Wales, but of which our single specimen is in too mutilated a state for full description, as it wants both the antennæ and stylets. The abdomen has the three segments before the last but little prolonged backward on either side, and the sides of the penult do not reach half way to the angles of the last segment. The postero-lateral angles of the last segment are very short acute, and do not reach beyond the low tooth on the posterior margin at the base of the stylets. The body is rather narrow, and the surface is fine granulous all over, the granules scattered. Length of body, seven lines.

LYGIA HAWAIIENSIS.

Corpus sat latum, fere læve, ad abdominis basin paulo interruptum. Oculi pergrandes, superficie frontali oculos sejungente duplo breviora quam oculi. Antennæ fere corporis longitudine, flagello 27–28-articulato, articulis plerumque triplo vel quadruplo longioribus quam latis, spinulis subtilissimis, perpauca, dimidio latitudinis articuli brevioribus. Segmentum abdominis ultimum non duplo latius quam longum, angulis postero-lateralibus brevissimè acutis, margine postico paulo triangulato, versus angulos parce undulato sine dente acuto.

Body rather broad, very nearly quite smooth, a little interrupted at base of abdomen. Eyes quite large, the frontal surface between them, not half as great as the horizontal length of the eye. Antennæ very nearly of the length of the body; flagellum 27–28-jointed, joints mostly three or four times as long as broad; spinules very minute and few, not as long as half the breadth of the joints. Last segment of abdomen not twice as broad as long; posterior angles very short acute; posterior margin somewhat triangulate, towards the angles a little undulate, but without an acute tooth.

Plate 49, fig. 4 *a*, animal (except caudal stylets), enlarged three diameters; *b*, part of flagellum of antennæ from basal half; *c*, extremity of flagellum; *d*, extremity of leg of seventh pair; *e*, outline of extremity of abdomen, more enlarged.

Oahu and Kauai, Hawaiian Islands.

Length of body, eight lines. The acute latero-posterior angles of the last abdominal segment are very short, not reaching beyond the obsolescent rounded tooth at the base of the stylets. In this respect, as well as the smooth body, much shorter space between the eyes, and longer joints of the flagellum, this species differs from the *L. occidentalis*. The abdomen at base is but slightly narrower than the posterior part of the thorax, the general outline of the two being continuous. The antennæ are shorter and smoother than in the *cursor*, with longer joints to the flagellum.

Lygia vitiensis.—A species of *Lygia* was collected at the Feejees, differing from the *hawaiiensis*; but the only specimen is mutilated in its last abdominal segment, besides wanting the stylets and antennæ. The surface is quite smooth, unlike the above; also the last abdominal segment is full twice as broad as long. The abdomen at its third segment is not abruptly narrower than the thorax, and the sides of the third, fourth, and fifth segments are much prolonged backward. The legs have very few spinules on the joints. The medial point of the posterior margin of the last segment of the abdomen, appears to project but little beyond the low tooth at the base of the stylets, the extremity being very low triangular. The fourth joint of the sixth and seventh pairs of legs projects but little (not half its length) beyond the side of the thorax, when in their natural position for walking.

Plate 49, fig. 5 *a*, extremity of abdomen, exclusive of latero-posterior angles, which are broken, but appear, from what remains, to have been rather long acute; *b*, leg of fifth pair, enlarged.

LYGIA GAUDICHAUDII ?

Common at Manila, Luzon, and at Singapore.

Plate 49, fig. 6 *a*, head and first thoracic segment; *b*, extremity of abdomen; *c*, caudal stylets; *d*, base of antennæ; *e*, basal part of fla-

gellum, more enlarged; *f*, extremity of flagellum, *ibid.*; *g*, tarsus of sixth or seventh pair of legs; *h*, outline of eye, in lateral view.

Length, twelve lines, exclusive of caudal stylets. Base of stylets as long as breadth of last abdominal segment; the branches equal, slender, with an oblique seta at apex of the inner. Joints of flagellum mostly having their length more than twice their breadth, twenty-seven to thirty-two in number, the spinules few, exceedingly short, not one-fourth the diameter of the joints in length; terminal joints appear scabrous under a high magnifying power. The last segment has the posterior angles prominent and acute; and a short distance inside of the angles, the posterior margin has a crenature with an angle either side, while the middle of the margin is low triangular and subacute. Surface of thoracic segments very nearly smooth.

LYGIA OCCIDENTALIS.

L. Gaudichaudii affinis. *Segmenta thoracis plane sed minutè granulata. Antennæ thorace non longiores, flagello 16-18-articulato, articulis versus basin latitudine raro duplo longioribus, spinulis subtilissimis, paucis. Styli caudales fere dimidii corporis longitudine, basi latitudinem segmenti ultimi vix æquante, ramis æquis, interno setâ obliquâ confecto.*

Near the *Gaudichaudii*. Segments of thorax distinctly though minutely granulate. Antennæ not longer than thorax; flagellum sixteen to eighteen-jointed; joints towards basal portion rarely twice as long as broad; spinules very minute and few. Caudal stylets not half as long as body; base shorter than breadth of last abdominal segment; branches equal, the inner with an oblique seta at apex.

Plate 49, fig. 7 *a*, abdomen, enlarged; *b*, part of base of antennæ; *c*, basal part of flagellum; *d*, extremity of flagellum; *e*, tarsus of sixth or seventh pair of legs.

Near Sacramento River, California.—C. Pickering.

Length, exclusive of caudal stylets, one inch. The eyes are large

and the front narrow, as in the *L. Gaudichaudii*. The antennæ and stylets are shorter, and the extremity of the flagellum was not scabrous, or scarcely so; the last joint is about as long as the preceding. The granulation of the surface is also much more distinct than in the *Gaudichaudii*.

LYGIA CURSOR.

Antennæ cephalothoracis longitudine, flagello 21-articulato [in specimine scrutato post 14 articulos constricto deinde articulis septem brevioribus confecto] versus apicem setis latitudinis articulo longitudine sæpeque setulâ utrinque armatis. Abdomen parce longius quam latum, thorace subito paulo angustius, segmento postico apice triangulato, angulis posticis breviter acutis.

Antennæ as long as the cephalothorax, flagellum twenty-one-jointed [in the specimen examined, after the fourteenth joint, a constriction and then seven smaller joints]; surface of the joints towards extremity bearing many setæ, which are as long as the diameter of the joints, and have often a setule on either side. Abdomen sparingly longer than its breadth, abruptly a little narrower than thorax; last segment triangulate at apex, the posterior angles short acute.

Plate 49, fig. 8 *a*, abdomen, without the stylets, enlarged; *b*, antenna; *c*, extremity of flagellum, more enlarged.

Valparaiso ?

Length of body, exclusive of stylets, ten lines. The stylets were not present in our specimen. The last joint of the flagellum is much longer than the preceding, and as in other species, has a tuft of setules or very short hairs at apex, as seen when magnified. The constriction in the flagellum appears to separate the extremity from the rest, and as it occurs just seven joints from the extremity (one-third the whole number), it may be a permanent characteristic of the species.

FAMILY ASELLIDÆ.

SUBFAMILY ASELLINÆ.

GENUS JÆRA.

JÆRA PUBESCENS.

Corpus elongato-ellipticum, pubescens, anticè truncatum, medio fronte apiculatum. Oculi parvuli, remoti. Caput segmento sequente longius. Abdomen rotundato-ovatum, prope basin suturâ obsoletâ notatum. Styli caudales dimidii abdominis longitudine. Pedes subæqui. Antennæ internæ basi externarum paulo breviores; externæ dimidio corporis longiores, flagello tenuissimo, duplo longiore quam basis.

Body oblong-elliptic, pubescent, truncate in front and apiculate at middle. Eyes quite small, remote. Head longer than next segment. Abdomen round-ovate; an indistinct suture near base. Caudal stylets half as long as abdomen, three or four-jointed. Feet subequal, apex prolonged beyond the claws. Inner antennæ shorter than base of outer; outer longer than half the body; flagellum twice longer than basal portion, very slender.

Plate 49, fig. 9 *a*, animal, enlarged; *b*, part of flagellum of outer antennæ; *c*, extremity of leg; *d*, abdomen in outline.

From Nassau Bay, Tierra del Fuego, found parasitic on the large common *Spheroma*, *S. lanceolata*.

Length, one line. The greatest breadth of the body is nearly twice that of the head; head but slightly narrower than first thoracic segment; length of head about half its breadth. Base of outer antennæ as long as breadth of head, four-jointed, fourth joint scarcely longer than the third. Thoracic segments gradually shorter from the fourth to the last, and the last not half the length of the fourth. The stylets are largish at base.

SUBTRIBE III. CYMOTHOIDEA.

EXCLUDING the Praniza and Serolis groups from the Cymothoidea, this subtribe has trenchant limits. The large abdomen, having the last segment broad and often scutiform, widened on either side by the lamellate or falciform caudal appendages, so as to make it a powerful natatory organ, give a peculiar character to the species. The five anterior pairs of abdominal appendages have a general similarity of form and structure, and are not divided between the third and fourth pairs into two series, like the Amphipods, and the Serolis group of Anisopods. The anterior pair of legs is sometimes more or less subcheliform, but rarely the second pair, unless at the same time the following pair and others, are also subcheliform.

The families in this subtribe are as follows:—

Fam. I. CYMOTHOIDÆ.*—Maxillipedes breves, 3-4-articulati, operculiformes, articulis terminalibus angustis, brevibus. Appendices caudales liberæ, marginibus rarissimè ciliatæ. Antennæ sub capite infixæ. Abdomen 4-6-articulatum, segmentis anterioribus raro coalitis. Pedes toti ancorales. Branchiæ sæpissime non ciliatæ. Epimeræ conspicuæ.

Fam. II. ÆGIDÆ.†—Maxillipedes elongati, 4-6-articulati, articulis totis lamellatis, terminalibus latis et brevibus. Appendices caudales liberæ, marginibus ciliatæ. Antennæ ad frontis marginem capitis affixæ, apertæ. Abdomen 4-6-articulatum. Pedes 6 antici interdum ancorales aut prehensiles, sæpe simpliciter unguiculati, 8 postici unguiculati et nunquam ancorales. Branchiæ ciliatæ. Epimeræ conspicuæ.

Fam. III. SPHEROMIDÆ.—Maxillipedes elongati, 5-6-articulati et palpi-

* *Cymothoadiens Parasites*, Edwards, Crust., iii., 228, 247.

† *Cymothoadiens Errans*, Edwards; *ibid.*, 228, 233.

formes. Appendices caudales margini abdominis laterali per ramum internum conjunctæ. Antennæ ad frontis marginem capitis affixæ, apertæ. Abdomen 1-2-articulatum. Pedes non ancorales [raro 4 antichi ancorales]. Branchiæ ciliatæ. Epimeræ non distinguendæ.

The Cymothoidæ, in their non-ciliate branchiæ and simply operculiform maxillipeds, appear to rank first in this subtribe. The high value of this non-ciliate character of the branchiæ in fixing the rank of the species, is apparent from the fact, that they are in this particular farthest removed from the Amphipods. In the passage to the Amphipod form, the first step is a ciliation of the margin, the next, an elongation of form, and finally appears the oblong natatory shape. The Cymothoidæ pass into the Ægidæ through certain species of the former group (Ægathoinæ), in which the caudal pair of abdominal appendages is ciliated, as in the Ægidæ, though not the branchial pairs.

The Ægidæ, hitherto ranked in the same family with the Cymothoidæ, have, in fact, an intermediate character between them and the Spheromidæ. Like the former, it is true, they have the caudal stylets free, and not attached by one of the plates to the abdomen; besides, the joints of the abdomen are free, and there are distinct thoracic epimerals: but in other important characteristics they are Spheromoid. For example, the antennæ are attached to the front margin of the head, and not to its under surface; the branchial leaflets are ciliated; the maxillipeds have usually the full number of joints, although unlike those of the Spheromidæ in being broad and short; the feet are not all ancoral, only the six anterior pair at the most having this character. The Spheromidæ are peculiar in their one or two-jointed abdomen, the more elongated palpiform maxillipeds, the absence of distinct epimerals, and in having the caudal stylets fixed by the inner plate to the side of the abdomen.

The following are the subfamilies and genera of these groups:—

FAM. I. CYMOTHOIDÆ.

SUBFAM. 1. CYMOTHOINÆ.—Lamellæ caudales nudæ. Abdomen multiarticulatum, segmentis liberis.

G. 1. CYMOTHOA, *Fabr.*—Femora lata, posteriora latissima. Segmenta thoracis

2 3ve postica multo breviora nunquam latere acutè producta. Segmentum caudale sæpissimè valde transversum. Antennæ graciles, 1mæ ad basin paulo remotæ.

G. 2. CERATOTHOA, *Dana*.—*Cymothoæ* affinis. Caput postice latum, fronte productum et sæpe angustum. Antennæ 1mæ crassæ, basibus conjunctæ.

G. 3. LIVONECA, *Leach*.—Femora latiuscula, 6ta vel 7ma 5tis vix latiora, non angustiora. Segmenta thoracis 3tium 4tum, 5tum 6tum longitudine fere æqua, 7mum paulo brevius. Abdomen thorace subito vix angustius. Caput parvulum. Frons non involutus et in processum inter-antennalem conspicuè non productus. Segmentum caudale vix transversum. [Corpus sæpe obliquè distortum.]

G. 4. ANILOCRA, *Leach*.—Femora angusta, posteriora angustiora. Segmenta thoracis ac in *Nerocilâ*. Abdomen thorace subito angustius, segmentis processu laterali spiniformi infra non instructis, ultimo vix transverso.—Subgenus *Anilocra* ramis appendicis caudalis multo inæquis; *Canolira*, *Leach*, ramis iisdem subæquis.

G. 5. NEROCILA, *Leach*.—Femora angusta, posteriora angustiora, pedibus posticis minoribus. Segmenta 2dum 3tium 4tum 5to 6to 7mo multo breviora. Abdomen thorace subito angustius, segmentis processu laterali spiniformi infra instructis, ultimo vix transverso.

G. 6. OLENCIRA, *Leach*.—Femora latitudine mediocria. Segmenta thoracis 3 postica anterioribus non longiora. Abdomen thorace subito multo angustius, segmentis processibus spiniformibus infra non instructis, ultimo non transverso.

SUBFAM. 2. OROZEUKTINÆ.—Segmentum abdominis posticum ac in *Cymothoâ*; alia coalita et non libera.

G. 1. OROZEUKTES, *Edw*.

SUBFAM. 3. ÆGATHOINÆ.—Lamellæ caudales ciliatæ. Abdomen multiarticulatum, segmentis liberis.

G. 1. ÆGATHOA, *Dana*.—Abdomen thorace subito non angustius, segmentis subæquis. Caput latum, subtriangulatum, segmento proximo parce angustius. Oculi grandes.

FAM. II. ÆGIDÆ.

SUBFAM. 1. ÆGINÆ.—Pedes 6 antici ancorales, unguibus validis confecti, reliqui unguibus parvulis.

G. 1. ÆGA, *Leach*.—Pedes 6 antici æque ancorales. Antennæ 1mæ basi contiguæ; 2dæ per epistomatis processum sejunctæ. Frons non saliens.

Subgenus 1. ÆGA.—Oculis remotis; antennis 1mis basi complanatis.

Subgenus 2. CONILERA, *Leach*.—Oculis remotis; antennis 1mis basi subcylindricis.

Subgenus 3. ROCINELA, *Leach*.—Oculis grandioribus inter se fere contiguis, antennis 1mis basi complanatis.

- G. 2. *ACHERUSIA*, *Lucas*.—*Ægæ* affinis. Antennæ 2dæ per processum non sejunctæ. Frons capitis saliens.
- G. 3. *PTERELAS*, *Guerin*.—*Ægæ* affinis. Pedes 2di 3tii sæpeque 1mi subdidactyli, processu e articulo penultimo instar digiti immobilis processu sive acuminato sive acie instructo.

SUBFAM. 2. *CIROLANINÆ*.—Pedes nulli ancorales.

- G. 1. *CIROLANA*,* *Leach*.—Segmenta thoracis subæqua. Pedes unguibus parvulis confecti. Antennæ 2dæ per processum epistomatis tenuem sejunctæ. Abdomen 6-articulatum.
- G. 2. *CORALLANA*, *Dana*.—Segmenta thoracis subæqua. Pedes unguibus parvulis confecti. Antennæ 2dæ epistomate transverso latissimè sejunctæ et partim tectæ, epistomate antennisque 1mis latè conniventibus.
- G. 3. *ALITROPUS*, *Edw*.—Segmenta thoracis 3 postica anterioribus longiora, ac in *Nerocilâ*. Pedes unguibus crassiusculis confecti.

FAM. III. *SPHEROMIDÆ*.

SUBFAM. 1. *SPHEROMINÆ*.—Lamella appendicis caudalis externa sub internâ se latens. Pedes nulli ancorales.

1. *Corpus in globum contractile*.

- G. 1. *SPHEROMA*, *Latr*.—Lamellæ appendicis caudalis subæquæ.

2. *Corpus in globum non contractile*.

- G. 2. *CYMODOCEA*, *Leach*, *Edw*.†—Caput valde transversum, multo convexum. Lamellæ appendicis caudalis subæquæ.
- G. 3. *CERCEIS*, *Edw*.—Caput parce transversum, subtriangulatum, vix convexum. Antennæ 1mæ quoad basin capite tectæ, processu non sejunctæ.
- G. 4. *CASSIDINA*, *Edw*.—Corpus latum. Caput valde transversum. Lamellæ appendicis caudalis angustæ, valde inæquæ, externâ parvulâ. Antennæ 1mæ quoad basin processu frontis sejunctæ.
- G. 5. *AMPHOROIDEUM*, *Edw*.—Antennæ quoad basin lamellate portentosè productæ.

SUBFAM. 2. *NESÆINÆ*.—Lamella appendicis caudalis externa sub internâ se non latens, usquam aperta. Pedes nulli ancorales.

* *Eurydice* and *Nelocira* of Leach are here included.

† *Dynamena* of Leach is included.

G. 1. NESÆA, *Leach, Edw.**—Lamella caudalis externa recta.

G. 2. CAMPECOPEA, *Leach.*—Lamella caudalis externa arcuata.

SUBFAM. 3. ANCININÆ.—Pedes 4 antici ancorales.

G. ANCINUS, *Edw.*—Appendices caudales unâ lamellâ oblongâ saliente basi que brevissimo instructæ.

The genus ANCINUS, we suspect may belong with the Anisopods, from the fact, that the two anterior pairs of legs are alike and unlike the following, this seeming to point to the serial arrangement of the legs 2 : 2 : 3, instead of that of 3 : 4, as in true Isopods. But, having seen no specimen of the genus, we leave it in this place, where it is arranged by Edwards. If Anisopodan, the type of structure is still like that of the Spheromidæ.

FAMILY I. CYMOTHOIDÆ.

SUBFAMILY CYMOTHOINÆ.

CYMOTHOA EXCISA. *Perthy.*

Corpus subovatum, crassum. Caput transversum, fronte arcuatum, inter segmenti thoracis 1mi processus dimidio inclusum, processibus subconicis, obtusis vel subacutis. Abdominis segmentum posticum plus duplo latius quam longum, margine postico paulo excavato. Articulus 1mus pedis 4ti versus basin tuberculo infra non armatus nec angulatus, pedis 7mi latissimus, parce longior quam latus. Styli caudales breves, ramis subæquis.

Body subovate, stout. Head transverse, rounded anteriorly; processes of anterior segment of thorax either side of head projecting to half the length of the head. Caudal segment very broad, much more than twice as broad as long; posterior margin a little excavate. First joint of fourth pair of legs without a prominence below near

* *Cilicæa* of Leach is included.

base, and not angulate, of seventh pair very broad, but not as broad as its length. Caudal appendages shorter than the last segment, branches subequal.

Plate 49, fig. 10 *a*, dorsal view, enlarged; *b*, ventral; *c*, leg of seventh pair; *d*, caudal appendage.

Rio Janeiro, from the outside of a fish, frequently about the head, and especially the upper part.

Length, one to one and one-eighth inches. Colour, pale yellowish white. Greatest breadth at articulation between fourth and fifth thoracic segments. Body somewhat compressed. Form and outline of head nearly semicircular. Abdomen one-third narrower at base than across last segment. Branches of caudal appendages a little unequal, slightly incurved, obtuse. Antennæ about seven-jointed. In female, membranous plates attached to ten posterior legs, which cover the whole thoracic venter; eggs abundant under them. Liver consists of two oblong masses, which extend either side of the intestine through the three anterior segments.

Var. *compressa*.—Plate 49, fig. 11 *a*, represents a *Cymothoa*, from Rio, probably a variety of the preceding. The body is more narrow and compressed; the last abdominal segment has the basal angles a little prominent, and is broadest at base, with the posterior side arcuate, and breadth about twice the length; the caudal appendages (fig. 11 *b*) extend quite to line of extremity of abdomen; the first thoracic segment projects either side of head, almost quite to line of front, and the projections are obtuse. Shell much thicker than the above.

Cymothoa excisa, PERTHY, Delect. An. Artic. Brasil. col. Spix et V. Martius, p. 211, pl. 40, f. 11.

CYMOTHOA FRONTALIS? *Edwards*.

Plate 49, fig. 12 *a*, dorsal view; *b*, extremity of abdomen.

Oahu, Hawaiian Islands; from the body of a fish.

Length, eight lines; length of head, equal to its greatest breadth.

Cephalothorax broader posteriorly. First joint of thorax nearly twice as long as second; second, third, and fourth subequal; the following shorter than preceding and subequal. Lateral angles obtuse. First five segments of abdomen together, about equal the last; last twice as broad as long, arcuate behind (thus differing from the preceding species). Stylets reaching as far backward as extremity of caudal segment; branches straight and rounded at apex.

CYMOTHOA RECTA.

Corpus latè lineare, lateribus parallelis. Caput paulo transversum, antice arcuatum, inter segmenti sequentis processus plus dimidio inclusum, processibus extremitate latis, arcuatis vel subtruncatis. Abdomen basi angustum, segmento ultimo parce latiore quam thorax, multo transversum, postice arcuatum, stylis extremitatem abdominis fere attingentibus, ramis obtusis, externo parce arcuato. Articulus 1mus pedis 4ti latus, postice versus basin subrectangulatus, non tuberculiger, pedis 7mi perlatus, parce oblongus.

Body broad linear, the sides being parallel. Head somewhat transverse, anteriorly arcuate; processes from following joint projecting beyond half the length of the head and very broad at extremity, and rounded or subtruncate. Abdomen narrow at base, last segment sparingly broader than thorax, very transverse; posterior margin arcuate, stylets reaching nearly or quite to line of extremity; stylets obtuse, outer slightly curved. First joint of fourth pair of feet quite broad, posteriorly near base subrectangulate but with no tubercle; of seventh pair very broad, a little oblong.

Plate 49, fig. 13 *a*, animal in outline, enlarged two diameters; *b*, leg of fourth pair; *c*, leg of fifth pair.

Obtained by Dr. C. Pickering, at Hilo, Hawaii.

The parallel sides of this species distinguish it from other species. The first thoracic segment has the breadth about twice as great as the length behind the head; the next three segments are each about three times as broad as long, and the last three, about five times as

broad as long. The posterior epimerals are smaller than the anterior.

GENUS CERATOTHOA, Dana.

Cymothoæ affinis. Caput postice latum, fronte productum et sæpe angustum. Antennæ 1mæ crassæ et basi contiguæ.

Near *Cymothoa* in most characters. Head broad at base, but with the front produced and often narrow. Superior antennæ stout and exposed nearly from base, in contact at base.

The caudal stylets are often partly concealed under the sides of the abdomen. This genus is in part *Cymothoa* of authors.

CERATOTHOA LINEARIS.

Corpus elongatè lineare. Caput transversum, fronte saliens, processibus anticis segmenti sequentis perbrevibus. Segmenta thoracis 4 antica paulo breviora quam lata. Antennæ ante frontem salientes, compressæ, validæ, 1mæ 5-articulatæ, 2dæ 7-articulatæ parce longiores. Segmentum abdominis ultimum paulo transversum, thorace non angustius, postice profundè emarginatum, angulis posticis latè rotundatis.

Body long linear. Head transverse, front prominently projecting; processes of next joint either side of head very short. Four anterior segments of thorax much longer than half their breadth. Antennæ prominent, compressed, very stout; first pair five-jointed, second pair seven-jointed, a little the longer. Posterior abdominal segment somewhat transverse, not narrower than thorax, posterior angles very broadly rounded, and margin behind deeply emarginate.

Plate 50, fig. 1 *a*, dorsal view, somewhat enlarged; *b*, ventral view; *c*, under view of head; *d*, mandible.

From a fish in the Gulf Stream.

Length, one and one-fourth inches. Antennæ curve around in a semicircle near the head; third and fourth joints of second pair longer than second joint. The four anterior thoracic segments are but little shorter than their breadth. The epimeral pieces of the anterior segments of thorax are oblong and prominent either side. Coxæ of legs very broad, claws large and much curved. Caudal appendages do not extend beyond the extremity of the abdomen; not seen in dorsal view, being concealed under the margin. Eyes near anterior angles of head, not very distinct.

CERATOTHOA CRASSA.

Corpus latum, crassum, subovatum, segmento thoracis 4to duplo latiore quam 1mum. Caput fronte productum. Segmentum thoracis 1mum capite subito latius, antice parce productum, processibus latis, truncatis. Segmentum caudale 4to thoracis segmento paulo angustius, duplo latius quam longum, extremitate rectiusculum, parce excavatum, stylis caudalibus brevibus, non exsertis, ramis ovatis, subacutis. Coxa pedis 7mi latè transversa.

Body broad and stout, subovate; fourth thoracic segment twice broader than first. Head produced in front. First thoracic segment abruptly wider than head, the processes either side of head very short, but wide and truncate in front. Caudal segment a little narrower than the fourth thoracic, twice as broad as long; posterior margin nearly straight transverse, slightly excavate; caudal stylets short, not exsert, branches ovate, subacute. Coxa of seventh pair of feet very broad transverse.

Plate 50, fig. 2 *a*, body in outline, enlarged one and one-half diameters; *b*, stylets, enlarged one and one-half diameters; *b'*, same, more enlarged; *c*, leg of sixth pair, showing coxa much wider than its length.

From the Southwestern Pacific.

Length of body, thirteen lines; breadth at middle, six lines; breadth of last abdominal segment, five lines. The preceding four

abdominal segments are as broad nearly or quite as the last thoracic segment. The antennæ are stout and flattened, and project either side of the prominent front.

The specimen is a dried one, and in some points the body may have lost somewhat its natural shape. The projections of the first thoracic segment either side of the head, are exceedingly short in the specimen, though broad, and have the anterior margin straight transverse, with the outer side a little revolute, and having an edge rising upward from the antero-lateral angle of the projection.

GENUS LIVONECA, *Leach*.

LIVONECA LONGISTYLIS.

Corpus duplo longius quam latum. Segmentum abdominis posticum paulo transversum, basi latius, posticè obtusi-angulatum. Styli caudales segmentum caudale multum superantes, angulo basis interno obtuso, ramis inæquis, lamellatis, interno obliquè truncato, externo obtuso, recto, longiore. Epimeræ breves, acuminatæ, obtusæ, segmenta vix superantes.

Body twice as long as broad. Last abdominal segment, shorter than broad, broadest at base, obtuse-angled behind. Caudal appendages extending a little beyond apex of abdomen; inner angle of base obtuse, branches unequal, lamellar; inner obliquely truncate, outer obtuse, straight, longer than the inner. Epimerals short, acuminate, obtuse, hardly reaching beyond their respective segments.

Plate 50, fig. 3 *a*, dorsal view; *b*, caudal appendage.

Rio Janeiro; found within the gills and on the body of an Ehippus; also, from the Sandwich Islands.

Length, about one inch. Colour, pale yellowish. Head semicircular in front; posterior angles projecting; eyes indistinct. Thoracic segments subequal, first longest, not extending forward either side of head. Claws of third pair of legs not smaller than on preceding pair; of seventh pair a little smaller than the preceding, but leg scarcely at

all more slender, its basal joint about as long as following portion. Posterior antennæ a little the longer, nine (or ten) jointed, last three joints smaller than the preceding; anterior pair eight-jointed, three basal joints largest. Caudal segment much narrower than tergal part of last thoracic segment.

The *L. Redmannii*, as figured by Milne Edwards, has not the inner branch of the stylets obliquely truncate, as in the *longistylis*.

LIVONECA EMARGINATA.

Corpus duplo longius quam latum. Segmentum abdominis posticum paulo transversum, fere semicirculare, posticè emarginatum, basi latius. Appendices caudales segmentum caudale superantes, angulo basis interno elongato, subacuto, ramis valde inæquis, interno brevi, crasso, compresso, ad apicem rotundato, externo tenui, obtuso, recto, longiore.

Body twice as long as broad. Last segment of abdomen somewhat transverse, almost semicircular, emarginate behind, broadest at base. Caudal appendages extending beyond line of extremity of abdomen; inner angle of base elongate, subacute; branches much unequal; inner short, stout, compressed, rounded at apex; external slender, obtuse, considerably the longer.

Plate 50, fig. 4 *a*, dorsal view; *b*, caudal appendage.

From the body of a fish, at Rio Janeiro.

Length, one inch. Colour, whitish, a little yellow. Head nearly semicircular, a little more prominent; posterior angles projecting; eyes indistinct. Joints of thorax subequal, first segment longest. Five abdominal segments very short transverse, equal. Antennæ moniliform; posterior pair a little the longest; anterior eight-jointed, three basal joints largest; posterior nine-jointed, last three joints much smaller than preceding. Seventh pair of legs more slender than preceding, or a little longer, and claw smaller. Claw of third pair not smaller than that of second. The body is a little oblique, from its position on the fish.

LIVONECA LATA.

Corpus latius, sesqui longius quam latum. Segmentum abdominis ultimum dimidio thoracis latitudine, basi latius, postice arcuatum et non angulatum nec emarginatum. Styli caudales abdominis extremitatem non superantes, ramis latis, apice rotundatis, paulo inæquis. Epimeræ posticæ ultra segmentum paululo salientes et non attenuatæ, obtusæ.

Body one and a half as long as broad. Last segment of abdomen half as broad as thorax, broadest at base, rounded behind, without an angle or emargination. Caudal stylets not reaching beyond line of extremity of abdomen, branches broad, rounded at apex, somewhat unequal. Posterior epimerals but slightly salient beyond the adjoining part of thoracic segment, not attenuated, obtuse.

Plate 50, fig. 5 *a*, animal, one and a half times the natural size; *b*, fourth, fifth, sixth, and seventh epimerals, left side, and part of attached segments; *c*, caudal stylet.

Sandwich Islands.

Length of body, eleven lines. Like the specimens of the other species, the body is distorted, owing to its position on the fish upon which it was found. The head is subtriangular, and its greatest breadth is about half that of the next segment. The posterior epimerals are the only ones that project beyond the segment adjoining, and these project but slightly. The caudal segment is much narrower than tergal part of last thoracic segment.

GENUS NEROCILA, *Leach*.

One of the most striking characters, separating *Nerocila* from either of the three preceding genera, is the different relative lengths of the six posterior thoracic segments. In *Livoneca*, these segments are subequal, as to length, the last being a little the shortest. In *Cymothoa*

and Ceratothoa, the three posterior are much shorter than the others, while in Nerocila, the three posterior are much longer than the others. Again, in the three preceding genera none of the thoracic segments nor their epimerals are acute behind, while in Nerocila, the posterior, at least, in all the species, are acute, and sometimes the anterior. The spiniform pieces below the abdominal segments distinguish the species from the Anilocræ, to which they are otherwise related.

NEROCILA LATA.

Corpus latius, vix sesqui longius quam latum. Thorax non oblongus segmentis 3 posticis latere acute productis. Epimeræ thoracis totæ acutæ, breves, 6tæ basin 7marum attingentes. Abdomen non oblongum, segmentis 5 anticis lateraliter productis, tenuibus, ultimo scutiformi, multo angustiore quam quintum, non oblongo, basi paulo latiore, extremitate late rotundatâ et medio subangulatâ. Appendices caudales aculeatæ, acutæ, externâ longiore, paulo curvatâ.

Body broad; length about one and a half times its breadth. Thorax not oblong, armed with acute points on sides of last three segments. Epimerals of thorax all acute, short; sixth reaching base of seventh. Abdomen shorter than broad; five anterior segments laterally long-produced and slender, the last scutiform, not oblong, little broader at base, widely rounded at apex, a low angle at middle of posterior margin. Caudal appendages aculeate, both acute; the exterior longer and a little curved.

Plate 50, fig. 6 *a*, animal, natural size; *b*, same, more enlarged, ventral view; *c*, first antenna; *d*, second antenna, right side; *d'*, same, left side.

Rio Janeiro.

Length, one inch; greatest breadth, two-thirds of an inch. Colour bluish-slate, little clouded with a darker or brownish shade. Head small, posterior angles nearly acute, about as long as broad. Thorax not longer than greatest breadth. Epimerals all aculeate, increasing

in length from the first to the sixth; sixth and seventh equal. The lateral prolongations of the first five abdominal segments are as long on either side as half the rest of the segment, and those of the fifth segment project beyond base of stylets. The last segment is as long as the five preceding together. The shorter branch of the caudal appendages is about two-thirds as long as the longer. Antennæ short and slender, each pair seven-jointed, posterior a little the longer. Eyes scarcely apparent at the posterior angles of the head. Legs increase in size from first pair to sixth; seventh more slender than the preceding. First joint in all nearly cylindrical; second, third, and fourth joints together shorter than the first, except in the seventh pair, in which they are about as long as the first. Claw of seventh pair about half the size of that of the preceding pair. Branchial plates beneath abdomen oblong; exterior one with a very short transverse basal joint, the inner margin of which forms an angle posteriorly, which is subacute.

This is a broad species, like the *depressa*; but the anterior thoracic segments are not laterally prolonged, as in that species. The sixth and seventh thoracic epimerals are shorter than in the *Blainvillii*, and longer than in the *maculata*, or *aculeata*; moreover, the three posterior thoracic segments are acute on either side, unlike the *maculata* or *affinis*.

NEROCILA LATIUSCULA.

Corpus ovatum, sesqui longius quam latum. Thorax parce oblongus, segmentis 5 anticis latere obtusis, duobus posticis acute productis; epimeris 2 anticis lateris utriusque extremitate rotundatis, proximâ subacutâ, reliquis acutis, sextâ basin 7mæ non attingente. Abdomen vix oblongum, segmento 5to basin stylorum utrinque attingente, segmento 6to paulo transverso, postice rotundato, medio emarginato (?). Styli caudales longi, ramis inaequis, externo styliformi.

Body ovate, one and a half times as long as broad. Thorax sparingly oblong; five anterior segments obtuse, last two acutely produced into a spine either side; epimerals of first two segments obtusely rounded, next subacute, the rest acute; sixth not reaching to base of seventh. Abdomen hardly oblong; fifth segment prolonged either side to base of caudal stylets; sixth segment a little transverse,

rounded behind, emarginate (?) at middle. Caudal stylets long, branches unequal, outer branch styliform.

Plate 50, fig. 7 *a*, body, enlarged one and a half diameters; *b*, side view, showing epimerals, enlarged two diameters.

Rio Janeiro.

Length, one inch; breadth, six to six and a half lines. Like the *maculata* and *affinis*, the five anterior thoracic segments are obtuse either side; but the epimerals are not all acute, those of the second and third thoracic segments being rounded, and as long as the tergal part of the segment, and those of the third segment are hardly acute. In the right caudal stylet, the outer branch is obtuse, and the inner branch is the longer and substyliform; while in the left, the inner is the shorter and is obtuse, and the right is long and slender styliform. The posterior legs are smaller than the penult.

NEROCILA BRASILIENSIS.

Corpus duplo longius quam latum, oblongo-ellipticum valde convexum.

Thorax oblongus, segmentis 3 posticis lateraliter acutis sed non valde divaricatis. Epimeræ acuminatæ, lateris utriusque 3 4ve posticæ acutæ.

Abdomen vix oblongum, segmentis quinque lateraliter productis, præcipue duobus anticis, ultimo scutiformi ad basin latiore, paululo transverso, postice semicirculari sed medio paulo angulato, obtuso. Styli caudales abdomine multo longiores, ramis inæquis, externo fere cylindrico, acuminato, interno compresso.

Body long-elliptical (twice as long as broad), very convex. Thorax much longer than broad; three posterior segments laterally acute, points prominent, but not much divaricated. Epimerals acuminate, those of fifth, sixth, and seventh segments acute. Abdomen hardly oblong; first five segments laterally produced, especially the two anterior, the fifth but little wider than following segment; last segment scutiform, broader at base, distinctly shorter than broad, posteriorly semicircular, with the middle angulate, obtuse. Caudal appendages straight, acute; outer branch nearly cylindrical, acuminate; inner compressed.

Plate 50, fig. 8 *a*, dorsal view; *b*, first antenna; *c*, second antenna; *d*, caudal appendage; *e*, side view, showing epimerals.

From the body of a fish, Rio Janeiro.

Length, about one inch. Colour, mostly brownish black. Head semicircular in front. Epimerals oblong, pointed, and those of the last three segments acute. Inner angle of base of caudal appendages prolonged and acute. Lateral processes of two anterior abdominal segments longest, each nearly one-half the breadth of the rest of the segment; the others rather long and about equal. Claw of third pair of legs scarcely smaller than that of second. Seventh pair of legs more slender than sixth, and claw much smaller.

This species is unlike the *maculata* and *affinis* in having the three posterior thoracic segments either side acutely prolonged, and in this character agrees with the *aculeata*, from which, however, it differs in its stylets, neither branch of which is truncate, and in the epimerals, only the three posterior of which are properly acute. Its acute branches of the caudal stylets and the character of the epimerals remove it from the *bivittata*. The epimerals of the third and fourth segments project a little posterior to the segments and are obtusish; while the fourth reaches about as far as the segment; and the fifth and sixth fall short of the posterior outline of the segment.

NEROCILA ACULEATA.

Plate 50, fig. 9 *a*, animal, dorsal view; *b*, anterior antennæ; *c*, caudal stylets.

From the body of a fish, Rio Janeiro.

The specimens referred to this species are similar to those of the *brasiliensis* in the thoracic segments; but the inner branch of the stylets is obliquely truncated, and the outer is hardly acute; and the caudal segment is but slightly transverse. Length, about one inch. Colour, light brownish black. Head subtruncate in front. Epimerals of second, third, and fourth segments rather short and obtuse; of three posterior long and acute. Claw of third pair of legs

a little smaller than that of second, posterior leg more slender than preceding, and claw smaller. Anterior antennæ rather the largest, eight joints, three basal largest. In the fact that the anterior epimerals are obtuse, the specimens do not agree with the description of the *aculeata*.

NEROCILA ARMATA.

Corpus angustum (plus duplo longius quam latum), oblongo-ellipticum. Segmenta thoracis 1mum 4tumque lateraliter breviter acuta, 3 postica elongatè producta instar spinæ longæ et divaricatæ. Epimeræ totæ acutæ, segmentorum 2di 3ti que longæ et marginem lateralem multo superantes, reliquæ breves, 6tâ basin 7mæ non attingente. Abdomen oblongum, segmentis duobus anticis lateraliter longè productis et reflexis, sequentibus breviter productis, ultimo paulo oblongo, scutiformi, ad basin parce latiore, apicemque obtusi-angulato. Appendices caudales ultra abdomen elongatæ, ramis acutis, interno fere dimidio brevior.

Body narrow elliptical, length, considerably more than twice the width. First and fourth segments of thorax with an acute tooth on either side; the fifth, sixth, and seventh prominently produced into a spine, which is divaricate. Epimerals all acute, those of second and third segments long, much exceeding lateral margin of segments; the others short, sixth not reaching base of seventh. Abdomen oblong, two anterior segments much produced laterally, and reflexed; next three short produced; last a little longer than broad, scutiform, slightly broadest at base, obtusely angled at apex. Caudal appendages elongate, extending much beyond the abdomen, branches acute, inner nearly half the shorter.

Plate 50, fig. 10 *a*, animal; *b*, ventral view, enlarged; *c*, side view, showing epimerals, enlarged three diameters; *d*, stylet.

From the body of a fish, Rio Janeiro.

Length, one inch. Colour, whitish, or white with three longitudinal brown or purplish-brown bands, one central and the other two along the sides. The second and third segments of the thorax

which have the longest epimerals, have no spine or tooth on either side; the epimerals of these segments are full one-half longer than the length of the segment along the back. The lateral process of the two anterior abdominal segments is bent backward, and reaches even beyond the line of base of last segment. Outer branch of caudal appendages extends nearly half its length beyond the abdomen, and is almost twice as long as inner; inner angle of base prolonged and acute. Eyes scarcely visible, very pale. Anterior antennæ seven-jointed, posterior ten-jointed; first joint of anterior longest, and penult longer than either of the two preceding; first joint of posterior short, second longest. Third pair of legs little smaller and with smaller claw than either of the two preceding; seventh pair more slender than preceding, the basal joint about as long as the remaining portion, while in the other legs it is nearly twice as long as the following joints; claw also half smaller. Five pairs of thoracic membranous leaflets, arising from base of five anterior pairs of legs; eggs below, as in *Cymothoa*. Distance between the fifth, sixth, and seventh legs larger, the anterior legs rather crowded.

NEROCILA TENUIPES.

Corpus angustum, oblongo-ovatum, paulo convexum. Thorax lateribus non armatus, segmentis duobus posticis lateraliter brevissimè acutis et strictè appressis. Epimeræ duæ posticæ utriusque lateris acutæ, 5ta subacutá, 6ta basin 7mæ non attingente. Abdomen vix oblongum, segmentis duobus anticis lateraliter longè productis, tribus sequentibus paulo productis, ultimo paululo transverso, scutiformi, posticè ad medium obtusi-angulato. Appendices caudales abdomine paululo longiores, angulo basis interno obtuso, ramis fere æquis, externo obtuso, interno parce breviorè, obliquè truncato.

Body narrow, oblong-ovate, little convex. Thorax with the sides not armed, last two segments very short acute either side and close appressed. Two posterior epimerals either side acute; the fifth subacute, sixth not reaching to base of seventh. Abdomen a little oblong, first two segments long-produced on either side, next three short-produced; last not as long as broad, scutiform, at middle behind low obtuse-angled. Caudal appendages slightly longer than

the abdomen, inner angle of base obtuse, branches nearly equal, external, slightly the shorter, obliquely truncate.

Plate 50, fig. 11 *a*, dorsal view; *b*, ventral; *c*, side view, showing epimerals; *d*, antennæ; *e*, claw of legs; *f*, caudal appendage.

From Rio Janeiro—rare.

Length, three-fourths of an inch. Colour, brownish yellow, with three broad brown longitudinal lines. The thorax widens slowly from the head and attains its greatest width at the penult joint; the articulations are convex backward to that between the last and preceding segment, which is nearly straight or slightly convex forward. Epimeral of second segment scarcely longer than segment, obtusish; of third and fourth longer than segment; of fifth subacute, and reaching as far back as lateral margins of segment; of sixth and seventh very acute, and much shorter than lateral margin of the segments; of the seventh attached to seventh segment beneath lateral margin of sixth segment. The linear processes each side of first two abdominal segments about as long as half the width of the segment. Third pair of legs and claw much smaller than first or second; seventh pair more slender than the preceding, and distant from it; the basal joint about as long as following portion; claw about half as large as that of sixth pair. Claws of legs very long, and gibbous within near base.

Anterior pair of antennæ seven-jointed; posterior ten-jointed; first joint of anterior pair short, second largest and longest; of posterior pair, fifth longer than either of the terminal *five*.

This species resembles the *aculeata* in the oblique truncation of the inner branch of the caudal appendages; but the inner angle of the basal portion is obtuse, the general form is different, the body narrower and the antepenult thoracic joint is not acute, and is quite closely appressed to the following on either side.

SUBFAMILY ÆGATHOINÆ.

GENUS ÆGATHOA, Dana.

Corpus angustum, elongate ellipticum, ad abdominis basin non interruptum (abdomine non angustiore), segmentis thoracis subæquis, abdo-

minis parce minoribus, ultimo scutiformi. Caput subtriangulatum, segmento proximo parce angustius. Oculi pergrandes. Epimeræ segmentorum abdominis triquetræ, non spiniformes. Lamellæ caudales ciliatæ.

Body narrow and long elliptic, not interrupted at base of abdomen (abdomen not being here narrower than thorax), segments of thorax subequal, those of abdomen sparingly shorter, the last scutiform. Head broad subtriangular, but little narrower than next segment. Eyes very large. Epimerals of abdominal segments triquetrous, not spiniform. Caudal lamellæ ciliate.

The species of *Ægathoa* have the general habit of an *Æga*, although with the large hooked claws of *Cymothoa*. The abdomen and thorax are so evenly continuous, that no subdivision into these two parts is apparent in a dorsal view, and it is necessary to count off the thoracic number before pronouncing which is the first abdominal. The sides of the thorax form an unbroken line without projecting spines or teeth. In the breadth and size of the head, as well as the ciliate caudal lamellæ, they are unlike the *Cymothoinæ*; while in the non-ciliate branchiæ and other characters, they are related to that group.

ÆGATHOA MACROPHALMA.

Oculi pergrandes, latera capitis omnino tegentes, antice bene approximati super caput angulati. Caput non transversum. Styli caudales subæqui, abdomine vix longiores, externo parce longiore et angustiore, interno lato, rectè truncato, angulis rotundatis.

Eyes very large, quite covering the sides of the head, and approaching one another rather nearly anteriorly, on top of head having an angle in the outline. Head not transverse. Caudal stylets hardly longer than abdomen, subequal, the outer little the longer and narrower, inner broad and straight truncate at apex, with the angles rounded.

Plate 50, fig. 12 *a*, animal, enlarged three diameters; *b*, oblique side view of part of abdomen, showing epimerals; *c*, leg of fifth pair; *d*, leg of seventh pair; *e*, caudal stylets.

Nassau Bay, Fuegia? Rio Janeiro?

Length, one-half an inch. The outer caudal lamella has its outer side nearly straight or but slightly arcuate, and the inner projecting somewhat into an angle. The head is longer than the first abdominal segment, and the antennæ are short, not as long as breadth of head. The last abdominal segment is about as long as broad, or scarcely longer, somewhat broadest at base and slightly angled at extremity.

ÆGATHOA LATICEPS.

Æ. macrophthalmæ affinis. Caput parce latius et brevius, vix transversum. Oculi grandes, antice remotiores, super caput marginibus oculorum rectis et inter se postice propinquioribus.

Near *Æ. macrophthalma*. Head a little broader and shorter, slightly transverse. Eyes large, more remote anteriorly, the outline on top of head straight, and those of the two eyes nearest behind.

Plate 50, fig. 13, animal, enlarged three diameters.

Nassau Bay, Fuegia? Rio Janeiro?

Length, half an inch. The eyes in an upper view are nearest to one another on the posterior part of the head at the articulation, and the margins as here seen diverge forward, so as to be nearly twice as far apart anteriorly.

FAMILY II. ÆGIDÆ.

SUBFAMILY ÆGINÆ.

THE species of this subfamily are often found attached to the body of fishes; while the Cirolaninæ do not appear to be parasitic in habit.

GENUS ÆGA, *Leach.*

ÆGA EFFERATA.

Corpus sat angustum, nudum. Segmenta thoracis subæqua, segmentis quatuor posticis quoad epimeras acutis et strictè appressis. Abdomen 6-articulatum, thorace subito angustius, lateribus parallelis, articulo sexto subtriangulato, ad basin latiore, latitudine parce brevior, extremitate rotundato et ciliato. Appendices caudales abdominem vix superantes, apice rotundatæ, angulo basis interno producto et acuto, lamellâ internâ paulo longiore, duplo latiore.

Body rather narrow, naked. Segments of thorax subequal, four posterior segments having the epimerals acute and closely appressed. Abdomen six-jointed, abruptly much narrower than thorax, sides parallel, sixth segment subtriangular, broadest at base, slightly shorter than its breadth at base, extremity rounded and ciliate. Caudal appendages scarcely extending beyond abdomen, rounded at apex, inner angle of base prolonged and acute, inner lamella a little the longer and twice the broader.

Plate 51, fig. 1 *a*, animal, enlarged; *b*, antennæ; *c*, one of the three anterior pairs of legs; *d*, one of the four posterior pairs; *e*, caudal stylet.

From a Serranus (?), harbour of Rio Janeiro. December, 1838.

Length, three lines. Colour, yellowish. Head short, posterior margin concave, and applied against the entire convex anterior margin of first thoracic segment. The acute angle of the four posterior thoracic segments belongs properly to the epimerals. Four anterior abdominal segments equal and similar; sixth about as long as five preceding. Caudal lamellæ extend to same line with apex of abdomen; the ciliation rather long, being nearly two-thirds as long as the branches. Anterior margin of first pair of antennæ on a line with the front margin of the head; basal joints followed by five shorter and smaller; second pair one-half the longer, not one-third the length

of the body; three basal joints observed, the second longest; flagellum ten-jointed, joints near the middle longest. Legs increase in length from the first to the seventh pair; anterior have the inner apex of antepenult joint prominent and armed with a short spine, which is opposed to the claw in clinging. Claws of eight posterior legs little curved.

ÆGA NOVI-ZEALANDIÆ.

Corpus nudum, sat angustum. Caput perbreve. Segmentum thoracis anticum longius, segmentis reliquis longitudine subæquis. Abdomen thorace subito non angustius, sensim latitudine decrescens, 6-articulatum, segmento 1mo partim celato, ultimo vix transverso, non triangulato, extremitate latè rotundato, breviter ciliato. Appendices caudales abdomine non longiores, breviter ciliatæ.

Body naked, rather narrow. Head very short. First thoracic segment longest, others subequal; abdomen not abruptly narrower than thorax, gradually narrowing, six-jointed, posterior segment broad but not transverse, not triangular, broadly rounded at extremity and ciliate. Caudal appendages not longer than abdomen.

Plate 51, fig. 2 *a*, animal, enlarged; *b*, anterior antenna; *c*, posterior antenna.

New Zealand, at Bay of Islands. Came up on bait while fishing.

Length, three lines. Colour, dirty brown. Length of posterior antennæ, about twice the breadth of the head; flagellum over twenty-jointed, joints short. Anterior antennæ more than half the length of posterior. The breadth of last abdominal segment at apex about half its breadth at base. Third and fourth segments of abdomen laterally much recurved and acute.

My notes fail to give the character of the feet, so that there is a little uncertainty whether the species is an *Æga* or a *Cirolana*; although its relation to *Æga* is most probable, since the bases of the antennæ are concealed by the head, as in our specimens of the *efferrata*, and they are not so in our *Cirolanæ*.

ÆGA MULTIDIGITA.

Dorsum corporis dimidio postico laxè pubescens. Segmentum abdominis ultimum precedentibus duplo longius, bene triangulatum, parce transversum, apice paulo obtusum. Lamellæ caudales extremitatem abdominis parce superantes, interior paulo latior et margine externo fere recta. Antennæ 2dæ longæ, segmentum thoracis 5tum attingentes. Tarsus pedis 1mi 2dive quatuor spinis oblongis crassis obtusis infra armatus et extremitate altero longiore deflexo, pedis 3tiii tribus spinis perbrevibus tuberculiformibus. Articuli pedum 6 posticorum nudiusculi præter apices articularum breviter spinulosas.

Back of body, through its posterior half lax pubescent. Last abdominal segment twice as long as all the preceding, triangular, a little transverse, somewhat obtuse at apex. Caudal lamellæ reaching a little beyond extremity of abdomen, inner lamella the broadest and nearly straight on its outer margin. Antennæ of second pair long, reaching to fifth thoracic segment. Tarsus of feet of first or second pair having the terminal spine flexed downward nearly at right angles with the preceding part, and on under side four oblong stout obtusish spines; tarsus of third pair with three similar spines, but obsolescent and like tubercles. Joints of last six feet nearly naked, excepting their apices, which are set with spinules or setæ.

Plate 51, fig. 3 *a*, animal, enlarged; *b*, under view, showing antennæ; *c*, leg of first pair; *d*, extremity of leg of second pair; *e*, ibid. of third pair; *f*, ibid. of sixth pair.

Balabac Passage, north of Borneo.

Length of body, three lines. The tarsi of the six anterior legs are very peculiar, as described. The preceding joint in the first pair is naked below; but in the second pair there are four short and stout spines, and in the third pair a tuft of short hairs at apex. The fifth joint of the sixth pair is slender, and has two pairs of minute spinules or setæ (not half the width of the joint in length), on lower side, besides others at lower and upper apices; the tarsus is nearly straight,

about half as long as the sixth joint, and somewhat gibbous below, with a minute seta below in advance of the gibbosity, and another above. The apex of the third and also that of the fourth joint is mostly set around with spines, in part about as long as the breadth of the joint at apex. The seventh pair is stouter and a little longer than the sixth.

GENUS PTERELAS, Guérin.

The specimen we refer to the genus Pterelas, has all the three anterior pairs of legs subdidactyle, and the process on the penult joint of the legs is hatchet-shape. It may, perhaps, be properly the type of a new genus; yet it seems to be preferable with our present knowledge to modify the characteristic of Pterelas so as to include it, this genus hitherto embracing only species having the second and third legs subdidactyle, while the first pair is ancoral simply.

PTERELAS MAGNIFICUS.

Corpus læve, sat angustum, ad abdominis basin non interruptum. Caput transversum, oculis grandibus paulo remotis. Pedes 6 antici subdidactyli, articulo penultimo processu lato axiniformi armato, articulo 3tio brevi, et spinibus brevibus infra armato, 8 postici spinulis paucis appressis armati. Abdomen 6-articulatum, segmentis 5 anticis subæquis, ultimo subtriangulato, lateribus arcuate dilatatis, extremitate subacutâ. Styli caudales abdomine parce longiores, basi producto et paulo brevioribus quam rami, ramis angustis, longitudine fere æquis, externo angustiore, interno ad apicem extus dilatato.

Body smooth, rather narrow, not interrupted at base of abdomen. Head transverse, eyes large but rather remote. Six anterior feet subdidactyle, the penult joint with a broad axiniform process; third joint short, and having a few very short spines on under surface. Abdomen six-jointed, five anterior segments equal in length, last subtriangular, with sides arcuately dilated, extremity subacute. Caudal stylets slightly projecting beyond abdomen, base produced and a little shorter than branches, branches narrow, equal, outer narrowest, inner with apex dilated on outer side.

Plate 51, fig. 4 *a*, animal, enlarged one and a half diameters; *b*, front view of front; *c*, leg of second pair; *d*, leg of seventh pair; *g*, caudal stylet; *e*, epimeral of first segment; *f*, epimeral of seventh segment.

Nassau Bay, Fuegia.

Length of body, fourteen lines; breadth, four and one-half lines. Colour, according to a sketch by Mr. J. P. Couthouy, bluish in the three posterior segments of the thorax, with the middle of the back bordering on a slate-green, and the lateral portions of the four anterior segments of the thorax and the abdomen a rose-red. The antennæ of the second pair are of sufficient length to reach to second thoracic segment; those of the first pair are half shorter; the latter meet at base on the medial line, and the first joint is very broad, being a little transverse and marginate below. The surface of the body is shining, and the texture of the shell is hard. The three posterior segments of the thorax are longer than the three next anterior, as in *Nerocila*. The short spines on the under side of the six anterior legs are evidently to aid in crawling, while the claw is used for prehension; the eight posterior legs are cylindrical, with a few spinules at apex of joints, and on their under surface. The abdomen and stylets are short ciliate.

The epimerals have two oblique (nearly longitudinal) lines on each. The posterior is nearly an oblique parallelogram in form, the lower posterior angle being considerably prolonged and subacute.

SUBFAMILY CIROLANINÆ.

GENUS CIROLANA, *Leach*.

The similarity in general character between the following two species, and the partly concealed first abdominal segment of the first while the same is wholly concealed in the second, seem to show that the distinction between *Cirolana* and *Eurydice* is generically of small importance.

CIROLANA ARMATA.

Corpus sat angustum, dorso nudum, ad abdominis basin paulo interruptum. Caput multum transversum. Abdomen paulo oblongum, segmento 1mo partim celato; ultimo subpentagono, non oblongo, postice obtuso, longissime ciliato. Styli caudales abdominem multo superantes, ramis latis, extremitate obliquè truncatis, interno duplo latiore, parce longiore, triangulato, ciliis longissimis (ramos longitudine æquantibus). Pedes toti spinis et setis longis densè armati. Antennæ 1mæ 2dæque longitudine subæquæ.

Body rather narrow, naked above, a little interrupted at base of abdomen. Head very transverse. Abdomen a little oblong, first segment partly covered; last segment subpentagonal, not oblong, obtuse behind, very long ciliate. Caudal stylets extending much beyond the abdomen, branches broad, at apex obliquely truncate, inner branch twice the broader, a little the longer, triangulate, ciliation as long as the branch. All the feet thickly armed with spiniform setæ, and slender setules. Antennæ of first and second pairs subequal in length.

Plate 51, fig. 5 *a*, head, much enlarged, the antennæ except basal joint, concealed by being thrown back under the sides of the body; *b*, abdomen; *c*, part of flagellum of second antennæ; *d*, leg of third pair; *e*, extremity of leg of sixth or seventh pair.

Rio Janeiro.

Length, four lines. The densely spinulous legs, the very broad triangular inner branch of the caudal stylets, the very long plumose ciliation of the stylets and extremity of the abdomen, are distinguishing characters. The stylets are narrow in the *hirtipes*, according to Edwards's figure (Cuv., pl. 67, f. 6), and the ciliation is short. The second antennæ when thrown back just reach to the fifth thoracic segment; the flagellum has ten joints, these joints are a little oblong, and have several spinules or setæ about the outer apex, and longish hairs on the inner side. The abdomen tapers slightly from its base; the

last segment has its sides slightly converging, and then towards its extremity there is a sudden convergence to the rounded apex.

CIROLANA LATISTYLIS.

Corpus læve, nudum, ad abdominis basin vix interruptum. Caput transversum, antice rotundatum, segmento proximo non longius. Abdomen 6-articulatum, segmento 1mo sub thorace fere celato; ultimo subtriangulato, paulo oblongo, extremitate late rotundato et crenulato, spinulis et pilis longiusculis ornato. Appendices caudales abdomen non superantes, lamellâ internâ latè subovatâ, pilis et spinulis ac in segmento caudali, pilis dimidio lamellæ brevioribus, externâ plane brevior, duplo angustiore.

Body smooth, naked, but slightly interrupted at base of abdomen. Head transverse, anteriorly rounded, not longer than next segment. Abdomen six-jointed; first segment nearly concealed under the thorax; caudal segment subtriangular, a little oblong, broadly rounded at extremity and crenulate, and ornate with spinules and shortish hairs. Caudal appendages not reaching beyond line of abdomen, inner lamella broadly subovate, having crenulations, spinules, and hairs like the caudal segment; the hairs not half as long as the lamella; outer lamella considerably the shorter and half narrower.

Plate 51, fig. 6 *a*, abdomen, much enlarged; *b*, part of flagellum of longer antennæ; *c*, leg of third pair.

Straits of Balabac, north of Borneo.

Length of body, three lines. The legs of the three anterior pairs are rather spiny below, especially the third joint; the fourth joint of the third pair is a little shorter than either the third or fifth pairs, and longer than the tarsus. The spinules of the extremity of the abdomen arise from the bottom of the crenulations. The joints of the flagellum of the second antennæ are quite oblong; there is a hair or two at upper apex as long as the diameter of the joint, and another below, a little shorter.

CIROLANA (EURYDICE) ORIENTALIS.

Corpus sat angustum, dorso nudum, ad basin abdominis interruptum. Caput multum transversum. Abdomen paulo oblongum, 5-articulatum, segmentis 4 anticis longitudine æquis, ultimo subtriangulato, lateribus arcuato, postice rotundato, brevissimè ciliato. Styli caudales abdomen superantes, ramis angustis, breviter ciliatis, externo angustiore, parce longiore, apice rotundato, interno angustè triangulato. Pedes sat nudi, spinulis brevibus paucis armati. Antennæ 2dæ multo longiores, segmentum thoracis 4tum fere attingentes.

Body moderately narrow, naked above, interrupted at base of abdomen. Head much transverse. Abdomen a little oblong, five-jointed, four anterior segments of equal length; last subtriangular, sides arcuate; behind rounded, very short ciliate. Caudal stylets extending beyond abdomen; branches narrow, short ciliate; outer narrow, slightly longer, apex rounded; inner triangular. Feet almost naked; a few short spinules. Second antennæ much the longer, reaching nearly or quite to fourth thoracic segment.

Plate 51, fig. 7 *a*, head, much enlarged and thrown up obliquely, so as to show the process between the antennæ; *b*, abdomen; *c*, part of leg of first pair; *d*, *ibid.* of fifth pair.

Sooloo Sea.

Length, five lines. The first antennæ when thrown back reach to second thoracic segment nearly; and also half way to extremity of flagellum of second pair; the first basal joint is quite broad. The eyes are of moderate size, and the facets are rather large. The tarsus of all the legs has a short spine, not far from the apex on inner side. The sides of the last thoracic segment project as far backward as to the third abdominal segment.

GENUS CORALLANA, *Dana*.

Cirolanæ affinis. Epistoma antice valde transversim lineare juxtaque bases antennarum 1marum insitum. Antennæ 1mæ basi contiguæ.

Related to *Cirolanæ*. The epistome anteriorly very broad and transversely linear, and situated against the bases of the anterior antennæ. The anterior antennæ contiguous at base.

The general habit of the species here included is like that of the *Ægæ* and *Cirolanæ*; and the position of the bases of the antennæ is somewhat as in *Æga*. But the epistome is very short, being transversely linear, and the second pair of antennæ seem to come out partly from under it.

CORALLANA HIRTICAUDA.

Corpus sat angustum, dimidio postico dorsi hirsutum usque ad abdominis extremitatem. Caput parce transversum. Oculi grandes. Antennæ valde inæquæ; 2dæ longæ segmentum thoracis 5tum attingentes, flagello fermè 18-articulato; 1mæ basi 2darum parce longiores. Abdomen 6-articulatum, segmento ultimo triangulato, lateribus recto, extremitate rotundato. Styli caudales abdominem non superantes, ramis obtusis, externo multo angustiore, non longiore. Pedes breviter setulosi.

Body moderately narrow, posterior half of back to extremity of abdomen hirsute. Head a little transverse. Eyes large. Antennæ very unequal; second pair long, reaching to fifth segment of thorax; flagellum about eighteen-jointed; first pair not much longer than base of second. Abdomen six-jointed, last segment triangular; sides straight; extremity rounded. Caudal stylets not extending beyond abdomen, branches obtuse, outer much the narrower, not longer than the inner. Feet short setulose.

Plate 51, fig. 8 *a*, animal, enlarged three and a half diameters; *b*, head, seen from above, more enlarged; *c*, head, seen obliquely, from above and forward, showing its actual form and the position of the antennæ; *d*, antennæ (*a*¹ and *a*²) seen obliquely from below, showing the epistome (*e*) and their bases; *e*, extremity of leg of fifth pair.

From the coral reefs of Tongatabu, where it was found in cavities in dead coral.

Length, nearly five lines. The posterior margin of the fourth thoracic segment is short pubescent; that of the next and others following, including the abdominal segments, is longer hairy. The epimerals are very distinct.

FAMILY III. SPHEROMIDÆ.

SUBFAMILY SPHEROMINÆ.

GENUS SPHEROMA.

1. *Abdomen posticè integrum.*

a. Segmenta thoracis nulla medio marginis postici vel processum vel dentem gerentia.

SPHEROMA GIGAS, *Leach.*

Plate 52, fig. 1, represents an under view, showing the caudal stylets and outline of the abdomen.

New Zealand, along shores of Bay of Islands.

The specimens here referred were four to five lines in length. Colours, brown to brownish black, with some irregular whitish spots. The caudal lamellæ do not quite reach to the line of the extremity of the abdomen; they are lamellate, the inner rounded at extremity, but subacute. The last segment of the abdomen is evenly convex, with the sides arcuate (and not sinuous), and extremity rounded and moderately narrow. The surface of the body is smooth, but some appearance of granulation may be detected under a high magnifying power.

SPHEROMA LANCEOLATA, *White.*—Plate 52, fig. 1 *a*, view of mouth;

b, c, mandible, in different positions; *d*, lower lip; *e*, maxilla of first pair; *f*, maxilla of second pair.

Nassau and Good Success Bay, Fuegia, along shores, under stones.

This species, as collected in Nassau Bay, where it is common and of large size, has the following characters. Three posterior thoracic segments scarcely shorter than three preceding. Caudal lamellæ lanceolate, equal, both obtuse; the inner reaching as far back as line of apex of abdomen. Outline of abdomen arcuate either side, and rather narrowly rounded at apex; its surface evenly convex, so that a medial longitudinal line is very nearly straight, or with a slight convexity. The epistome is but little broader posteriorly than its length. Flagellum of second antennæ eighteen to twenty-jointed. The texture of the shell corneous, as usual. Mandible with black or brownish-black summits; in a profile view (showing the breadth of the summit, the triturating edge extending inward from the ventral surface in the animal), there are three tooth-like prominences; the apical two are stout, oblong, and corneous, obtusely pointed; the outer has a notch just below the summit, and the other bears a cluster of setæ, the lower of which are gradually longer; the third prominence has a broad truncate summit, which is minutely scabrous or denticulate. The palpus of the mandible consists of three oblong joints; the second is longest, and on outer apex there are a few ciliæ; the third joint is curved acute, and has a few short setæ on the margin below the apex. Lower lip bilobate, lobes large, rounded, margin edged with extremely short spines or stiff hairs. Upper lip subtriangular, nearly equilateral, anterior angle broad and rounded, posterior side convex, others concave.

SPHEROMA CALCAREA.

Testa calcarea, levis. Thorax posticè paulo latior et depressior. Segmentum abdominis posticum subtriangulatum, superficie convexum, extremitate paulo productum angustum et obtusum. Appendices caudales abdomine parè breviores, lamellis subæquis, lanceolatis, obtusis. Pedes mediocres, articulis 3tio 4to 5toque densè villosis. Flagellum antennarum 2-darum 14-16-articulatum.

Shell calcareous, smooth. Thorax little broader posteriorly and somewhat more depressed; posterior segment of abdomen subtriangular, surface convex, apex a little produced, narrow, obtuse. Caudal appendages reach almost to line of apex of abdomen, the two lamellæ subequal, lanceolate, obtuse. Legs moderately short, three joints before the last densely villous. Flagellum of inferior antennæ fourteen to sixteen-jointed.

Plate 52, fig. 2 *a*, animal, enlarged; *b*, under view of mouth; *c*, inferior antennæ.

Latitude 46° 53' south, longitude 65° 11' west, off Fuegia, in fifty fathoms water. Collected by Lieut. Case.

Length, six-tenths of an inch; breadth, three-tenths of an inch. Finely coloured; but as Lieut. Case placed in my hands only specimens in alcohol, the exact colours were not ascertained; probably yellow, with large regularly arranged spots of reddish purple; these spots largest on the four anterior segments. The calcareous texture is quite peculiar. The first thoracic segment is, as usual, the longest; the next three are about equal, and longer than the following three; lateral portions of the segments abruptly inflexed. The last segment of the abdomen has a smooth even surface, but the median longitudinal line is a little concave towards the extremity. The interval between the two emarginations in the basal margin of this joint about equals one-third the length of this margin, which is much less than the same in the *lanceolata*. Length of the inferior antennæ, rather greater than width of head. Claw of legs short and dark-coloured; a short spine just below base of claw. Maxillipeds nearly as in the *lanceolata* (see figure). Tips of mandibles brownish black. Lower lip with the anterior margin hairy.

SPHEROMA CHILENSIS.

Corpus læve. Abdomen prominentiis duâbus obsoletis supernè ornatum, segmento caudali brevi, postice latè rotundato. Styli caudales abdomen non superantes, lamellâ internâ extus arcuatâ, apice subacutâ, externâ rectè lanceolatâ, apice rotundatâ. Flagellum antennarum 1marum 5-articulatum.

Body smooth. Abdomen with two obsolete prominences above, caudal segment short, very broadly rounded behind. Caudal stylets reaching just to line of extremity of abdomen; inner lamella arcuate on outer side, subacute at apex; outer, straight lanceolate, rounded at apex.

Plate 52, fig. 3 *a*, animal, enlarged six diameters; *b*, under view of abdomen, in outline; *c*, antenna of first pair.

Valparaiso, Chili.

Length of body, two lines. The prominences on the last abdominal segment are barely apparent, and have the same position as those in the *armata*.

SPHEROMA OREGONENSIS.

Corpus læve. Segmentum caudale breve, posticè latissimè rotundatum, supra læve. Styli caudales abdomen non superantes, lamellâ internâ multo longiore quam externa, fere obtusâ, externâ obtusâ. Flagella antennarum 1marum 2darumque 12-14-articulata.

Body smooth. Caudal segment short, very broadly rounded behind, smooth above. Caudal stylets not reaching beyond line of extremity of abdomen; inner lamella much the longer, nearly obtuse; outer obtuse. Flagella of antennæ of both pairs twelve to fourteen-jointed.

Plate 52, fig. 4 *a*, animal, enlarged three diameters; *b*, part of antennæ of second pair; *c*, under view of extremity of abdomen, showing caudal appendages.

Puget's Sound, Oregon; also, Bay of San Francisco, California. Collected by Dr. C. Pickering.

Length of body, four and a half lines. This species is near the *chilensis*; but the lamellæ of the caudal appendages are much more unequal, the flagellum of the first antennæ has many more joints, and the abdomen is more broadly rounded behind.

SPHEROMA OBTUSA.

Corpus læve, nudum. Segmentum abdominis posticum subtriangulatum, lateribus prope apicem subito convergentibus, apice obtuso; concavitate ventrali posticè latâ. Lamellæ caudales abdomine plane breviores, integræ, ad apicem ambæ truncatæ. Pedes læves, fere nudæ, æquè tenues; secundi primis tertiusve longiores.

Body smooth, naked. Feet smooth, nearly naked. Segments of thorax similar. Last abdominal segment subtriangular, the sides towards apex abruptly convergent, apex obtuse; ventral cavity broad behind. Caudal lamellæ shorter than abdomen, entire, both truncate at apex. Feet smooth, nearly naked, all equally slender; second pair longer than first or third.

Plate 52, fig. 5 *a*, animal, enlarged; *b*, abdomen, under view.

Bay of Islands, New Zealand, along shores of Parua Harbour.

Length, three lines. Colours, dull yellow or brownish yellow. The first thoracic segment is nearly as long as the next two together. The outer of the caudal lamellæ has both sides slightly convex, and has the same width nearly at base and apex. Tarsus of the legs terminates obtusely and is furnished at apex with a very short and slightly curved hook, a short spine below the hook, and a slender pair of setæ between the two.

SPHEROMA VERRUCAUDA? *White.*

From Bay of Islands, New Zealand; found in rotten wood, in cavities bored by *Teredo*.

Length, seven lines. Colour, dirty gray, and without lustre. In the specimens referred to this species, the surface has a tomentose appearance and is granulous. Abdomen with a granular surface and

slightly prominent either side of medial line, behind broad truncate entire. Caudal appendages small, not shorter than abdomen, outer lamella obliquely truncate at apex and 3-4-dentate (Plate 52, f. 6), inner lanceolate and subacute. In the dentate outer lamella, this species differs from all the preceding. Flagellum of anterior antennæ about seven-jointed; of posterior, fifteen to eighteen-jointed; posterior antennæ very slender; anterior with basal joint stout. First three pairs of legs more slender than the following; second pair longer than first or third; from fourth to seventh gradually increase in length. Abdomen broadly truncate, so that the posterior margin is half as long as basal, or even exceeds this; ventral cavity of abdomen broadly rounded at apex.

Spheroma verrucauda? A. WHITE, Voyage of Erebus and Terror, pl. 6, f. 1.

b. Segmentum thoracis 7^{mo} medio marginis postici dentem processumve gerens.

SPHEROMA ARMATA, *Edwards.*

Bay of Islands, New Zealand, along rocky shores.

Body smooth, a little shining, under a high magnifier granulous. Seventh thoracic segment having a tooth behind, the tooth sometimes obsolescent; last segment of abdomen triangular, sides obsoletely sinuous, apex narrow and obtuse, dorsal surface near base with two slight prominences; cavity below narrow at apex (Plate 52, fig. 7); caudal lamellæ not reaching to apex of abdomen; inner truncate; outer acuminate, tip curved outward a little. Flagellum of anterior antennæ eight to twelve-jointed; of outer, fourteen to sixteen-jointed. The legs of the fourth to seventh pairs are hairy on the posterior side of third and fourth joints. Anterior three pairs nearly naked, and not more slender than the following; second pair longer than first; third about as long as second. Length, three to four lines. Colour, whitish, bluish white; also, brownish, with whitish spots.

SPHEROMA SPINIGERA.

S. armatæ similis. *Corpus depressius, læve, nudum, posticè ad apicem*

abdominis obtusius. Dens posticus segmenti thoracici septimi spiniformis, dimidio abdominis longior. Lamellæ caudales latiores et abdomen longitudine paulo superantes; externâ prope apicem obsolete serrulatâ.

Near *S. armata* in form, caudal lamellæ and abdomen above and below. Body more depressed, smooth, naked, apex of abdomen more blunt. Tooth of seventh thoracic segment elongate spiniform, longer than half the abdomen. Caudal lamellæ broader, and extending a little beyond the abdomen; outer near its apex obsoletely serrulate.

Plate 52, fig. 8 *a*, animal, enlarged; *b*, under view of antennæ; *c*, abdomen, under view.

In bored wood, and in pools of water along shores of Parua Harbour, Bay of Islands, New Zealand.

Length, three to four lines. Colour, brown or brownish green; some specimens with a longitudinal medial broad line of emerald green. This species is very near the *armata*. But its caudal lamellæ, though like those of the *armata* in form, extend beyond the apex of the abdomen, and are broader; and the spiniform process of the seventh thoracic segment is quite long.

2. *Abdomen posticè emarginatum vel fissum.*

SPHEROMA GLOBICAUDA.

Corpus fere læve, partim subtilissimè granulosum et pubescentulum. Abdomen subtriangulatum, præter partem versus margines valde tumidum, posticè unifissum, fissurâ profundâ et ad ejus extremitatem internam utrinque paulo transversim productâ. Appendices caudales abdomen parce superantes, lamellâ internâ latiore, parce longiore, apice latè rotundatâ, externâ quoad marginem externum valde reflexâ.

Body nearly smooth, in part very fine granulous and pubescent. Abdomen subtriangular, very tumid, excepting the part towards the margin around; at extremity a deep fissure, which at its inner end is produced a short distance transversely in either direction.

Caudal appendages reaching slightly beyond line of abdomen; inner lamella the broader and slightly the longer, broadly rounded at apex; outer having the external margin much reflexed.

Plate 52, fig. 9 *a*, animal, enlarged six diameters; *b*, abdomen, more enlarged.

Nassau Bay, Fuegia.

Length of body, two and a half lines. The fissure in the extremity of the abdomen is of peculiar depth and shape; the part of the surface of the abdomen anterior to its inner extremity is a little raised, independently of the general globose elevation which characterizes the whole segment anterior to this raised point. The minute hairs of the surface and slight granulation, are seen with a lens most distinctly on the caudal segment.

SPHEROMA SAVIGNII, *Edw.*

Corpus fere læve, subtilissime granulatum. Thoracis margines subtilissime et sparsim pubescentes. Segmentum abdominis posticum subtriangulatum, latitudine non longius, parte versus margines exceptâ valde tumidum, apice emarginato, emarginatione simplice, paulo oblongâ. Antennæ 2dæ flagello 10-12-articulato; 1mæ flagello 7-8-articulato. Styli caudales abdomine vix breviores, lamellis extremitate late rotundatis, externâ brevior vix angustiore.

Body nearly smooth, very minutely granulous. Margin of thoracic segments minutely and sparingly pubescent. Posterior abdominal segment somewhat triangular, about as long as broad, very tumid, excepting parts towards margins; at base much narrower than thoracic segment, near apex pubescent, sides arcuate, apex emarginate, emargination small, a little oblong. Second antennæ having the flagellum ten-jointed; flagellum of first pair seven-jointed. Caudal stylets scarcely shorter than abdomen; lamellæ broadly rounded at extremity, or subtruncate; outer the shorter; both entire.

Plate 52, fig. 10 *a*, animal, magnified six diameters; *b*, part of flagellum of second antennæ; *c*, antenna of first pair; *d*, margin of segments of thorax, much enlarged.

Harbour of Rio de Janeiro; caught in the cavities among Balani, on the shores of Rat Island.

Length, one-fifth of an inch. Colour of head, light greenish yellow, a central longitudinal line along thorax of same colour, which widens near the middle of the body; other parts deep brown, with some light spots. Colours sometimes faint.

Spheroma Dumerilii, AUDOUIN, Explic. des planches de M. Savigny, Egypte, pl. 12, f. 4.

Spheroma Savignii, EDWARDS, Crust., iii. 208.

SPHEROMA ORIENTALIS.

Corpus fere læve. Segmentum abdominis ultimum subtriangulatum, tumidum, dimidio vel tertio dorsi postico subito depresso, extremitate emarginato, emarginatione rectangulatâ, latiore quam profundiore. Appendices caudales laterales ciliatæ, extremitatem abdominis paulo superantes, externâ acutâ, internâ apice emarginatâ.

Body nearly smooth. Last segment of abdomen subtriangular in outline, tumid. Posterior half or third abruptly depressed, extremity bidentate, the emargination rectangular, broader than deep. Caudal appendages ciliate, extending a little beyond extremity of abdomen, outer acute; inner emarginate or bidentate at apex.

Plate 52, fig. 11 *a*, body, much enlarged; *b*, part of leg of one of three posterior pairs; *c*, lateral profile of abdomen, upper side, showing the abrupt depression of posterior part; *d*, under view.

Singapore.

Length of body, one and a half to two lines. The tarsus of the six posterior legs has a prominent spine or tooth on under side; preceding joints nearly naked, a spinule at lower apex. Segments of thorax

either side produced backward considerably; first segment of abdomen as long as three preceding thoracic segments. Inner caudal lamella somewhat denticulate on outer margin.

CASSIDINA LATISTYLIS.

Corpus sat angustum, multum convexum. Caput paulo transversum. Segmenta thoracis 2-7 subœqua. Abdominis segmentum ultimum parce brevius quam latum, extremitate latè rotundatum, truncatum. Styli caudales abdomen paulo superantes, lamellâ internâ perlatâ, subtriangulatâ, extremitate obliquè truncatâ, externâ parvulâ oblongo-ovatâ, subacuminatâ, triplo breviorè et plus triplo angustiorè quam interna.

Body rather narrow, much convex. Head somewhat transverse. Segments of thorax from second to seventh subequal. Abdomen sparingly shorter than broad, broadly rounded at extremity, and truncate. Caudal stylets extending a little beyond line of abdomen, inner lamella very broad, subtriangular, extremity oblique truncate; outer oblong-ovate, subacuminate, quite small, one-third the length and less than one-third the breadth of the inner lamella.

Plate 52, fig. 12 *a*, animal, enlarged two diameters; *b*, under view of abdomen; *c*, upper view of caudal appendage; *d*, under view of head, showing mouth, antennæ, and anterior legs (except part of the leg on the right in the figure); *e*, extremity of leg of fourth pair.

Locality doubtful.

Length of body, six and a half lines; breadth, three lines. The front has nearly the same outline as in Amphoroidea. A median process extends downward between the bases of the superior antennæ, which bases are rather broad. The legs are very nearly naked; the tarsus of the different legs has a small spine beneath the terminal claw. The first antennæ are about two-thirds as long as the second, and the flagellum of the latter has seventeen or eighteen joints.

GENUS AMPHOROIDEA, *Milne Edwards.*AMPHOROIDEA TYPICA, *Edwards.*

Plate 52, fig. 13 *a*, animal, enlarged; *b*, under view of head; *c*, under view of abdomen; *d*, mandible; *d'*, profile of its extremity; *e*, maxilliped.

From floating fucus (*Macrocystis*) near Valparaiso; found about the bases of the fronds, and near the roots.

Length, nine lines to one inch. Colour, olive-green, often with a browner green line in basal joints of superior antennæ parallel with its margin; also, sometimes in other parts of the body; in some large specimens a medial longitudinal line along back, white. The lamellar bases of the anterior antennæ, in this species, are scarcely as long as their breadth; the emargination of the caudal segment at its extremity is rounded within; the outer of the lamellæ of the caudal appendages is broadest at its middle, or just below it; the antero-lateral margin of the caudal segment is straight. Flagellum of second antennæ about eighteen-jointed, the joints not oblong.

AMPHOROIDEA AUSTRALIENSIS.

A. typicæ affinis. *Articulus antennarum 1marum basalis lamellatus parce oblongus, margine apicali arcuato, angulo externo rotundato. Flagellum antennarum 2darum 20-articulatum. Abdomen postice emarginatum, emarginatione triangulatâ, margine segmenti ultimi antero-laterali paulo sinuoso. Appendices caudales abdomen parce superantes, lamellâ internâ recte truncatâ, externâ acuminatâ, angustiore quam lamella A. typicæ externa.*

Near the *A. typica.* The lamellar basal joint of the anterior antennæ sparingly oblong, the apical margin arcuate, and outer angle rounded. Flagellum of inferior antennæ twenty-jointed. Abdomen emarginate behind, the emargination triangular; antero-lateral margin

of last segment a little sinuous in outline. Caudal appendages extending somewhat beyond line of extremity of abdomen; inner lamella straight truncate; outer acuminate, narrower than the same lamella in the *typica*.

Plate 52, fig. 14 *a*, head, much enlarged; *b*, dorsal view of extremity of abdomen; *c*, under view of same; *d*, basal portion of second antennæ.

New South Wales.

Length, ten lines. The resemblance to the *typica* is at first sight very close; yet the differences are important, and authorize the separation of the species. The surface is smooth and naked.

TRIBE II. ANISOPODA.

THE relations of the group Anisopoda to the other Choristopods have been briefly pointed out. The exact extent of this subtribe is, however, not yet ascertained. We may briefly mention the genera hitherto ranked with the Isopoda that appear to be Anisopodan, and remark upon the characters which lead us to conclude that this is their true relation.

1. *Arcturus* and *Leachia*.*—The thoracic members in these genera are Amphipodan in arrangement, and, as in the Caprellids, the three posterior pairs are used as feet for clinging, while the four anterior pairs are extended forward as arms for collecting their food. The abdominal members are as in *Idotæa*.

* These are the *Idotéides Arpenteuses* of Edwards, Crust., iii. 122.

2. *Anthura*.*—In *Anthura* there is the same Amphipod arrangement in the thoracic legs, the series being 4 (or 2+2) : 3, and not 3 : 4, as in Isopods. The genus is, therefore, near *Arcturus*.

3. *Tanais*, *Apseudes*, *Rhœa*.†—The thoracic members in *Tanais* are as in *Arcturus*, and the three posterior pairs are used in the same manner. The four anterior pairs, Amphipod-like, are in two sets of 2+2 (or 1+1+2). *Apseudes* and *Rhœa* are closely related to *Tanais*, and more like Amphipods than Isopods in habit.

4. *Praniza* and *Anceus*.‡—The three posterior pairs of thoracic legs belong to a distinct set from the preceding, as in Amphipods. The abdomen is considerably elongated in *Praniza* and flexible, though still Isopodan in having but a single pair of stylets.

5. *Serolis*.§—The structure of these species and their relation to the Amphipoda and Isopoda are mentioned on a preceding page. We only add here, that the two anterior pairs of thoracic legs differ from the following, indicating the Amphipod series, 2+2 : 3.

6. *Ancinus*.—On page 749 we have suggested that this genus may possibly be Anisopodan.

7. *Bopyridæ*.||—It is sometimes difficult to distinguish any difference among the several pairs of thoracic legs of the Bopyri, especially in females. Yet, in males, the Amphipod arrangement is often apparent, and besides, there is at times an elongated abdomen, with lateral appendages very unlike those of the true Isopoda. Certain figures by Krøyer illustrate these points. Fig. 1 A, Pl. 28, of the Voyage to Scandinavia, represents a Bopyrid, called *Dajus Mysidis*. Five pairs of abdominal appendages are long, and the abdomen has the elongate form and free articulation of *Tanais*; at the extremity there is a short caudal pair of stylets. In the male *Bopyrus abdominalis*, and the young female (figs. 1 o, 1 q, Pl. 29), the abdomen is similarly jointed, but the appendages appear to be short. In a female, not adult (fig. 1 l), the thoracic legs are obsolete on one side, excepting the three posterior pairs,—a fact that seems to show that these legs conform to the Amphipod series (4 : 3).

* *Idotéides Ordinaires*, in part, of Edwards, Crust., iii. 124.

† *Asellotes Hétéropodes* of Edwards, Crust., iii. 137. *Apseudes* was referred to the Amphipoda by Latreille.

‡ Family *Pranisiens* of the *Isopodes Nageurs* of Edwards, Crust., iii., 191; *Amphipoda* according to Latreille.

§ *Cymothoadiens Ravisseurs* of Edwards, Crust., iii. 228.

|| *Isopodes Sédentaires* of Edwards, Crust., iii. 277; *Epicarides* of Latreille.

Among the figures by Rathke, in his Norwegian Fauna,* we find the same conclusion sustained. The figure of a Bopyrid, called by him *Phryxus Hippolytes* (fig. 3, Pl. 2), represents the male, with the *three posterior* pairs of legs thrown obliquely backward, and the *four anterior* obliquely forward, with a wide interval between the two series. In this case, the Amphipod character (supposing the figure to be correct) is beyond dispute. This species, as Rathke states, appears to be identical with the Bopyrus Hippolytes of Kröyer. The genus Ione much resembles Phryxus, especially in the males of the species.

In the Bopyrid genus, Cepon of Duvernoy, the three posterior pairs of appendages, both dorsal and ventral, differ in certain points from the four pairs preceding, as represented in the figures.

These facts appear to determine the true nature of the Bopyri, showing that they are related most closely to Tanais, and through this genus to the Jæræ, which also are partly parasitic species. But there is another fact, proving even more strongly their Amphipod affinities, which is, the occurrence in some species of *thoracic* branchiæ; for these are the only species among all the so-called Isopoda that have this prominently Amphipodan characteristic. We are, therefore, fully authorized in arranging the Bopyridæ with the Anisopoda.

8. *Liriope*, *Crossurus*.—These genera, established by Rathke in his Norwegian Fauna, are related both to the male Bopyri and Tanais, but more closely to the latter. There is the same grouping of the legs as in Tanais, the three posterior pairs being in one group, and the two anterior pairs being chelate. The abdominal appendages are elongated in *Liriope*† nearly as in the Amphipoda, and to this group the genus is referred by Rathke. The legs of the three anterior pairs are two-branched; of the three posterior, simple.

A related genus, named by the author *Cryptothir*, has thoracic legs like those of *Liriope*, the two anterior pairs being chelate, and the three posterior in one group apart from the preceding. The species occurred as a parasite within a *Creusia* (barnacle).

The tribe Anisopoda hence embraces a considerable number of known genera, and this number will no doubt be greatly increased; for

* Fauna Norwegens, pl. 1, 2.

† The species described by Rathke was found as a parasite to a worm (*Peltogaster Paguri*), found on the abdomen of *Bernhardus streblonyx*.

the species are, to a great extent, very small, and have not been generally sought for.

The name of the tribe is from the Greek α , *not*, and *Isopoda*. To most of the species, the name has also a literal application, as they have commonly one or two pairs of anterior chelate legs, differing from the following; and, in some cases, as in *Arcturus* and *Tanais*, the uses of the three hinder pairs and the four preceding are widely different. Thus the species are as strikingly *Anisopodous* or *unequal-footed*, as the *Isopoda* are *isopodous* or *equal-footed*.

In arranging the Anisopoda, we should regard the striking parallelism that exists between the several groups of genera, and those of the *Isopoda*: thus, corresponding

1. To the *Idotæidea*, there are *Arcturus*, *Leachia*, *Anthura*.
2. To the *Oniscoidea*, there are *Tanais*, *Apseudes*, *Rhæa*, *Bopyris*, *Ione*, and the allied.
3. To the *Cymothoidea*, there are *Serolis*, *Praniza*, and *Anceus*.

There are, therefore, three grand divisions, similar in character to those of the *Isopoda*, as follows:—

Subtribus I. SEROLIDEA, vel ANISOPODA CYMOTHOICA.—Appendices abdominis duæ posticæ lamellatæ, apud abdominis latera dispositæ.

Subtribus II. ARCTURIDEA, vel ANISOPODA IDOTÆICA.—Appendices abdominis duæ posticæ operculiformes, laminas branchiales tegentes.

Subtribus III. TANAIDEA vel ANISOPODA ONISCICA.—Appendices abdominis duæ posticæ plus minusve styliformes, fere terminales, raro obsoletæ.

Viewing the species with reference to their greater or less divergence from the *Isopodan* type, we arrive essentially at the same arrangement. This divergence is to be distinguished mainly in the character of the abdominal appendages. In the first group, part or all of the five anterior pairs of abdominal appendages are well-formed branchial leaflets, as those of the *Cymothoidæ*. In the second, the same is equally true, and the first pair are opercula, like those of the true *Idotæidæ*. In the third, the divergence is wider, the abdo-

men being usually more elongated and freer in its articulations, and the appendages below, although Isopod in arrangement, usually more elongated, so as to approximate to the Amphipod type. And, as we descend in the scale, we find in *Liriope* nearly the Amphipod character. Through *Praniza* and *Anceus* the Cymothoid division descends in scale. Both of these genera correspond to imperfect forms, the two anterior thoracic segments being obsolete, and the legs but ten in number.

Some of the Anisopods appear to be inferior in character to the Amphipods, although ranking between this, the lower group, and the Isopoda. But this is no objection to our views, and is strikingly in harmony with a general principle already explained. The Anisopoda, as stated, constitute a transition group. There are two distinct types of structure among the Choristopods, that of the Amphipods and that of the Isopods, and between these, lie these connecting links, which are the Anisopods. So, between the *Brachyura* and *Macroura*, there are transition species, which are called *Anomoura*, not conforming to either of the two great types among the Eubranchiata Decapoda, but of an intermediate or transition character. And, as among the *Anomoura*, we find forms of less perfection as to structure, more sluggish as to habits, and evidently lower in rank as regards intelligence, than occur among the great majority of the *Macroura*, although these are inferior in grade of structure; so, in the Anisopoda, the most sluggish of the Choristopods are to be found. These two transition groups are analogous in this respect, and illustrate a fundamental truth of great interest.

The following is a synopsis of the families, subfamilies, and genera of Anisopoda, as far as they are ascertained:—

SUBTRIBUS I. SEROLIDEA, *vel* ANISOPODA CYMOTHOICA.

FAM. I. SEROLIDÆ.

Appendices abdominales sex anticæ liberæ, subnatatoriæ, quatuor sequentes branchiales, bene lamellatæ, ultimæ ac in *Cymothodis*.
Antennæ 1mæ sub capite insitæ.

G. 1. SEROLIS, *Leach*.

FAM. II. PRANIZIDÆ.*

Appendices abdominales totæ ac in *Ægidis*. Antennæ 1mæ sub capite insitæ. Pedes thoracis numero decem, paribus duobus anticis rudimentariis. Thoracis segmenta numero quinque non superantia.

SUBFAM. 1. PRANIZINÆ. — Caput parvum. Mandibulæ vix salientes.

G. 1. PRANIZA, *Leach*.

SUBFAM. 2. ANCEINÆ. — Caput grande. Mandibulæ ultra caput longè exsertæ.

G. 1. ANCEUS, *Risso*.

SUBTRIBUS II. ARCTURIDEA, *vel* ANISOPODA IDOTÆICA.

FAM. I. ARCTURIDÆ.

SUBFAM. 1. ARCTURINÆ.—Opercula abdominis ad ventrem stricte appressa.

G. 1. ARCTURUS, *Latr.* — Segmenta thoracis subæqua. Antennæ 2dæ flagello longo confectæ.

G. 2. LEACHIA, *Johnston*. — Segmentum thoracis 4tum prælongum. Antennæ 2dæ longæ, ungue 1-3-articulato confectæ. Pedes 8 antici ciliati, non unguiculati.

SUBFAM. 2. ANTHURINÆ.—Opercula abdominis ad ventrem non bene appressa, sed libera et latera abdominis partim tegentia.

G. 1. ANTHURA, *Leach*. — Antennæ breves, 4-8-articulatæ. Pedes antici subchelati.

* *Pranisiens* of Edwards, *Crust.*, iii. 191. The subdivisions adopted are those of Edwards, the first being his "Tribu des Pranisiens Ordinaires," and the second, "Tribu des Anceens."

SUBTRIBUS III. TANAIDEA, *vel* ANISOPODA ONISCICA.

FAM. I. TANAIIDÆ.

Pedes 1mi 2dive subchelati, sequentes non ancorales. Abdomen paribus quinque appendicum subnatatoriis unoque postico stylium instructum.

SUBFAM. 1. TANAINÆ. — Corpus lineare, segmento thoracis 1mo sæpe oblongo capiteque parvulo. Styli caudales longo.

G. 1. TANAI, *Edw.**—Antennæ 1mæ flagello non confectæ. Pedes antici breves crassè chelati, digitis vix hiantibus; reliqui unguiculati. Styli caudales sat longi, 3-7-articulati, simplices.

G. 2. PARATANAI, *Dana.*—*Tanai* similis. Styli caudales biramei, ramis inæquis, articulis uno vel pluribus instructis.

G. 3. LEPTOCHELIA, *Dana.*†—Antennæ 1mæ longæ, flagello confectæ. Pedes antici longi, manu elongatâ, digitis hiantibus; reliqui unguiculati. Styli caudales sat longi, articulati, ramo laterali instructi.

G. 4. APSEUDES, *Leach.*—Antennæ 1mæ 2dæque flagello unico confectæ. Pedes antici breves, crassè chelati, 2di extremitate laminati, non unguiculati.

G. 5. RHŒA, † *Edw.*—Antennæ 1mæ 2dæque flagello confectæ, 1mis quoque flagello appendiculari. Pedes 1mi 2dique crassi, 1mis chelatis, 2dis unguiculatis.

SUBFAM. 2. LIRIOPINÆ.—Corpus antice latius, postice sensim angustans, segmento thoracis 1mo reliquis vix longiore, capite mediocri. Appendices abdominales numero decem elongatæ.

G. 1. LIRIOPE, *Rathke.*§—Pedes 4 antici subprehensiles, 5ti 6tique unguiculati, 7mi abbreviati, articuloque styliiformi confecti. Antennæ 1mæ perbreves [setarum scopulâ ornatæ].

G. 2. CRYPTOTHIR, *Dana.*—*Liriopi* affinis. Pedes 7mi non abbreviati, unguiculati.

SUBFAM. 3. CROSSURINÆ. — Corpus antice latius, postice sensim angustatum, segmento thoracis 1mo vix longiore, capite mediocri. Appendices abdominales inferiores numero sex, ciliatæ.

* Genus *Zeuzo*, Templeton (Trans. Ent. Soc., ii. 203), is included.

† Amer. Jour. Sci. [2], viii. 425, 1849.

‡ Genus *Triura*, Teilkampf (Archiv. f. Nat., 1844, p. 321), is probably near *Rhœa*. Caudal styles very long and setiform. The description and figures are unsatisfactory.

§ Faun. Norw., 60, pl. 1, f. 8-12.

- G. 1. *CROSSURUS*, *Rathke*.*—Pedes antici chelati, robusti, reliquis unguiculatis. Abdomen duabus tæniis semicircularibus e magno pilorum erectorum numero compositis fimbriasque duas exhibentibus cinctum.

FAM. II. BOPYRIDÆ.†

Pedes toti sæpius aliquo modo subprehensiles vel ancorales. *Maris*, corpus angustum, abdomen 1–6-articulatum, appendicibus subnatoriis stylisque duobus sæpe instructum, interdum totis appendicibus obsoletis; *feminæ*, corpus latum et obesum, oculis carens, et quoad pedes sæpe partim obsoletum.

SUBFAM. 1. BOPYRINÆ. — Thorax appendicibus branchialibus carens.

- G. 1. *BOPYRUS*, *Latr.*—Pedes thoracis *feminæ* manu imperfectâ confecti. Appendices abdominis branchiales laminatæ, laminâ unicâ compositæ et abdomine tectæ.
- G. 2. *PHRYXUS*, *Rathke*.‡—Pedes thoracis *maris* ancorales, *feminæ* manu imperfectâ confecti. Appendices abdominis *feminæ* branchiales magnæ, laminis duabus inæquis nudis compositæ, una vel ambæ laminæ laterales; *maris* rudimentariæ.
- G. 3. *CEPON*, *Duvernoy*.§—Pedes thoracis *feminæ* non unguiculati, per pulvillum terminalem ancorales. Appendices abdominis *feminæ* branchiales numero duodecim elongate lamellatæ et bene ciliatæ.
- G. 4. *DAJUS*, *Kröyer*.||—*Maris* abdomen 6-articulatum, segmento ultimo prælongo; pedes thoracis bene unguiculati; appendices abdominis numero decem oblongæ, ciliatæ, aliis duabus terminalibus minutis. *Feminæ* appendices abdominis laterales, duæ posticæ caudales breves, exsertæ.

SUBFAM. 2. IONINÆ.—Pedes thoracis *feminæ* appendices branchiales ad basin gerentes.

- G. 1. *IONE*, *Latr.*—Pedes thoracis manu imperfectâ confecti. Appendices abdominales laterales, *maris* tenuiter cylindricæ, *feminæ* ramosæ præter duas ultimas simplices.
- G. 2. *ARGEIA*, *Dana*. — Pedes thoracis manu imperfectâ confecti. Appendices *feminæ* abdominales laterales, birameæ, ramis simplicissimis, nudis; *maris* nullis abdomine non articulado, nudo.

* *Ibid.*, 35, pl. 1, f. 1–7.

† *Epicarides*, *Latr.*; *Isopodes sedentaires*, *Edw.*, *Crúst.*, iii. 277.

‡ *Fauna Norwegens*, p. 40. § *Annales des Sci. Nat.* [2], xv. 110, pl. 4.

|| *Voy. Scand.*, etc., *Crúst.*, tab. 28, 29.

SUBTRIBE SEROLIDEA.

FAMILY SEROLIDÆ.

SEROLIS PLANUS.

Corpus fere planum. Segmenta 1-6 thoracis lateraliter vix producta, tota usque ad marginem strictè appressa. Segmentum caudale juxta marginis lateralis medium unidentatum, dente vix marginali, superficie costâ obliquâ carente sed costam medianam parvulam et aliam prope marginem ante dentem lateralem habente. Antennarum 2darum articuli duo basales ultimi longitudine æqui.

Body very nearly flat. First to sixth thoracic segments hardly produced backward at sides, all closely in contact quite to the lateral margin. Caudal segment having a submarginal tooth near middle of lateral margin; no oblique costa, but a small one at middle, and another near margin either side anterior to the tooth. Last two basal joints of second antennæ of equal length.

Plate 53, fig. 1 *a*, male, enlarged two diameters; *b*, opercular plate of abdomen; 1 *c*, part of flagellum of inferior antennæ.

Fuegia.

Length, one inch; breadth, three-fourths of an inch. As the segments of the thorax are in contact quite to the lateral margin, the margin of the body is very even and uninterrupted. The sixth segment is much less produced backward, either side, than that of the *S. Gaudichaudii*. Moreover, the articulation in the opercular abdominal plates is much more nearly transverse, than in that species, and the margin of the abdomen, above, has the tooth mentioned, situated just below the termination of the marginal costa. The medial costa is obsolete posteriorly. The eyes are rather near, and subconical. The

fourth thoracic segment has a low prominence just inside of the epimeral suture. The hands of the first pair of legs resemble those of the *Gaudichaudii*.

SUBTRIBE ARCTURIDEA.

FAMILY ARCTURIDÆ.

GENUS LEACHIA, *Johnston*.

LEACHIA NODOSA.

Corpus tuberculosum. Thoracis segmenta secundum tertiumque brevissima; quartum maximum, valde elongatum, anticè latius et utrinque cuspidatum. Abdomen 2-articulatum; segmento primo transverso; secundo oblongo, posticè parce latiore, rotundato, ad latera prope basin emarginato. Antennæ superiores tenues, articulis duobus inferiorum parce longiores; inferiores pediformes fere corporis longitudine, 6-articulatæ, articulo quinto breviorè quam quartus, infra brevissimè paulum setuloso, sexto quadruplo breviorè, unguiformi, fere recto, infra parce setuloso.

Body tuberculate. Second and third segments of thorax very short; fourth large and much elongate, widest anteriorly with a pointed prominence either side. Abdomen two-jointed; first segment transverse; second oblong, not narrower posteriorly, rotund behind, on either side near base emarginate. Superior antennæ slender, hardly longer than the first two joints of the inferior; inferior pair pediform, nearly as long as body, six-jointed, fifth joint shorter than fourth, and very short and setulose below; sixth hardly one-fourth the fifth, unguiform, nearly straight, sparingly setulose below.

Plate 53, fig. 2 *a*, lateral view of animal, enlarged; *b*, dorsal view; *c*, one of the anterior legs.

Balabac Passage, off Mangsi Islands, north of Borneo; brought up from a depth of thirty-one fathoms.

Colour, dull yellow. Length, half an inch. This species attaches itself to seaweeds or Corallines by means of its six hinder legs, and stands like a Caprella, with the body nearly erect; the anterior legs are commonly thrown over the mouth, being used principally for taking food, for which purpose they are adapted by means of their ciliæ, which form a kind of net for capturing prey. These four anterior pairs are five-jointed; they gradually increase in length from the first to the fourth; and the last three pairs as gradually diminish. The latter are naked or nearly so; of the six joints, the second is longer than the third or fourth; the sixth is shorter than the fifth, and has a tooth under the extremity. The head is oblong, with five tubercles on the dorsal surface, and one spinous process in front below. The eye is lateral and prominent. The inner antennæ have a few short hairs at tip. The second joint of the outer or inferior antennæ is stout and angular. The abdomen is very convex below. The plates below are barely seen in a dorsal view projecting a little on either side, near the apex.

Leachia nodosa, DANA, Amer. J. Sci. [2], viii. 424, 1849.

SUBTRIBE TANAIDEA.

FAMILY I. TANAIIDÆ.

SUBFAMILY TANAINÆ.

GENUS TANAIS.

THE head in this genus is very short, and often appears as if soldered to the first thoracic segment; and the latter is oblong and of diffe-

rent shape from the following, being narrower anteriorly. The segments of the abdomen are five or six in number, and often subequal, yet usually the posterior is largest. The stylets are simple, and three to seven-jointed. The anterior or cheliform legs are short and stout, and well fitted for prehension; the fingers are short, and touch by their inner sides. The second pair of legs is monodactyle, and very slender. The eyes consist of but few facets; in the *T. brasiliensis* there are only six facets, five being arranged around a central one: in some instances, the eyes form a projecting protuberance at the anterior angles of the front. The abdomen is commonly about as long as the last two thoracic segments.

TANAIS (PARATANAIS?) BRASILIENSIS.

Segmentum thoracis primum anticè valde angustius, septimum sexto vel quinto brevius. Abdomen oblongum, ad extremitatem apiculatum, 6-articulatum, segmentis subæquis, ultimo non longiore quam penultimum, stylis abdomine paulo brevioribus, 6-articulatis. Pedes antici crassi, manu ad basin angustiore, carpo oblongo, recto, nudo, articulo precedente recto. Antennæ primæ paulo majores, corpore quadruplo breviores, secundæ 6-articulatæ.

First thoracic segment much narrowed anteriorly; seventh shorter than fifth or sixth. Abdomen oblong, apiculate at apex, six-jointed, segments subequal, the last not longer than the preceding, stylets but little shorter than the abdomen, six-jointed. Anterior feet stout; the hand narrower at base; carpus oblong, straight, naked; preceding joint straight. Superior antennæ a little the larger, about one-fourth as long as the body, inferior six-jointed.

Plate 53, fig. 3 *a*, animal, enlarged; *b*, eye; *c*, caudal stylet; *d*, second antennæ; *e*, anterior legs; *f*, second pair of feet; *g*, one of three posterior pairs.

At Rio Janeiro, on sea-shores in cavities among Serpulas.

Length, four lines. Colour, pale greenish or yellowish green. The head and first thoracic segment together have a somewhat pyriform

outline. The eyes consist of six facets. None of the thoracic segments are as long as broad; the fifth and sixth are somewhat the longest, and are much longer than the seventh, which is twice as broad as long. The segments of the abdomen are of nearly equal length, the last not being longer than the preceding. The stylets consist of a rather stout basal joint and five more slender joints; they are somewhat hairy. The legs, excepting the first pair, terminate in a claw, which is short, excepting in the second pair; in this the claw is slender and nearly as long as preceding joint, upon which it closes. First pair of legs thrown forward either side of head. The thumb has a depression in the inner margin near its base, and another near its apex; to the former a tooth in the finger corresponds; and into the latter the extremity of the finger closes; the intermediate portion of both thumb and finger is finely denticulated; the second joint of the leg is compressed near its base. The superior antennæ decrease in diameter from base to apex. The second pair has a two-jointed base and a four-jointed extremity.

This species is near the *Tanais dubius* of Kröyer (Tidsskr. Heft., 2, 1842); but it is peculiar in having the last of the six abdominal segments not longer than the preceding, and also slightly apiculate behind.

Tanais brasiliensis, DANA, Amer. J. Sci. [2], viii. 425.

GENUS PARATANAIS, Dana.

Tanai pedibus anticis breviter et crassè chelatis antennisque 1mis flagello non confectis similis. Styli caudales biramei, ramis inæquis, uno vel pluribus articulis instructis.

Like *Tanais* in having the anterior feet stout chelate and short, and the antennæ without a flagellum. Caudal stylets two-branched, branches unequal, one or many-jointed.

This genus is separated from *Tanais* by only a single character; yet the distinction may be convenient. The accessory branch of these stylets may exist in the preceding Brazilian species; and, if so,

it was overlooked in the examinations made when the specimen was obtained by the author.

PARATANAIS ELONGATUS.

Gracilis. Caput segmentumque thoracis primum simul sumta subelliptica. Oculi minuti. Segmenta quatuor thoracis postica subæqua, fere quadrata. Abdomen pubescens, 6-articulatum, posticè rotundatum, articulo postico longiore, semicirculari. Styli caudales biramei, ramo uno 2-articulato, altero breviorè 1-articulato, apicibus setulosis. Antennæ primæ 4-articulatæ; secundæ quoque 4-articulatæ. Manus crassa, ad basin non angustior, articulo pedis 2do supra profundè excavato.

Quite slender. Head and first thoracic segment together nearly elliptical in outline. Eyes minute. Last four thoracic segments subequal, nearly quadrate. Abdomen pubescent, six-jointed, rounded behind; last segment longest, semicircular. Caudal stylets two-branched, one branch two-jointed, the other shorter, one-jointed; tips with a few hairs. Superior antennæ four-jointed, apical joint longest; inferior pair also four-jointed. Hand not narrower at base; second joint of leg profoundly excavate on upper side.

Plate 53, fig. 4 *a*, animal, enlarged; *b*, antennæ; *c*, first pair of legs; *c'*, hand, more enlarged; *d*, second pair of feet; *e*, caudal stylet.

Sooloo Archipelago.

The second thoracic segment is much the shortest, and the last is not shorter than the preceding. The antennæ are shorter than one-fourth the length of the body. The anterior feet, as in the preceding species, extend forward just beyond the line of the front, and then are flexed downward, the inflexed part being the hand. The thumb has a seta on the under side, as well as one on the inner, at the summit of a triangular prominence. The body of the hand, preceding the articulation with the finger, is nearly square, a little oblong. The second pair of legs is quite slender and small.

Tanais elongatus, DANA, Amer. J. Sci. [2], viii. 425.

GENUS LEPTOCHELIA.

Tanais similis. *Pedes antici longi, digitis tenuibus hiantibus. Antennæ Imæ elongatæ, et flagello confectæ. Abdomen 6-articulatum, styliis caudalibus articulatis.*

Near *Tanais*. Anterior feet long, fingers slender and gaping. Superior antennæ elongate and ending in a flagellum. Abdomen six-jointed; caudal stylets jointed.

The head, thorax, and abdomen, and general characters are like those of *Tanais*. The anterior feet, in the species examined, are much longer than the body, and the hand alone more than two-thirds as long. The exterior antennæ are but little shorter than the body. The caudal stylets have a short branch from the base. The feet are otherwise nearly as in *Tanais*; the second pair is rather longer than the two following, and has a longer claw. *Tanais Edwardsii* of Kröyer (Tids. iv. 1842), is of this genus.

Leptochelia, DANA, Amer. J. Sci. [2], viii. 425, 1849.

LEPTOCHELIA MINUTA.

Corpus lineare, capite angusto, fronte fere truncato, thoracis segmentis duobus posticis fere quadratis, aliis brevioribus. Abdomen postice subobtusum, segmentis subæquis. Styli caudales abdominis longitudine, ramo longo 6-articulato, altero minuto 2-3-articulato. Antennæ superiores corpore paulo longiores, basi longissimo, 4-articulato, articulo secundo longiore; flagello 6-7-articulato vix longiore quam articulus basis secundus. Pedes antici corpore valde longiores, carpo dimidium corporis longitudine valde superante, manu paulo longiore, digitis tenuissimis incurvatis, nudis, digito immobili prope apicem infra dentigero.

Body linear; head small, front nearly truncate; two posterior segments of thorax transverse but nearly quadrate, the others shorter. Abdomen subobtuse behind; segments subequal. Caudal stylets as long as abdomen, longer branch six-jointed, shorter minute, two or three-

jointed. Superior antennæ a little longer than the body, or of same length; base elongate, four-jointed; second joint longest; flagellum hardly longer than this joint, six to seven-jointed. Anterior feet much longer than body; carpus much longer than half the body; hand still longer; fingers very slender and incurved, naked, the immoveable one with a low tooth within near apex.

Plate 53, fig. 5 *a*, dorsal view of animal, enlarged; *b*, lateral view; *c*, posterior leg; *d*, caudal stylet.

From among sea-weed and small corals, Feejees, Island of Ovalau.

Length, one-tenth of an inch. The head is transverse, and nearly a rectangular segment, with the eyes near the anterior angles; the following segment is somewhat ovate, wider behind; the next three are short, but very gradually increasing. The caudal stylets are a little hairy. The superior antennæ have the second joint about as long as third and fourth together. The inferior antennæ are slender, and shorter than the first two basal joints of the inner antennæ. The anterior legs excluding the hand are nearly as long as the superior antennæ. The fingers are very slender, and widely separated when their apices are in contact. There are one or two setæ on the finger near apex. Abdominal legs five pairs.

This species is Caprelloid in habit. It was observed by the author attached by its hinder legs to sea-weed, and reaching out the long arms in different directions, as if in search of prey.

SUBFAMILY LIRIOPINÆ.

GENUS CRYPTOTHIR.

Maris:—*Corpus angustum, 14-articulatum, annulatum, posticè acuminatum. Pedes 4 antici cheliformes, reliquis unguiculatis, unguibus longis, 6 posticis subæquis. Abdomen stylis tenuibus acutis strictè appressis confectum. Antennæ quatuor, secundæ elongatæ, flagello confectæ, primæ perbreves, breviter scopuligeræ.*

Male:—Body narrow, fourteen-jointed, annulate, narrowing behind

nearly to a point and terminating in a pair of slender pointed stylets, which are not jointed. Four anterior legs subchelate, the rest unguiculate; six posterior subequal. Antennæ four; second pair having a flagellum; first pair very short, with a tuft of short hairs at apex.

The animal for which this genus is instituted resembles much the males of some Bopyri in form and its members. It is very close to Rathke's *Liriope* (Beit. Fauna Norweg., p. 60, tab. 1), which this author makes an Amphipod; but the *Liriope* has the posterior legs short, and ending in a slender styliform joint, not unguiculate.

CRYPTOTHIR MINUTUS.

Corpus oblongo-lanceolatum, posticè acuminatum, anticè truncatum. Caput transversum, segmento proximo majus, ad frontem paulo angustius. Abdomen 6-articulatum, segmento postico minore. Styli caudales terminales, strictè appressi, articulos abdominis quatuor longitudine æquantés. Antennæ primæ 3-articulatæ, scopulâ perbrevis instructæ; secundæ corpore fere triplo breviores, basi 4-articulato, flagello fere duplo longiore, 7-articulato.

Body oblong lanceolate, acuminate behind, truncate in front. Head transverse, larger than next segment, a little narrower in front than behind. Abdomen six-jointed, posterior segment smallest. Caudal stylets terminal, close appressed together, as long as last four segments of abdomen. First pair of antennæ minute, three-jointed, furnished with a small brush of setæ; second pair about two-fifths as long as body, base four-jointed, flagellum nearly twice as long as base, seven-jointed.

Plate 53, fig. 6 *a*, animal, enlarged; *b*, inner antenna; *c*, outer antenna; *d*, foot of second pair.

Feejee Islands. Found in a *Creusia*, three or four specimens in different individuals of this corallidomous barnacle.

Length, about half a line. Body broadest near middle of thorax;

seven joints to thorax; six to abdomen; segments very distinct, and a little prominent, all transverse. Head of trapezoidal form. First and second thoracic segments shorter than the following. Abdominal stylets naked, the two forming a prolonged pointed termination to the body. Inner antennæ not seen in upper view, excepting the tuft of hairs which projects at either corner of the head. Flagellum of outer antennæ very slender; joints slender, nearly naked. First pair of legs minute; second has a short and stout triangular hand, with the base of the triangle set against the carpus; breadth less than length; moveable finger at apex of hand, not half length of hand. Following five pairs of legs similar; third and fourth pairs a little the stoutest; claw slightly curved, half or two-thirds as long as preceding joint.

FAMILY II. BOPYRIDÆ.

SUBFAMILY IONINÆ.

GENUS ARGEIA, Dana.

Corporis articulationes uti in Bopyro. Appendices abdominis femine non ramosæ, vesiculiformes. Thorax appendicibus branchialibus instructis. Abdomen maris appendicibus carens, non articulatum.

Like *Bopyrus* in general form. Abdominal appendages quite simple sacs. Thorax furnished with branchial appendages of similar form. Male abdomen without appendages and not jointed.

Ione differs from this genus in having the female abdominal appendages branched, and the male abdomen jointed and furnished with appendages. The feet in the males are all similar, and terminate in a small hand. The first thoracic segment is united to the head by a separating suture. The following six segments are similar and free. The abdomen is oval, pointed behind, and without any division into segments. The female abdomen has six pairs of appendages, and each

pair excepting the last consists on either side of two blind sacs. The branchial thoracic appendages are attached to the margins of the segments, or normally to the bases of the legs. The legs are quite small, and terminate in a small hand.

ARGEIA PUGETTENSIS.

Feminae:—*Corpus parce oblongum, usque ad extremitatem bene articu-
latum, segmentis numero 15. Caput transversum. Appendices
abdominales submarginales, 10 anticæ bi-partitæ, ramo externo sat ob-
longo, interno subgloboso, parvo; duæ posticæ simplicissimæ, oblongæ.*
Maris:—*Corpus fere lineare. Abdomen latè ovatum, margine inte-
gram, postice subacutum.*

Female:—Body sparingly oblong, quite to the extremity prominently jointed, the segments fifteen in number. Head transverse. Abdominal appendages submarginal; the ten anterior bi-partite; outer branch oblong, inner subglobose and small; two posterior quite simple, oblong. *Male*:—Body nearly linear. Abdomen broad ovate, margin entire, subacute at extremity.

Plate 53, fig. 7 *a*, male, enlarged; *a'*, extremity of leg; *b*, female, upper view; *c*, same, under view; *d*, leg of fourth pair of female; *d'*, same, in another position; *e*, fifth pair; *e'*, same, in another position.

From *Crangon munitus*, Puget's Sound, Northwest Coast of America.

Length of female, three to four lines; of male, a line. The egg-pouch of the females is nearly circular in outline, and lies beneath the thorax, encroaching hardly upon the abdomen. The under surface of the female abdomen is naked, showing well the articulations across, and having only a narrow part towards the margin covered with the inner branch of the abdominal appendages. The maxillipeds in the females are each a small oblong plate, placed transversely, not one-sixth as large as the left lamina of the first pair covering the eggs. In their natural position, the male legs do not project beyond the margin of the body, as observed in a dorsal view. The head in the

male is very nearly as broad as the first thoracic segment. The six posterior thoracic segments are truncate either side.

TRIBE III. AMPHIPODA.

THE thoracic position of the branchial appendages, and the styli-form or non-branchial character of the three posterior pairs of abdominal appendages, distinguish all the Amphipoda from both the Isopoda and Anisopoda.

Among the Amphipoda, two types of structure, as regards the organs of the mouth, are recognised, and the distinctions of the two sections thus indicated, extend to various parts of the body. In one type, the outer maxillipeds are small and operculiform; the eyes are large, the facets covering the greater part of the large head, and giving the animal a wild, staring look; the extremity of the abdomen is broad and depressed, and the natatory abdominal appendages are usually oval lamellar. Such are the species of the *Hyperia* group—the HYPERIDEA.

In the other type, the outer maxillipeds are elongated and palpi-form, the eyes are small, the head of moderate size, the abdomen, when not obsolete, narrow, and the natatory abdominal appendages usually slender.

Under this second type all the Amphipoda, excepting the Hyperidæ, are included. They comprise, however, two distinct groups, based upon as important characters as those which separate them from the Hyperidea. These differences are most prominently exhibited in the abdomen. In *one* section, the CAPRELLIDEA, embracing *Caprella*, *Cyamus*, and related genera, the abdomen is obsolescent. In a second, the GAMMARIDEA, the abdomen is fully developed, with three pairs of natatory appendages, and as many of stylets. This second section embraces the typical Amphipods, the Gammari, Talitri, and the like. The abdomen in these species is usually a powerful organ of motion.

The nearest approach of the Amphipoda to the Isopoda, or rather, to the Anisopoda, takes place in the Caprellidea and the Gammaridea.

In the Caprellidea the resemblance to Isopods is close in general form; the broad Cyami have the habit of a Cymothoidan, and the lank Caprella, that of a Tanais or Arcturus.

The Gammaridea are, in general, widely diverse from the Isopods, through the long inflexed abdomen, which is used in locomotion, often as an organ for leaping, and their thoracic legs, which are unfit for walking or clinging. Yet, there are genera representing the Caprellidea and Anisopoda, which have a gressorial habit. In *Corophium* and the related genera the species are simply gressorial; while the genus *Dulichia* includes slender species that cling by their hind legs, like Caprella and Tanais, and have a similar mode of life.

The subtribes which have been enumerated, are distinguished as follows:—

Subtribus I. CAPRELLIDEA.—Maxillipedes caputque ac in *Gammarideis*.
Abdomen obsolescens.

Subtribus II. GAMMARIDEA.—Maxillipedes palpiformes, elongati, 5–6-articulati. Caput oculique mediocres. Appendices abdominales sæpius perangustæ.

Subtribus III. HYPERIDEA. — Maxillipedes operculiformes, breves. Caput grande, oculorum corneis plerumque tectum. Appendices abdominales sæpius latiores.

SUBTRIBE I. CAPRELLIDEA.

THE Caprellidea pertain to two families, as laid down by different authors:—

FAM. I. CAPRELLIDÆ. — Corpus anguste elongatum, fere filiforme. Antennæ 2dæ longitudine mediocres. [Species non parasiticæ.]

Fam. II. CYAMIDÆ.—Corpus late depressum. Antennæ 2dæ rudimentariæ. [Species parasiticæ.]

The Caprellidæ cling by their six hinder legs to sea-weeds, coral-lines, and other objects of support, while the long body moves in various directions, and wields its well-handed anterior legs for taking its prey. The Cyamidæ, on the contrary, are found attached like the Cymothoidæ, to the body of marine animals.

The genera in these families, thus far recognised, are as follows:—

FAM. I. CAPRELLIDÆ.

1. *Pedes thoracis numero 14.*

- G. 1. PROTO,* *Leach*.—Mandibulæ palpigeræ. Branchiæ segmentis 2do 3tio 4toque affixæ. Pedes thoracis toti articulis normales.
 G. 2. PROTELLA, *Dana*.—Mandibulæ palpigeræ. Branchiæ segmentis 3tio 4toque affixæ. Pedes 3tii 4tique obsoleti articulo 1mo styliformi excepto.

2. *Pedes thoracis 3tii 4tique omnino obsoleti.*

- G. 3. CAPRELLA, *Lamk.*—Mandibulæ non palpigeræ. Branchiæ segmentis thoracis 3tio 4toque affixæ. Abdomen brevissimum, 1-2-articulatum.
 G. 4. ÆGINA, *Kröyer*.†—Mandibulæ palpigeræ, palpis 3-articulatis. Branchiæ ac in *Caprellâ*. Abdomen brevissimum, 1-2-articulatum.
 G. 5. CERCOPS, *Kröyer*.‡—Mandibulæ palpigeræ. Branchiæ segmentis 2do 3tio 4toque affixæ. Abdomen 5-articulatum, appendicibus 4 elongatis 3-articulatis.

3. *Pedes 3tii 4ti 5tique obsoleti.*

- G. 6. PODALIRIUS, *Kröyer*.§—Branchiæ segmentis 3tio 4toque affixæ.

FAM. II. CYAMIDÆ.

G. 1. CYAMUS.

* *Leptomera*, Latreille.

† Tids., iv. 1842.

‡ Ibid.

§ Voy. Scand., pl. 25, and Tids. [2], i. 288.

FAMILY CAPRELLIDÆ.

IN the study of the Caprellidæ, the sexual differences are found to be great and perplexing, and even in the same sex there are wide variations of form in a single species. These differences are most strikingly exhibited in the relative lengths of the head and first thoracic segments, the character of the hands of the second pair, the position of the second pair of legs on the segment bearing it, and also, to some extent, in the relative lengths of the pairs of antennæ, and the several thoracic segments. Besides these differences, there is the existence of ovarian plates in females, beneath the third and fourth segments of the thorax, which are wanting in males.

In a single species, the *males* may have the head three or four times shorter than the first thoracic segment; while in the *females* it is but twice as large. Again, in other males of the same species, the proportion may be nearly that of the female.

In *males*, the second pair of legs is often attached to some part of the posterior half of the second thoracic segment; in *females*, the attachment is always anterior to the middle of this segment, and often quite to the anterior extremity. But, while there is the widest diversity in this respect between the males and females of the true Caprellæ, the difference is slight, or none, in Proto and Protella, the attachment being in neither sex posterior to the middle, and often much anterior.

The hand of the second pair in *male* Caprellæ of some species, has often two prominent teeth anterior to the middle of the palm, one of the two (the more apical) sometimes truncate and rhombic, and the palm is frequently a little concave; besides these teeth, there may be another on the same margin, exterior to where the end of the finger shuts down. But this arrangement does not occur in all males, nor is it absent from all females, unless it be that the truncate rhombic form of tooth is a male characteristic, whenever it occurs, as we deem probable. In females, the teeth on the palm are usually less prominent, and the palm itself is more frequently somewhat convex.

The second, third, fourth, and fifth segments of the body in Caprellæ are commonly approximately equal in length. In the more

slender species, however, the second segment is often much longer than the third and following. But, while this may be true of the male of a species, it sometimes is not true, or but slightly so, of the female.

The ovigerous females are readily distinguished from males by the plates beneath the third and fourth thoracic segments. But females without eggs appear to be without this mark of the sex, and resemble the males.

There are, hence, hardly any characters which are with certainty common to both sexes in a species. The occurrence of individuals at the same locality, the similarity in the hairs of the antennæ, and in the form of the joints of the flagellum (not their number), and the spines or tubercles of the body, are the most important characteristics common to the sexes—yet, even in the spines, the sexes may differ. In *Caprellæ*, the articulation of the second pair of legs with the *posterior* half of the thoracic segment in males, and with the *anterior* half in females, appears to be a constant character.

GENUS PROTO, *Leach*.

PROTO ELONGATUS.

Corpus gracile, omnino inerme et inornatum. Caput antice rotundatum segmento proximo fere duplo longius. Segmenta thoracis 2dum, 3tium, 4tum, 5tum, 6tumque oblonga et subæqua. Antennæ 1mæ dimidio corporis parce longiores, flagello 8-10-articulato, paululo brevior quam basis, articulis oblongis, setis paucis, brevioribus quam articuli. Antennæ 2dæ basi 1marum vic longiores, flagello 4-articulato, paulo brevior quam articulus precedens. Manus 1ma oblonga, triangulata, margine inferiore ad basin dente saliente armato, digito parce brevior quam manus. Manus 2da elongata, palmâ rectiusculâ prope manus basin dente acuto armatâ, et maris dente alio versus apicem. Branchiæ longæ fere lineares. Pedes 3tii 4tive 5tis longiores.

Body slender, without spines or tubercles. Head rounded in front, about twice as long as next segment. Second, third, fourth, fifth, and sixth thoracic segments subequal, oblong. Superior antennæ longer than half the body; flagellum hardly as long as base, eight

to ten-jointed, joints oblong, setæ few, shorter than joints. Inferior antennæ about as long as base of superior; flagellum four-jointed, and about as long as fourth basal joint. Hand of first pair triangular, lower angle near base prolonged into an acute tooth. Hand of second pair elongate, palm nearly straight, having an acute tooth near base, and in males, a tooth towards apex. Branchiæ long, and nearly linear. Third and fourth pairs of feet longer than fifth pair.

Plate 54, fig. 1 *a*, male, enlarged; *b*, hand of first pair; *c*, *ibid.* of second pair; *d*, mandible; *e*, lip; *f*, second pair of maxillæ; *g*, maxillipeds; *h*, extremity of abdomen; *i*, female, probably of this species; *k*, antenna of first pair.

Rio Janeiro, in ten to twelve fathoms water; taken from the anchor along with various Caprellids, January, 1839.

Length, two-thirds of an inch. Head and first thoracic segment together but little shorter than second thoracic segment; fifth thoracic segment somewhat the longest; seventh very short, but slightly oblong and rounded behind. Eyes large and round. Second joint of base of superior antennæ about twice as long as first, and one-third longer than third; joints of flagellum oblong and slender. First pair of thoracic legs nearly half as long as second pair; first joint about equal to three following; hand broadest at base, and with a straight transverse basal margin, extending into the tooth below, this tooth tipped with one or two short spines; a few short hairs on posterior margin of third and fourth joints. Second pair of legs has a slender basal joint, as long as the segment or a little exceeding it, and as long as hand; the finger is nearly as long as hand and much curved, rather abruptly so, just exterior to centre; branchia of this pair about half as long as basal joint; when the finger is closed on the hand there is an interval between it and the palm. The hand of males has the palm somewhat concave, a low convex prominence near its middle, an emargination for the extremity of the finger, with a spine below, and one or two smaller above; also a tooth near apex. In the female, the hand is narrow subelliptical; it has a tooth, as in the male, near base, which is the limit of the palm, but the palm is slightly arcuate instead of excavate, and has some small teeth. Third and fourth

pairs of legs similar, subequal; basal joint of fourth pair shorter than that of third pair; third joint in fourth pair longer than in third; fifth joint with four or five short spines on the inner margin; fourth and fifth joints subequal; claw a little longer than the joint. Branchiæ in male, one-fourth shorter than basal joint; in female, about as long as this joint. Fifth pair of legs much smaller than fourth, rather more than half their length; fourth joint about one-third the fifth; claw shorter than fifth; no spines on inner side of fifth joint. Sixth and seventh legs long, subequal; coxa of sixth pair longest and most slender; claw shorter than last joint; three or four short spines on inner margin of this joint. Abdomen very short; but there are two pairs of very slender and very short appendages, and the first pair terminates in a short moveable joint, which is subacute.

The mandibles terminate in a flat dentated edge; palpus long, three-jointed; first joint shortest; second longest; third a little curved and acute. Palpi usually seen extending in front of the head, just below the antennæ. Maxillipeds six-jointed; terminate in a stout claw, as the sixth joint; fifth joint shorter than the claw; first joint prolonged and enlarged on inner side; second prolonged at inner apex, and extremity finely denticulated. Lower lip obtusely emarginate with membranous suboval appendages on either side.

The female in most respects resembles the male. The second pair of feet is attached, in males, to the middle of the second segment, and in females, just forward of middle.

GENUS PROTELLA, Dana.

Segmenta thoracis tertium quartumque branchias et pedes rudimentarios uni-articulatos gerentia. Pedes sex ultimi subæqui. Mandibulæ palpigeræ.

Third and fourth thoracic segments bearing branchiæ and rudimentary one-jointed feet. Feet of last three pairs subequal. Mandibles palpigerous.

The rudimentary feet of the third and fourth pairs, which distinguish this genus from Caprella, are simply an oblong, styliform joint. As in *Ægina*, the mandibles are furnished with a three-jointed palpus.

PROTELLA GRACILIS.

Maris:—*Corpus gracile, aculeis tuberculisve non ornatum, fronte obtuso, segmento thoracis 1mo paulo longiore quam caput, segmentis 2do 3tio 4to 5to subæquis, bene oblongis. Antennæ 1mæ gracillimæ, corpore longiores, basi paulo brevioribus quam corpus, articulis 2do 3tioque subæquis, flagello plus dimidio longiore quam articulus precedens; 2dæ articulis 1marum duobus basalibus parce longiores. Manus 1ma parvula, carpo non brevioribus quam manus; 2da plus quadruplo longior, sat angusta, palmâ fere nudâ, dentibus tribus armatâ, uno externo* acuto, uno prope hunc interno acuto, uno subapicali truncato rhombico. Pedes rudimentarii tenuiter styliformes, segmento paulo breviores. Branchiæ anguste ellipticæ.*

Feminæ:—*Manus 2da vix latior, infra arcuata, palmâ spinulosâ, 3-dentatâ, dente uno externo, duobus acutis brevissimis subapicalibus.*

Male:—Body slender, without spines or tubercles, front obtuse, first segment of thorax a little longer than head; second, third, fourth, and fifth segments subequal, rather oblong. Superior antennæ very slender, longer than the body; the base but little shorter than body; second and third joints of base subequal; flagellum more than one and a half times the preceding joint. Hand of first pair very small, carpus not shorter. Hand of second pair four times as long as hand of first pair, rather narrow; palm nearly naked, armed with three teeth, one external, one internal, and one subapical, truncate and oblique. Rudimentary feet slender and styliform, a little shorter than segment. Branchiæ narrow subelliptic.

Female:—Hand of second pair hardly broader than in male; palm arcuate, spinulous, short three-toothed, one exterior acute, and two acute very short subapical teeth.

Plate 54, fig. 2 *a*, male, enlarged; *b*, part of flagellum of superior antennæ; *c*, extremity of leg of last pair; *d*, female; *d'*, part of flagellum of superior antennæ, *ibid.*; *e*, head of another variety; *f*, hand of female of second pair of legs.

From thirty-one fathoms water, in Balabac Passage, attached to a Plumularia and a Gorgonia.

* The finger closes upon the hand just inside of the tooth here referred to as the *exterior*.

Length, seven-eighths of an inch. Colour, pale yellowish. Second thoracic segment is about as long as head and first thoracic segment. Joints of flagellum of superior antennæ oblong cylindrical; setæ minute, one on under side close appressed to the joint, which is about as long as the joint, besides two or three others much smaller; base naked, or very nearly so. Inferior antennæ with fourth joint about as long as preceding part, and remaining portion not half the fourth joint in length; a row of about six extremely short setules on under margin of fourth joint, and four on preceding joint. First joint of second pair of legs longer than second thoracic segment. Finger of same much curved, about two-thirds as long as hand; fifth pair of legs more slender than sixth or seventh. The rudimentary legs end in a few minute setules.

The female is closely like the male in all points nearly, excepting the hand of the second pair. The third joint of the superior antennæ may be a little longer or a little shorter than the second; the first joint is not half the second.

GENUS CAPRELLA, *Lamarck*.

I. THORAX NEC ACULEATUS NEC TUBERCULATUS.

1. *Frons aut dorsum capitis spinâ tuberculove armata*.

CAPRELLA DILATATA, *Kröyer*.

Plate 54, fig. 3 *a*, animal, enlarged; *b*, side view of head; *c*, hand of second pair of legs; *d*, abdomen; *e*, part of flagellum of superior antennæ.

Rio Janeiro; brought up on the anchor, January, 1839; also, on sea-weed, along the sea-shore, beyond Praya Grande, December 21, 1838.

Body slightly granulous under a high magnifier, stout, segments but little oblong or not at all so. Head twice as long as next segment, armed in front with a horizontal spine. Third segment of thorax somewhat quadrate, anterior angles prominent, fourth triangular. Superior antennæ a little shorter than half the body, very

stout at base, the first two joints being about four times as thick as the following joint; last joint of base slender; flagellum about twelve-jointed, a little shorter than base, joints slightly oblong, narrow at base; inferior antennæ slender, ciliate below, sparingly longer than base of superior pair. Hand of first pair of legs with a small acute prominence on the palm near the base of the joint, and the palm is hairy; length of the hand half that of the second pair. Hand of the second pair broad and oblong, narrowing from middle towards apex, with the lower posterior angle rounded; palm nearly straight and densely hirsute, without a tooth or spine where the closed finger reaches; it has a slender acute tooth near middle, and an oblique, truncate, subquadrate one, just anterior. Flagellum of the superior antennæ about twelve-jointed. Branchial appendages nearly round. First joint of last six legs with the upper apex prolonged and acute; second joint very small; tarsus stout, and having a prominence with two short spines, below near base. Length, one half to two-thirds of an inch. Colour of specimens found on sea-weed, nearly brick-red.

Caprella dilatata, KRÖYER, Tidssk., iv. 1843, 585, pl. 8, figs. 1-9. Krøyer's specimens were also obtained from the anchor. Krøyer makes both teeth of the palm of the hand of second pair of legs acute; but our specimens have the anterior one truncate, giving it an oblique, subquadrate form.

CAPRELLA ROBUSTA.

C. dilatata rostro horizontali, capite brevi, branchiis, aliisque affinis, sed paulo angustior, segmentis paulo oblongis, 3tio thoracis vix latiore quam 2dum. Antennæ 1mæ basi graciliores, articulis flagelli ac in dilatata, sæpe paucioribus, 2dæ basi 1marum longiores, infra ciliatæ. Branchiæ rotundato-ellipticæ. Manus 2da lata, palmâ sparsim hirsutâ, versus basin acutè dentigerâ, et ante medium dente acuto sæpe armatâ.

Near the *C. dilatata* in the horizontal beak, short head, the branchiæ, and other characters, but somewhat narrower. Superior antennæ more slender at base, a little longer than half the body; flagellum a little shorter than the base; inferior pair longer than base of superior, ciliate below. Branchiæ round-elliptic. Hand of second pair broad, palm sparsely hirsute, near base bearing an

acute tooth, and above the middle usually another small acute tooth.

Plate 54, figs. 4 *a*, *b*, male, enlarged; *c*, part of female; *d*, hand of second pair, in another specimen; *e*, extremity of leg of fifth pair.

Rio Janeiro; from among sea-weed near the fort, not far from Praya Grande, abundant; also, brought up with the anchor in the harbour.

Length, about half an inch. Colour, dirty yellowish, or reddish to flesh-red. Vertical width of head about equal to its length. The spine on the head forms a short horizontal beak in advance of the front, as in the *dilatata*. The first four joints of the inferior antennæ are about equal in length to the first three (basal portion) of superior antennæ. The flagellum of the superior antennæ consists of ten joints in the specimen figured; but the first joint was long, and apparently corresponded to three or four joints; the joints bear a few very short setæ. Two rows of ciliæ on the inferior antennæ, as usual. Anterior hand about two-thirds as long as second pair. Superior apex of basal joint of posterior feet acutely prolonged.

The female is rather smaller than the male, and has the second pair of legs proceeding from the anterior part of the second thoracic segment, near the articulation. But the proportion of the head to the first thoracic segment is the same very nearly in both sexes. The scales forming the egg-sac are nearly quarters of a hemisphere, and the form of the sac is almost hemispherical.

The last two joints of the inferior antennæ are together little longer than the preceding one.

The females were supposed by the writer to be the females of the *dilatata*, but as there are males with like hands to the second pair of legs, the species seem to be distinct. The males and females are distinguished by the articulation of the second pair of legs with the segment which is posterior to the middle in the males, and close to the anterior extremity in the females (fig. 4 *c*). The males differ from those of the *dilatata* in the tooth of the hand limiting the palm; which tooth is wanting in the *dilatata*, though described by Krøyer as characterizing the female.

CAPRELLA CORNUTA.

Corpus gracile, segmentis oblongis, 2do thoracis, 3tio, 4to, 5toque inter se longitudine subæquis. Caput aculeo arrecto prope dorsum medium armatum, segmento proximo interdum dimidio brevius. Segmentum thoracis 2dum non triplo longius quam latum. Antennæ 1mæ dimidio corporis paulo longiores, sat graciles, flagello 10-14-articulato, 4tâ parte breviora quam basis. Antennæ 2dæ basi superiorum vix longiores aut breviores. Branchiæ angustè ellipticæ. Manus 1ma parva, secunda oblonga, duplo longior, palmâ rectiusculâ dente sub-basali et altero ante medium acutis armatâ.

Body slender, segments oblong, second, third, fourth, and fifth of thorax subequal in length. Head hardly higher than long, a little shorter than next segment, armed near middle of dorsal surface with an acute spine, obliquely erect. Second thoracic segment not three times as long as broad. Superior antennæ rather longer than half the body, moderately stout; flagellum ten to fourteen-jointed, one-fourth shorter than base. Inferior antennæ very little longer or slightly shorter than base of superior. Branchiæ narrow elliptic. Hand of first pair small; hand of second pair oblong; palm nearly straight, having an acute tooth on palm near base, and another anterior to middle.

Plate 54, fig. 5 *a, b*, views, enlarged; *c*, part of flagellum of superior antennæ; *d*, third thoracic segment; *e*, hand of first pair; *f*, *ibid.* of second pair; *g*, extremity of leg of last pair.

From among sea-weed near the fort, not far from Praya Grande, Rio Janeiro. December, 1838; both males and females were abundant.

Length, about one-half an inch. Colour, dull yellowish, reddish. The acute spine on the head is situated near middle of dorsal surface. The flagellum of the superior antennæ had but ten joints; but the first joint was oblong, and seemed to consist of three or four joints united; the last two joints of the inferior antennæ are together as long as preceding one; the joints are oblong, more than twice as long

as broad, and the few setæ are a little shorter than the joint. The segments of the thorax, from the second to the fifth inclusive, are subequal, and the two following are about as long as the preceding one. The third thoracic segment is broader posteriorly, and in some males both this and the following have a low oblong prominence below, as in figure *d*, and the first pair is but little longer than half the second. The legs of the second pair, in males, are inserted quite near the posterior part of the second thoracic segment, and in females near the anterior margin.

Var. *obtusirostris*.—Fig. 6 *a, b*, Plate 54, represents a variety of the preceding, from the same locality.

Length, half an inch, or nearly so. Colour, dirty yellowish or reddish. It has a small, obtuse tubercle, which, in a vertical view, projects upon the head between the eyes, and not in front of it. The second, third, fourth, and fifth thoracic segments are subequal in length. The first four joints of the inferior antennæ are about equal to basal portion of superior, and the remaining portion is slightly longer than the preceding joint, or about half the flagellum of the superior pair. Hand of first pair of legs about two-thirds as long as hand of second pair. Spine near base of tarsus of posterior six legs on lower side very slender; outer apex of first joint of these legs not prolonged.

The specimen figured had the second pair of legs attached to second segment *just anterior to middle*, as if it were a female; yet there were no ovarian lamellæ.

CAPRELLA ATTENUATA.

Corpus gracillimum, segmentis elongatis, 2do thoracis gracili, multo longiore quam 3tium. Caput segmento proximo quadruplo brevius, prope dorsum medium aculeo acuto arrecto armatum. Antennæ 1mæ dimidio corporis longiores, articulo 1mo fere dimidii 2di longitudine, flagello 8-10-articulato, duplo brevior quam basis, articulo 1mo longo composito. Antennæ 2dæ articulos basis 1marum duos basales fere æquant. Branchiæ fere lineares. Manus 2da perangusta, fere

sextuplo longior quam lata, infra dente acuto pone medium et altero ante medium armata, digito sat brevi.

Body very slender, segments elongate, second thoracic segment nearly twice as long as third, and very slender. Head hardly one-fourth as long as next segment, bearing an acute spine on middle of dorsal surface. Superior antennæ longer than half the body; first joint about half as long as second; flagellum eight to ten-jointed, about half as long as base, the first joint very long and composite. Inferior antennæ about as long as first two joints of base of superior. Branchiæ nearly linear. Hand of second pair very narrow (about one-sixth as broad as long), having an acute tooth just posterior to middle of lower margin, and another anterior to middle.

Plate 55, fig. 1 *a, b*, male, enlarged; *c*, another variety; *d*, flagellum of superior antennæ of same; *e*, extremity of inferior, *ibid.*; *f*, finger of anterior hands; *g*, hand of second pair.

Rio Janeiro, with the preceding; abundant.

Length, two-thirds of an inch. Colour, yellowish white, sometimes with a tinge of red. The head is small, rather higher than long, and but one-fourth as long as the first thoracic segment. The flagellum of the superior antennæ, is usually shorter than the two preceding joints, and the first joint appears to be made up of five to seven segments, indicated by the notches and setæ of the margin. Inferior antennæ about as long as base of superior, excluding the last joint, which is a long one. The last two joints together of the inferior antennæ are hardly as long as preceding joint. The anterior legs are about half as long as basal joint of second pair. This basal joint is very slender, and rather longer than the segment to which it is attached, and longer than the hand of the same pair. The finger is hardly half as long as hand. The second pair of feet is attached to second segment, in the individual figured, very near its posterior margin. The palm of the hand bears a few very short hairs.

Var. *subtenuis*.—Our figure 1 *c*, represents this variety. It differs in its less slender form, the second joint of the thorax about one-half longer than the third, the inferior antennæ slightly longer than the

first two joints of the superior antennæ, the legs of the first pair stouter, the head about one-third the length of the first thoracic segment. The finger of the hand of second pair reaches nearly two-thirds of the way to the base, and closes beneath an acute process or tooth. The hands of the first pair are rather more than half as long as those of second pair.

The second pair of legs in the specimen figured is united to the posterior part of the second thoracic segment, and the individual was therefore a male. The basal joint of this pair of legs is slender, and about as long as the segment, and also about as long as the hand.

2. *Caput non armatum nec rostratum.*

CAPRELLA JANUARI (Kröyer).

Maris:—*Corpus gracillimum, segmento thoracis 1mo quadruplo longiore quam caput, 2do 1move gracili duplo longiore quam 3tium. Antennæ 1mæ dimidio corporis longiores, 2dis plus duplo longiores, articulo 1mo brevior quam 2di dimidium, flagello brevi, valde brevior quam articulus precedens. Branchiæ elongato-ellipticæ. Manus paris secundi oblonga, palmâ pubescente, dentibus acutis duobus armatâ et altero intermedio obsoleto.*

Body very slender, first segment of thorax four times as long as the head, second or first quite slender, and either twice as long as third. Superior antennæ longer than half the body, and more than twice the length of the inferior; first joint not half as long as second; flagellum much shorter than preceding joint of base. Branchiæ narrow-elliptical. Hand of second pair of legs oblong, palm pubescent, and armed with two acute teeth and another obsolete intermediate.

Plate 55, fig. 2 *a*, animal, enlarged; *b*, probably the female; *c*, part of flagellum of the superior antennæ; *d*, extremity of inferior pair; *e*, hand of second pair; *f*, extremity of leg of last pair.

Rio Janeiro; from the anchor, in ten to twelve fathoms.

Length, one and one-fourth inches. Head quite small, obtuse in

front. Margin of body very finely serrulate, as seen in vertical view, and the whole thorax pubescent. Inferior antennæ about half as long as base of superior, ciliate below. Superior pair pubescent; second joint very long and slender, more than twice the first in length; the third joint a little shorter than the second. The flagellum slightly longer than first basal joint, few-jointed. Hand of first pair of legs about one-third the length of hand of second pair. Anterior margin of coxa of second pair, serrulate; near base there is a short spinous process attached to the thoracic segment. The tarsus of the six posterior legs has two short spines below near base, not situated on a prominence, and the joint suddenly decreases from these spines towards the apex. Last two joints of inferior antennæ together about as long as preceding.

Krøyer described and figured this species in his *Tidsskrift*, iv. 1843, Heft 5, and tab. 6, figs. 14–20. He makes the body and superior antennæ a little less slender than in our specimens. He figures a female, which may possibly be another species.

The animal which we have figured (fig. 2*b*, pl. 55), as the female, differs widely from the *Januarii*, and may be distinct. The head is unarmed, as in the *Januarii*, but it is but slightly shorter than the first thoracic segment; the flagellum of the superior antennæ is much longer than the preceding joint, and about twelve-jointed, joints rather long; the second thoracic segment is hardly longer than the third; the inferior antennæ are as long as first two basal joints of superior, and half of nearly third joint; the branchiæ are narrow elliptical, but not linear. The hand of the second pair is narrow, the palm slightly arcuate, and armed with four or five minute spinules; a tooth below rather near base, two near apex; finger three-fourths as long as the hand.

This species is named in the author's earlier manuscripts *Caprella humilis*, and should it prove that the species is distinct, the name may be retained. One specimen of similar characters appears to be a male, as the second pair of legs are attached to the segment posterior to its middle; and if this is a safe criterion the species should be sustained.

CAPRELLA GLOBICEPS.

Corpus crassiusculum, segmentis thoracis 2do 3tio 4to 5toque, longitudine

subæquis, paulo oblongis. Caput rotundatum, segmento proximo duplo longius. Antennæ 1mæ pubescentes, dimidio corporis paulo longiores et inferioribus plus duplo longiores, articulo 1mo parce brevior quam 2dus, flagello vix brevior quam basis, 10-12-articulato. Antennæ 2dæ parvulæ, basi 1marum multo breviores. Branchiæ oblongæ. Manus secunda oblonga, palmâ rectiusculâ, pubescente, versus basin prominulâ.

Body rather slender, second, third, fourth, and fifth thoracic segments subequal, somewhat oblong. Head rounded, twice as long as next segment. Superior antennæ pubescent, rather longer than half the body, and more than twice as long as the inferior, first joint a little shorter than second; flagellum ten to twelve-jointed, hardly shorter than the base. Inferior antennæ much shorter than base of superior, quite short ciliate. Branchiæ oblong. Hand of second pair oblong; palm pubescent, nearly straight; a prominence towards base.

Plate 55, fig. 3, animal, enlarged.

Rio Janeiro, in ten to twelve fathoms; taken from the anchor with the preceding.

Length, half an inch. The rounded front of the head is peculiar; so, also, the small size of the inferior antennæ, which are not half as long as the superior, while the flagellum of the superior antennæ is about half the whole organ. The head, moreover, is twice as long as the first thoracic segment. The inferior antennæ are about as long as first two basal joints of the superior. The first basal joint of the superior is but little shorter than second, and about equal to third. Hand of first pair of legs very small, less than half the length of second pair. Branchial appendages subovate. Fifth thoracic segment is but little shorter than the preceding.

In the specimen figured, the second pair of legs is attached below to the second thoracic segment near its middle, and not anterior to it.

The species may possibly be a variety of the *dilatata*.

GENUS *ÆGINA*, Kröyer.

The character of this genus of Kröyer's, derived from the length of the abdomen, appears to have comparatively small importance; a strict adherence to the distinction "abdomen 2-articulatum," is not, therefore, considered necessary or convenient.

ÆGINA? TENELLA.

Corpus gracillimum. Caput fronte subacutum, sed instar rostri non productum, segmento proximo paulo longius. Segmentum thoracis secundum 3tio 4to 5tove brevius, aculeis mediano et postico dorso armatum, tertium postice aculeatum tantum, reliqua ineremia. Antennæ 1mæ tenues, dimidio corporis multo longiores, articulo 1mo dimidii 2di longitudine, flagello articulado, paulo breviorè quam basis. Antennæ 2dæ basi 1marum parce longiores. Manus 2da angusta, apice obliquè truncata, palmâ non arcuatâ, medio obliquè profundè excavatâ sparsim brevissime pubescente. Branchiæ parvulæ, oblongæ.

Body very slender. Head subacute in front, but not produced into a beak, longer than next segment. Second segment of thorax shorter than either of the three following, armed with spines on the middle and posterior margin of the back; the third aculeate at posterior margin only; remaining segments unarmed. Superior antennæ slender, much longer than half the body, first joint half as long as second, flagellum jointed, a little shorter than base. Inferior pair hardly longer than base of superior. Hand of second pair narrow oblong, with a broad obliquely truncate apex; palm not arcuate, near middle obliquely excavate, a few minute tufts of pubescence. Branchiæ quite small, oblong.

Plate 55, fig. 4, animal, enlarged.

Coral reef, Sooloo Sea; from the shores of a small island off the harbour of Soung, in the large island Xolo.

Length, half an inch. Colourless, or yellowish. Our doubt about

referring this and the following species to *Ægina*, rests mainly on our not knowing whether the mandibles are palpigerous or not; the drawings and description drawn up in the East Indies by the author, containing no information on this point, and the specimens being lost. Moreover, the species have seven joints to the inferior antennæ; the last three joints (corresponding to a flagellum in other Amphipods), are together much shorter than the preceding.

The third basal joint of the superior antennæ is nearly as long as the second; the first is about half shorter; the flagellum of this pair consists of slender oblong joints, and bears a few short setæ at apex of each. Hand of first pair of legs not half as long as in second pair; claw about as long as hand. Hand of second pair with the dorsal margin arcuate, the opposite straight and thin through basal half, and nearly parallel to dorsal, then a deep rounded emargination, directed towards base, and bounded outwardly by an acute point. Claw or finger nearly as long as hand. The last two thoracic segments are hardly longer than half the preceding. The branchiæ are less than one-third the length of the segments to which they are attached. Head vertically oblong in profile view. Second thoracic segment as long as head and first thoracic together; third as long as first and second. One of the spines of the second thoracic segment is at the middle of the back, and the other near the articulation behind. The legs of the second pair in the specimen examined, were attached quite near the anterior extremity of the second segment, as in female *Caprellæ*; but there were no ovarian lamellæ under the third and fourth segments.

ÆGINA? ACULEATA.

C. tenellæ affinis, paululo crassior. Caput ad frontem vix acutum. Segmenta thoracis secundum tertiumque aculeis duobus quoad dorsum armata, reliquis inermibus. Manus secunda latè elliptica, infra arcuata, obsoletè erosa et remotè pubescens. Branchiæ parvulæ, oblongæ.

Near *tenella*, slightly stouter. Head hardly acute in front. Second and third thoracic segments armed with two curved spines on the back, the others unarmed. Hand of second pair broad elliptical, arcuate below, obsoletely erose and remotely pubescent. Branchiæ quite small, oblong.

Plate 55, fig. 5 *a*, animal, enlarged; *b*, portion of flagellum of superior antenna.

Found with the preceding.

Length, nearly half an inch. This species has nearly the same proportional lengths between the thoracic segments as in the preceding. The antennæ are also similar, though stouter. The flagellum consists of cylindrical joints, and at apex there is a seta on the under side as long as the joint, while on the outer apex, the seta is not half as long. This species differs from the preceding widely in the hands of the second pair of legs, and moreover, it has two hooked spines to both the second and third segments of thorax—one at middle of back and the other posteriorly near articulation. The flagellum of the superior antennæ is about as long as base, or but little shorter; the third joint of base is *not longer than first*. The fourth joint of inferior pair (as in the *tenella*), is slender and much longer than the following portion, which appears to consist of *three* joints. Finger of hand of second pair nearly as long as hand.

The feet of the second pair in the specimen figured, were attached quite near the anterior extremity of the segment, as in females; consequently this is probably of the same sex with the specimen of the *tenella* described, and the two are not, therefore, male and female of the same species, as might be deemed possible from the general similarity of habit.

It is possible, however, that the rule with regard to the second pair of legs in the Caprellæ may not hold for these species, and the two, the *tenella* and *aculeata*, may then be male and female of the same species. The hands of the second pair correspond with this view, the *tenella* having a male character, and the *aculeata* a female character. As our specimens are not in the collections for farther study, we cannot settle this point.

SUBTRIBE II. GAMMARIDEA.

THE subdivision of the Gammaridea into families depends partly on the adaptation of the thoracic legs to different modes of locomotion, and partly on the character of the abdomen, which is also an organ of motion, and undergoes wide variations. Species with the habit of certain Anisopods, naturally stand apart from the typical families or groups.

The species that have pre-eminently the narrow elongate body and habit of *Tanais* and *Caprella*, are the DULICHIDÆ; the abdomen is abbreviated, the six posterior legs are fitted for clinging, *Caprella*-like, while the anterior legs are used for taking its food. They are, in fact, but a grade removed from certain *Caprellids*—the *Cercopes*—in which the abdomen has four or five joints developed. Still they are quite distinct; for the five joints existing have regular abdominal appendages, and the thoracic branchiæ are more fully developed. These are the *Caprelloid Gammaridea*.

A second group includes the boring *Gammaridea*—the CHELURIDÆ. The abdomen has the fourth and fifth segments united into a long styliform joint, and the three pairs of caudal stylets are very unlike, and of abnormal forms.

The above two families are the *aberrant* groups among the *Gammaridea*. We pass now to the family of gressorial *Gammarids*, which is *subtypical*.

The species—the COROPHIDÆ—differ widely from the *typical Gammaridea* in being capable of walking on a flat surface like *Isopoda*, and they have nearly the habit of animals of that tribe. Yet, in structure, excepting the power of spreading the legs for gressorial use, they are closely like the *Gammarids*. They are usually broader species with a somewhat depressed body, and very narrow or obsolescent epimerals, while the typical *Gammarids* have compressed bodies, often with large epimerals, which so confine the legs that they could not be spread laterally, if the articulation at base admitted of it. The articulations and members of the abdomen and thorax are of the normal type.

The *typical* Gammaridea pertain to two groups, differing in habit, and somewhat in structure.

In one of these groups—the GAMMARIDÆ—the mandible is, with a rare exception, furnished with a palpus, and the palpus or outer branch of the inner maxillæ is largely developed, being two-jointed (very rarely one-jointed). They are thus like the Corophidæ. They farther approach that group in the extremity of the abdomen. The structure of this part is of unusual importance among the Gammaridea because of its use in locomotion. The Gammaridæ are either natatory, or imperfectly saltatory; and have not the pre-eminent leaping power of the Orchestidæ. We find, consequently, that the caudal stylets are commonly unequally or irregularly projecting, and rather lax in their motions; the last pair is usually two-branched and elongated, and often projects beyond the others; they are, therefore, not constructed in the most effective manner for leaping.

In the other group—the ORCHESTIDÆ—the mandibles are *without* palpi; the inner maxillæ have the palpus *small* and one-jointed, or obsolete; the habits of the species are peculiarly saltatory; the caudal stylets project behind in such a way that the tips lie in a straight line, the last pair being very short and simple, and the others in order projecting beyond it, so that the whole combine together to render the extremity of the abdomen peculiarly well fitted for their saltatory habits; the stylets are less free in their motions than those of the Gammaridæ, and are consequently calculated to act more unitedly. The Orchestidæ have the body much compressed, with large epimerals. The Gammaridæ are sometimes as much compressed; but there is a gradation to species with a subdepressed body, and very small epimerals, and thence by an easy transition to the Corophidæ.

The Orchestidæ probably rank higher than the Gammaridæ. The organs of the mouth in the latter may appear to be better furnished for action, by the presence of mandibular palpi and more fully developed maxillary palpi. Yet such accessories, may be only a mark of inferiority, as they show that there is something lacking in the other parts, which render them necessary. The highest Crustacea, the Brachyura, have no mandibular palpi; while among the Macroura, a lower order of the Eubranchiates, such palpi are common.

The Orchestidæ are mainly land species of Gammaridea, living to great extent in sand-beaches or similar places; and they are exceed-

ingly agile; while the Gammaridæ are water species, and generally less active in their movements.

The several families above mentioned may be characterized as follows:—

Fam. I. DULICHIDÆ.—Habitu Caprelloideæ. Corpus lineare, epimeris obsoletis. Pedes 6 postici longi, subprehensiles. Abdomen 5-articulatum.

Fam. II. CHELURIDÆ.—Corpus fere cylindricum, epimeris mediocribus. Abdomen abnormale, segmentis 4to 5toque coalitis et oblongis, stylis inter se valde dissimilibus.

Fam. III. COROPHIDÆ.—Gressoriæ, pedibus partim lateraliter porrectis. Corpus plus minusve depressum, sive latum sive lineare, epimeris perbrevibus, interdum obsoletis. Abdomen formâ appendicibusque normale. Antennæ sæpe pediformes.

Fam. IV. ORCHESTIDÆ.—Saltatoriæ, pedibus nullis lateraliter porrectis. Corpus compressum, epimeris magnis. Abdomen appendicibus normale. Antennæ non bene pediformes. Styli caudales 1mi 2dique biramei; 3tii simplices, brevissimi et ultra 2dos non prolongati. Mandibulæ non palpigeræ. Maxillæ 1mæ palpo sive parvulo et 1-articulato sive obsoleto instructæ.

Fam. V. GAMMARIDÆ.—Saltatoriæ vel natatoriæ, pedibus nullis lateraliter porrectis. Corpus sæpius compressum, raro subdepressum, epimeris sive magnis sive parvis. Styli caudales laxiores, duobus ultimis oblongis sæpiusque ultra 2dos prolongatis, raro simplicibus. Mandibulæ sæpissimè palpigeræ. Maxillæ 1mæ palpo 2-3-articulato (rarissimè 1-articulato) instructæ.

The homologies of the parts of the shell forming the surface of the head in the Gammaridea, are considered in our general remarks on the family Orchestidæ.

The most difficult point in the study of the Gammaridea, as in the Caprellidea, is that of ascertaining sexual distinctions. Males and females are often very diverse. The former may have the antennæ

twice as long as the latter, and the joints of the flagella twice as numerous, and the extremities of both the first and second pairs of legs may be entirely unlike, so that when the second pairs are dissimilar, we cannot look to the first as a guide to determine identity of species.

The relative lengths of the five posterior pairs of legs; the number and size of the hairs or setules on the legs, and their length, as compared with the diameter of the joints; the length and size, in the same manner, of the hairs on the antennæ; the size of the epimerals; the length and relative size of the caudal stylets,—appear to be constant characters for both sexes. The young, however, differ from adults in these respects, as well as others, their antennæ being not only shorter but far less hairy, and the legs and stylets shorter, and also more nude.

FAMILY I. DULICHIDÆ.

THERE is but one known genus of this family—*Dulichia* of Kröyer.* It has the legs of the fifth, sixth, and seventh pairs subequal and prehensile, as in *Caprella*, and the first and second pair are furnished with hands, the latter the larger. The four antennæ are long, the supe-

* Tids. [2], i. 512, 1845, and Voy. Scand., etc., pl. 22, fig. 1. He thus describes the genus:—

“Corpus valde elongatum, gracile. Antennæ longissimæ (imprimis superiores), subpediformes; superiores flagello instructæ appendiculari. Oculi prominentissimi, acuminati. Pedes thoracici 1mi paris compressi, manu (articulo 4to) magna, ungueque 2-articulato instructi (qui unguis articulo 5to 6toque junctis efficitur). Pedes 2di paris manu instructi subchælifirmi (quæ apud mares maxima est). Pedes 3tii 4tique paris minimi, fere filiformes, invicem ejusdem ferme longitudine et forma. Pedes 5ti 6ti 7mique paris elongati, lineares (femore non dilatato), prehensiles. 6tus thoracis annulus cum 7mo coalitus ut difficiliter distinguantur. Epimera nulla vel prorsus rudimentaria. Abdomen 5 modo compositum annulus et 5 præditum pedum paribus quorum tria anteriora natatoria, duo posteriora saltatoria sunt.”

rior much the longer. The head is triangular in an upper view, and pointed rostrate in front. The segments in the species described are more or less nodose or spinous.

FAMILY CHELURIDÆ.

THE genus *Chelura* of Philippi,* the only one of this family yet discovered, includes a boring species of Amphipod. The body, as described and figured, is nearly cylindrical; the epimerals of moderate size. The fourth and fifth segments of the abdomen are united, and form a long, styliform joint. The pairs of caudal stylets are very unlike one another, the last being very long and lanceolate; the preceding short and broad foliaceous; the first pair short styliform. The mandibles are palpigerous. The antennæ are short; the superior are the shorter and appendiculate; the inferior are pediform and without a flagellum.

FAMILY COROPHIDÆ.

THE Corophidæ are near the Gammaridæ in the general form of the thoracic legs, and in both sets of abdominal appendages, although usually very dissimilar in appearance when observed in motion. The more common species have pediform or subpediform antennæ; these form the subfamily COROPHINÆ (Podoceridæ, of Leach). There are others—ICILINÆ—which have slender flagella, as in the Gammari, with no pediform character. A few—CLYDONINÆ—have the caudal stylets simple, the legs long and slender, and two long, stout, rigid antennæ.

* Archiv für Nat., 1839; *G. J. Allman*, Ann. and Mag. Nat. Hist., xix. 361, June, 1847.

The species of Corophinæ have generally the fingers of the hands of the first and second pairs of legs all simple; yet, in a few species, the second pair has the fingers two-jointed, the hand being formed of the fourth normal joint; and, in a few others, the legs of neither the first nor second pair are prehensile. The species also differ strikingly in the stylets, and are thus naturally divided into genera.

The posterior stylets may be exceedingly short and quite simple, or they may have two short branches, ending in a few short hairs or setæ; or they may have two branches, the outer of which is recurved uncinately at apex. The stylets of the preceding pairs, as in *Corophium* and *Siphonocetes*, may be subcultriform, with the outer edge more arcuate and set with spines, which fits them for special action by their outer margin; or they have, in common style, the two sides or edges essentially alike, without spines on the outer margin or no more than on the inner. These characters appear to be proper distinctions for genera. The importance of characteristics based upon these organs will be farther considered in the remarks on the Gammaridæ. Their value may, however, be obvious, from the fact, that two of the forms mentioned are not found in the families Gammaridæ or Orchestidæ: for in no other groups, except certain Corophidæ is the posterior pair of stylets so short as to be concealed nearly by the extremity of the abdomen, nor the other stylets spinous and arcuated on the outer edge for special action by this margin.

Krøyer has stated that the hands of the second pair in the male of the *Podocerus Leachii* has the finger two-jointed, as in *Erichthonius*, and only the female has it one-jointed, corresponding with the generic character.* We have not been able to verify this observation. Among our species of *Pyctilus* (which we think may still be true *Erichthonii*), we observed that there were *females* with the finger bi-articulate, and thus not at all like *Podocerus*. The posterior stylets in *Pyctilus* end in a single short conical branch, with a sub-reflexed apex; which is not a form occurring in *Podocerus*: whether this is the form in *Erichthonius*, is not given in the figures or descriptions published.

* It is possible that the *Podocerus Leachii* (Krøyer) should form a distinct genus, as the animal lived in a tube like a *Cerapus*.

The subfamilies and genera of Corophidæ are as follows:—

SUBFAM. 1. CLYDONINÆ.—Styli caudales 1mi 2dique simplices, subulati.

G. 1. CLYDONIA, *Dana*.*—Pedes filiformes, 5ti 6ti 7mique longitudine incrementes, 1mi 2dique non prehensiles. Antennæ duæ longæ, crassæ, rigidæ.

SUBFAM. 2. COROPHINÆ.—Antennæ plus minusve pediformes. Styli caudales 1mi 2dique biramei.

A. DIGITUS NULLUS 2-ARTICULATUS.

1. *Styli caudales 3tii minuti, simplices, 2di 1mique ramo externo cultriformi.*

G. 1. COROPHIUM, *Latr.*—Antennæ inferiores longiores et crassiores, flagello carentes. Pedes 2di non prehensiles, 1mis crassiores, articulo 4to latiore quam 5tus.

G. 2. SIPHONOCETES, *Krøyer*.†—Antennæ inferiores longiores, flagello carentes. Pedes 1mi 2dique subchelati. [Pedes 3tii 4tique articulo 4to laté obcordato. Tubum lapillis fragmentisque concharum formatum inhabitat.]

2. *Styli caudales 3tii minuti, vix exserti, simplices, 2di 1mique ramis extus non præcipue spinosis nec cultriformibus, interdum nudis.*

G. 3. PLATOPHIUM, *Dana*.—Corpus superne visum subellipticum, abdomine bene inflexo. Antennæ flagello brevi sæpe instructæ, inferiores longiores, superiores appendiculatæ. Pedes 1mi 2dique subchelati, 2dis validioribus. Pedes 10 postici mediocres.

G. 4. CYRTOPHIUM, *Dana*.—*Platophio* similis. Antennæ superiores non appendiculatæ.

* Amer. J. Sci. [2], viii. 140.

† Voy. Scand., etc., 1838–1840, pl. 20, f. 1; Tidsskr. [2], i. 481, 1845. Krøyer, in his description, says:—

“Pedes thoracici primi et 2di paris validissimi, manu instructi subcheliformi. Pedes 3tii et 4ti paris articulo primo latissimo, laminari; articulo quarto obcordato, laminari, manum præbente, cujus unguis efficitur articulo quinto subconico articuloque sexto aciculari. Pedes 5ti 6tique paris minutissimi, sed robusti, recurvati, articulo primo clavato, ungue furcato. Pedes 7mi paris graciles, recurvati, articulo primo laminari, ungue minutissimo, furcato. Pedes abdominales 1mi, 2di et 3tii paris natatorii breves validissimi, parte basali latissima, rhomboidali; pedes 4ti 5tique paris saltatorii; pes abdominalis sexti paris natatorius unica instructus lamina terminali.”

3. *Styli caudales 3tii parvuli, biramei, ramo externo non uncinato, 2di 1mique ramis extus non præcipue spinosis nec cultriformibus.*

G. 5. UNCIOLA, *Say*.*—Pedes 1mi 2dique manu confecti, 1mis validioribus. Antennæ flagellis confectæ, subpediformes, validæ, superiores paulo longiores, appendiculatæ.

4. *Styli caudales 3tii paulo elongati, biramei, ramo externo uncinato.*

G. 6. PODOCERUS, *Leach*.†—Pedes 1mi 2dique subchelati, 2dis validioribus. Antennæ superiores breviores, non appendiculatæ. [An maris digitus 2dus interdum 2-articulatus, Kröyer teste.]

G. 7. CERATOPHIUM, *Dana*.—Pedes 1mi 2dique subchelati, 2dis validioribus. Antennæ superiores breviores, appendiculatæ.

B. DIGITUS 2DUS 2-ARTICULATUS.

G. 8. CERAPUS, *Say*.—Antennæ pediformes, subæquæ, flagellis carentes. Pedes 1mi 2dique prehensiles, 1mis parvulis, 2dis manu bene confectis. Styli caudales 3tii biramei, ramis subæquis, longiusculis. [Tubum membranaceum inhabitat.]

G. 9. CERAPODINA, *Edw.* (*Cerapus*, Templeton.) Antennæ totæ flagellis confectæ. Pedes 4ti 5ti 6tique obsoleti (?). [Tubum papyraceum inhabitat.]

G. 10. ERICHTHONIUS, *Edw.*‡—Antennæ flagellis confectæ. Pedes 10 postici

* *Jour. Acad. Nat. Sci. Philad.*, i. 388.

Glaucome of Kröyer has the hands and antennæ and apparently the other characters of *Unciola*. *Say* describes the hands of the second pair in *Unciola* as *adactyle*; but they still are probably like those of *Glaucome*. The following is Kröyer's description:—

“*Antennæ* subpediformes; superiores flagello ornatæ appendiculari perparvo. *Oculi* minuti, parum distincti. *Mandibulæ* apex in duos fissus ramos qui dentibus sunt armati conicis; tuberculus molaris dentibus confertissimis instructus. *Labium superius* breve, depressum latissimum, margine anteriori medio inciso; *labium inferius* quatuor compositum laminis setosis. *Laminæ maxillares* pedum maxillarium dentibus armatæ validis; unguis palpi apice setosus. *Pes primi paris* robustissimus, manu subcheliformi; *pes secundi paris* gracilior, manu carens subcheliformi, pedes 3tii 4tique paris pergraciles; pedes 5ti 6ti 7mique paris graciles femoribus parum dilatatis. Pedes abdominales 1mi 2di et 3tii paris natatorii, breves sed robustissimi; 4ti 5tique paris saltatorii, validi; 6ti paris fere rudimentares, natatorii. *Epimera minima* fere evanescentia.”

† *Jassa* of *Leach* may, without inconvenience, be united to *Podocerus*, as there is no essential generic difference between them.

‡ The author obtained three species in the cruise of the Expedition having the hands

mediocres. Epimeræ anteriores obsoletæ. [An styli caudales 3ti simplicissimi?]

SUBFAM. 3. ICILINÆ.—Antennæ non pediformes nec subpediformes, flagellis sat longis basique sat brevi instructæ. Styli caudales ac in *Corophinis*.

- G. 1. ICILIUS, *Dana*.—Pedes toti unguiculati et tenues, 4 antici longi, non prehensiles, ciliati, 10 postici fere similes. Antennæ superiores breviores, non appendiculatæ.
- G. 2. PTERYGOCERA, *Latr.*—Pedes posteriores sublamellati. Antennæ superiores breviores, appendiculatæ, inferiores basi dilatatae.

SUBFAMILY CLYDONINÆ.

The Clydonia group is aberrant in most of its characters, as will be observed in the following descriptions and the illustrating figures. The caudal stylets are unlike any others in the Gammaridea. The antennæ are also anomalous. Only two were observed, and these were long, straight, stout, rigid organs, lying side by side, and excepting the basal joints, hardly articulated, or only indistinctly so. The legs are very long, and filiform; the fifth pair is much the longest, and from the fifth to the seventh the decrease in length is very rapid, the seventh being short. These legs appear to be used for standing; and, as the fifth pair is the longest, they are fitted to place the body in a horizontal position rather than in the erect posture, observed in the Caprellids and Arcturi. The claw, moreover, is exceedingly short.

The body is narrow, with very small or obsolescent epimerals. The abdomen has the usual number of segments, as also the thorax. The eyes are small. The specimens are not in our collections, and we are not, therefore, able to add more details to what are given in our original descriptions and figures, made in 1838 and 1839, when the specimens were taken. The following genus is the only one detected.

and many other characters of *Erichthonius*, but with the epimerals of the anterior thoracic segments of considerable size; and, moreover, no gressorial habits were observed. They are, therefore, with some hesitation, arranged in a genus named *Pyctilus*, among the Gammaridæ, subfamily Gammarinæ.

GENUS CLYDONIA, Dana.

Corpus elongatum paulo depressum. Abdomen 6-7-articulatum. Oculi parvi. Antennæ duæ elongatè styliformes, rectæ, rigidæ, articulo brevi basali et altero longissimo subulato obsolete multiarticulato instructæ. Pedes tenues, 6 postici filiformes, quintis longissimis.

Body elongate, somewhat depressed. *Abdomen* six to seven-articulate. *Eyes* small. The two antennæ long styliform, straight, consisting of a short basal joint and a long, rigid, subulate, extremity, obsolete multiarticulate. Feet slender; six posterior long filiform; fifth longest.

The long, straight, and rigid antennæ of the species, and the long slender legs, are unlike what is elsewhere found in the Gammaridea. Owing to the very long legs, flexed as they are for walking, the species have some general resemblance in habit to a Mantis. The four anterior legs are the shortest, and have no proper hands.

These animals were procured in the open ocean, one species in the Atlantic, and the other in the Pacific. The name of the genus is from κλυδωνί, a wave, and alludes to the place of occurrence of the species.

DANA, Am. J. Sci. [2], ix. 1850.

CLYDONIA GRACILIS.

Antennæ duæ fere corporis longitudine, subulatæ. Oculi parvi, lenticulis 9. Styli caudales tenues, primi ultimique secundis longiores, ultimis medio ramum brevem acutum ferentibus. Pedes quinti corpore non breviores, articulo primo longissimo infra minute spinoso, apice spinose producto; septimi quintis plus dimidio breviores. Abdominis segmenta 3 antica latere acuta, angulo postico subtruncato.

Two antennæ about as long as the body, subulate. Eyes small, with nine lenses. Caudal stylets slender; the first and last longer than

second; last having a short acute branch near middle. Fifth pair of feet as long as the body; first joint very long, minutely spinulose below; seventh pair less than half the fifth.

Plate 55, fig. 6 *a*, animal, enlarged; *b*, eye.

Atlantic Ocean, latitude 1° north, longitude 18° west. Collected, October 31, 1838, at 4 h. A. M.

Length, three lines. Colour, reddish in irregular spots; long antennæ, in part reddish. The body consists of a head, seven thoracic segments, and six abdominal. The head is short, about half as long as wide. The last three thoracic segments are as long as the first four. The three anterior abdominal segments are nearly of the same size, the anterior a little the longest; the following one is much smaller, and the others rapidly decrease in size. The stylets are slender acute. The posterior one is branched, and this branch is short acute, and is articulated with the middle of the organ. The antennæ are stout at base, and gradually taper to an acute apex, they have minute spines on the outer side, and are short pubescent on the inner. The eyes consist of eight lenses around a central one.

The four anterior legs are short hirsute, and end in a small claw; the second pair is a little longer than the first; the next two pairs are longer, and very nearly naked. The fifth pair is about twice as long as fourth, and equally slender or even more so; the first joint is about as long as the next three; the second is very short; the fifth is one-fourth the length of the first; the claw is very small. The sixth pair is much shorter than fifth, and the seventh not half the fifth.

In the specimen examined, one antenna was more than one-half shorter than the other, and yet apparently perfect. It is probable that it had been broken at the articulation below, and was growing out.

Along the sides of the segments of the body, the outline of the epimerals was barely distinguished.

CLYDONIA LONGIPES.

C. gracili similis. *Antennæ duæ fere corporis longitudine, subulatæ, parce crassiores, obsolete multi-articulatæ. Pedes septimi quintis non*

dimidio breviores. Abdominis segmenta duo antica angulos posticos acuta non truncata.

Similar to *C. gracilis*. The two long antennæ nearly as long as the body, a little stouter than in the preceding, obsoletely multiarticulate. Seventh pair longer than half the fifth. Two anterior abdominal segments with the posterior angles acute and not truncate.

Plate 55, fig. 7 *a*, animal, enlarged, posterior stylets and one antenna mutilated; *b*, outline of front in vertical view.

Pacific Ocean, latitude 18° 10' south, longitude 126° west. Collected, August 8, 1839.

Length, four to five lines. Colour of thorax, mostly brownish; of abdomen, red, and part of antennæ same colour. There is a prominent angle on front of head and a low angle over each of the antennæ; but the front angle is not apparent in a vertical view, as the front margin, which is in advance of the angle, is depressed below the upper surface of the head. The eyes are as in the *gracilis*. In the second and third pairs of legs the fourth joint is longer than either the fourth or third. A large oval lamella, branchial in character, is attached to the base of several of the legs. The posterior angles of the first two abdominal segments are acute, and the acute points occupy the posterior part of the margin, instead of being in advance of it, as in the *gracilis*.

SUBFAMILY COROPHINÆ.

GENUS COROPHIUM, Latr.

COROPHIUM? QUADRICEPS.

Corpus depressum, lineare, capite quadrato, abdomine postice rotundato. Pedes 4 antici similes, primis minoribus. Pedes quinti quartis breviores, articulo primo non setoso; septimi tenues, articulo primo setoso, setis longiusculis, plumosis. Antennæ ad marginem posticum subæquæ; superiores parce breviores, 7-articulatæ, articulo primo longiore; inferiores crassiusculæ, 7-articulatæ, quartam partem corporis

longitudine vix superantes, articulo tertii longiore, tribus ultimis parvulis, subæquis.

Body depressed, linear, head quadrate, abdomen posteriorly rounded. Four anterior feet similar; the first pair the smaller; fifth pair shorter than fourth, first joint not setigerous; seventh long and slender; first joint setigerous on posterior margin, setæ rather long and plumose. Antennæ subequal; superior a little the smaller, seven-jointed, the first joint longest; inferior rather stout, seven-jointed, about one-fourth as long as body, third joint longest; last three quite short and subequal.

Plate 55, fig. 8, animal, imperfectly figured, enlarged, the caudal extremity not finished.

Harbour of Rio Janeiro, near the city. Collected, December 22, 1838.

Length, nearly one line. Head longer than the two following segments, nearly square in a vertical view; in a lateral view largest posteriorly. Extremity of abdomen nearly as broad as thorax. Eyes small, with few facets, round, distant, black. Inferior antennæ with a whorl of short setæ at apex of each of the last four joints. The last three joints together about as long as either of the two preceding. The anterior four feet have a few short hairs on the joints. The claw is but slightly curved. There are plumose setæ on the first joint of the seventh pair of legs; also, a few on posterior margin of same joint of sixth pair; but none, or not more than one or two, on fifth pair. The first pair of stylets extends backward farther than the second, and the second pair farther than the third pair.

GENUS PLATOPHIUM, Dana.

Cephalothorax anguste ellipticus, abdomine sub ventre bene inflexo, capite subquadrato, oculis ad angulos anticos insitis et sæpe paulo prominentibus. Antennæ inferiores paulo longiores, totæ bene pediformes, flagellis perbrevis sæpe confectæ. Pedes 4 antici subchelati, 2dis validioribus. Styli caudales 3tiii minuti, simplicissimi, extremitate abdo-

minis partim celati; 2di 1mique biramei, ramis inæqualibus, extus non præcipue armatis.

Cephalothorax narrow elliptical, abdomen inflexed under the venter; head subquadrate; eyes situated at the anterior angles, and a little prominent. Antennæ pediform, with a very short flagellum, or none, the inferior pair a little the longest. Four anterior feet subchelate; second pair much the stouter. Caudal stylets of the third pair minute, simple, partly concealed by the extremity of the abdomen; first and second pairs with the branches unequal, and not specially armed on the outer side.

The species of this genus, as the figures show, have somewhat of a spider-like aspect, when seen in a dorsal view. The abdomen is flexed commonly close against the venter, and is quite narrow, its width being less than half that of the thorax.

The branches of the stylets of the first and second pairs are subcylindrical, and the inner of each is considerably longer than the outer. Both are armed above with a few spines, in two series, and there are longer spines at the extremity. The extremity of the abdomen is gibbous and setose above, and covers mostly or wholly the third pair of stylets. The species approximate in form to the *Icilia*, but have the hands and antennæ of the *Corophinæ*.

PLATOPHIUM BRASILIENSE.

Maris:—*Corpus superne visum angustè ellipticum. Antennæ infra ciliatæ; internæ basi externarum breviores, flagello 3-5-articulato; externæ dimidio corporis paulo longiores, flagello 3-articulato. Pedes 1mi manu parvâ instructi; 2di manu validâ, oblongâ, infra fere rectâ, et pilis plumosis tenuissimis et longissimis (latitudine manus longioribus) et confertis ornatâ, carpo parce oblongo infra non producto, articulo 3tio anticè infra valde producto. Pedes 10 postici subæqui, setis brevibus, sat paucis, articuli diametro 5ti non longioribus.*

Feminæ:—*Corpus latius ellipticum. Antennæ paulo breviores, internæ basi externarum paulo longiores. Pedes 2di manu mediocri instructi, latâ, paulo oblongâ, infra arcuatâ et hirsutâ, pilis longis non ornatâ, carpo non oblongo.*

Male:—Body seen from above narrow-elliptical. Antennæ ciliate below; inner shorter than base of outer, flagellum three to five-jointed;

outer pair a little longer than half the body, flagellum three-jointed. Feet of first pair furnished with a small hand; hand of second pair short, oblong, nearly straight below, and furnished very thickly with very fine, long, plumose hairs, longer than the breadth of the joint; carpus slightly oblong, not produced below; third joint much produced below anteriorly; ten posterior feet subequal, setæ short, rather few, not longer than diameter of fifth joint.

Female:—Body more broadly elliptical than in male. Antennæ a little shorter, the inner pair a little longer than base of outer. Hand of second pair of legs of moderate size, broad and but little oblong, arcuate below and hirsute, but not furnished with long hairs like the male; carpus not oblong.

Plate 55, fig. 9 *a*, *male*, in dorsal view, much enlarged; *b*, same, lateral view; *c*, flagellum of superior antennæ; *d*, tarsus of one of the six posterior legs; *e*, extremity of abdomen, upper view; *f*, same, side view.—*g*, *female*, upper view; *h*, leg of first pair; *i*, part of leg of second pair; *k*, hand of same, seen somewhat obliquely, as in its natural position in a side view of the animal; *l*, extremity of one of the other legs.

Dredged in the harbour of Rio Janeiro.

Length, the abdomen inflexed, about two lines; with the extended abdomen, three lines. The epimerals are very small, but distinct. The hairs on the under side of the hand of the second pair of legs in the male are longer than the width of the hand, and much less than half the same width in the female. The hairs on the under surface of the third joint of the same legs are in a few transverse series. The tarsus has an angle below near base, and no setæ towards apex. The males and females differ very considerably; yet we think there is little doubt of their being the same species. Numerous specimens of both sexes were obtained together.

GENUS CYRTOPHIUM, *Dana*.

Platophio ferme affinis. *Antennæ superiores non appendiculatæ*.

Very near *Platophium*. Superior antennæ not appendiculate.

The single species of this genus obtained (at Singapore), has the

rings of the body very prominently projecting, giving the thorax a nodose appearance. It differs from the species of *Platophium* in the first and second pairs of stylets, one branch of which, the inner, is not only longer than the outer, but is lamellar, instead of subcylindrical or styliform, and the terminal spines or setæ are longer, the longest being nearly as long as the branch.

CYRTOPHIUM ORIENTALE.

Antennæ bene pediformes, infra ciliatæ; inferiores flagello vix instructæ duobus articulis parvulis confectæ, articulo precedente (ad normam 1mo flagelli) valde oblongo, longiore quam proximus præcedens; superiores articulis apicalibus 3 subæquis simul sumtis articulum 3tium longitudine æquantibus confectæ, ciliis prælongis. Manus 2da crassa, subelliptica, infra fere recta et hirsuta, digito parce brevior quam manus. Pedes 6 postici subæqui, fere nudi. Styli caudales 2di 1mi-que apicè spinis longis armati, ramo interno lamellato et margine interno spinuloso, ramo externo brevior, subterete.

Antennæ pediform, ciliate below; inferior pair hardly having a flagellum, ending in two very small joints, the preceding joint (normally the first of the flagellum), being long styliform, longer than the joint next preceding; superior antennæ with three subequal joints at extremity, which together are as long as the third joint of the antenna; ciliæ below very long. Hand of second pair quite stout, subelliptical, nearly straight below and hirsute; finger very nearly as long as hand. Caudal stylets of first and second pairs with very long spines at extremity (one nearly as long as the branch); inner branch lamellar, having inner margin spinulous; outer branch shorter than inner, and subterete.

Plate 56, fig. 1 *a*, lateral view, unfinished; *b*, dorsal view; *c*, leg of seventh pair; *d*, extremity of abdomen, showing stylets.

Singapore, East Indies.

Length two lines.

GENUS CRATOPHIUM, Dana.

Podocero ferme similis, manu 2dâ validâ, antennis bene pediformibus,

superioribus brevioribus. Styli caudales 3tiii ramis duobus confecti, uno subconico apice uncinato altero paulo compresso. Antennæ superiores appendiculatæ.

Very similar to *Podocerus*, the hands of the second pair being very stout, the antennæ pediform, the superior pair the shorter. The caudal stylets of third pair with two branches, one subconical and uncinatè at apex, the other somewhat compressed. *Superior antennæ appendiculate.*

The appendiculate character of the superior antennæ is the only essential point of difference between *Cratophium* and *Podocerus*. This accessory branch consists but of a single joint. The legs of the five posterior pairs have nothing peculiar. The basal joints of the six posterior legs are quite broad in the species observed.

The two forms under *C. validum* may be male and female of the same species, and are here so described, although we somewhat doubt it. The females were well furnished with eggs, and were collected at the same time with the males. They are remarkable for the large size of the hands of the second pair in this sex. The tarsi of the ten posterior legs are without a seta below near apex.

The abdomen was often flexed beneath the body in the specimens, but never thrown up as close to the venter as in the *Platophia*.

CRATOPHIUM VALIDUM.

Maris:—*Caput segmentis duo sequentibus vix brevius, ad oculum utrinque paulo saliens. Antennæ infra ciliatæ; superiores graciliores, flagello 5-articulato (articulo 1mo oblongo) confectæ, inferioribus parce breviores, articulo 3tio brevioribus quam 2dus; inferiores valde crassæ, articulo 4to multo longiore quam 3tius, 5to 3tium fere æquante, duobus sequentibus (ultimis) minutis. Pedes antici parvi, manu subovatâ; 2di validissimi, manu oblongâ, crassâ, nudâ, infra prope basin digito immobili longo crasso instructâ, digito mobili longiore, vix curvato. Styli caudales 3tiii ultra 1mos vix producti. Pedes 6 postici setis paucis brevibus ornati.*

Feminae:—*Corpus crassius. Pedes 2di manu validâ et vix minore confecti, manu oblongâ, supra arcuatâ, infra fere excavatâ 3-den-*

tatâ et partim hirsutâ, dentibus duobus prope basin uno prope apicem.

Male.—Head as long as next two segments together, a little salient before the eye. Antennæ long ciliate below; superior pair much more slender, sparingly shorter than inferior pair, third joint shorter than second, flagellum five-jointed, first joint oblong; inferior pair very stout, fourth joint much longer than third, fifth as long as third, sixth and seventh (last) minute. Anterior feet with a small subovate hand; second pair very stout, the hand oblong and thick, nude, having a long, stout, immoveable finger below near base, moveable finger longer than the other, scarcely curved. Posterior caudal stylets reaching back hardly beyond the first. Six posterior legs with few short setæ.

Female.—Body stouter. Hand of second pair stout, oblong, but little smaller than in males, arcuate above, somewhat excavate and hirsute below and three-toothed, two of the teeth near base, and one near apex.

Rio Janeiro, Brazil; dredged in the harbour.

Plate 56, fig. 2 *a*, *male*, much enlarged; *b*, part of superior antennæ; *c*, part of leg of first pair; *d*, leg of fifth pair; *e*, extremity of abdomen, upper view; *f*, upper view of last pair of stylets; *g*, same, side view.—*h*, *female*, much enlarged; *i*, mandibular palpus; *k*, maxillipeds; *l*, part of leg of first pair; *m*, *ibid.* of second pair; *n*, *ibid.* of third or fourth pair; *o*, *ibid.* of sixth or seventh pairs.

Length, five lines. The males are much more slender than the females. The large hand is as long as three of the thoracic segments, or even longer. The eye-margin of the head is somewhat salient between the bases of the inferior and superior antennæ. The hand of the first pair in males has a few hairs below; the carpus is but little shorter than the preceding joint, is protuberant a little below, and bears a tuft of rather long hairs. The same hand in the female is more hairy below, and the third joint of the leg is narrower, and not longer than the carpus.

The mandibular palpus, as observed in the female, is three-jointed; the second joint longer than the third, and furnished with many setæ

at apex, rather longer than the joint. Outer maxillipeds with the inner lamellar processes long.

CRATOPHIUM ORIENTALE.

Feminae?—*Oculi rotundati. Antennæ quatuor subæquæ, fere dimidiâ corporis longitudine, 1mæ paulo longiores, articulis basis tribus fere æquis, flagello duplo longiore quam articulus 3tius, 5-articulato, articulo 1mo reliquos longitudine æquante, appendice uni-articulato; 2dæ crassæ, 5-articulatæ articulis 2do 3tio 4toque subæquæ, ultimo minimo. Manus 1ma mediocris, oblonga, supra rectiuscula, infra arcuata et pilosa, digito sat longo; 2da paulo major, subovata, palmâ fere longitudinali, 3-dentatâ ac in C. validi feminâ, dente uno anteriore, uno submediano unoque posteriore, dente submediano obtuso, digito longo, carpo minimo inter manum articulumque 3tium non producto.*

Female?—Eyes round. The four antennæ subequal, about half as long as body; superior pair a little the longer, three basal joints nearly equal in length, flagellum twice as long as third joint, five-jointed, first of the joints as long as all the rest, appendage one-jointed; second pair stout, five-jointed, second, third, and fourth joints subequal, the last minute. Hand of first pair of moderate length, oblong, nearly straight above, arcuate and hairy below, finger rather long; hand of second pair somewhat stouter, subovate, palm nearly longitudinal, three-toothed like the female of *C. validum*, one tooth anterior, one submedian, and one posterior, the submedian obtuse; finger long, carpus very small, not produced below between hand and third joint.

Plate 56, fig. 3 *a*, animal, enlarged; *b*, hand of second pair.

From the sea, off the eastern entrance of the Straits of Sunda. Collected, March 4, 1842.

Length, nearly three lines. Finger of hand of first pair of legs two-thirds as long as the hand; folds against lower margin of hand. Finger in second pair, extends three-fourths of the distance to the base of the hand, as far as the posterior of the three teeth. The legs of the

third and fourth pairs are short and rather stout; the last three are subequal, and the basal joint is quite broad.

Gammarus orientalis, DANA, Proc. Amer. Acad., Boston, ii. 212.

SUBFAMILY ICILINÆ.

GENUS ICILIUS (*Dana*).

Corpus valde compressum. Antennæ elongatæ, flagellis longis confectæ; inferiores longiores. Pedes non prehensiles, toti vergiformes, apice unguiculati. Styli caudales sex furcati.

Body much compressed. Antennæ elongate, and having long flagella; the inferior pair longest. Feet not prehensile, all vergiform and unguiculate. Caudal stylets six, furcate.

The genus *Pterygocera* of Latreille has evidently close relations to *Icilius* and some other Corophidea, though peculiar in its legs and antennæ.

ICILIUS ELLIPTICUS.

Cephalothorax ellipticus, capite brevi, latè triangulato, fronte lateribusque obtusis, oculis remotissimis, segmento proximo angustiore et brevissimo. Abdomen 7-articulatum, segmentis tribus anticis posticè ad medium acutis, segmento ultimo parvulo, ovato. Antennæ subteretes; inferiores corpore longiores, flagello fere duplo longiore quam basis, tenuissimo; superiores fere dimidio breviores, flagello non duplo longiore quam basis. Pedes 4 antici infra densè hirsuti; 3 postici consimiles, tenues, fere nudi; septimi sextis valde longiores.

Cephalothorax oval; head short, broad triangular, front and side angles obtuse; eyes very remote; following segment narrower and very short. Abdomen seven-jointed, the last segment small ovate, the three anterior at middle of posterior margin acutely prolonged. Antennæ subterete; inferior longer than body, flagellum about

twice as long as base, very slender; superior nearly half shorter, flagellum not twice as long as base. Four anterior feet densely hirsute on the inner or anterior side of last two or three joints; three posterior pairs similar; the seventh much longer than the sixth.

Plate 56, fig. 4 *a*, animal, enlarged; *a'*, same, natural size; *b*, abdomen extended straight; *c*, outline of part of same, showing dorsal outline; *d*, mandible; *e*, maxilla of first pair; *f*, *ibid*, of second pair; *g*, maxilliped.

Balabac Passage, north of Borneo; brought up on corallines in thirty-one fathoms.

Length, two lines. Colour, a little reddish. The head is more than twice as broad as long and is triangular with one angle in front, and the eyes occupying the lateral angles. The fourth segment of the thorax is broadest; the first and second much shorter than either of the following; the last longest, and as narrow as the first. The legs are all vergiform and similar, except that the four anterior are hirsute on the anterior or inner side; in the second pair, only the last two joints preceding the claw are thus hirsute. The other legs have only a few very minute setæ. The eyes are a little oblong, nearly transverse with the head. The superior antennæ have the first joint of base largest; the second a little longer than third; the whole organ is a little longer than the thorax. The base of the inferior pair is longer than the base of the superior by its last or fourth joint, which is long and slender, and nearly as long as preceding part of base; third joint a little longer than half the fourth; two preceding short. The third and fourth pairs of legs are a little stouter than first or second, though still slender. The first joint of seventh pair is prominently acute at posterior apex; the fifth and sixth pairs are nearly equal.

The abdomen has an acute triangular process at centre of posterior margin of first three joints. As the abdomen is generally curved up under the body, at about the third articulation, one of these spines projects behind. The three pairs of stylets are rather long, and extend back some distance. The branches of the last pair are quite unequal. The forms of the organs of the mouth are shown in the figures.

FAMILY ORCHESTIDÆ.

THE dissimilarity between the sexes in the Orchestidæ has produced some confusion in the genera as well as species of this family. Fr. Müller was the first to point out that the females have sometimes the characters of one genus, while the males have those of another.* The Talitri have been characterized as having a styliform or unguiculate termination to the first pair of feet and no proper hand to the second pair, while the Orchestiæ have a hand to these legs, more or less distinct. It is now shown, and our own observations sustain it, that the females of certain Orchestiæ are true Talitri; and M. Müller hence brings the genera together in one which he calls *Orchestia*, this name being appropriated hitherto to much the larger group. The styliform or unguiculate termination of the legs of the first pair is the best characteristic of the old genus *Talitrus*; those of the second pair have hands, although small and imperfect.

In the species of *Orchestia* most widely distinct from Talitri, the first and second pairs have distinct hands; the first pair more or less small or rudimentary. In others, the males are true Orchestiæ, with hands to both of these pairs, while the females have hands only on the second pair; Talitrus-like, the first pair terminates in a claw not closing against the preceding joint. There is, beside these, a third group, in which both males and females have the first pair of legs without hands, and ending in a claw. In other words, in one group, the individuals of both sexes are Orchestiæ; in another, the males are Orchestiæ and the females Talitri; in a third, both sexes are Talitri. The transition to the Talitrus-form in the female Orchestiæ is very gradual. The finger of the small anterior hands, which closes against the apical margin of the preceding joint or hand, is, in the first step of the transition, a little longer than this margin; in the next, it is considerably longer, and only the basal portion of its inner side closes against the margin; in the next, it stands upon the whole breadth of the extremity of the penult joint, and has no power of flexing against any portion of the joint, in which case the leg is unguiculate, if the last joint is small like a claw, and styliform, if rather stout and nearly or quite straight.

* Archiv für Naturgeschichte, 1848, p. 53.

It seems proper, that the three groups, just pointed out, although united by transitions, should still be kept apart as *subgenera* of a common genus, *Orchestia*; and we therefore so retain them, naming the subgenera *Talitrus*, *Talorchestia*, *Orchestia*.

The *Orchestiæ* have been described by previous writers as having the superior antennæ shorter than the base of the inferior pair. But there are other species of similar habit, and alike in the caudal stylets, mandibles, and maxillæ, in which the superior pair of antennæ is longer than the base of the inferior. They are distinct from *Orchestiæ*, moreover, in having the maxillipeds unguiculate, like the Gammarids. These species, not before recognised as distinct, constitute our genus *Allorchestes*.

Structure.—The mandibles in the *Orchestidæ* have a double denticulate summit, a lateral molar prominence, and a cluster or line of setæ on the space below the inner part of the summit.

The inner maxillæ have a number of stout serrulate or setulose setæ at the extremity, a slender inner branch terminating in two or more longish setæ, usually bent, and commonly a small, slender, one-jointed outer branch, arising from near the middle of the outer side of the main stem.

The maxillæ of the second pair consist of two oblong ligulate lamellæ, the outer properly a second joint to the other; both have a fine brush of shortish plumose hairs at summit, and on the inner they extend partly down the inner side; besides these hairs, there are two longer setæ on the inner side.

The maxillipeds are lamellar, and terminate in an obtuse joint, furnished with some short setæ or hairs, in *Orchestia*, and with a stout claw, and usually longer setæ, in *Allorchestes*.

The legs have the ordinary structure. The setæ are in pairs as usual along both margins; those of the upper or outer margin of the ten posterior pairs are usually shortest and sometimes obsolete. Alongside of the pairs, there is often another smaller spinule, on one side or both, sometimes a second; and rarely, there are scattered spinules upon the surface between. The tarsi are slender, and have a minute seta on the lower side towards apex, just below the base of the proper claw, and often a minute projecting point on the upper side. They are very similar in all the legs excepting in those of the fourth pair, in which they have generally greater breadth and an angle or gibbous prominence below.

The hands of the second pair in female *Orchestiæ*, have an oblong elliptical, ovate, or spatulate form, with a rounded apex. The finger is minute, and is more or less lateral in position, being articulated with the dorsal margin, and seldom reaching when closed as far as the extremity of the hand. Rarely, the finger is terminal, and then it is oblique from above outward, in the species examined. In some cases the hand is deeply emarginated below the finger; and the position of the closed finger may be either longitudinal or nearly transverse, and the latter even when remote from the extremity. The lower margin and adjoining part of the lateral surface of the hand, has a minutely scabrous surface, besides having some short hairs near the limits of this rasp or scabrous part. The preceding joint in its lower projecting part is in general similarly scabrous, and often also a corresponding part of the joint next preceding. The first pair of legs in the same females, has usually a still smaller size. The hand has a truncate extremity in most species, and the finger is articulated with the apex. The lower part of the outer and the under surface is often scabrous, like the same in the second pair, and the two preceding joints may have a similar character in this respect.

The large hand in the males (second pair) is commonly ovate, or triangulato-ovate, the triangular form arising from an oblique truncation of the margin for the finger to close against. This margin we call for convenience in description the *palm* of the hand. It is often spinulous and sometimes emarginate or dentigerous. The carpus (fourth joint) in these legs in the *Orchestiæ*, is very small, and never extends downward between the hand and the third joint; so that the third joint is contiguous anteriorly with the lower back margin of the hand. This is not true, however, of all *Allorchestes*. The articulation of the carpus with the preceding joint is longitudinal in both sexes, and approximately so, in the legs of the first pair.

The stylets have one and the same arrangement throughout the species of *Orchestidæ*. The two anterior pairs have two subequal branches, which are furnished with a few setæ or spinules along the upper side, and four or five unequal spinules at apex. The second pair projects less far than the first. The last pair is extremely short, and consists of a stout base and a very small terminating joint. At apex there are a few minute spinules, and often others on the upper margin towards the extremity.

The epimerals are seldom shorter than their width, and often are

much longer (that is, vertically). The fifth on either side in the *Orchestia* is generally about as long anteriorly as the fourth, and near its middle or just posterior, it narrows, and there is a second rounded lobe, about half the length of the anterior. In the *Allorchestes*, the fifth epimeral is abruptly much shorter than the fourth. The epimerals may be quite naked, or sparsely edged with minute hairs or setules; they are rarely sculptured or sulcate, and in this case, the bases of the six posterior legs, which are large and broad, have similar markings.

Homologies of the parts of the head.—On pages 23 to 28 of this Report, we have pointed out the subdivisions of the carapax, especially its anterior and buccal portions, in the *Brachyura*; and we now turn to the head of the *Orchestidæ*, taking these as the type of the *Amphipoda*. Figures *i*, *k*, *l*, on Plate 57, represent the head of the *Orchestia (Talitrus) insculpta* of the author, in different positions, fig. *i*, representing a side view; *k*, a front view; *l*, an under view (the front part or extremity of the maxillipeds being towards the observer); *m*, a view of the back part of the head below the ventral surface adjoining. Like parts are lettered alike in all these figures.

In figure *k* (the front view), *md*, *m*¹, *m*², *m*³, are respectively the mandibles, the first maxillæ, the second maxillæ, the maxillipeds, as they lie in sight, in their natural position; and *a*¹, *a*², are the bases of the two pairs of antennæ. The same parts are lettered by the same letters in figures *i* and *l*, except that the antennæ are, of course, not shown in an under view (fig. *l*), and they are added in full in the lateral view (fig. *i*).

Again, in figure *k* (with which the other figures should be compared), the areas of the shell or surface are—*b* *b'*, the top of the head and upper part of the sides of the head; *c*, an area adjoining the antennæ, having a membranous covering, and properly a part of the base of the outer antennæ; *d*, a shelly area either side of *e* or epistome; *l*, what is called the labrum, situated between the mandibles.

The epistome (*e*) is subtriangular in form. It extends upward to a narrow point between the antennæ; and below on either side it is prolonged by a narrow process. This process is united at its extremity by a suture with a piece *f*, of similar width. This piece *f*, as seen on figure *i*, extends backward, on the sides of the head, forming an area directly below *b'*, with which it coalesces posteriorly.

The area *l*, below the epistome, consists of an upper and lower part, it being divided transversely by a suture crossing it with a curve convex downward; this suture is much less distinct than that separating the labrum from the epistome.

In order to compare these parts with those corresponding in the *Brachyura*, the reader should refer again to figure 9 *d*, Plate 11, and to the description on pages 23 and beyond. It is there shown that anterior to the mandibles, there is what is called the prælabial plate and epistome; and that the posterior part of the so-called epistome, is, in fact, but a part of the prælabial plate, while the anterior part is normally distinct and the true epistome; the posterior part with the anterior part of the prælabial plate is the segment pertaining normally to the second antennæ; and the anterior part represents the first antennary segment; also, the outer part of the prælabial plate and the so-called epimerals (or lateral pieces) of the *Brachyural* carapax correspond to the mandibular segment.

In the *Orchestia*, the plate, *d*, appears to be part of the second antennary segment or annulus, judging from its connexion with the base of the second antennæ.

The epistome, *e*, lies between the two plates, *d*, and may be the sternal portion of the same annulus. The piece *f*, as it is continuous with the lower angles of *e*, appears at first to be of the epistome annulus. But this would make the epistome normally posterior to the second antennary annulus, as it is posterior to *d*, which is beyond doubt second antennary. Moreover, *f* is evidently mandibular, as it supports the base of the mandible. Hence as *d* stands against *e*, the first view, making the epistome antennary, is most probably correct.

The piece *f* terminates anteriorly at the upper lip (*l*) as well as against the lower angles of the epistome; and if *f* is mandibular in its relations, we should thence conclude that the labrum (*l*) also pertains to the mandibular annulus. The deep suture separating it from the epistome (*e*) is sufficient reason for considering the two as pertaining to distinct annuli.

The maxillipeds are supported on a piece, *n*, the back piece of the lower part of the head (*p*). *n* is, therefore, the proper episternal of the maxilliped annulus, and *p* the continuation of the segment. The maxillæ segments are not represented, unless combined with the maxilliped segment in the part *p*. The piece *h* is the proper base of the inner maxillæ.

In this view, the front of the head contains—

e (epistome) and *d*, representing the sternal and episternal pieces of the *second-antennary* annulus.

l (labrum) and *f*, representing the sternal and episternal pieces of the *mandibular* annulus; and *f'* is the continuation on either side of the same annulus.

The two annuli, the first and second maxillary, are not distinct; but along the posterior side, we have parts of the *maxilliped* annulus.

The sides and top of the head will hence correspond to the *first antennary* and *ophthalmic* annuli, one or both.

If the labrum (*l*) be considered an appendage to the epistome and its annulus, the mandibular annulus would be unrepresented in the front of the head.

The structure in the Gammaridæ is in general like that of the Orchestidæ. The most striking difference is the absence of the suture separating the piece *f*, from the part above. *e*, has nearly the same shape, though under considerable variations; and in some cases it is very prominently keeled, and the labrum also may be carinate, as in Plate 62, fig. 4 *f, g, h*. The piece *d* is distinct, and it lies, as in Orchestia, just below the base of the inferior antennæ, being plainly the episternal piece of the second antennary annulus. The labrum (*l*) is separated, as usual, by a deep suture from *e*. The mandibular palpus in its retracted position extends upward over the epistome either side of the medial line or carina. Compare also figures 5 *b, c*, Plate 64.

The following are the characteristics of the genera and subgenera of Orchestidæ:—

G. 1. ORCHESTIA.—Maxillipedes non unguiculati. Antennæ 1mæ basi 2darum breviores. Epimeræ 5tæ 4tis parce breviores.

Subgen. 1. TALITRUS.—Pedes 1mi *maris feminæve* manu non instructi.

Subgen. 2. TALORCHESTIA.—Pedes 1mi *maris ac in Talitro, feminæ* manu parvulâ instructi.

Subgen. 3. ORCHESTIA.—Pedes 1mi *maris feminæque* manu plus minusve instructi.

G. 2. ALLORCHESTES, *Dana*. *—Maxillipedes unguiculati. Antennæ 1mæ minores, basi inferiorum sæpissime longiores. Epimeræ 5tæ 4tis sæpius multo breviores.

The very short posterior stylets readily serve to distinguish the

* Amer. Jour. Sci. [2], viii. 136, 1849.

Allorchestes from species of Amphithoe which they may resemble, even if the mandibles are not examined.

ORCHESTIA (TALITRUS?) NOVI-ZEALANDIÆ.

Feminae:—*Epimeræ grandes, nudæ, spinulis minutis margine armatæ. Antennæ 2dæ dimidii corporis longitudine, setis brevissimis (latitudine antennæ plus dimidio brevioribus), flagello vix longiore quam basis, articulis transversis, numero 25–27. Antennæ 1mæ basi 2darum non dimidio breviores. Pedes 1mi validiusculi, elongati; 2di paulo breviores, articulo 5to obtuso, fere brevioribus quam precedens, digito minuto, in margine superno affixo. Pedes 10 postici densè setulosi, setulis diametrum articulorum longitudine partim æquantibus, 6 postici valde inæqui, 7mis duplo longioribus quam 5ti, articulo primo latissimo.*

Female:—Epimerals large, naked, edged with minute spinules. Inferior antennæ half as long as the body; setæ very short (not half the diameter of the antenna), flagellum scarcely longer than basal part, joints transverse, 25 to 27 in number. Superior antennæ more than half the length of base of inferior. Anterior feet stout, elongate; second pair slightly shorter, the fifth joint a little smaller than the preceding, finger minute. Feet of five posterior pairs densely setulose along the margin, the setules in part as long as diameter of joints; of the three posterior pairs, the last longest, the first but half the last, the basal joint very broad.

Plate 56, fig. 5 *a*, animal, enlarged; *b*, under lip; *c*, mandible; *d*, first pair of maxillæ; *e*, second pair of maxillæ; *f*, maxillipeds; *g*, part of flagellum of second antennæ; *h*, extremity of first pair of legs; *i*, ibid. of second pair; *k*, ibid. of third pair; *l*, ibid. of fifth pair.

Bay of Islands, New Zealand. Found under sea-weed along the shores.

Length, ten lines. The epimerals are moderately long, and the fifth are anteriorly but slightly shorter than the fourth. The superior

antennæ have the flagellum about as long as the base, and together they are as long as two-thirds the base of the inferior antenna. The third joint of base of inferior pair is about once and a half times as long as second joint. The joints of the flagellum are very short, and have each three or four minute spines at apex. There are many similar short spinules on the basal portion. The mouth is prominent, making the whole height of the head twice its length. The maxillipeds have an obtuse extremity, and the last three joints are rather broad. The first pair of feet is a little longer than the second, and terminates in a large claw, slightly curved, which does not fold against the preceding joint; fourth joint oblong and rather stout; the fifth much smaller than fourth; all the joints furnished with short spinules, especially the penult, which is thickly beset with them. The hand of the second pair is a small, flat, oblong joint, subspatulate in form, and having the short finger on the dorsal margin not reaching to apex, and lying in a line with the dorsal margin of the joint. The third joint is subquadrate, and bears the fourth by its anterior side. Spines or setæ of joints short. Third and fourth pairs subequal, the third a little the largest, and hardly exceeding half the length of the seventh pair. The spines are rather numerous on the joints of the three last pairs; on the penult joint of the fifth pair there are five or six pairs of spines along the lower margin, besides other spinules smaller, and as many pairs on the upper or dorsal margin, half the length of those below. The stylets are slender. The first pair is much the longest, and extends far beyond the others. There are numerous short spinules on the upper margin, and both branches of the first pair are thus spinulous, there being seven or eight sets of spinules. The third pair is about one-third as long as the first. The seventh abdominal segment is D-form, and has the surface and margin covered with minute spines.

The male of this species was not obtained, unless it be the *Orchestia Quoyana*, Edwards, which is barely possible, as the legs and caudal stylets are somewhat similar in their setæ. The flagella of the inferior antennæ of the *O. Quoyana* are less transverse, being as long as broad, but the number of joints is nearly the same, being about twenty-five; the setules appear to be shorter and fewer. If the *O. Quoyana* proves actually to be the male of the *Talitrus* here described, the species will belong to the subgenus *Talorchestia*.

Talitrus novi-zealandiæ, DANA, Proc. Amer. Acad. Sci., Boston, ii. 201.

TALITRUS BREVICORNIS, *Edwards.*

Plate 56, fig. 6 *a*, antennæ, enlarged; *b*, extremity of second pair; *c*, extremity of second pair of legs; *d*, *ibid.* of fourth pair; *e*, *ibid.* of fifth pair; *f*, *ibid.* of sixth pair; *g*, stylets of first pair.

Bay of Islands, New Zealand.

This species is near the *novi-zealandiæ*. The second pair of legs has a similar hand, the finger being on the dorsal margin, and not reaching to the apex; but the position of this finger is more oblique, and not in the same line with the dorsal margin of the joint. The inferior antennæ are shorter; the joints of the flagellum are slightly oblong, and about twelve or fourteen in number; the three or four spinules are half as long as the joint; the last joint of the base has but few (three or four sets) instead of many spinules along the margin. The legs have similar spinules but fewer of them; the penult joint of the fifth pair has but three sets on the lower margin, and they are without other shorter spinules; their length is not over the diameter of the joint; on the dorsal margin there are but two or three sets. The antepenult joint has three sets on the lower side, the apical much longer than the diameter of the joint; and there are two or three sets on the dorsal margin of this joint. The caudal stylets have fewer spinules than in the *novi-zealandiæ*; the two branches of the first pair of these stylets have each but three or four spinules or sets of spinules on the upper margin exclusive of the apical (three were observed on the outer and four on the inner branch). The fourth pair of legs is shorter than the third, and the tarsus differs from the tarsus of all the other pairs in being stouter and gibbous below (fig. 6 *d*); the other tarsi are slender and nearly straight. The spinules of the antennæ have a subdivided extremity, as shown in fig. *b*, and a cluster of setules forms the extremity of the organ.

Talitrus brevicornis, EDWARDS, Crust., iii. 15.

ORCHESTIA (TALITRUS) INSCULPTA.

Maris:—*Segmenta cephalothoracis, epimeræ, et coxæ pedum 6 posteriorum insculptæ, vel lineis et granulis seriatis notatæ. Epimeræ latæ, 5tis sat breviores. Antennæ 1mæ basi 2darum plus duplo breviores; 2dæ dimidio corporis longiores, basi longo et crasso, flagello non longiore quam basis, fere nudo, articulis vix oblongis. Pedes 1mi subgraciles, ungue fere recto. Pedes 2di pervalidi, manu latâ, elliptico-subtriangulatâ, palmâ* obliquâ rectiusculâ, medio emarginatâ, digito longo. Pedes 3tii 4tis longiores, 5ti breves, 6ti 7mi subæqui, 7mis brevioribus, setulis brevibus, diametro articuli non longioribus, articuli 6ti ad marginem inferiorem ferme 5 paribus setularum, ad marginem supernum setulis subtilissimis. Styli caudales dense spinulosi, ramis paris 1mi ambobus spinulosis.*

Feminæ:—*Segmenta cephalothoracis lævia, vix sulcata, epimeræ et coxæ pedum 6 posteriorum areolis leviter notatæ. Antennæ 2dæ dimidio corporis breviores, articulis flagelli transversis. Pedes 2di manu parvulâ fere ellipticâ, digito minuto in margine superno affixo, longitudinali, apicem manus vix attingente.*

Male:—Segments of thorax and epimerals, and also coxæ of six posterior legs, sculptured or marked with raised lines and seriate granules. Epimerals broad; fifth considerably shorter than the fourth. Superior antennæ more than twice shorter than base of inferior; inferior pair longer than half the body, base long and stout, flagellum not longer than base and nearly naked, joints but slightly oblong. Feet of first pair rather slender, claw nearly straight. Feet of second pair very stout, subtriangular, palm oblique, nearly straight, emarginate near middle, finger long; third pair of legs longer than fourth; fifth short; sixth and seventh subequal, seventh a little the shorter.

Female:—Segments of cephalothorax smooth, slightly sulcate. Epimerals and coxæ of six posterior legs slightly sulcato-areolate. Inferior antennæ hardly half as long as body; joints of the flagellum transverse. Feet of second pair with a small hand, which is nearly

* By *palm* (*palm* of the hand) we mean the part of the margin of the hand against which the finger closes.

elliptical, finger minute and articulated with the hand by the dorsal margin, lying longitudinally, and hardly reaching to apex. In other characters like the *male*.

Plate 57, figs. 1 *a* to *m*, male; *n* to *r*, female: fig. 1 *a*, *male*, enlarged; *b*, mandible of same; *c*, maxilla of first pair; *d*, *ibid.* of second pair; *e*, maxilliped; *f*, leg of first pair; *g*, hand of second pair; *h*, leg of fifth pair; *i*, side view of head; *k*, front view *ibid.*; *l*, under view; *m*, view of lower part of same from behind.—*n*, *female*, enlarged; *o*, extremity of leg of sixth pair; *p*, *ibid.* of seventh pair; *p'*, same, more enlarged; *q*, extremity of second pair; *r*, *ibid.* of first pair.

Very abundant along the beaches near Valparaiso, burrowing in the sand. The females were also common under sea-weed thrown up by the tides.

Length, nine or ten lines. Colour, yellowish-white; base of inferior antennæ, orange. The males and females are very unlike in the markings of the segments and epimerals, the sculpturing of the male being represented in the female by merely a few faint sulcations, forming areolets, which are confined mainly to the epimerals and coxæ of the six posterior legs. Still they appear from the similarity of the setules of the legs, the stylets, the relative sizes of the legs, and other characters, to pertain to the same species. Moreover, they were found in the same sand beach very abundantly—the sculptured individuals all having large hands to the second pair of legs; the areolated all with rudimentary hands, like females.

Males. — Eye subrotund. The inferior antennæ vary much in length, from variations in the flagellum; in general, they are considerably longer than half the body. The flagellum of the superior antennæ contains about six or seven joints. In the first pair of legs, the fourth and fifth joints are subcylindrical, and the claw is about half as long as the fifth. The palm of the second hand is spinulous below the emargination, besides having a few minute spines above it. The claw of the third pair of legs is slender; and that of the fourth has a projecting angle below like a tooth; all the claws are without a seta below towards apex. The molar prominence of the mandible has a spinulous surface. The animal is rather sluggish in its motions.

Females.—The flagellum of the inferior antennæ, varies as in the males, though usually shorter, as the separate joints have less length; the number of joints is twelve to nineteen. The superior antennæ are about half as long as the base of the inferior; the flagellum is about five-jointed. The second pair of legs is usually concealed by being folded up under the body. The fourth joint of the first pair of legs is but slightly broader and longer than the hand; the lower margin is regularly arcuate and long. Hundreds were collected under the sea-weed thrown up on the beach, as well as in the sand; and they were exceedingly nimble in their movements.

It is still possible that the females and males may belong to distinct species.

Talitronus insculptus, DANA, Proc. Amer. Acad. Sci. Boston, ii. 202 (male), and *Talitrus ornatus*, D. (female) *ibid.*, p. 201.

ORCHESTIA (TALITRUS) BRASILIENSIS.

Feminæ:—*Corpus læve*. *Antennæ inferiores dimidio corporis breviores, flagello vix longiore quam basis, ferme 16-articulato, articulis parce oblongis, setis paucis diametrum articuli longitudine fere æquantibus, superiores perbreves dimidio basis inferiorum breviores, flagello 3-articulato. Pedes setis perbrevibus instructi, illis articuli 5ti parium 3 posticorum totis diametro articuli non longioribus; pedes 1mi 2dis longiores, unguiculati tantum, ungue crasso, curvato, parce brevior quam articulus precedens; 2di manu semi-ovatâ confecti, margine manus superno recto, digito minutissimo, marginali et ab apice remoto, longitudinali, articulo 3tio duplo brevior quam 4to, infra rectangulato. Pedes 5ti 6tis dimidio breviores, 6ti 7mique fere æqui, articulo 5to angusto, setulis supernis et inferis inter se æquis, utroque margine 6–7 paribus.*

Maris:—*Pedes 1mi ac in feminâ; 2di manu grandi instructi, manu ovatâ, palmâ longâ, non emarginatâ nec concavâ nec dentatâ, spinulis armatâ; digito longo, ad marginis inferi angulum attingente, carpo brevissimo, multo transverso, articulo 3tio rectangulato, parce oblongo, nudo.*

Female:—Body smooth. Inferior antennæ not half as long as the

body, flagellum hardly as long as the base, about sixteen-jointed, joints slightly oblong, setæ few, hardly as long as diameter of joints; superior pair very short, half shorter than base of inferior, flagellum three-jointed. Feet with short setæ, those of fifth joint of three posterior pairs not longer than diameter of joint; first pair of feet longer than second, ending in a curved claw, which is a little shorter than preceding joint; hand of second pair semi-ovate, the upper margin straight, minute finger ending remote from apex, longitudinal in position, third joint half shorter than fourth, rectangular below; fifth pair of legs half shorter than sixth; sixth and seventh subequal, fifth joint quite narrow, the setules of upper and under margins about equal, and in six or seven sets.

Male.—Feet of first pair, as in females; second with a large hand, which is subovate, the palm ending in a low angle, and not concave, nor emarginate, nor toothed, but set with spinules, finger long, carpus very transverse, third joint rectangular, a little oblong, naked.

Plate 57, fig. 2 *a*, *female*, enlarged; *b*, antenna of first pair; *c*, part of flagellum of second pair; *d*, extremity of same, more enlarged; *e*, extremity of leg of second pair; *f*, *ibid.* of fifth pair; *g*, *ibid.* of sixth pair.—*h*, hand of *male*.

Rio Janeiro; dredged in the harbour.

Length, six lines. The fifth epimeral is much smaller than the fourth, which is the largest. The eyes are rather large, and approximate in front. The flagellum of the female superior antennæ consists of three subequal joints, and together they are a little longer than half the three basal joints. The finger of the female hand of second pair is articulated with the dorsal margin of the hand about two-fifths its length from the extremity, and is very short, stopping far short of the extremity; the preceding joint is about twice as broad as the hand, very strongly arcuate below, somewhat less so above, and very nearly naked. The flagellum of the second pair of antennæ (as in other Gammaridea) terminates in a tuft of setæ, (fig. 2 *d*.) like the same in the Oniscidæ and other Isopoda. The posterior stylets are very short, and, as usual, simple. The setules of the other stylets are few and short.

ORCHESTIA (TALITRUS) PUGETTENSIS.

Feminæ:—*Corpus læve. Epimeræ mediocres, 5tæ 4tis vix breviores. Oculi rotundati. Antennæ inferiores dimidio corporis non longiores, flagello fere brevioribus quam basis, articulis numerosis, transversis, setulis semidiametro articuli non longioribus, basi partim scabriculo; superiores basi inferiorum triplo breviores. Pedes 1mi unguiculati tantum, articulo penultimo scabriculo, ungue brevi, dimidii articuli precedentis longitudine; 2di manu angustè subellipticâ, digito marginali, longitudinali, fere ad apicem manus attingente, articulo 3tio parce oblongo, dimidio articuli 4ti longitudine minore, infra arcuato et processu brevi quasi 2-articulato et subacuto armato. Pedes 10 postici numerosis spinulis setisve brevibus fasciculatis armati sed non scabriculi, setis vix diametri articularum longitudine; 6ti 7mi subæqui; 5ti tertiâ parte breviores. Styli caudales spinulis numerosis ornati, ramo externo paris 1mi nudo.*

Female:—Body smooth. Epimerals of moderate size, fifth hardly shorter than fourth. Eyes round. Inferior antennæ not longer than half the body, flagellum hardly as long as base, the joints numerous, transverse, the setules not a semidiameter of joints in length, base partly scabrous; superior pair one-third as long as base of superior. Anterior feet simply unguiculate, penult joint scabrous, claw short, half as long as preceding joint, hand of second pair narrow subelliptic, finger marginal, longitudinal, reaching nearly to apex of hand, third joint sparingly oblong, having a seemingly two-jointed process below, the extremity narrow and subacute. Ten posterior feet armed with numerous short setæ in sets, but not scabrous, the setæ hardly as long as breadth of joints; sixth and seventh pairs subequal; fifth one-third shorter. Caudal stylets with numerous setules, outer branch of first pair naked.

Plate 57, fig. 3 *a*, female, enlarged; *b*, part of flagellum of inferior antennæ; *c*, leg of second pair; *d*, part of leg of sixth or seventh pair.

Puget's Sound.

Length, eight lines. The inferior antennæ are rather stout; and the joints of the flagellum are but little longer than half their breadth. The superior antennæ are hardly longer than the head, and the flagellum is more than half shorter than the basal portion. The setæ or spinules of the legs are more numerous than usual, each set consisting of four to six setules, and those of the upper margin are about as long as those of the lower. The tarsus has a seta just beyond middle of lower margin.

ORCHESTIA (TALITRUS?) SCABRIPES.

Maris:—*Corpus læve. Epimeræ sat magnæ, 5tæ 4tis parce breviores.*

Oculi magni, paulo reniformes. Antennæ inferiores prælongæ, corpore multo longiores, articulo ultimo basis plus duplo longiore quam precedens, flagello longiore quam basis, 20–22-articulato, articulis longiusculis, setis diametro articulorum brevioribus. Pedes 1mi 3tii et sequentes spinulis minutis scabriculi, 3tii, 4ti, 5ti, 6ti, 7mi spinulis aliis paucis longioribus; 1mi unguiculati tantum, ungue parvulo, triplo brevior quam articulus precedens; 2di manu pergrandi instructi, manu latè subtriangulatâ, palmâ obliquâ, scabriculâ, juxta digitum emarginatâ, digito longo, valde curvato; 3tii 4ti subæqui, 5ti 6ti 7mi longitudine sensim incrementes, ungue fere recto. Styli caudales spinulis numerosis ornati, ramo externo paris 1mi nudo.

Male:—Body smooth. Epimerals rather large, fifth hardly shorter than fourth. Eyes large, a little reniform. Inferior antennæ very long, much longer than body, last joint of base more than twice the preceding in length, flagellum longer than the base, twenty to twenty-two-jointed, the joints long, the setæ shorter than the diameter of the joints. Feet of first, third, and following pairs scabrous over the surface with minute spinules, and these legs excepting first pair having also some longer spinules or setæ; first pair simply unguiculate; the claw quite small, one-third the preceding joint in length; second pair with a very large subtriangular hand, the palm oblique, scabrous, and having an emargination adjoining base of finger, finger long and very much curved; third and fourth legs subequal; fifth, sixth, and seventh gradually increase in length, tarsus nearly straight. Caudal stylets with numerous setæ, outer branch of first pair naked.

Plate 57, fig. 4 *a*, male, enlarged; *b*, extremity of leg of seventh pair.

Puget's Sound.

Length, eleven to twelve lines. The eye and inferior antennæ are very unusually large. The scabrous character of the legs distinguishes the species from the *pugettensis*; the longer setæ of the posterior legs are about two in a set, and they are not longer than the diameter of the fifth joint. The superior antennæ do not reach nearly to apex of penult joint of base; the flagellum is about seven-jointed, and is shorter than the base.

ORCHESTIA (TALORCHESTIA) GRACILIS.

Feminæ:—*Epimeræ grandes*, 5tæ *vix breviores*. *Antennæ 2dæ dimidio corporis valde longiores, setis brevissimis (latitudine antennæ duplo brevioribus)*; *flagello multo longiore quam basis, articulis paulo oblongis*. *Antennæ 1mæ basi secundarum triplo breviores*. *Pedes 1mi validiusculi, unguiculati, ungue parvulo, articulis 2do 3tio 4to 5to subæquis*. *Pedes 2di paulo breviores, articulo penultimo infra prominente; manu apice rotundatâ, margine antico parce excavato et digito minutum versus apicem gerente*. *Pedes 3tii 4tis longiores*. *Pedes 6 postici paulo graciles, minute setulosi, articulo primo anguste elliptico; 7mi 6tis longiores 5tis multo longiores setulis in marginibus articuli 5ti numerosis et æquis, in utroque margine triplo brevioribus quam articuli diametrum*.

Maris:—*Antennæ 2dæ corpore longiores, flagello paulo longiore quam basis, ferme 30-articulato*. *Pedes 1mi manu parvulâ confecti, oblongâ, apice truncatâ, digito perbrevis, terminali*. *Pedes 2di manu grandî, ovatâ, infra integrâ et arcuatâ, spinulosâ, digito paulo brevior quam manus, carpo minimo, articulo 3tio vix oblongo*.

Female:—Epimerals large; the fifth pair hardly shorter than fourth. Inferior antennæ much longer than half the body, setæ very short (half shorter than diameter of antenna); flagellum much longer than base, joints a little oblong. Superior antennæ about one-third as long as base of inferior. Anterior feet rather stout, with quite a

small claw, and the second, third, fourth and fifth joints subequal. Second pair shorter than first, penult joint prominent behind; last joint lamellar, rounded at apex, nearly naked, concave on anterior side, and having on this margin towards apex a minute finger. Third pair of feet much longer than fourth; last three pairs gradually increase in length, rather slender, first joint narrow-elliptic, and edged with minute spinules, other joints with very short setæ at small intervals on the opposite sides; feet of seventh pair considerably longer than sixth, very much longer than those of fifth; the setules of the fifth joint numerous, and not one-third as long on either margin as the diameter of the joint.

Male.—Inferior antennæ longer than the body; flagellum a little longer than the base, about thirty-jointed. Feet of first pair with a small, narrow hand, the finger minute and acting against the truncate apical margin, and hardly longer than this margin. Feet of second pair having a large ovate hand, lower margin convex entire, and spinulose; finger a little shorter than hand. Carpus minute; third joint slightly oblong.

Plate 57, figs. 5 *a* to *f*, *female*, *g* to *m*, *male*.—5 *a*, *female*, enlarged; *b*, portion of flagellum of inferior antenna; *c*, extremity of legs of second pair; *d*, *ibid.* of third pair; *e*, *ibid.* of fourth pair; *f*, first pair of caudal stylets.—*g*, *male*, enlarged; *h*, extremity of leg of first pair; *i*, hand of second pair; *k*, extremity of leg of third pair; *l*, *ibid.* of fourth pair; *m*, third pair of stylets and extremity of abdomen.

Sandy shores of a small coral island in the Balabac Passage.

Length, about half an inch. Nearly colourless. The superior antennæ are short, with a flagellum shorter, or not longer, than the base, and the whole in both sexes, not reaching to apex of penult joint of base of inferior antennæ. The flagellum of the inferior antennæ is straight and not very flexible. The last joint of base is one-third longer in females than the preceding, and more than half longer in males. The claw of the legs is slender and nearly straight, excepting in fourth pair, in which it is gibbous below, or has a prominent angle and is stout. The caudal stylets of the first pair have the upper margin of outer branch naked in both sexes, and the inner branch with four or five setules or sets of setules besides the terminal. The

males and females were found together, and are judged to belong to the same species, from their similarity in the setæ of the legs, the narrow basal joint of the six posterior legs, the fifth epimeral hardly shorter than the fourth in both, and similar caudal stylets.

Talitrus gracilis, DANA, Proc. Amer. Acad. Sci. Boston, ii. 201 (female).

ORCHESTIA (TALORCHESTIA?) QUOYANA (*Milne Edwards*).

Plate 58, fig. 1 *a*, animal, enlarged; *b*, part of inferior antennæ, more enlarged.

Bay of Islands, New Zealand.

Epimerals rather broad; fifth anteriorly not narrower than fourth. Eye quite large and round. Superior antennæ more than half the length of base of inferior, extending beyond apex of penult joint; flagellum about half whole length. Inferior antennæ half as long as body; flagellum scarcely longer than base, joints not oblong, setæ nearly obsolete, last joint of base longer than preceding. Hand of last pair of feet slender, short hairy, apex not enlarged; claw minute, half as long as hand. Hand of second pair subtriangular, the palm nearly straight, and having a sharp, slightly curved tooth on the upper half, thumb (or prolonged inferior angle of hand) not like an acute tooth; following two pairs of feet subequal; next three pairs gradually increase in length, all rather densely setose, and first joint very broad, with posterior margin slightly uneven.

Length, about six lines. The body is naked; there are a few minute hairs on the edges of the epimerals.

O. Quoyana, EDWARDS, Crust., iii. 19, and Cuv. Illust., pl. 59, f. 4.

ORCHESTIA SCUTIGERULA.

Maris:—*Epimeræ sat latæ, quintis paulo brevioribus quam quartæ. Antennæ 2dæ breves, corpore fere triplo breviores, flagello moniliformi, paulo longiore quam basis, setis minutissimis, articulis non oblongis. Pedes 1mi parvuli, manu oblongâ, subtriangulatâ, apice transversâ*

articulo 4to infra gibboso. Pedes 2di validi, manu latâ, subtriangulâtâ, supernè arcuatâ, palmâ obliquè transversâ, fere rectâ, medio dentigero, angulo infero acuto, digito longo, carpo brevissimo. Pedes 4 sequentes sat longi, subæqui; 6 ultimi sensim incrementales, 7mi 5tis plus duplo longiores, articulo primo elliptico et laminam crassam magnam latè ellipticam posticè gerente, setis perpaucis perbreuibus.

Feminæ:—Articulus pedis 7mi 1mus angustior. Pedes 1mi unguiculati et manu vix instructi, articulo 5to apice non latiore, apice inferiore parce prominente, digito unguiformi, quam margo articuli 5ti apicalis duplo longiore, articulo 4to paulo longiore quam 5tus et parce latiore. Pedes 2di manu minutâ subspatulâtâ, apice rotundatâ, digito laterali subapicali, extremitatem manus non attingente, articulo 3tio infra arcuato.

Male:—Epimerals rather broad, fifth shorter than fourth. Inferior antennæ short, about one-third as long as the body, flagellum moniliform, a little longer than base, setæ very minute, the joints not oblong. First pair of feet small, hand oblong, subtriangular, apex transverse, claw not longer than apical margin, fourth joint gibbous below; second pair of feet stout, hand broad, subtriangular, with the dorsal margin arcuate, palm of hand oblique transverse, nearly straight, with a single prominence near middle, inferior angle acute, but scarcely prolonged. Following four feet subequal; last six gradually increase in length; seventh more than twice as long as fifth, the first joint bearing behind a broad elliptical plate; setæ few and very short.

Female:—First joint of seventh pair of legs much narrower than in the male. Feet of first pair unguiculate and hardly furnished with a hand, the fifth joint not being broader at apex, the lower apex not produced, and the unguiform finger stout and full twice as long as the apical margin, fourth joint a little longer than the fifth and sparingly broader. Feet of second pair with a minute subspatulate hand, rounded at apex, finger-lateral, subapical, not reaching to extremity of hand, third joint arcuate below.

Plate 58, figs. 2 *a* to *h*, male, *i* to *l*, female:—fig. 2 *a*, male, enlarged; *a'*, part of flagellum of inferior antennæ; *b*, mandible; *c*, first pair of maxillæ; *d*, second pair of maxillæ; *e*, maxillipeds; *f*, leg of first

pair; *g*, leg of seventh pair.—*h*, female, side view of head; *i*, extremity of leg of first pair; *k*, ibid. of second pair; *l*, leg of seventh pair.

Abundant among the sea-weed thrown up on the shores of Nassau Bay, Tierra del Fuego.

Length, three-fourths to seven-eighths of an inch. Colour, greenish brown. The large peltate plates on either side of the body posteriorly, pertaining to the basal joint of the posterior legs, give the males a singular appearance. These plates, in a side view, conceal much of the abdomen and the appendages below; they are concave within. The superior antennæ are short, they extend beyond apex of penult joint of base of inferior pair; the flagellum is about six-jointed. The flagellum of the inferior antennæ contains sixteen to eighteen joints. The setæ of the flagella are about one-fourth the diameter of the joints in length; the base of this pair is quite short in males as well as females. Eye round. Mandible has a large molar prominence, which is minutely granulous at apex. The terminal setæ of the inner maxillæ are toothed within. The penult joint of first pair of feet in males is subtriangular like the hand, and nearly of the same size; lower apex of hand and also of preceding joint rounded and prominent. The hand of the second pair in males is large; the palm is nearly straight and almost naked, with a low triangular prominence just above its centre; the third joint of this pair is a little oblong and rectangulate below. In females, the second pair of legs has the fourth and fifth joints subequal in length, and longer than the third; the third and second subequal; the fourth is articulated with the third by nearly one-half of its lower side, the other half being regularly arcuated below. The first pair in females is nearly as in *Talitrus*; yet the claw does close so as to hit the lower apex of the preceding joint by its inner surface; the fifth joint has its two margins nearly parallel, and is sparsely scabrous below.

This species has many of the characters of the *O. chilensis* of Edwards; but the terminal segment of the abdomen is not longer than broad, and is D-shape (fig. 2*m*) instead of being long and pointed; moreover, the finger of the hand has but a single curvature.

ORCHESTIA CAPENSIS.

Maris:—*Epimeræ permagnæ*, 5^{tæ} 4^{tis} parce breviores. *Oculi* subrotundati. *Antennæ inferiores* dimidio corporis paulo longiores, basi sat longo, articulo basis ultimo plus duplo longiore quam precedens, flagello paulo longiore quam basis, 14–16-articulato, articulis parce oblongis, setis minutissimis. *Antennæ superiores* breves, dimidio basis inferiorum breviores, flagello 7–10-articulato. *Pedes antici* angusti, manu oblongâ, apice excavata, truncatâ, digito latitudine manus vix longiore. *Pedes 2di* pervalidi, manu permagnâ, subtriangulatâ, supra arcuatâ, palmâ obliquo-transversâ, paucis subtilissimis spinulis instructâ, profunde excavatâ, juxta digiti basin dentigerâ. *Pedes 5ti* 6^{tis} multo breviores; 4 postici subæqui, crassi, breves, valde spinulosi, articulo 5to crasso, spinulis diametro articuli vix brevioribus.

Male:—Epimerals very large, the fifth sparingly shorter than fourth. Eyes subrotund. Inferior antennæ a little longer than half the body, base rather long, last joint of base more than twice as long as preceding joint, flagellum a little longer than base, fourteen to sixteen-jointed, joints sparingly oblong, setæ very minute. Superior antennæ not half as long as base of inferior, flagellum seven to ten-jointed. Anterior feet narrow, hand narrow, scarcely broader at apex and excavato-truncate, finger hardly longer than breadth of joint. Hand of second pair very large and stout, subtriangular, upper margin arcuate, palm obliquo-transverse, deeply excavate, and having a tooth near base of finger, a few exceedingly minute spinules on palm, and no hairs. Feet of fifth pair much shorter than sixth; sixth and seventh subequal, quite stout and short, and strongly spinulous; the fifth joint stout, its spines about as long as breadth of joint.

Plate 58, fig. 3 *a*, male, much enlarged; *b*, part of flagellum of outer antennæ.

Cape of Good Hope.

Length, eight to nine lines. The superior antennæ reach to apex

of penult joint of base of inferior pair, and its flagellum is nearly half its whole length. The setules of the flagellum of the inferior antennæ are hardly one-fourth the diameter of the joints in length. The ten posterior legs are all stout, and the sets of spines are rather crowded; there being five sets on the margin of the fifth joint in the last two pairs; the margin of the joint is strongly serrated to receive the spines. The epimeral of the sixth joint is unusually long, being nearly as large as that of the fifth.

Krauss mentions that the *O. Bottæ*, Edwards, is found in South Africa, at Port Natal. The published description of that species is too brief to enable us to identify our species with that.

ORCHESTIA CHILENSIS? *Edw.*

Feminae:—*Epimeræ sat magnæ, 5tæ 4tis vix breviores. Antennæ 2dæ dimidio corporis breviores, basi sat brevi, articulo basis ultimo parce longiore quam precedens, flagello parce longiore quam basis, 19–20-articulato, articulis parce oblongis, setis minutissimis. Pedes 1mi 2dis breviores et tenuiores, manu apice truncatâ, paulo latiore, digito vix longiore quam margo apicalis; 2di manu subspatulatâ, digito marginali, longitudinali, apicem vix attingente. Pedes 10 postici setis minutis et sat paucis ornati, setis articuli 5ti inferis dimidii articuli longitudine, supernis multo brevioribus. Pedes 5ti 6ti 7mique graciles, 5tis brevioribus, 6tis 7misque æquis, coxis 7morum paulo latioribus.*

Female:—Epimerals rather large, fifth but slightly shorter than fourth. Inferior antennæ half shorter than the body, base rather short, last joint of base hardly longer than preceding, flagellum a little longer than base, nineteen to twenty-jointed, joints sparingly oblong, setæ very minute. Feet of first pair shorter and more slender than those of second, hand truncate at apex and here a little broader, finger as long as apical margin. Hand of second pair subspatulate, finger marginal, longitudinal, hardly reaching to apex. Feet of ten posterior pairs with the setæ minute and rather few; those of the fifth joint on its under surface half as long as width of joint; those on upper margin much shorter. Legs of fifth, sixth, and seventh pairs slender; fifth considerably shorter than sixth;

sixth and seventh equal; coxæ of seventh pair somewhat broader than that of preceding.

Plate 58, fig. 4 *a*, animal, much enlarged; *b*, part of flagellum of inferior antennæ; *c*, extremity of leg of first pair; *d*, *ibid.* of second pair; *e*, *ibid.* of leg of fourth pair.

Valparaiso.

Length, eight lines. The setæ of the flagellum of the inferior antennæ are not longer than half the breadth of the joints. The hand of the second pair is about half as broad as preceding joint, and much shorter; it is broadest towards the extremity and rounded at apex. The hand of the first pair is very short setulose below; the preceding joint is arcuate below, and furnished with five setæ (or sets of setæ), the middle of which is the longer.

We suspect that this may be the female of the *O. chilensis* of Edwards (Crust., iii. 18); but males and females are so very different, that it is impossible to be certain from a description of the male only. Our specimens are all like the figures.

ORCHESTIA NITIDA.

Epimeræ mediocres, quintæ quartis breviores. Antennæ 2dæ dimidio corporis breviores, flagello longiore quam basis, moniliformi, 12-14-articulato, articulis parce oblongis, setis minutissimis. Antennæ 1mæ dimidio basis secundarum parce longiores, flagello 5-articulato. Pedes 1mi parvuli, manu brevi, apice oblique truncato et latiore, carpo juxta manum infra gibboso. Pedes 2di validi, manu subovatâ, palmâ rectâ vix excavatâ, fere longitudinali, digito dimidio manus longiore. Pedes 4 sequentes subæqui; reliqui breviusculi, sensim increscentes, setis articuli 5ti semidiametro articuli multo brevioribus, articulo primo lato, margine subtilissimè serrulato. Ramus stylorum 1morum externus nudus.

Epimerals of moderate size, fifth smaller than fourth. Inferior antenna shorter than half the body; last two of the basal joints subequal, flagellum longer than base, moniliform, twelve to fourteen-jointed, joints slightly oblong, setæ very minute. Superior

antennæ about half as long as base of inferior, and flagellum five-jointed. First pair of feet having a small hand, slightly oblong, somewhat securiform, at apex somewhat broader and obliquely truncate, the carpus below near hand gibbous. Hand of second pair large subovate; palm straight, nearly longitudinal; finger longer than half the hand. Next four feet subequal, the rest gradually increasing in length, rather short; setæ of fifth joint much shorter than the semidiameter of the joint; first joint broad, margin minutely serrulate. Outer branch of first pair of stylets naked.

Plate 58, fig. 5 *a*, animal, enlarged; *b*, part of flagellum of inferior antennæ; *c*, superior antenna; *d*, extremity of leg of first pair; *e*, *ibid.* of third; *f*, *ibid.* of sixth pair.

From among floating *Fucus*, near the shores of Tierra del Fuego. Caught with a hand-net.

Length, one-third of an inch. Colour, green. Body compressed, shining. The head in profile is short vertically, but the organs of the mouth are not concealed. Eye round. The epimerals are broad and subrotund; the fifth a little smaller than fourth. The last segment of the abdomen is triangular, with the apex slightly recurved. The superior antennæ extend to apex of penult joint of base of inferior antennæ; the flagellum is five-jointed. The flagellum of inferior antennæ fourteen to fifteen-jointed and flattened, and in the specimens preserved in alcohol the margins are reddish; the base is short; the last two joints subequal. The claw of the hand of first pair of legs shuts against the apical margin, and is as long as this margin. The penult joint has a protuberance on the under side. The hand of the second pair has an emargination towards base on the inferior side, where the finger when closed terminates, and below the emargination, at the apex, there is a very minute spine. Breadth of hand, about half the length. The fifth joint of the sixth or seventh pair of legs has about five sets of setæ on the under side, none over one-third as long as the diameter of the joint, and four sets on the upper side, which are still shorter.

This species resembles the *Orchestia euchorus* of Fr. Müller (Archiv

f. Nat., 1848, 53, pl. iv.), but in that the finger of the large hand is shorter, and the palm has an emargination below its middle.

O. nitida, DANA, Proc. Amer. Acad. Sci., ii. 204.

Figures 6 *a* to *d*, Plate 58, represent parts of a female, which may possibly be female of the *nitida*, judging from the size and number of the setæ of the posterior legs. Fig. *a*, part of the anterior legs, the extremity mutilated; *b*, second pair; *c*, extremity of hand of second pair; *d*, extremity of leg of sixth pair.

The head in the only specimen in the collections is mutilated. The fifth epimeral is considerably shorter than the fourth. The setæ of the six posterior legs are very short; on the fifth joint of the sixth pair of legs there are five sets of setæ on the under side, hardly one-third as long as the diameter of the joint, and three sets (besides the apical) on the upper side, still smaller. The tarsus has below towards apex a setule, as in the *nitida*. The fourth joint is closely like that of the *nitida* in the number and size of the setæ (compare figures 5 *f* and 6 *d*). The second pair of legs has the hand subspatulate, the upper and under sides nearly parallel, the minute finger marginal, lying longitudinally, and not reaching to apex, the scabrous surface covering nearly half the whole width of the hand, and, as usual, some hairs near its upper limit. This scabrous surface under a high magnifier is minute hirsute. The fourth joint or carpus is strongly arcuate below, and has a rather broad scabrous surface upon its lower part, like the hand. The preceding joint has the lower apex projecting and rounded, and scabrous, with minute hairs under a magnifier, like the hand. The third joint of the first pair of legs has a low angle below near middle.

ORCHESTIA SERRULATA.

Maris:—*Epimeræ sat magnæ, quintæ anticè quartis non angustiores. Antennæ 2dæ ferme dimidiū corporis longitudine; flagello vix longiore quam basis, articulis non oblongis, setis fere obsoletis. Antennæ 1mæ dimidio basis inferiorum vix longiores, flagello 7-8-articulato. Pedes 1mi parvuli, manu subtriangulatâ, paulo oblongâ, apice latiore, trans-*

versâ, parce excavatâ. Pedes 2di validi, manu magnâ, subellipticâ, palmâ infero-subapicali, excavatâ, subtilissimè spinulosâ, angulo infero rotundato. Pedes 3tii 4ti tenues, subæqui; 5ti 6ti 7mi sensim incrementes, setis minutissimis, paucis, articulo primo latissimo, margine postico serrulato, antico 2-3 setis minutis ornato.

Feminæ (?):—*Pedes 1mi manu parvulâ, breviter lineari, apice non latiore, truncatâ, articulo 4to longiore et parce latiore, infra fere recto; 2di manu subovatâ, supra fere rectâ, digito terminali, transverso, paulo obliquo, brevissimo. Flagellum antennarum 2darum 14-articulatum.*

Male:—Epimerals moderately broad, fifth anteriorly not narrower than fourth. Inferior antennæ about half as long as body, flagellum as long as base; joints not oblong, setæ nearly obsolete. Superior antennæ hardly longer than half the base of the inferior, flagellum seven or eight-jointed. Hand of first pair of feet quite small, broadest at apex, straight truncate, and a little excavate. Hand of second pair large suboval, palm infero-subapical, this part of inferior margin excavate and minutely spinulose. Third and fourth pairs of feet slender, subequal; fifth, sixth, and seventh gradually increase in length, similar setæ very minute and few, first joint very broad serrulate behind, and having two or three minute setæ on the front margin.

Female (?):—Feet of first pair with a very small hand, short linear in form, not broader at apex, which is truncate, fourth joint longer and sparingly broader, below nearly straight, finger terminal, slightly oblique though transverse, very short. Flagellum of inferior antennæ fourteen-jointed.

Plate 58, fig. 7 *a*, male, enlarged; *b*, *b'*, mandible in different positions; *c*, *d*, maxillæ; *e*, maxillipeds; *f*, superior antenna; *g*, part of flagellum of same, much enlarged; *h*, hand of first pair; *i*, hand of second pair; *k*, posterior margin of first joint of seventh pair of feet; *l*, extremity of seventh pair.—*m*, female, part of leg of first pair; *n*, ibid. of second pair; *o*, ibid. of seventh pair.

From among the sea-weed thrown up by the tides, on the shores of islands called the Black Rocks, in the Bay of Islands, New Zealand.

Length, nine and a half lines. The epimerals are rather narrow. The flagellum of the superior antennæ consists of seven joints; of the

inferior, of fifteen to eighteen joints in the male, and about fourteen in the female.

Male.—The claw of finger of hand of first pair of feet is not as long as the apical margin. The finger of second pair when closed, extends half way or rather more toward base of hand; the hand is naked, except the minute spinules or setæ on the palm. The third and fourth pairs of legs are very slender; the fifth is much longer than half the seventh; the seventh is longer than the sixth. The setules of the legs of the fifth joint of the seventh pair are nearly alike on both margins, and about one-fourth the diameter of the joint in length. The tarsus is straight and slender.

O. serrulata, DANA, Proc. Amer. Acad. Sci., ii. 204.

ORCHESTIA TENUIS.

Feminae:—*Epimeræ* sat breves. *Antennæ* 2dæ tenues, dimidii corporis longitudine, flagello tenuissimo, valde longiore quam basis, articulis oblongis, cylindricis, setis articulo vix brevioribus. *Antennæ* 1mæ basi 2darum vix breviores. *Pedes* 4 antici debiles; primi minimi; secundi parvuli, manu minutâ, oblongâ, retrorsum inflexâ, extremitate dimidio truncatâ, apice inferiore producto et obtuso, digito minuto, fere transverso, ab extremitate paulo remoto. *Pedes* 4 sequentes parvuli, 4tis brevioribus. *Pedes* 6 postici sensim incrementos, 7mis fere duplo longioribus quam 5ti; setis brevibus, articuli diametro non longioribus.

Female:—*Epimerals* rather narrow. *Inferior antennæ* slender, about half as long as body, flagellum very slender, much longer than base, joints oblong, setæ hardly shorter than joints. *Superior antennæ* about as long as base of inferior. *Four anterior pairs of feet* quite small and weak; first pair much the smallest; hand of second pair very small, oblong, bent backward, truncated half across towards apex, finger minute, rather remote from extremity and nearly transverse; third and fourth pairs small; the fourth pair smaller than third; three posterior pairs very unequal, increasing regularly in length; seventh pair nearly twice longer than fifth, setæ short, scarcely longer than diameter of joints.

Plate 59, fig. 1 *a*, animal, enlarged; *b*, *b'*, different views of mandible; *b''*, molar prominence of mandible; *c*, inner maxilla; *d*, a maxilla of second pair; *e*, maxillipeds; *f*, part of flagellum of inferior antennæ, much enlarged; *g*, hand of second pair of feet.

Bay of Islands, New Zealand.

Length, half an inch. The flagellum of the inferior antennæ has about fourteen joints, and is very slender, the last joint of basal part is about one-fourth longer than the next preceding. The first pair of feet has similar hands to the second, though more than half smaller. The hand of the second pair has the apex prolonged and narrow; and, therefore, the joint appears to be abruptly narrowed where this apical prolongation begins, and has a transverse margin at the narrowing. The finger is applied against this transverse margin, being articulated apparently at its outer extremity, where there are a few very minute setæ. The mandible has the molar prominence transversely ribbed.

O. tenuis, DANA, Proc. Amer. Acad. Sci., ii. 202.

ORCHESTIA SYLVICOLA.

Feminæ:—*Epimeræ mediocres*, 5^{tæ} 4^{tis} vix breviores. Antennæ 2^{dæ} tenues, dimidii corporis longitudine; flagello longiore quam basis, articulis oblongis, setis verticillatis paulo numerosis, articulo parce brevioribus. Antennæ 1^{mæ} basi 2^{dæ} dimidio breviores, flagello 6–7-articulato. Pedes 4 ^{antici debiles}; 2^{di paulo majores}, manu oblongâ, subellipticâ, antrorsum inflexâ, apicem rotundatâ, digito minuto, ad marginem versus medium affixo, longitudinali. Pedes 4 ^{sequentes subæqui}, ungue parvulo. Pedes 6 ^{ultimi paulo inæqui}, setis brevibus, his articuli 5^{ti in marginibus ambobus inter se æquis}, utroque margine pedis 7^{mi paribus setarum ferme sex}, articulo primo pedum 5^{torum oblongo}, 7^{morum latissimo}. Styli caudales ramo externo paris 1^{mi non nudo}.

Female:—Epimerals of moderate size, fifth hardly shorter than fourth. Inferior antennæ slender, about half as long as body, flagellum

longer than base, its joints oblong, and setæ very nearly as long as joints, verticillate and rather numerous. Superior antennæ half shorter than base of inferior. Four anterior feet quite small; those of the second pair a little the largest, the hand oblong sub-elliptic, reversed or bent forward, broadly rounded at apex, the minute finger articulated with the margin towards its middle, and lying longitudinally along the joint. Four following feet subequal, claw small. Last six feet not very unequal, setæ or spinules short, those of the fifth joint on both margins about equal, and in seventh or sixth pair of legs about six sets of spinules; first joint of fifth pair oblong, of seventh very broad. Outer branch of first pair of caudal stylets bearing a few spinules.

Plate 59, fig. 2 *a*, animal, enlarged; *b*, mandible; *c*, inner maxilla; *d*, second pair *ibid.*; *e*, maxillipeds; *f*, part of flagellum of inferior antennæ, much enlarged; *g*, hand of second pair of feet; *h*, superior antennæ.

From moist soil in the bottom of the extinct volcano of Taiamai, New Zealand, twenty miles from the sea, and about the joints of succulent plants.

Length, one-half to two-thirds of an inch. The superior antennæ reach to apex of penult joint of base of inferior antennæ. The joints of the flagellum of the inferior antennæ are rather longer than twice their breadth, and the last of the basal joints—all of which are very slender—is two-thirds the length of the next preceding. The hands are very small. In the second pair the length is more than twice their breadth, and they are bent forward at right angles with the preceding portion of the leg; they are naked except some very minute setæ on the under side near apex, at a faint emargination, just where the extremity of the finger terminates. The setules of the legs are in pairs, as usual, with one or two additional of smaller size. The tarsi are slender and nearly straight. The tarsus of the fourth pair of legs is much stouter than the others.

This species is quite similar to the *tenuis* in the superior antennæ, even to the whorl of setæ at the apex of the joints. But the superior antennæ are very much shorter, and the hands of the second pair are very different.

The following is the description of a male which probably pertains to the above species:—

Maris:—*Pedes 3tii et sequentes ac supra. Antennæ inferiores paulo longiores, articulis flagelli valde oblongis. Antennæ superiores dimidio basis inferiorum paulo longiores, flagello 6-articulato. Pedes 1mi manu minutâ oblongâ, apice truncato et digitum minutum gerente; 2di manu grandi, subovatâ, palmâ obliquâ, dimidio manus parce longiore, integrâ, spinulosâ, carpo brevissimo, transverso, articulo 3tio infra obtuso-rectangulato, nudo, brevior quam articulus 2dus. Styli caudales pauci-spinulosi, ramo externo paris 1mi nudo.*

Male:—Feet of third and following pairs as above. Inferior antennæ longer, and joints of flagellum three or more diameters in length. Feet of first pair having a very small oblong hand, truncate at apex and having a minute finger; of second pair, with a large hand, subovate, palm oblique, a little longer than half the hand, spinulous, entire, carpus very short and transverse, third joint below obtuso-rectangular, naked, shorter than second joint. Caudal stylets with a few spinules, outer branch of first pair naked.

Plate 59, fig. 3 *a*, male, enlarged; *b*, side view of head; *c*, part of flagellum of outer antennæ; *d*, extremity of leg of first pair; *e*, *ibid.* of second pair; *f*, *ibid.* of third pair; *g*, *ibid.* of seventh pair; *h*, stylet of first pair.

New Zealand, but whether from the Bay of Islands or the volcano of Taiamai, we are uncertain.

The difference in the first pair of stylets, the outer branch being naked in the male and not so in the female, is one point which suggests a doubt as to the two being of the same species. If not the male of the *O. sylvicola*, it is, probably, male of the *O. tenuis*.

O. sylvicola, DANA, Proc. Amer. Acad. Sci., ii. 202.

ORCHESTIA SPINIPALMA.

Maris:—*Epimeræ sat breves, quartæ quintis parce longiores. Antennæ*

2dæ dimidii corporis longitudine, setis minutissimis semidiametro articulorum non longioribus, flagello basin longitudine æquante, articulis plerumque paulo oblongis, setis semidiametro articulorum vix longioribus. Antennæ 1mæ minutæ, basi secundarum quadruplo breviores, flagello 3-5-articulato. Pedes 1mi parvuli, manu minutâ, oblongâ, apice vix latiore quam articulus precedens, apice rectè truncato, digito minuto. Pedes 2di validi, manu subovatâ, margine inferiore (palmâ) arcuato et versus apicem parce concavo, spinulis armato, digito longo, paulo brevioris quam manus. Pedes sequentes tenues; 4 proximis subæquis; 4 ultimis subæquis; setis in paribus numerosis articuli 5ti inferis et supernis æquis, diametro articuli non longioribus.

Feminæ:—Pedes 2di debiles, manu minutâ, elongatè obovatâ, apice rotundatâ, digito laterali, longitudinali, apice extremitatem manus vix attingente.

*Male:—*Epimerals rather narrow, fifth slightly narrower than fourth. Inferior antennæ scarcely longer than half the body, setæ very minute, flagellum as long as base, the joints mostly a little oblong, setæ half the diameter of the joints in length. Superior antennæ one-fourth the length of base of inferior, the flagellum three to five jointed. First pair of feet small and weak, hand minute, oblong, with the sides parallel, and apex straight truncate, finger minute. Second pair of feet stout, hand subovate, lower margin (palm) a little excavate and spinulous, finger elongate, somewhat shorter than hand. Following feet slender; the next four subequal; last four subequal; fifth pair shorter; setæ of the margins of the fifth joint equal.

*Female:—*Hand of second pair minute, obovate, oblong, rounded at apex, finger lateral, longitudinal, its apex reaching nearly to extremity of hand.

Plate 59, fig. 4 *a*, animal, enlarged; *b*, more enlarged view of flagellum of inferior antennæ; *c*, hand of second pair of feet; *d*, extremity of last pair of feet; *e*, second pair of feet in female.

Tongatabu, under sea-weed on beaches.

Length, half an inch. The body is naked. The hand of the first pair of feet in males is a little shorter than the preceding joint, and

both are alike in having the inferior margin nearly parallel with the superior. The claw shuts against the truncate apex. The hand of the second pair has no angle at the termination of the palm. The setæ or hairs of the legs are very short, hardly as long as diameter of the joint bearing them. The ten posterior legs are all very slender. These animals were very active.

O. spinipalma, DANA, Proc. Amer. Acad. Sci., ii. 203.

ORCHESTIA TAHITENSIS.

Feminæ:—*Epimeræ mediocres*, margine minutè setulosæ. Antennæ 2dæ dimidii corporis longitudine, flagello parce longiore quam basis, articulis paulo oblongis, setis brevibus latitudinem articuli fere æquantibus. Antennæ 1mæ, basi 2darum tertiâ parte breviores, flagello fere 7-articulato. Pedes 4 antici debiles, 1mis subtilissimè unguiculatis, manu imperfectâ; 2dis paulo longioribus, manu parvulâ rectâ, subspatulatâ, apice rotundatâ, digito minuto laterali, longitudinali, apicem articuli vix attingente. Pedes 4 sequentes subæqui. Pedes 6 ultimi non multo inæqui, setis brevibus, articulo primo latissimo, margine postico setuloso.

Female:—Epimerals rather broad, margin minutely setulose. Inferior antennæ about half as long as body, flagellum little longer than base, the joints a little oblong, setæ not longer than diameter of joints. Superior antennæ one-third shorter than base of inferior, flagellum about seven-jointed. Four anterior feet quite small; first pair having a minute claw and an imperfect hand; hand of second pair oblong, spatulate with rounded apex, minute finger lateral and longitudinal, hardly reaching to apex of joint. Next four feet subequal; last six not very unequal, first joint very broad and posterior margin setulose, setæ of feet very short.

Plate 59, fig. 5 *a*, animal, enlarged; *b*, mandible; *c*, first pair of maxillæ; *d*, second pair; *e*, maxillipeds; *f*, antennæ, much enlarged; *g*, extremity of leg of second pair.

In damp places among leaves, and under rotten wood in the damp

earth, at fifteen hundred feet elevation, on the island of Tahiti, several miles from the sea.

Length, one-fourth to one-third of an inch. Colour, bluish to bluish green. The epimerals of the fifth segment may be too narrow in the figure: the loss of the specimen prevents our verifying this point. The superior antennæ are nearly three-fourths as long as the base of the inferior. The abdominal natatories are very small. The stylets of the first and second pairs are quite long and slender; those of the third pair are very short.

These animals hop off with agility, when exposed by turning over the leaves that cover them, until they reach a spot where they are more or less concealed, and there they lie quiet till disturbed again.

Orchestia rectimana, DANA, Proc. Amer. Acad. Sci., Boston, ii. 203.

ORCHESTIA DISPAR.

Maris:—*Epimeræ mediocres, quintæ 4tis vix breviores. Antennæ 2dæ vix dimidii corporis longitudine; flagello paulo longiore quam basis, articulis vix oblongis, setis brevissimis semidiametrum articuli non superantibus. Antennæ 1mæ dimidio basis secundarum longiores. Pedes 1mi parvuli, manu ad apicem latiore, obliquè truncatâ et excavatâ. Pedes 2di validi, manu late subellipticâ, obliquè truncatâ, palmâ paulo sinuosâ, pubescente. Pedes 3tii 4tis parce longiores; 7mi 6tis paulo breviores, articulis tertio quartoque incrassatis, late compressis, setis perbrevis, illis articuli 5ti semidiametro articuli vix longioribus.*

Male:—Epimerals of moderate size, fifth but little shorter than fourth. Inferior antennæ scarcely half as long as body, last two joints of base subequal, flagellum longer than base, joints hardly oblong, setæ not longer than half the diameter of the joints. Superior antennæ shorter than base of inferior. First pair of feet having the hand quite small, broadest at apex and obliquely truncate, with the apical margin excavate. Hand of second pair stout, broad, subelliptical, obliquely subtruncate, palm of hand a little sinuous, pubescent. Third pair of feet longer than fourth; seventh a little shorter than sixth, and *having the third and fourth joints stout, and*

very broad, being much compressed, setæ very short, on fifth joint about as long as semidiameter of the joint.

Plate 59, fig. 6 *a*, animal, enlarged; *b*, mandible; *c*, inner maxilla; *d*, second pair; *e*, maxillipeds; *f*, part of flagellum of inferior antennæ; *g*, hand of first pair of legs; *h*, hand of second pair; *i*, leg of seventh pair; *k*, stylet of first pair; *l*, stylet of last pair; *m*, side view of extremity of abdomen.

Sea-shores of Illawarra, New South Wales.

Length, six to seven lines. The head is but little longer than the first thoracic segment. The flagellum of the superior antennæ is nearly half the whole length. The hand of the second pair of feet has the apex slightly prominent, and the palm below is a little sinuous, the claw or finger not fitting tightly to it when closed; the hand is naked, except a few extremely minute hairs on the margin against which the finger shuts. The broad compressed third and fourth joints of the last pair of legs are peculiar; the next joint is slender as usual.

This species is near the *O. littorea* of Europe.

O. dispar, DANA, Proc. Amer. Acad. Sci., Boston, ii. 204.

ORCHESTIA QUADRIMANA.

Maris:—*Epimeræ sat magnæ, 5tæ 4tis breviores. Antennæ 2dæ dimidio corporis paulo breviores, bene setulosæ, basi brevi; flagello parce longiore quam basis, articulis non oblongis, cylindricis, setis verticillatis, diametro articulorum fere duplo longioribus. Antennæ 1mæ basi 2darum fere dimidio breviores. Pedes 1mi parvuli, manu fere triangulatâ, apice latiore, truncatâ, paululo excavatâ. Pedes 2di validi, manu subquadratâ, paulo oblongâ, palmâ apicali, transversâ, paulo excavatâ. Pedes 3ti 4ti debiles subæqui; 5ti 6ti 7mi similes, sensim incrementes, valde inæqui (7mis duplo longioribus quam 5ti), bene setulosi, setis articuli 5ti numerosis longioribus quam diametrum articuli.*

Male:—Epimerals rather broad, fifth shorter than fourth. Inferior

antennæ hardly half as long as the body, neatly setose, base short, flagellum sparingly longer than base, joints not oblong, cylindrical, setæ verticillate and nearly twice longer than joints. Superior antennæ nearly half shorter than base of inferior. First pair of feet minute, hand subtriangular, apex truncate and a little excavate. Hand of second pair stout, quadrate, a little oblong, apex nearly straight truncate, the palm of the hand consequently transverse, or but slightly oblique, somewhat excavate. Third and fourth pairs weak, subequal; fifth, sixth, seventh similar, very unequal, but gradually increasing in length; fifth half shorter than seventh, setæ of fifth joint numerous, rather crowded, and exceeding the diameter of the joint in length.

Plate 59, fig. 7 *a*, animal, enlarged; *b*, part of flagellum of inferior antennæ; *c*, maxilla of first pair; *d*, second pair; *e*, maxillipeds; *f*, hand of first pair of feet.

Illawarra, New South Wales.

Length, seven lines. Head but little longer than first thoracic segment. Epimerals short. Last joint of base of inferior antennæ but little longer than preceding, joints of flagellum not longer than breadth, and as large at base as at apex, setæ six or eight in a whorl and mostly longer than the joint. The hands of the second pair are oblong quadrate (the two equal), and the finger closes against the broad transverse apical margin, leaving a space between it and the palm, the length of the palm equalling the breadth of the hand, and being three-fourths as long as the hand; the carpus is very short and is not produced below between the hand and third joint. The setæ of the posterior legs are in close clusters or whorls, though short, and there are seven or eight sets on either margin of the fifth joint of the seventh pair. The first pair of caudal stylets have the outer branch naked above.

O. quadrimana, DANA, Proc. Amer. Acad. Sci., Boston, ii. 204.

ORCHESTIA HAWAIIENSIS.

Feminæ:—*Epimeræ sat magnæ, 5tæ 4tis vix breviores. Antennæ gra-*

ciliores, 2dæ dimidio corporis non breviores, basi sat longo, fere nudo, flagello longiore, 17-18-articulato, articulis bene oblongis, setis paucis, diametro articularum non longioribus. Antennæ 1mæ longæ, basi inferiorum vix breviores, flagello 7-articulato, articulis longis. Pedes antici fere unguiculati, manu imperfectâ, paulo oblongâ, apice angustiore et non bene truncato, digito paulo longiore quam manus latitudo. Pedes 2di paulo longiores, manu debili subspatulatâ, supra rectâ, digito fere apicali et transverso, articulo 3tio infra gibboso et scabriculo. Pedes sequentes graciles; 3tii 4tique longi; 5ti 4tis non breviores, 5ti 6ti 7mique sensim increscentes, setis articuli 5ti paris 7mi inferis (in paribus sex) et supernis (in paribus septem) longitudine æquis, diametro articuli vix brevioribus. Ramus stylorum 1morum externus supra nudus, spinâ apicali prælongâ.

Female:—Epimerals rather large, fifth hardly shorter than fourth. Antennæ quite slender; inferior pair somewhat longer than half the body, base rather long, flagellum longer than base, seventeen to eighteen-jointed, joints quite oblong, setæ few, not longer than diameter of joint. Superior antennæ long, hardly shorter than base of inferior, flagellum seven-jointed, joints long. Anterior feet almost unguiculate, the hand imperfect, oblong, narrower at apex, and not properly truncate, finger a little longer than the width of the joint. Feet of second pair with the small hand subspatulate, narrow, minute finger subapical, nearly transverse, third joint gibbous and fine scabrous below. Following legs slender; third and fourth pairs long; fifth not shorter than fourth; fifth, sixth, and seventh gradually increasing in length, setæ of fifth joint of seventh pair equally long on both margins, and not longer than the diameter of the joint, six sets below, seven above. Outer branch of first pair of stylets naked, a very long apical seta.

Plate 59, fig. 8 *a*, female, much enlarged; *b*, first pair of antennæ; *c*, part of flagellum of second pair; *d*, extremity of leg of first pair; *e*, *ibid.* of second pair; *f*, *ibid.* of seventh pair; *g*, first pair of stylets.

Oahu or Kauai, Hawaiian Islands.

Length, eight or nine lines. Eyes nearly round. The setules of the flagellum of the inferior antennæ spread but little, and the joints

are more than twice their length in breadth; the joints of the flagellum of the superior antennæ are full four times as long as broad. The tarsi of the posterior legs are very slender, nearly straight, and have a seta below near apex. The fourth joint of the second pair of legs is but little broader than the hand. There are no hairs, setæ, or notches on the lateral margin of the three anterior abdominal segments. The first joint of the fifth pair of legs is rather narrow, of the seventh quite broad.

ORCHESTIA PICKERINGII.

Maris:—*Epimeræ mediocres*, 5tæ 4tis paulo breviores. *Antennæ 2dæ fere dimidii corporis longitudine, basi sat brevi, flagello longiore subnudo, articulis oblongis, setis paucis semidiametro articulorum non longioribus. Antennæ 1mæ dimidio basis inferiorum breviores, flagello 3-articulato. Pedes 1mi parvuli, manu subtriangulatâ, paulo oblongâ, apice truncatâ et latiore, digito brevi. Pedes 2di manu pervalidâ confecti, manu ovatâ, infra et supra bene arcuatâ, palmâ non excavatâ, versus digiti basin parce bilobatâ, lobo 1mo rotundato, 2do subrectangulato. Articulus 5tus pedis 7mi tenuis, setis perbrevibus, inferis (in paribus sex) semidiametro articuli non longioribus, supernis brevioribus.*

Male:—Epimerals of moderate size, fifth a little shorter than fourth. Inferior antennæ about half as long as body, base rather short, flagellum longer than base, joints oblong, setæ few, not longer than semidiameter of joints. Superior antennæ not half as long as base of inferior, flagellum three-jointed. Feet of first pair very small, hand subtriangular, oblong, apex truncate, broader, finger short. Hand of second pair very stout, ovate, above and below arcuate, without a tooth or angle below at termination of palm, palm convex and not excavate, naked, having two very low prominences near base of finger, the first rounded and minutely setulous, the second subrectangular. Fifth joint of seventh pair of legs slender, setæ in six sets on under side, not longer than half the diameter of the joint, still shorter on upper side of joint.

Plate 59, fig. 9 a, male, enlarged; b, superior antenna; c, part of

flagellum of inferior antenna; *d*, extremity of leg of first pair; *e*, ibid. of second pair; *f*, ibid. of seventh pair.

Length, five to six lines. The antennæ look naked. The superior antennæ hardly reach to apex of penult joint of base of inferior antennæ; last joint of base of inferior antennæ a little longer than preceding, and whole base but slightly longer than head and first thoracic segment; the joints of the flagellum of this pair are longer than twice their breadth. The hand of the first pair of legs is naked below; the preceding joint is very narrow triangular, being widest at apex, and from this part narrowing backward, at first rather rapidly. The third joint of the legs of the second pair is nearly rectangular at lower apex, but obtuse. There are setules on the basal joints of the legs of the last three pairs. The tarsi are very slender and nearly straight, and have a seta below near apex.

GENUS ALLORCHESTES, *Dana*.

Antennæ 1mæ elongatæ, basi 2dorum sæpissimè longiores. Maxillipedes apice unguiculati. Pedes 1mi 2dique subchelati. Styli 3tii caudales brevissimi, simplicissimi.

Superior antennæ longer than base of inferior. Maxillipeds unguiculate at apex. Feet of first and second pairs subchelate. Posterior stylets very short and quite simple, as in *Orchestia*.

The *Allorchestes* differ from the *Orchestiæ*, in the claw or stout spiniform joint terminating the outer maxillipeds; in the longer superior antennæ, this pair usually exceeding in length the base of the inferior; in the fifth epimeral being very short, and never nearly as wide as the fourth; in the carpus of the second pair of legs being sometimes in males produced downward back of the hand, between the hand and the anterior extremity of the third joint (while in *Orchestia*, the third joint is never separated from the hand by a portion of the carpus, and the carpus is always short transverse, and is situated wholly above the third joint); in the female hands of the second pair, although smaller than those of the male, never being as rudimentary a hand, the form not rounded at apex, the finger not exceedingly minute and

articulated with the dorsal margin remote from the apex, the lower part of outer surface of the hand not (?) minute scabrous, but the hand having a more perfect form, and furnished with a stouter finger articulated with the proper apex of the hand. Moreover, the upper side of the fifth and fourth joints of the ten posterior legs is very often naked, the setæ or spinules being confined to the opposite or lower side.

The species differ from the Amphithoe group, in the absence of a mandibular palpus; in the Orchestia-like posterior stylets fitting them well for saltatory habits; in the small and slender one-jointed palpus of the inner maxillæ. They approximate most nearly to the Iphimedia; but these have the posterior stylets much longer and two-branched instead of simple, besides having other characteristics of the Gammarus tribe. *Amphithoe Marionis* (Edwards) is described as having no mandibular palpus unlike other species; but it is far removed from *Allorchestes* in its long two-branched posterior stylets, as well as in other particulars.

The species among the following which have the carpus of the second pair of legs in males produced downward in a process between the hand and the third joint, are the *Gaimardii*, *australis*, and the *novi-zealandicæ*, species from either New Holland or New Zealand. In females this appears to be common, and the specimens obtained of *A. humilis* and *A. brevicornis* are supposed to be females.

1. *Antennarum 2darum basis flagello valde longior. Antennæ 1mæ basi 2darum breviores.*

ALLORCHESTES GAIMARDII? (Edw.), D.

Corpus valde compressum, epimeris permagnis. Antennæ superiores basi inferiorum breviores, flagello 14-articulato, fere duplo longiore quam basis. Antennæ inferiores dimidio corporis paulo breviores, crassiusculæ, subpediformes, basi prælongo, flagello fere quadruplo brevior quam basis, articulis basis tribus ultimis subæquis, flagello 8-10-articulato. Pedes 1mi parvuli, manu vix oblongâ, apice obliquè truncatâ et paulo excavatâ, basi parce angustiore, digito brevi. Pedes 2di validi, manu magnâ subovatâ, palmâ rectiusculâ, fere nudâ, digito longo, carpo infra tenuiter producto inter manum et articulum 3tium. Pedes 5ti 6ti 7mi sensim increscentes, setis sparsis minutissimis diametro articuli 5ti 4plo brevioribus.

Body much compressed, epimerals very large. Superior antennæ a little shorter than base of inferior, flagellum fourteen-jointed, nearly twice longer than base. Inferior antennæ hardly half as long as the body, rather stout, subpediform, base very long, four times as long as flagellum, its last three joints subequal, flagellum eight to ten-jointed. Hand of first pair of feet but slightly oblong, a little narrower at base, apex somewhat obliquely truncate, and a little excavate. Hand of second pair large subovate, palm on under side straight, nearly naked. Fifth, sixth, and seventh pairs of legs gradually increase in length, setæ sparse and very minute, hardly one-fourth as long as the breadth of the fifth joint.

Plate 60, fig. 1 *a*, animal, enlarged; *b*, mandible; *c*, *d*, first and second pairs of maxillæ; *e*, maxillipeds; *f*, flagellum of inferior pair of antennæ; *g*, part of same of superior; *h*, extremity of leg of sixth pair; *i*, posterior stylet.

Shores of Illawarra, New South Wales.

Length, seven to eight lines. Head oblong, much exceeding in length the first thoracic segment. Eye round. The epimerals very broad, and the anterior usually conceals the mouth in a lateral view; fifth very short. The superior antennæ are three-fourths or two-thirds as long as the inferior, the basal portion is about as long (or nearly) as first two basal joints of inferior pair. The flagellum of the inferior pair is not longer than last joint of base. The finger of the first pair of legs is not longer than apical margin of hand; the inferior margin of the hand is about as long as the breadth of the hand; the preceding joint is subtriangular. The hands of the second pair are equal, the finger extends, when closed, about two-thirds the way to the base of the hand, and there is no proper emargination and but a slight depression where the finger terminates. The tarsi of the following legs have an exceedingly short seta below. The setæ of the joints are confined mostly to the under side of the leg, and wholly so on the fifth joint. The maxillipeds have the terminal joints flattened and broad; the penult joint is very broad at apex, somewhat excavate, and towards the outer side bears a large, stout claw or spine. The posterior stylets have a single very short branch.

Allorchestes compressa, DANA, Proc. Amer. Acad. Sci., Boston, ii. 205.

Amphithoe Gaimardii? EDWARDS, Crust., iii. 37. The description by Edwards agrees with our specimens in most points, though differing in making the posterior stylets end in two rudimentary branches, instead of one.

2. *Antennarum 2darum flagellum basi longius. Antennæ 1mæ basi 2darum multo longiores.*

ALLORCHESTES VERTICILLATA.

Epimeræ mediocres. Antennæ 2dæ 1mis fere duplo longiores, tertiâ parte corporis non longiores, basi brevi, articulis basis ultimo penultimoque subæquis, flagello fermè duplo longiore quam basis, 14-articulato, articulis parce oblongis, setis densè verticillatis, brevibus, diametro articulorum non longioribus. Antennæ 1mæ nudiusculæ. Pedes 1mi parvuli, carpo infra non producto, manu oblongâ, basi vix angustiore, apice obliquo. Pedes 2di pervalidi, manu subovatâ, palmâ inferiore, rectiusculâ, pubescente, digito longo; carpo inter manum articulumque 3tium infra non producto. Pedes 5ti 6ti 7mique subæqui, breves, setis paucis sparsis, crassis, diametro articuli non longioribus, margine articuli 5ti superno nudo. Tarsus setâ infra instructus.

Epimerals of moderate size. Inferior antennæ nearly twice longer than superior, about one-third as long as the body, base short, last two joints of base subequal, flagellum about twice longer than base, fourteen-jointed, joints slightly oblong, setæ densely verticillate, short (not longer than breadth of joints). Superior antennæ nearly naked. Feet of first pair quite small, hand oblong, hardly narrower at base, oblique at apex, carpus not produced below. Hand of second pair large subovate, palm along inferior side, nearly straight, pubescent, finger long, carpus not produced downward between hand and third joint. Fifth, sixth, and seventh feet subequal, short, setæ few, stout, short, not longer than diameter of joint, upper margin of fifth joint naked. Tarsus with a seta below.

Plate 60, fig. 2 *a*, animal, enlarged; *b*, part of flagellum of antenna of second pair; *c*, mandible; *d*, second pair of maxillæ; *e*, maxillipeds; *f*, extremity of leg of first pair; *g*, *ibid.* of posterior pair.

Along the shores near Valparaiso.

Length, four lines. The eyes are subrotund. The first thoracic segment is a little longer than the following.

The base of the superior antennæ is but half as long as base of inferior and consists of three subequal joints; the flagellum contains ten to twelve joints, with a few extremely short hairs at the apex of each joint. The flagellum of the inferior antennæ has the joints a little the smallest at base.

The hand of the first pair of legs is sublinear, a little longer than twice the breadth. The short claw shuts against the oblique terminal edge. There are a few short setæ on the inferior surface of the hand. The finger of the second pair is longer than half the length of the hand.

The sixth and seventh pairs of legs are about equal. The maxillipeds have the last joint narrow and the terminal spine small. The abdominal natatory legs are long and slender.

Allorchestes verticillata, DANA, Proc. Amer. Acad. Sci., Boston, ii. 205.

Female of A. verticillata?—Figures 3 a to k, Plate 60, illustrate a species of *Allorchestes*, which we suspect to be the female of the *A. verticillata*. Still, it is different in some points that appear to be important. The short hairs or setæ of the flagellum of the inferior antennæ are not as dense and hardly as long; the setæ of the legs are stout, as in the *verticillata*, but shorter; on the fifth joint of the last pair, there are four sets of setæ on the under side, none more than half the diameter of the joint in length, excepting the lower, which is but slightly longer. The proportion between the pairs of antennæ is about the same.

The hand of the first pair of legs is similar in form and size to that of the *verticillata*. The hand of the second pair is a little larger than that of the first pair, not twice as long or as broad, and has some resemblance in form to the first pair; it is oblong, rather broad, the upper and under sides nearly parallel, the upper very slightly arcuate, and one-third the longer, the lower with three or four tufts of longish setæ, the apex truncate a little obliquely, forming a nearly transverse palm and somewhat hairy, the finger not longer than the margin against which it is applied, and not half as long as the hand; the carpus is broader than the third joint; the third joint is nearly rectangular. The flagellum of the superior antennæ is ten to twelve-

jointed; of the inferior antennæ about fourteen-jointed, the joints sparingly oblong. Length, four lines.

Among sea-weed, on the shores near Valparaiso.

Fig. 3 *a*, animal, enlarged; *b*, *c*, *d*, *e*, *e'*, parts of the mouth; *f*, part of flagellum of inferior antennæ.—*g*, from another specimen; *h*, *ibid.*, part of flagellum of inferior antennæ; *i*, *ibid.*, hand of second pair; *k*, extremity of seventh pair.

Kröyer has described an *Orchestia* from the beaches of Valparaiso under the name *O. grandicornis* (Tids., [2], i. 283, 1844), which appears to be an *Allorchestes*, and near our species, though still differing from it. The superior antennæ are one-third, and the inferior one-fifth the length of the body. The flagellum of the inferior antennæ has nine oblong joints; of the superior, twelve joints; the former is less naked than the latter. The eyes are large and nearly confluent in front. The hand is large, oval, and “ad basin marginis postici tuberculo armata 2-aculeato, nullis vero unguis validissimi dentibus.”

A. peruviana, DANA, Proc. Amer. Acad. Sci., Boston, ii. 206.

ALLORCHESTES HIRTIPALMA.

Antennæ 1mæ tenuissimæ, inferioribus paulo breviores, basi perbrevis. Antennæ 2dæ corpore plus dimidio breviores, flagello plus duplo longiore quam basis, infra densè breviter villosa, articulis non oblongis. Pedes 1mi parvuli, manu magnâ, oblongâ, basi angustiore, infra subtiliter ciliatâ, apice oblique truncatâ. Pedes 2di validi, manu subovatâ, infra subtruncatâ et dense villosâ, palmâ paulo depressâ, rectiusculâ, digito sat longo. Pedes 4 ultimi subæqui, setis paucis minutissimis, semidiametro articuli 5ti brevioribus, apicibus articularum 3tii 4tique paulo productis et setulosis.

Superior antennæ very slender, a little shorter than inferior, base very short. Inferior pair somewhat shorter than half the body, flagellum more than twice as long as base, lower side densely short

villose, joints not oblong. Hand of first pair of feet oblong, smaller at base, finely ciliate below, obliquely truncate at apex. Hand of second pair large subovate, flattened below and villous, palm a little depressed, nearly straight, finger rather long. Last four feet subequal, setæ few and very minute, not as long as half the diameter of the fifth joint, posterior apices of third and fourth joints prolonged and setulose.

Plate 60, fig. 4 *a*, animal, enlarged; *b*, part of flagellum of inferior antennæ; *c*, inner maxillæ, in different positions; *d*, maxilla of second pair; *e*, maxillipeds; *f*, hand of second pair of legs; *g*, hand of first pair; *h*, part of sixth pair of legs; *i*, posterior stylets.

Sea-shores near Valparaiso; and also, those of the island of San Lorenzo, Peru.

Body smooth, glabrous. Eye nearly round. Front margin of head in lateral view sinuous, and the superior antennæ appearing to arise from a small concavity in the outline. Both pairs of antennæ very slender. Superior antennæ about three-fourths the inferior in length; flagellum terete; three basal joints subequal. Inferior antennæ thickly, but short hairy on under side; last basal joint much longer than preceding; first two quite short; whole base rather short. Maxillipeds with joints somewhat short hairy, penult joint narrow cylindrical; terminal claw or spine moderately long.

A. hirtipalma, DANA, Proc. Amer. Acad. Sci., Boston, ii. 205.

ALLORCHESTES GRACILIS.

Antennæ tenuissimæ; 1mæ 2dis dimidio breviores et basi inferiorum paulo longiores; 2dæ vix dimidii corporis longitudine, flagello multo longiore quam basis, articulis oblongis, setis perbrevis (diametro articulorum non longioribus), paucis. Pedes 1mi parvuli, manu parce oblongâ, basi angustiore, apice paulo oblique truncatâ, palmâ rectâ, breviter hirsutâ, carpo triangulato, infra producto et acuminato. Pedes 2di validi, manu magnâ subellipticâ, palmâ rectiusculâ, sparsim brevissimè hirsutiusculâ, carpo inter manum articulumque 3tium infra non

producto; articulo tertio, infra acutè producto, digito sat longo. Pedes paris 6ti 7mis breviores, setis sparsis brevissimis.

Antennæ very slender; superior pair twice shorter than inferior, and a little longer than base of inferior; inferior hardly half as long as the body, flagellum much longer than base, joints oblong, setæ very short, few (not longer than breadth of joints). Hand of first pair of feet but little oblong, narrowest at base, somewhat obliquely truncate at apex, palm straight, short hirsute; carpus triangular, below produced and acuminate. Hand of second pair large suboval, palm nearly straight, a few minute tufts of hairs, third joint of this pair short and acutely prolonged behind, the fourth or carpus not produced below in a process between the hand and third joint. Sixth pair of legs a little shorter than seventh, the setæ few and very short.

Plate 60, fig. 5 *a*, animal, enlarged; *b*, portion of inferior antennæ; *c*, hand of first pair of legs; *d*, hand of second pair.

Tongatabu, Pacific Ocean; in shallow water among delicate seaweeds.

Length, six to eight lines. Body naked. The basal portion of the superior antennæ reaches to apex of penult joint of base of inferior pair. The joints of the flagellum of the inferior antennæ much narrower at base than at apex. Maxillipeds densely hairy at apex. The fifth pair of epimerals is very narrow. The head is vertically short. Finger of second pair of feet much curved, and when closed leaves some space between it and the palm, although the palm is straight or slightly convex. The fourth joint of this pair is narrow and short, and the preceding projects much below it, to an acute point.

A. gracilis, DANA, Proc. Amer. Acad. Sci., ii. 205.

ALLORCHESTES HUMILIS.

Feminæ?—*Antennæ 1mæ 2dis paulo breviores, flagello 6-8-articulato. Antennæ 2dæ corpore fere triplo breviores, flagello 9-10-articulato,*

articulis parce oblongis, setis totis brevissimis. Pedes 1mi parvi, manu oblongâ, supra rectiusculâ, apice obliquâ, basi parce angustiore. Pedes 2di validiusculi, manu vix duplo longiore quam 1ma et formâ simili, infra parce emarginatâ, palmâ oblique transversâ, hirsutâ, digito brevi; carpo inter manum articulumque 3tium producto. Pedes 4 ultimi subæqui, 5tis paulo brevioribus, setis paucis brevissimis, articulo 1mo fere rotundato, margine postico obsolete crenulato. Maxillipedes articulo penultimo angusto.

Female?—Superior antennæ a little shorter than the inferior, flagellum six to eight-jointed. Inferior pair about one-third as long as body, flagellum nine to ten-jointed, joints little oblong, setæ all very short. Hand of first pair of feet small, oblong, a little smaller at base, oblique at apex. Hand of second pair of same form, and not twice as long, inferior margin slightly emarginate, palm oblique transverse, hirsute, finger short. Last four feet nearly equal, fifth pair a little shorter, setæ few, very short, first joint nearly orbicular, posterior margin slightly crenulate. Maxillipeds with the penult joint narrow.

Plate 60, fig. 6 *a*, animal, enlarged; *b*, mandible; *c*, first maxillæ; *d*, maxilla of second pair; *e*, maxillipeds.

From shallow pools of water along shores of Port Jackson, New South Wales. Collected, December 25, 1839.

Length, four lines. Eye a little oblong. Base of superior antennæ two-thirds as long as base of inferior, and last two joints of base of inferior subequal. Joints of flagellum of the superior pair very distinct, somewhat moniliform; less distinct in inferior pair. The hand of second pair has a small prominence on the inferior margin near middle, just along side of the emargination, which is hirsute like the oblique apical margin. The finger is curved and short, and shuts close against the oblique apical margin. The third and fourth pairs of legs are nearly equal; the following three pairs have a few short setæ on margins of third joint, and also, at apex of fourth and fifth joints, and on inner margin of fifth; claw curved, with inner seta, as usual. The first pair of stylets extends back beyond apex of second.

The third pair is very short, recurved, and projects but little beyond the extremity of the abdomen.

A. humilis, DANA, Proc. Amer. Acad. Sci., Boston, ii. 206.

ALLORCHESTES AUSTRALIS.

Antennæ 1mæ 2dis paulo breviores, flagello longiore quam basis, fermè 14-articulato, articulis versus basin transversis. Antennæ 2dæ corpore plus dimidio breviores, flagello parce longiore quam basis, 12-14-articulato, articulis plerisque oblongis, setis fere obsoletis. Pedes 1mi parvuli, manu paulo oblongâ, basi valde angustiore, apice fere recte truncatâ, digito non longiore quam manus latitudo. Pedes 2di validi, manu subovatâ, palmâ inferiore, depressâ, angulo postico obsoletè setuligero, digito longiusculo, carpo inter manum articulumque 3tium angustè producto. Pedes sex postici sensim incrementos, setis brevissimis, articulo 3tio perlato.

Superior antennæ a little shorter than inferior, flagellum longer than base, about fourteen-jointed, joints towards base transverse. Inferior antennæ less than half the body in length, flagellum rather longer than base, twelve to fourteen-jointed, joints mostly oblong, setæ nearly obsolete. Hand of first pair of feet quite small, but little oblong, much narrower at base than at apex, nearly direct truncate at apex, finger not longer than breadth of hand. Hand of second pair large subovate, palm depressed, posterior angle with a few minute setæ, carpus produced in a narrow process between the hand and third joint. Posterior six feet gradually increase in length, third joint quite broad, setæ very short.

Plate 60, fig. 7 *a*, animal, enlarged; *b*, mandible; *c*, *d*, maxillæ; *e*, maxillipeds; *f*, lower lip; *g*, inferior antenna; *h*, superior antenna; *i*, part of leg of first pair; *k*, ibid. of second pair; *l*, ibid. of fifth pair; *m*, stylet of first pair; *n*, of second pair; *o*, of third pair.

Shores of Illawarra, New South Wales.

Length, six lines. The head is a little longer than the first thoracic segment. The first three segments of the thorax are shorter than the

following. The epimerals are quite broad to the fifth; and the first covers the mouth in a side view; the fifth is very narrow, and the following still more so.

The inferior antennæ are about one-fourth longer than the superior. The base of the latter scarcely exceeds the first three joints of the base of the former. On the flagellum of the superior antennæ, the setæ are not as long as width of joints, except one or two nearly equalling it on the under side of each joint, and lying in the direction of the joint. The maxillipeds have a broad apex and a very stout spine or claw, with some setæ at apex as long as the spine.

The finger of the anterior hands is nearly straight, and not longer than the apical margin against which it is closely applied. The second hand has the palm a little depressed for its whole length, and very slightly concave; finger two-thirds the length of hand. Feet of third and fourth pairs equal.

Female.—Other specimens had the hands of the second pair of feet both small and like those of the first pair; and these are believed to be the females of this species. The antennæ were, however, a little shorter, flagellum of inferior pair about ten-jointed, and these joints a little more oblong.

A. australis, DANA, Proc. Amer. Acad. Sci., ii. 206.

ALLORCHESTES BREVICORNIS.

Antennæ breves; 1mæ corpore plus quadruplo breviores; 2dæ corpore plus triplo breviores, basi brevi, flagello longiore quam basis, articulis parce oblongis, setis brevissimis, densè verticillatis. Pedes 1mi parvuli, manu parce oblongâ, subrectangulatâ, infra pubescente, apice rectè truncato, paululo excavato, angulo infero acuto, prominulo. Pedes 2di paulo grandiores, manu angusto-ovatâ, apice angustâ, setarum fascibus parvulis paucis infra instructâ, digito brevi (plus dimidio brevior quam manus), fere longitudinali, palmâ totâ depressâ, rectâ; carpo breviter transverso, infra producto. Pedes 4 postici æqui, setis minutis.

Antennæ quite short; the superior not one-fourth as long as the body, and the inferior not one-third; inferior pair having the base quite short, flagellum longer than base, joints very slightly oblong,

setæ very short, dense verticillate. Hand of first pair of feet quite small, a little oblong, subrectangular, pubescent below, apex transversely truncate, slightly excavate, lower apex acute and a little prolonged. Hand of second pair narrow ovate, rather small, apex narrow, with a few tufts of short setæ below, finger short, not half as long as hand, nearly longitudinal, whole palm depressed, straight, carpus very short transverse, produced below. Four posterior feet equal, setæ minute.

Plate 60, fig. 8 *a*, animal, enlarged; *b*, mandible; *c*, *d*, maxillæ; *e*, maxillipeds; *f*, part of inferior pair of antennæ; *g*, hand of first pair of feet; *h*, ditto of second pair.

Along shores of the Bay of Islands, New Zealand.

Length, five lines. Flagellum of superior antennæ a little longer than base; of inferior about once and a third the base. Setæ of superior antennæ like those of inferior, scarcely longer than breadth of joints.

Hand of second pair about twice as long as that of first pair, gradually narrows towards apex, and the palm is so much depressed that when the finger is closed, the outline of the hand below it and that of the outer margin of the finger is a continuous line; the closed finger points towards the base of the hand, and is applied close to the palm, leaving no space between; the back of the hand is flattened.

The anterior margin of the first joint of the six posterior legs bears a few minute setæ. The claw has the usual seta on the under side. The maxillipeds have the penult joint narrow, and the last is a stout spine, nearly as long as the penult joint. The epimerals are of moderate width; the posterior three of each side very narrow.

A. brevicornis, DANA, Proc. Amer. Acad. Sci., ii. 206.

ALLORCHESTES NOVI-ZEALANDIÆ.

Maris:—*Epimeræ permagnæ*. *Antennæ* 1mæ 2dis quartâ parte breviores, *flagello* 16-articulato, plus duplo longiore quam basis; 2dæ vix dimidii corporis longitudine, *articulis* basis duobus ultimis subæquis,

flagello longiore quam basis, 14-articulato, tenuissimo, articulis oblongis, setis fere obsoletis. Pedes 1mi parvuli, manu oblongâ, basi parce latiore, apice truncato et valde excavato, apice inferiore acuto, digito plus duplo longiore quam manus latitudo, carpo latiore, infra anguste producto et subacuto. Pedes 2di pervalidi, manu subovatâ, palmâ inferiore, rectiusculâ, vix depressâ, minute spinulosâ, digito longo, carpo inter manum articulumque 3tium angustè producto. Pedes 5ti 6ti 7mi sensim increscentes, setis minutissimis, articulo 3tio lato.

Feminæ:—Pedes 1mi 2dique parvuli; 1mi parce minores, manu oblongâ, marginibus fere parallelis, apice fere rectè truncato, digito non longiore quam manus latitudo; carpo infra subtriangulate producto; manu 2dâ formâ simili, carpo sub manu elongate producto et obtuso, articulo 3tio infra multum producto.

*Male:—*Epimerals very large. Antennæ of superior pair about one-fourth shorter than inferior, flagellum sixteen-jointed, more than twice as long as base; second pair hardly half as long as the body, last two joints of the base subequal, flagellum longer than the base, fourteen-jointed, very slender, joints oblong, setæ nearly obsolete. Feet of first pair quite small, hand oblong, sparingly broader at base, truncate and deep excavate at extremity, lower apex acute, finger more than twice as long as breadth of hand, carpus broader, with a narrow, subacute prolongation below. Feet of second pair very stout, hand large ovate, palm along under side nearly straight, hardly depressed, minute spinulous, finger long, carpus with a narrow prolongation below between hand and third joint. Feet of fifth, sixth, and seventh pairs regularly increase in length, setæ very minute, third joint broad.

*Female:—*Hand of first pair oblong, two margins nearly parallel, truncate at apex, finger not longer than breadth of hand, carpus with a short triangular or rounded prolongation below. Hand of second pair a little larger but of similar form, carpus long produced below hand, and obtuse or rounded at the extremity, third joint also much produced.

Plate 61, figs. 1 *a* to *f*, *male*; *g* to *v*, *female*:—fig. 1 *a*, *male*, enlarged; *b*, part of flagellum of superior antennæ; *c*, *ibid.* of inferior; *d*, hand of first pair; *e*, *ibid.* of second pair; *f*, part of fifth pair.—*g*, *female*, enlarged; *h*, *i*, *k*, *l*, *m*, parts of the mouth; *n*, part of leg of first pair; *o*, *ibid.* of second pair; *p*, *ibid.* of fifth pair; *q*, *ibid.* of

seventh pair; *r*, first pair of stylets; *s*, antennæ of a young female; *u*, part of first and second pair of legs, *ibid.*; *v*, fifth pair of legs, *ibid.*

Bay of Islands, New Zealand, on the shores of Parua Harbour. This species was found in holes in wood that had been bored by *Teredos*.

Length, five lines. The setæ of the antennæ are not as long as the breadth of the joints. The species is near the *A. australis*, and like that, the maxillipeds have a broad penult joint. But in the males of the *australis* the finger of the hand of the first pair of legs is not longer than the breadth of the hand, and does not, therefore, project beyond it.

A. novi-zealandiæ, DANA, Proc. Amer. Acad. Sci., ii. 207, *female*; *A. intrepida*, *ibid.*, *male*.

ALLORCHESTES ORIENTALIS.

Antennæ 1mæ 2dis paulo breviores, flagello moniliformi, 7-articulato, basi longiore. Antennæ 2dæ dimidii corporis longitudine, articulis 2 ultimis basalibus æquis, flagello fere duplo longiore quam basis, moniliformi, 14-articulato, articulis oblongis, setis brevibus. Pedes 1mi parvuli, manu ellipticâ. Pedes 2di validi, manu subovatâ, palmâ rectiusculâ, parce excavatâ, minutè setulosâ, digito longo; carpo inter manum articulumque 3tium non producto. Pedes 6 postici sensim increscentes, setis paucis minutis.

Superior antennæ a little shorter than inferior, flagellum moniliform, seven-jointed, longer than base. Inferior pair half as long as body, last two basal joints equal, flagellum nearly twice as long as base, moniliform, fourteen-jointed, joints oblong, setæ short. Hand of first pair of feet quite small, oval. Hand of second pair ovate, palm a little depressed, and bearing a few short setæ, finger long, carpus not produced below between hand and third joint. Six posterior feet gradually increase in length, setæ few, minute.

Plate 61, fig. 2 *a*, animal, enlarged; *b*, mandible; *c*, *d*, maxillæ; *e*, maxilliped; *f*, part of flagellum of superior antennæ; *g*, *ibid.* of inferior antennæ; *h*, hand of second pair of feet.

Island in the Sooloo Sea, off the harbour of Soung.

Length, three lines. The superior antennæ are about one-fourth shorter than the inferior; the first joint of the base is the longest. The whole base is a third shorter than base of inferior pair. Setæ about as long as diameter of joint.

The hand of the second pair of feet has the upper margin a little flattened; the palm is somewhat uneven. There is a very low prominence on the posterior margin of hand, just beyond where the finger reaches when closed. The setæ of the posterior legs are all short, not exceeding the diameter of the joints.

The third and fourth pairs of legs are slender and subequal. The first joint of the last six legs is very broad, as usual.

ALLORCHESTES (?) GRAMINEA.

Antennæ 1mæ 2dis tertiâ parte breviores, flagello longiore quam basis, fermè 14-articulato; 2dæ corpore plus dimidio breviores, flagello moniliformi, valde longiore quam basis, articulis vix oblongis, setis minutis. Oculi reniformes. Pedes 1mi parvuli, manu angustâ, medio paulo latiore, palmâ inferiore, digito parce brevior quam manus, crasso. Pedes 2di pervalidi, manu elongato-ovatâ, apice angustâ, infra rectiusculâ, palmâ non depressâ, digito longo (longiore quam manus dimidium), carpo inter manum articulumque 3tium infra non producto. Pedes sex postici sensim increscentes, fere nudi.

Superior antennæ one-third shorter than inferior, flagellum longer than base, about fourteen-jointed; inferior not half as long as body, flagellum moniliform, much longer than base, joints hardly oblong, setæ minute. Eyes reniform. Hand of first pair of feet narrow, a little the broadest at middle, finger long, stout, folding against under side of hand. Hand of second pair quite large, narrow ovate, narrow at apex, lower margin nearly straight, palm not depressed, finger long (longer than half the hand); carpus not produced below between the hand and the third joint. Six posterior feet gradually increasing in length (sixth and seventh pairs nearly equal), almost naked.

Plate 61, fig. 3 *a*, animal, enlarged; *b*, leg of sixth pair.

Rio Janeiro. Collected, January 4, 1839.

Length, six to seven lines. Colour, green, shaded with olive-green and yellow; posterior legs in third and fourth joints, partly carmine.

The reniform eye of this species leads me to doubt the correctness of arranging it with the *Allorchestes*; and as I made no dissection, I am not sure that its mandible has no palpus, or that its posterior stylets are simple. The head is a little longer than the next segment. The last two basal joints of the inferior antennæ are subequal. The flagellum of this pair rather stout; of the superior quite slender.

The claw of the anterior feet is rather longer, and closes against a considerable part of the lower margin of the hand or preceding joint. The same remark applies to the finger of the next pair; when closed it points towards the base of the hand; the palm has a few minute setæ; the hand is about twice as long as its breadth.

The first pair of stylets extends farther back than the second, and the third pair is very short. The branchiæ are narrow oblong; they are attached to the bases of all the legs excepting the first and last pairs.

Allorchestes? *graminea*, DANA, Proc. Amer. Acad. Sci., ii. 208.

ALLORCHESTES MEDIA.

Epimeræ magnæ. Antennæ 1mæ dimidio 2darum longiores, flagello 14-articulato, articulis parce oblongis, setis partim divaricatis et perbrevis, partim infra stricte appressis et brevibus; 2dæ dimidio corporis breviores, flagello longiore quam basis, 16-articulato, articulis parce oblongis, setis numerosis et verticillatis præter in latere externo nudo, latitudine articulorum non longioribus. Pedes antici parvuli, manu oblongâ, marginibus fere parallelis, infra partim hirsutis, apice oblique truncatis, digito brevi, carpo infra rotundato et pilis ornato. Pedes 2di pervalidi, manu subovatâ, supra arcuatâ, palmâ multo oblique transversâ, spinulosâ, versus digiti basin paulo elevatâ, digito dimidio manus parce longiore, carpo inter manum articulumque 3tium infra non producto, articulo 3tio antice triangulato, fere acuto. Pedes 5ti 6ti 7mi sat breves, subæqui, sensim increscentes, setis paucis, articulo 5to

paris 5ti unâ setâ crassâ medio infra armato, paris 7mi setis duâbus similibus, supra nudo.

Epimerals large. Superior antennæ longer than half the inferior, flagellum fourteen-jointed, joints sparingly oblong, setæ partly very short and divaricate, partly close appressed and about as long as the joint. Inferior pair not half as long as the body, flagellum longer than the base, sixteen-jointed, joints sparingly oblong, setæ numerous and verticillate, except on outer side which is naked, setæ hardly as long as breadth of joint. Feet of first pair quite small, hand oblong, margins nearly parallel, below hirsute in part, at apex obliquely truncate, finger short. Hand of second pair quite large, subovate, arcuate above, palm very oblique transverse, spinulous, ending in an angle below, finger a little longer than half the hand, carpus small, not produced below between the hand and the third joint, third joint triangulate anteriorly and nearly acute. Six posterior feet subequal, increase gradually in length, setæ few, one stout one, as long as diameter of joint on fifth joint of fifth pair, and one or two such on same joint of sixth and seventh pairs.

Plate 61, fig. 4 *a*, animal, much enlarged; *b*, part of flagellum of superior antennæ; *c*, same of inferior pair, inner side; *d*, *ibid.*, outer side; *e*, mandible; *f*, outer maxilliped; *g*, part of leg of first pair; *l*, *ibid.* of seventh pair; *m*, posterior stylet; *n*, leg of first pair of a smaller specimen.

Rio Janeiro, dredged in the harbour; also, Cape Verdes, Porto Praya.

Length, five to six lines. The spiniform seta on the under side of the fifth joint of the fifth pair of legs near its middle marks well the species; on the same joint of the following legs there are either one or two such spines. The posterior apex of the third and fourth joints in these legs is somewhat projecting, and set around with strong setæ. The under side of the flagellum of the inferior antennæ is rather closely or crowdedly setulous at the apices of the joints, and the upper side is comparatively bare; but this character fails in the younger specimens, three lines or less in length.

One specimen is probably from Tierra del Fuego.

ALLORCHESTES HAWAIIENSIS.

Epimeræ mediocres. *Antennæ 1mæ 2dis multo graciliores, quartâ parte corporis vix breviores, flagello 14-articulato, articulis longis tenuibus, setis paucis, diametro articulorum non longioribus; 2dæ basi duplo longiore quam basis 1marum, articulis flagelli paulo oblongis, setis paucis latitudine articulorum dimidio brevioribus. Pedes 1mi parvuli, manu late subovatâ, supra fere rectâ, infra arcuatâ, palmâ obliquâ fere longitudinale, carpo infra rotundato. Pedes 2di validi, manu crassâ, ovatâ, infra et supra arcuatâ, palmâ obliquâ, fere longitudinali, vix depressâ, parce setulosâ, carpo inter manum articulumque 3tium infra non producto. Pedes 4 antici subæqui, setis paucis, minutis, semilatitudine articuli 5ti non longioribus.*

Epimerals of moderate size. Antennæ of superior pair much more slender than those of second, nearly one-fourth the body in length, flagellum fourteen-jointed, joints long and slender, setæ about as long as breadth of joints. Inferior pair with the base twice as long as base of superior, joints of flagellum oblong, setæ few and half as long as breadth of joints. Hand of first pair of legs very small, broad subovate, above nearly straight, below arcuate, palm oblique and nearly longitudinal, carpus rounded below. Hand of second pair stout, ovate, arcuate above and below, palm very oblique so as to be nearly longitudinal, sparingly setulous, carpus not produced below between hand and third joint. Legs of two posterior pairs subequal, setæ few, minute, not longer than half the breadth of the joint.

Plate 61, fig. 5 *a*, animal, enlarged (extremity of inferior antennæ broken off); *b*, part of flagellum of superior antennæ; *c*, ibid. of inferior pair; *d*, part of maxilliped; *e*, part of leg of first pair; *f*, ibid. of second pair; *g*, ibid. of third or fourth pair; *h*, stylet of first pair.

Island of Maui, Hawaiian Group.

Length, four to five lines. The extremity (or penult joint) of the maxillipeds is quite broad and hirsute. There are no setæ on upper

margin of fourth or fifth joints of six posterior legs. The outer branch of the first pair of caudal stylets has two spinules on the upper margin besides the apical, and the inner has three.

ALLORCHESTES PUGETTENSIS.

Epimeræ sat magnæ. Antennæ 1mæ 2dis dimidio breviores, basi 2darum parce longiores, multo graciliores, flagello 15-articulato, setis fere obsoletis; 2dæ dimidio corporis breviores, flagello parce longiore quam basis, 12-articulato, articulis paulo oblongis, setis minutissimis. Manus 1ma ovata, infra supraque arcuata, palmâ valde obliquâ, non depressâ. Manus 2da pervalida, subovata, infra truncata, palmâ rectiusculâ, spinulosâ, parce depressâ, digito longo, marginis manus angulum attingente, carpo inter manum articulumque 3tium infra non producto, articulo 3tio antice triangulato et subacuto. Pedes 5ti 6ti 7mi sensim increscentes, setis brevissimis, perpaucis.

Epimerals moderately large. Superior antennæ half shorter than inferior, slightly longer than base of inferior pair and much more slender, flagellum fifteen-jointed, setæ nearly obsolete. Inferior not as long as half the body, flagellum slightly longer than base, joints a little oblong, setæ very minute. Hand of first pair ovate, arcuate above and below, palm very oblique and not excavate. Hand of second pair very stout, subovate, truncate below, so that the palm is straight or nearly so and slightly excavate, finger long and reaching to the angle terminating the palm, carpus not produced below between hand and third joint, third joint triangular and subacute anteriorly. Legs of sixth and seventh pairs subequal, setæ few and very short.

Plate 61, fig. 6 *a*, animal, enlarged; *b*, part of flagellum of inferior antennæ; *c*, mandible; *d*, extremity of maxilliped.

Puget's Sound, Northwest America.

Length of body, nine or ten lines. The setæ of the inferior antennæ are about one-fourth the breadth of the joints in length. The basal joints of the six posterior legs are nearly as broad as long. The

tarsi are much curved and have a seta below. The maxillipeds have the penult joint broad. The eye is oval.

FAMILY GAMMARIDÆ.

THE characters of the Gammaridæ distinguishing them from the Orchestidæ have been pointed out, and here are only briefly reviewed. Instead of the exceedingly short posterior stylets of the Orchestidæ, these stylets are elongated, and often extend backward beyond the preceding pair; moreover, they are usually two-branched. Instead of having no mandibular palpus, there is a long one- to three-jointed palpus; only in a rare instance is it wholly obsolete. Instead of having the palpus of the inner maxillæ small and one-jointed, it is large and two- or three-jointed, and extends beyond the body of the organ; it is rarely simple. The few species of Gammaridæ that have no mandibular palpus, like the Orchestidæ, are remote from that family in the longer posterior stylets and in the palpus of the inner maxillæ. The maxillipeds terminate in a claw, as in *Allorchestes*, the palpiform part being five-jointed. The epimerals may be as large as in the Orchestidæ; but there is a transition to the small size found in the Corophidæ.

This family includes several subfamilies.

In much the larger part of the genera, the base of the superior antennæ is slender. But there are a few in which it is thick and short; and these species have large epimerals, a very compressed body, a three-jointed mandibular palpus, a pointed, sparingly toothed apex as the extremity of the mandible, quite unlike the denticulate edge and accessory denticulate lobe of other Gammarids. Besides, the inner lamellar process of the maxillipeds is large. The genus *Lysianassa* is of this group, and we name the subfamily *LYSIANASSINÆ*.

There is one Lysianassoid genus, with a short and stout base to the inner antennæ, large epimerals, and large inner lamella of the maxillipeds, in which the mandibular palpus is one-jointed, with a denti-

culate edge, and the mandible itself has a denticulate summit. These constitute the subfamily STEGOCEPHALINÆ.

The remaining species, with the base of the inner antennæ more elongate and slender (the second and third joints of these antennæ being much oblong, instead of transverse), are naturally distributed according to certain characters in the mandibles, the maxillipeds, and legs.

The LEUCOTHOINÆ are peculiar in having the *maxillipeds long and slender, and the inner lamellar process very small or obsolescent*; and some or all of the species have no mandibular molar prominence. The genus *Stenothoe* is of this subfamily, although peculiar in wanting the mandibular palpus. Only the first and second pairs of legs are prehensile.

The GAMMARINÆ, like the Leucothoinæ, have hands only to the first and second pairs of legs, and even these may be wanting. The mandible has a molar prominence, a doubly edged denticulate summit, a three-jointed palpus. The maxillipeds are rather stout, and the inner lamellar process is elongate.

The PONTOPOREINÆ, unlike the Gammaridæ, have the legs of the third and fourth pairs more or less prehensile; and the ISÆINÆ, have the legs of the fifth, sixth, or seventh pairs prehensile.

It is possible that a better knowledge of the characters of the mandibles in the Pontoporeinæ and Isæinæ may require a different arrangement of them. The genera of the former subfamily are known to us only from Krøyer's descriptions.

Among the *Gammarinæ*, there are two series of species, the *Amphithoe* series, having the superior antennæ simple; and the *Gammarus* series, having these organs appendiculate.

In the *Amphithoe* series, the genus *Amphithoe*, as at present adopted, includes all the species with the first and second pairs of legs subchelate, the posterior legs of ordinary length, the mandibles with a molar prominence. In *Acanthonotus* of Owen, the legs of the second pair have no trace of a hand; in *Ædicerus* of Krøyer, the posterior legs are very long, and the claw is obsolete; in *Microcheles*, Krøyer, the mandible has no molar prominence; in *Photis*, Krøyer, the fifth pair of legs is described as reversed, and the last pair of stylets as having one of the branches rudimentary. Other subdivisions have been proposed, but they are not accepted by Edwards; and, in fact, they were not instituted on characters of importance. *Pherusa* of Leach, distin-

guished only by the form of the hands, is united by Edwards to Amphithoe. *Melita* of Leach, based on the hand, the finger closing on the side instead of the edge, is also rejected. *Acanthosoma* of Owen, and *Iphimedia* of Rathke, characterized by having the superior antennæ shortest, have fallen back into Amphithoe. Some of these proposed genera, although instituted on unimportant characters, are still natural groups, and, as we show beyond, should be retained.

In the *Gammarus* series, the group *Gammarus* embraces, in the latest system, all the species with hands to the first and second pairs of legs; while *Alibrotus* (Edwards) has no hands to the four anterior legs. *Leptochirus* (Zaddach) is a new genus, in which the first pair alone is subchelate; and *Ischyrocerus* (Kröyer) differs from *Gammarus* in its elongate front, the antennæ being situated on its under side, one pair before the other. The genus *Mæra* of Leach, characterized by having one hand of the second pair very large and stout, and the other quite small, has been restored to *Gammarus* by Edwards. *Eusirus* of Kröyer scarcely differs from *Gammarus*: it has the four hands large and subequal, and of somewhat peculiar form, with large epimerals and reniform eyes; and it may be doubted whether it should be sustained.

In instituting the genera of *Gammarinæ*, certain important sources of distinction have been overlooked. The natural groups have in part been recognised, and have again been rejected for want of the sufficient characters which these means afford. These characteristics are found in the caudal stylets, the epimerals, and the organs of the mouth. The caudal stylets, especially the posterior pair, are highly distinctive, affording truthful lines of demarcation among natural groups, although organs seemingly unimportant. That this unimportance is not real, the connexion of these organs with the powers of locomotion in both the *Orchestidæ* and *Gammaridæ* fully evinces.

We may briefly review the forms in the posterior stylets occurring among these species.

1. *One-branched*, the branch very short, straight, with a few setules at apex and rarely elsewhere. This is the only form occurring in the *Orchestidæ*.

2. *One-branched*, the branch short and naked or nearly so, on rather a long base, the apex somewhat reflexed, and enclosing two exceedingly short but thickish spines, pointing upward or a little inward, and looking as if just emerging from the apex. This form is found

in the genus *Pyctilus* (Dana),—a genus closely resembling *Erichthonius* and possibly the same,—and also in *Darcothoe* (Dana).

3. *One-branched*, the branch naked and subulate, without spines at apex, or ending in a single spine, appearing as the continuation of the branch itself, and hardly as an added spine. Found in the genus *Stenothoe* (Dana).

4. *One or two-branched, the inner branch nearly or quite obsolete*; the other long, often very long and far exsert, furnished with short hairs, and unlike the branches of the first and second pairs of stylets. The long branch may be either cylindrical or lamellar, and when the latter, the edges may be ciliated. This form occurs in certain species of the genera *Amphithoe* and *Gammarus*.

5. *Two equal or subequal branches*, which are straight, either short or long, and end in short hairs, or more rarely with spines, these hairs or spines not reflexed like spines at the apex of the branches in the first and second pairs. A prominent division of *Gammarus* and also one of *Amphithoe* are thus characterized.

6. *Two equal or subequal branches*, the branches dissimilar and quite short; one of them, the outer, subconical and *biuncinate* at apex, the two reflexed hooks in the same longitudinal line; the other compressed, with a truncate extremity, and having a few minute hairs at apex. A prominent part of the genus *Amphithoe* has stylets of this kind; the form is not known to occur among the *Gammari*.

7. *Two subequal branches*, the branches similar, subulate, nearly straight, ending in a slender point, like the form in No. 3. Occurs in the genus *Leucothoe*.

The *epimerals* exhibit also wide variations, corresponding in part with the distinctions afforded by the stylets. These variations consist in the relative sizes of the fourth and fifth epimerals, and the form of the fifth.

In one large division of the genus *Amphithoe* (the same that is characterized by the sixth kind of posterior stylets), the *fifth epimeral is even larger than the fourth*, or, at least, not smaller, and instead of being subequally two-lobed, the posterior lobe is very small, and is on the posterior margin of the epimeral.

In other species of *Amphithoe*, characterized by posterior caudal stylets of a different kind, the *fifth epimeral is much smaller than the fourth*, and subequally two-lobed.

Some species of *Gammarus* have the fifth epimeral as large as the fourth, but it is subequally lobed, and does not resemble the form mentioned as occurring in certain *Amphithoe*. In other species the fourth is much smaller than the fifth, as in a part of *Amphithoe*.

There are thus good grounds for subdividing the accepted genera *Amphithoe* and *Gammarus*.

1. The species of *Amphithoe* with the fifth epimeral not smaller than the fourth, and its posterior lobe very small, and with the posterior caudal stylets two-branched, with one branch biuncinate (6th kind), may retain the name *Amphithoe*. The superior antennæ are usually the longest.

2. The species of the same genus with the fifth epimeral smaller than the fourth and subequally lobed, and with the posterior caudal stylets two-branched, the branches nearly similar and neither of them uncinata (5th kind), we call *Iphimedia*. The genus so called of Rathke embraces species of this kind; they generally have the superior antennæ shorter than the inferior. The genus *Acanthosoma* of Owen includes a species of the same group, and is of earlier date; but the name is unfortunately significant, as the existence of spines on the body is unessential; and it cannot, therefore, be accepted for the group.

3. The species having one branch of the posterior caudal stylets rudimentary, and, as in *Amphithoe*, no appendicular branch to the superior antennæ, make a third group; and this is the *Melita* of Leach, as we propose to sustain it. The character of the hands, mentioned by Leach, is of common occurrence, but we would not make it essential to the genus.

4. In the more characteristic group of the genus *Gammarus*, the posterior caudal stylets have two branches, like those in *Iphimedia*, the two being subequal and different in the apical setæ from those of the first or second pair; they are often much longer than occurs in *Iphimedia*, though not always so. This division includes the *Gammarus pulex*, and may well retain the old name *Gammarus*.

5. Another portion of the genus *Gammarus* has one branch of the posterior caudal stylets rudimentary, as in *Melita* of the *Amphithoe* series. These make the genus *Mœra*, Leach's species being included.

6. A third portion has the stylets quite simple, with the other characters stated under No. 2, page 904, the terminal branch being short, on a long base, and the apex reflexed, quite unlike the form in

Mæra. The species constitute our genus *Dercothoe*. The eye usually occupies a prominence projected forward on the side margin of the head. The fifth epimeral, in the species examined, is as long as the fourth, and subequally lobed. It is probable that all the species have the upper antennæ appendiculate. *Gammarus zebra* of Rathke* appears to be of this group. The hands of the second pair have a simple finger, and in this respect the genus differs from our *Pyctilus*, which has the stylets and general habit of *Dercothoe*. *Pyctilus* is near *Erichthonius* of Edwards, but it has the anterior epimerals of moderate size instead of obsolete; both males and females of this genus were observed, and in each the finger of the second pair of legs was bi-articulate.

In Krøyer's description of his genus *Photis*, he mentions that the fifth pair of legs is reversed, the claw being turned backward and very short. We look upon this apparently reversed position of the legs as of small importance. In *Amphithoe*, as the genus is here restricted, this reversion is common, and it may extend to the sixth and seventh pairs; in some, the claw is quite reversed, in others it points outward, and in others downward and outward; these various positions showing that the distinction is not generic. It appears to depend on a slight turning of the fifth joint of the legs, at its articulation with the fourth, and may be in part voluntary with the animal. This genus is near *Gammarus* in its antennæ, but has one branch of the posterior caudal stylets rudimentary, and the fifth epimeral as large as the fourth.

In the following synopsis of the Gammaridæ the distinguishing characteristics of the several genera are presented, and remarks are also added on different genera that are passed by without mention in the preceding pages.

I. PEDES 10 POSTICI NON PREHENSILES.

SUBFAM. 1. STEGOCEPHALINÆ.—Antennæ breves, superiores basi crassæ. Mandibulæ acie denticulatâ instructæ, palpo brevi, uniaarticulato, intus dentato. Epimeræ permagnæ.

* Faun. der Norwegens, 74, pl. 3, f. 4.

G. 1. *STEGOCEPHALUS*, Kröyer.*—Epimeræ 4tæ maximæ, 5tis parvis. Antennæ superiores appendiculatæ. Pedes 1mi 2di manibus carentes. [Pedes 5ti 3tii 4tique directione similes.]

SUBFAM. 2. *LYSIANASSINÆ*.—Antennæ breves, superiores basi crassæ. Mandibulæ apice parce dentatæ et cuspidatæ, acie vix instructæ palpo 2–3-articulato. Maxillipedes lamellis internis grandibus. Epimeræ permagnæ.

1. *Pedes 1mi 2dique non subchelati, 2dis parvulis interdum exceptis.*

G. 1. *LYSIANASSA*, Edw.—Antennæ superiores appendiculatæ.

G. 2. *PHLIAS*, Guérin.—Antennæ superiores non appendiculatæ.

2. *Pedes 1mi subchelati, 2dis non subchelatis.*

G. 3. *OPIS*, Kröyer.†—Antennæ superiores appendiculatæ. Pedes 1mi crassè chelati, 2di debiles.

G. 4. *URISTES*, Dana.‡—Antennæ superiores non appendiculatæ. Pedes 1mi subchelati, 2di articulo styliformi confecti.

3. *Pedes 1mi 2dique plus minusve subchelati.*

G. 5. *ANONYX*, Kröyer.§—Epimeræ permagnæ. Antennæ superiores appendiculatæ, basi breves. Maxillipedes lamellis internis grandibus. Styli caudales postici biramei, ramis subulatis.

G. 6. *UROTHOE*, Dana.—Epimeræ permagnæ, 5tis parvis. Antennæ 1mæ breviores, appendiculatæ, basi sat elongato. Styli caudales postici longi, biramei, ramis foliaceis, ciliatis. Mandibulæ palpo 3-articulato.

* Kröyer's Nat. Tids., iv. 150, 1842. "Caput oculis ut videtur destitutum."

† Tids., iv. 149. "Pedes 1mi paris chelis armati portentosæ magnitudinis. Reliqua cum genere Anonyce ferme conveniunt."

‡ Amer. J. Sci. [2], viii. 135. The genus *Stenia* is rejected.

§ Tids. ii. 256, and iv. 164.

The genus *Ephippiphora* of White (Ann. and Mag. N. Hist. [2], i. 226, 1848) has been but briefly described, and we cannot pronounce upon its exact relation to either of the genera of Lysianassinæ. The habit is like that of Anonyx, the epimerals large, the superior antennæ appendiculate, the posterior caudal stylets elongate as in Anonyx, and not short like the Orchestidæ. But the character of the termination of the four anterior legs is not stated, neither are they in view in the figure of the species on Plate 5 of the Zool. of the Erebus and Terror. This figure represents the fifth and sixth pairs of legs as rudimentary, or the basal joints twice as long as the following part, and the basal joint of the sixth smaller than that of the fifth or seventh.

SUBFAM. 3. LEUCOTHOINÆ.—Antennæ superiores basi plus minusve graciles. Maxillipedes elongati, angusti, articulo longo unguiformi confecti, *lamellis internis perbrevibus*. Mandibulæ sive palpigeræ sive non palpigeræ, processu molari carentes. [An semper?] Epimeræ magnæ.

G. 1. STENTHORE, *Dana*.—Epimeræ permagnæ, 4tæ maximæ, 5tæ parvulæ. Pedes 4 antici subchelati, 2dis validioribus. Antennæ superiores longiores, non appendiculatæ. Mandibulæ non palpigeræ, processu molari carentes. Styli caudales 1mi 2dique ramis bene subulati, 3tii simplicissimi, subulati, spinâ crassâ confecti.

G. 2. LEUCOTHOE, *Leach*.—Epimeræ magnæ, 5tæ parvulæ. Pedes 4 antici subchelati, 2dis validioribus. Antennæ superiores longiores, non appendiculatæ. Mandibulæ palpigeræ. Styli caudales toti biramei, ramis subulatis.

[Cujus sedis est *Microcheles*, Kröyer, † *Amphithoe* affinis, cui mandibulæ processu molari carentes: quoque *Amphithoe Marionis*, Edw., cui mandibulæ non palpigeræ.]

SUBFAM. 4. GAMMARINÆ.—Antennæ 1mæ basi graciles. Maxillipedes sat lati, lamellis internis sat elongatis. Mandibulæ acie denticulatâ instructæ et alterâ accessoriâ quoque processu molari et palpo 3-articulato. Pedes 10 postici non subprehensiles.

A. FRONS PRODUCTUS ET INFRA ANTENNIGERUS NON EST, ANTENNIS 1MIS
INFERIORIBUS NON ANTERIORIBUS.

1. *Styli caudales postici biramei, ramis subæquis.*

A. PEDES 2DI NON SUBCHELATI.

G. 1. ACANTHONOTUS, *Owen*.—Antennæ quatuor subæquæ, 1mæ non appendiculatæ. Epimeræ magnæ. Pedes 2di filiformes, manu omnino carentes, 1mi manu vix confecti.

G. 2. ALIBROTUS, *Edw.*—Antennæ 1mæ breves, appendiculatæ. Epimeræ magnæ. Pedes 1mi validi, non subchelati.

* Kröyer states that the *bi-articulate* finger of *Leucothoe* is not a true generic characteristic, and adds two species to the genus, one of which has this character imperfectly, and the other not at all (*Nat. Tids.*, iv. 141, 1842, and [2], i. 539, 1845). This character of the hand depends mainly on the prolongation of the inferior apex of the antepenult joint, which prolongation is variously developed in species of allied genera. They agree with *Leucothoe* in their peculiar slender maxillipeds; in the very small epimerals to the first segment, large fourth, and small fifth, sixth, and seventh; in the caudal stylets; the very short third joint of the superior antennæ, and other characters.

† *Tids.* [2], ii. 5.

G. 3. *LEPTOCHIRUS*, Zaddach.*—Antennæ 1mæ appendiculatæ. Pedes 1mi bene subchelati, 2di manu carentes.

B. PEDES 2DI IMIQUE SUBCHELATI.

* Antennæ 1mæ non appendiculatæ.

G. 4. *IPHIMEDIA*, Rathke, † *D.*—Epimeræ magnæ, 4tæ maximæ, 5tis multo brevioribus et vix bilobatis. Styli caudales postici ramis duobus oblongis consimilibus apice setigeris et non uncinatis instructi. Antennæ 1mæ sæpius breviores.

G. 5. *ÆDICERUS*, Kröyer. ‡—*Iphimediæ* affinis. Pedes 7mi longissimi, fere filiformes. Antennæ 1mæ breviores.

G. 6. *AMPHITHOE*, Leach, *D.* §—Epimeræ magnæ, 5tæ maximæ, vix bilobatæ lobo posteriore minimo. Styli caudales postici ramis duobus brevibus dissimilibus instructi, ramo externo apice recurvatim bi-uncinato, interno compresso apice non spinuloso sed pilis parce ciliato. Antennæ 1mæ sæpissime longiores.

** Antennæ 1mæ appendiculatæ.

G. 7. *GAMMARUS*, Fabr., *D.* ||—Epimeræ sive mediocres sive breves. Styli cau-

* The genus *Leptochirus* is described by Zaddach (Syn. Crust. Boruss. Prodrum, 1844), as having no appendicular branch to the superior antennæ. But Fr. Müller states (Archiv für Naturgeschichte, 1848, xiv. 62) that there is a small one-jointed appendage in the *Leptochirus pilosus*. The legs of the second pair are described as having no proper hand, but terminating as in the genus *Talitrus*. May the form be female only?

† Beit. zur Fauna Norwegens, p. 85, Act. Leop. xx. *Dexamine* of Leach, may perhaps be included here.

The genus *Hyale* of H. Rathke (Fauna der Krym, Mem. Acad. Imp. St. Petersb., iii. 1837, p. 378, pl. 5) contains no characters in its description by this author which do not apply equally well to species of *Iphimedia*. The description is as follows:—

“Corpus elongatum, compressum. Antennæ inferiores superioribus aliquantulum longiores; earum quælibet e tribus articulis atque flagello composita. Oculi disciformes. Pedes 14; duo eorum paria antica chelis monodactylis complanatis, 2di paris multo majoribus. Stylorum abdominalium paria tria. Abdominis appendicula terminalis simplex, erecta, verruciformis.” The posterior stylets are two-branched, though short; and the species (*H. pontica*) is thus distinct from the *Allorchestes*.

‡ Tids., iv. 155, 1842. “Frons in rostrum producta, plus minus acutum obtusumve, semper vero nodo pellucenti, ovali, flavo-rubescente turgidum. Oculi nulli? Pedes 3tii 4tiq; paris validi, ungue instructi lato laminari, quod quoque usu venit 5to 6toque pari, quorum articulus 1mus dilatatus non est.”

§ Includes *Pherusa* of Leach.

|| *Amathia*, Rathke (Fauna der Krym, Mem. Acad. Imp. St. Petersb., iii. 1837, p.

dales postici 2dis non similes, ramis sæpe longis cum pilis raro spinulis ornatis, apice non uncinatis. Antennæ superiores sæpius longiores.

2. *Styli caudales postici sive ramo uno longo altero parvulo instructi, sive simplicissimi et apice non paulo reflexi.*

* Antennæ 1mæ non appendiculatæ.

G. 8. PHOTIS, *Kröyer*. *—Epimeræ magnæ, 5tæ 4tis non breviores et postice profundius excisæ. Styli caudales postici ramo interno rudimentario.

G. 9. MELITA, *Leach, D.*—Epimeræ 5tæ 4tis multo breviores (sic an semper?) Styli caudales uno ramo longo, sive subcylindrico sive foliaceo, altero brevi vel obsoleto. [Digitus in manus latus sæpe claudens.] Antennæ 1mæ sæpius longiores.

** Antennæ 1mæ appendiculatæ.

G. 10. MÆRA, *Leach, D.*—Epimeræ et styli caudales postici ac in *Melitâ*.

3. *Styli caudales postici simplicissimi, ramo uno brevi et nudo, apice paulo reflexo et spinas duas perbreves paulo exsertas gerente.*

G. 11. DERCOTHOE, *Dana*.—Epimeræ mediocres, 5tæ bene bilobatæ, 4tis sæpius vix breviores. Pedes 1mi 2dique digito uni-articulato confecti.

G. 12. PYCTILUS, *Dana* (Erichthonius, *Edw.*?)—Epimeræ mediocres vel breves, corpore lineari, subdepresso. Antennæ longæ, flagellis sat longis. Manus 1mæ articulis 4to 5toque sæpe instructæ, digito uni-articulato; 2dæ digito bi-articulato.

291, and *Beit. zur Faun. Norw., Act. Leop. xx.*), includes those Gammari that have the superior antennæ the shorter—not of itself a proper basis for a genus. The eye is described as reniform.

The genus *Eusirus* of Kröyer, which is very near Gammarus, has the hands of the two anterior pairs of legs large and equal, and the carpus is articulated with the upper margin of the hand near its middle. The eye is reniform. The superior antennæ have a short appendicular branch, consisting of a minute joint. "Mandibula parva, apice bifurco, dentato, flabello setarum marginis interioris, tuberculo molari transverso-elliptico dentibus minutissimis confectis formato; palpus triarticulatus duplam fere æquat mandibulæ longitudinem. Sex branchiarum paria in maribus (annuli thoracici 2di-7mi), 4 laminarum in feminis paria (annuli 2di-5ti)."—*Tids.* [2], i. 501.

* *Tids.*, iv. 155, 1842. "Pes 5ti paris recurvatus, inversus, ungue rudimentari. Epimera permagna, 5 paria anteriora ad marginem inferiorem setis sat longis instructa, 5tum eadem est ac 4tum altitudine, postice profundius excisum. Lamina terminalis interior pedis saltatorii 3tii paris rudimentaris."

G. 13. (An hujus sedis?) *PARDALISCA*, *Kröyer*.*—Epimeræ breves. Pedes 1mi 2dique digito 2-articulato manuque 1-articulatâ instructi. Antennæ tenues, 1mæ appendiculatæ.

B. FRONS PRODUCTUS ANTENNASQUE 1MAS VERSUS EXTREMITATEM GERENS.

[AN SPECIES COROPHIDIS AFFINIORES.]

G. 14. *ATYLUS*, *Leach*.—*Iphimediæ* paulo affinis. Antennæ subpediformes, breviores, non appendiculatæ. Digni 1mi 2dique uni-articulati.

G. 15. *ISCHYROCERUS*, *Kröyer*.†—*Gammaro* paulo affinis. Antennæ pediformes, 1mæ appendiculatæ. Palpus mandibularis longus, articulo ultimo obovato. Pedes 2di *maris* manu validissimâ instructi. Digni uni-articulati. Epimeræ mediocres.

II. PEDES 10 POSTICI PARTIM PREHENSILES.

SUBFAM. 5. PONTOPOREINÆ.—Pedes 3tii 4tique plus minusve prehensiles; 6 postici non prehensiles.

1. *Antennæ 2dæ inferiores et non posteriores.*

G. 1. *LEPIDACTYLIS*, *Say*.‡—Epimeræ magnæ. Antennæ superiores appendiculatæ, inferiores basi infra valde dilatato et partim dolabriformi. Pedes 4 antici filiformes; 3ti 4tique manu compressâ digitoque laminato instructâ; 5ti 6ti 7mique valde compressi, 7mis longioribus, articulis superne valde productis.

G. 2. *PONTOPOREIA*, *Kröyer*.§—Epimeræ magnæ. Antennæ superiores appendiculatæ. Pedes 1mi 2dique perbreves, robusti, 1mi manu latâ et ungue brevi confecti, 2di manu carentes; 3tii 4tique validi, manu articulo 4to dilatato instructâ, ungue conico aculeato; 7mi ungue vel articulo 6to rudimentario.

G. 3. *AMPELISCA*, *Kröyer*.||—Epimeræ magnæ. Antennæ graciles. Pedes 1mi

* Tids., iv. 153, 1842. "Caput crassiusculum." "Mandibula apice dilatata, quadridentata, palpo 3-articulato." "Pedes 3tii 4tique paris ungue sublaminari postice subtiliter serrulato." "Pedes spurii [abdominales] 2di et 3tii paris natatorii, reliqui saltatorii."

† Tids., iv. "Pedes spurii 4ti 5ti 6tique paris saltatorii; articulus basalis 6ti paris articulis terminalibus triplo vel quadruplo longior."

‡ Jour. Acad. Nat. Sci. Philad., i. 379. Here falls *Bellia* of C. Spence Bate (Ann. and Mag. Nat. Hist., 1851 [2], vii. 318).

§ Tids., iv. 152. "Pedes 5ti et 6ti paris recurvi, articulo 1mo parum modo dilatato ungue armati pusillo."

|| Tids., iv. 154. "Oculi simplices?" "Sextum pedum abdominalium par natatorium."

2dique manu nullâ subcheliformi; 3tiii 4tiq̄ue manu articulo 3tio instructâ, digito articulis 3 sequentibus formato, articulo ultimo vel ungue longissimo et gracillimo; 5ti 6tiq̄ue 5-articulati, ungue rudimentario recurvo, immobili (vel parum mobili). Styli caudales postici natatorii.

G. 4. PROTOMEDEIA, *Kröyer*.* — Corpus subdepressum, epimeris sat brevibus. Antennæ superiores appendiculatæ, inferiores pediformes, basi prælongo. Manus 3tiæ 4tæque articulis 3tio 4toque instructæ et digiti longi articulis sequentibus coalitis. Pedes 2di parvi, manu subcheliformi non instructi.

G. 5. AORA, *Kröyer*.† — Corpus subdepressum, epimeris sat parvis. Antennæ superiores longæ, appendiculatæ, inferiores subpediformes. Pedes 1mi 2dique manu subcheliformi, 1mis maximis, articulo 3tio posticè in apicem longissimum producto, manu angustâ, ungue fere lamellari. Manus 3tiæ 4tæque articulo 4to ovali instructæ digitis articulis 5to 6toque. Styli caudales saltatorii, 6tis 7mis setis non aculeis apice instructis.

2. *Antennæ 2dæ multo posteriores, fronte in rostrum producto.*

G. 6. PHOXUS, *Kröyer*.‡ — Epimeræ permagnæ. Pedes 1mi 2dique manu subcheliformi validâ instructi. Manus 3tiæ 4tæque articulis 3tio 4toque junctis instructæ, digitis 5to 6toque. Pedes 6ti multo longiores. Caput longum, triangulare, antice productum et acuminatum. Antennæ anteriores perbreves (capite breviores), elongate appendiculatæ; posteriores paulo longiores. Mandibulæ palpo longissimo. Segmentum caudale laminis constans duâbus.

SUBFAM. 6. ISÆINÆ. § — Pedes quatuor vel sex postici subprehen-
siles.

G. 1. ISÆA, *Edw.* — *Gammara* similis. Pedes 10 postici similes, articulo 5to apice dilatato et truncato, ungue in articuli 5ti extremitatem latiusculam claudente. Pedes 2di manu magnâ confecti. Antennæ superiores appendiculatæ.

G. 2. ANISOPUS, *Templeton*. — Pedes 4 postici ac in *Isæa*, validiores, articulo 5to apice inferiore dentato, ungue magno. Pedes 1mi tenues et breves; 2di manu angustâ; 3tiii manu grandiore; 4ti 5ti 1mis similes.

* Tids., iv. 154.

† Tids. [2], i. 335, 1845.

‡ Tids., iv. 150.

§ An genus *Laphystius* (*Kröyer*, Tids., iv. 156, 1842) *Isæinis* vel *Corophidis* affine. Species in Sturiones Squalosve parasitica! Descriptio sequens:—

“Corpus latum depressum, epimeris mediocribus, 4tis infra acutè productis. Caput transversum, rostratum. Antennæ sat breves, subulatæ, validæ; 1mæ validissimæ, anteriores, 2dæ posteriores. Mandibulæ palpo instructæ. Pedes 1mi gracillimi, manu lineari; 2di breves, manu validâ, ungue sublaminari. Reliqui decem pedes validi, subcheliformes, longitudine subæqui. Styli caudales debiles. Palpus maxillarum 1marum uniarticulatus.”

SUBFAMILY LYSIANASSINÆ.

Besides the size of the base of the superior antennæ, the Lysianassinæ appear to be peculiar in having the mandible very sparingly dentate at extremity, and pointed, instead of having a long and thin denticulate edge with a supplementary edge below. They are related to some of the genera of Pontoporeinæ. The epimerals in all the species are very large, and the body is much compressed. The eyes are usually reniform, and the superior antennæ are rather short and rarely without an appendicular branch. The species also differ from the Orchestiæ in not having a narrow horizontal piece in the shell in continuation of the epistome, directly over the mandible on either side of the head. Moreover, the epistome and upper lip are of different shape (see figures of Anonyx, on Plate 62).

LYSIANASSA? BRASILIENSIS.

Corpus valde compressum, epimeris pergrandibus. Oculi reniformes. Antennæ 1mæ breves, quartâ parte corporis breviores, flagello duplo longiore, quam basis fermè 10-articulato, appendice 7-articulatâ. Antennæ inferiores, dimidio corporis valde longiores, scepe reflexæ et sub epimeris celatæ, basi brevi, articulo basis penultimo crasso. Pedes 4 antici tenues; tertii quartis longiores; quinti sexti septimique consimiles, sensim increscentes, articulis primis margine postico serrulatis.

Body much compressed, epimerals very large. Eyes reniform. Superior antennæ short, less than a fourth of the body in length, flagellum twice as long as base, about ten-jointed, appendage seven-jointed. Inferior antennæ about two-thirds as long as body, often bent backward and concealed beneath the epimerals, the base short, and having penult joint of base very stout, four anterior feet similar, slender; third longer than fourth; fifth to seventh gradually increasing in length, posterior margin of first joint serrulate.

Plate 62, fig. 1 *a*, animal, enlarged; *b*, superior antenna; *c*, inferior antenna; *d*, leg of third pair; *e*, fifth pair; *f*, sixth pair.

Rio Janeiro, about the sand-beach near the Sugar Loaf.

Length about one-fourth of an inch. Colour a tinge of green. The head is scarcely longer than the first thoracic segment. The inferior antennæ have the flagellum more than three times the length of the base. The anterior feet are minutely hairy on the lower side, and the others somewhat less so. Caudal stylets of first pair are longest; second pair next longest; of third pair shortest, and not extending as far back as preceding. The branchial appendages of the third and fifth pairs are represented in figures *d* and *e*. No branchiæ were observed on the first, second, or seventh pairs; but there may be some doubt as to the absence from the second.

This species is peculiar in its concealing the flagella of the inferior antennæ beneath the epimerals; and as this character has not been mentioned of other species, it may be distinct in genus. No specimens are in our collections, and the author can cite for description only the notes and figures made by him when the specimens were collected. It is possible that the four anterior legs have very imperfect hands, and the species, on this account, may be nearer *Anonyx* than *Lysianassa*.

L. brasiliensis, DANA, Proc. Amer. Acad. Sci. Boston, ii. 208.

LYSIANASSA NASUTA.

Corpus valde compressum, epimeris pergrandibus. Oculi reniformes. Antennæ 1mæ breves, 2dis longiores, flagello ferme 7-articulato, appendice 3-4-articulatâ. Pedes antici, ungue triplo brevioribus quam articulus 5tus, articulo 5to oblongo, apice angustiore, setis dimidio articuli non longioribus. Pedes 2di articulo 5to spatulato apice rotundato, ungue terminali fere obsoleto, articulo 4to fere duplo longiore quam 5tus. Pedes 4 proximi infra setosi, setis longiusculis: 6 postici sensim incrementales, articulo 5to parvis 7mi gracili, setis semilati-tudine hujus articuli non longioribus.

Body much compressed, epimerals very large. Eyes reniform. Superior antennæ short, longer than the inferior, flagellum about seven-jointed, appendage three or four-jointed. Anterior feet with a small

claw, not longer than one-third of the fifth joint; this joint oblong, narrower at apex, setæ not more than half as long as the joint. Feet of second pair ending in a spatulate joint, which is rounded at apex and has an obsolescent claw at middle of apical margin. Third and fourth pairs of feet setose below, the setæ rather long; six posterior pairs gradually increase in length, the fifth joint of seventh pair slender, with the setæ hardly half the diameter of the joint in length.

Plate 62, fig. 2 *a*, animal, much enlarged; *b*, head (in which *t* is a keel on the front; *m*³, maxilliped; *p*, extremity of the anterior legs); *c*, posterior stylets and extremity of abdomen, in profile; *d, e*, mandible, in different positions; *f*, maxilla of first pair; *g*, *ibid.* of second pair; *h*, part of leg of first pair; *i*, *ibid.* of second pair; *k*, *ibid.* of third pair; *l*, *ibid.* of fifth; *m*, *ibid.* of seventh pair.

Rio Janeiro, Brazil.

Length of body, five lines. The fifth epimeral is about half as long as the fourth. The second joint of the superior antennæ is fully as long as broad, and stouter and longer than third; the appendage has the three joints oblong, and not very short as in the *brasiliensis*; it is nearly two-thirds as long as the flagellum. The flagellum of the antennæ consists of six or seven similar joints, which are nearly twice as long as broad. The epistome has a keeled projection which is very prominent, projecting obliquely upward with the extremity horizontally truncate (see fig. 2 *b*). The mandible has a subconical extremity, of a dark colour, which consists of a single tooth and one smaller on the side; behind this narrow part there is another small rounded process, which is also dark-coloured. Below the extremity there is a narrow line or crest of setæ; just below them is a small prominence, answering to the molar process, although imperfectly, of this character. The palpus is three-jointed, with very few setæ, and these apical; the inner surface of the last joint is minutely short hairy, as seen under a high magnifying power. The palpus of the inner maxillæ is dentate at summit, and but faintly two-jointed. The fifth joint of the first pair of legs is slightly longer than the fourth; the fifth joint of the second pair has stoutish setæ below, which increase in length to the subapical; on the upper side there is a

spot of very short setæ near middle. The posterior caudal stylets are two-branched, the branches equal, pointed, and naked.

GENUS URISTES (*Dana*).

Corpus compressum, epimeris latis. Antennæ mediocres; superiores basi crassæ, non appendiculatæ. Pedes antici subcheliformes; secundi vergiformes, articulo styliformi confecti; tertii quartique brevissimi; reliqui inter sese similes et longitudine mediocres.

Body compressed, epimerals broad. Antennæ of moderate length; the superior with a stout base, not appendiculate. Anterior feet subcheliform; second vergiform, ending in a long styliform joint; third and fourth very short; remaining similar, and of moderate length.

This genus is instituted for a species from the Antarctic seas. It is peculiar in the very short third and fourth pairs of feet, which are nearly concealed by the epimerals, while the others are of good size, and in the absence of an appendage to the superior antennæ. The anterior feet are rather slender, with the hand small; and the last joint of the second pair is long and slender. The antennæ are subequal, and the flagella of both pairs in the species examined are furnished with peculiar lateral processes.

The mandibles have a three-jointed palpus, a molar prominence, and a pointed dentate apex. The inner maxillæ have a broad, spinous apex, a slender appendage within, and a two-jointed appendage on the back, which has extremely short setæ at apex, and a few much longer on the first joint. The second maxillæ have the usual form.

The epimerals are very broad, and the anterior conceal the mouth organs in a lateral view. The abdomen terminates in an oblong seventh joint. The posterior stylets are rather long, and extend backward beyond the tips of the preceding pair, and about as far as the first pair.

URISTES GIGAS.

Antennæ subæquæ, crassiusculæ, 1mæ dimidio corporis breviores; flagello processibus obtusis infra breviter fimbriato, articulis brevissimis; 2dæ

parce longiores, flagello fere triplo longiore quam basis, articulis transversis, processibus minutis triangulatis supra ornato. Oculi reniformes. Pedes 1mi 2dis breviores, manu oblongâ, apice obliquè truncatâ, marginibus fere parallelis, digito parvulo; 2di 5-articulati, articulo ultimo elongate styliformi, acuto; 7mi 6tis paulo breviores. Segmentum abdominis antepenultimum posticè acutum.

Antennæ subequal, rather stout, not half as long as the body; the superior pair having the flagellum very short jointed and fringed below with short, obtuse processes; the inferior somewhat the longer, and flagellum having minute triangular processes along the upper margin. Eyes reniform. Anterior feet shorter than second pair, hand oblong, apex oblique, margins nearly parallel, finger short; second pair five-jointed, the last joint long styliform. The seventh pair shorter than sixth. Antepenult segment of abdomen acute behind.

Plate 62, fig. 3 *a*, animal, enlarged; *b*, mandible; *c*, *d*, maxillæ; *e*, maxillipeds; *f*, *g*, portions of superior and inferior antennæ.

Taken from the stomach of a fish, in the Antarctic seas.

Length, nine lines. The processes fringing the superior antennæ are obtuse and fleshy; otherwise the joints, which are very short transverse, are nearly naked. The processes on the margin of the inferior pair are attached only to alternate joints; they are acute at apex. The last joint of the second pair of feet is slender and pointed, exceeding the preceding joint in length. The first and second pairs are pubescent below. The third and fourth pairs are nearly concealed by the epimerals. The basal joint of fifth to seventh pairs is very large and serrulate behind. The claw is short, not half as long as the preceding joint. The maxillipeds terminate in a very stout spine or claw, and the joints are hairy along the inner margin, as well as at apex. The palpus of the mandible has a few setæ towards apex, which gradually increase in length to the apical, which is longest, though none are one-fifth as long as the palpus.

The four anterior epimerals on each side are very broad and sub-rectangular, with rounded angles; the fifth is two-thirds as broad as the fourth, and the following are a little smaller.

GENUS ANONYX, Kröyer.

ANONYX FUEGIENSIS.

Oculi reniformes. Antennæ 1mæ 2dis plus duplo breviores, articulis basis 2do 3tioque brevissimis, flagello longiore quam basis, 7-8-articulato. Antennæ 2dæ fermè dimidii corporis longitudine, basi brevi, articulis flagelli vix oblongis, setis brevibus. Pedes 4 antici parvuli, consimiles, antici parce minores, manu parvulâ, oblongâ, apice obliquâ, digito minuto. Pedes tertii quartique subæqui, setis articuli 5ti latitudine articuli multo brevioribus; 6ti 7mique æqui, articulo primo lato et posticè serrulato, setis perbrevibus. Abdominis segmentum ultimum oblongum, emarginatum.

Eyes reniform. Superior antennæ hardly half as long as inferior pair, second and third joints of base very short, flagellum longer than base, seven or eight-jointed. Inferior antennæ about half as long as body, base short, joints of flagellum hardly oblong (excepting near apex). Four anterior feet quite small, similar, the first pair a little the smaller, hand very small, oblong, oblique at apex, finger minute. Third and fourth pairs equal, the setæ very short, those of the fifth joint much shorter than breadth of joint. Sixth and seventh pairs nearly equal, first joint broad and serrulate behind, setæ very short. Last segment of abdomen oblong, emarginate.

Plate 62, fig. 4 *a*, animal, enlarged; *b*, mandible; *c*, *d*, maxillæ; *e*, maxillipeds; *e*¹, same, side view; *f*, front view of head, (showing the position of the mandibular palpi, *p*, *p*, against the face of the epistome *e*, either side of the middle, also the upper lip (*l*, labrum) below *e*, both the epistome and lower lip carinate; *md*, the mandibles; *m*³, the maxillipeds, with *t*, the lamellar processes of the basal joints between; *a*¹, *a*², the bases of the antennæ); *g*, side view of head, (showing *a*¹, superior antennæ; *a*², inferior antennæ, with *s*, a spinous process at the base of the antennæ, as seen also in fig. *f* and *i*; *e*, carinate part of the epistome; *l*¹, *l*², *l*³, *l*⁴, *l*⁵, *l*⁶, *l*⁷, *l*⁸, *l*⁹, *l*¹⁰, *l*¹¹, *l*¹², *l*¹³, *l*¹⁴, *l*¹⁵, *l*¹⁶, *l*¹⁷, *l*¹⁸, *l*¹⁹, *l*²⁰, *l*²¹, *l*²², *l*²³, *l*²⁴, *l*²⁵, *l*²⁶, *l*²⁷, *l*²⁸, *l*²⁹, *l*³⁰, *l*³¹, *l*³², *l*³³, *l*³⁴, *l*³⁵, *l*³⁶, *l*³⁷, *l*³⁸, *l*³⁹, *l*⁴⁰, *l*⁴¹, *l*⁴², *l*⁴³, *l*⁴⁴, *l*⁴⁵, *l*⁴⁶, *l*⁴⁷, *l*⁴⁸, *l*⁴⁹, *l*⁵⁰, *l*⁵¹, *l*⁵², *l*⁵³, *l*⁵⁴, *l*⁵⁵, *l*⁵⁶, *l*⁵⁷, *l*⁵⁸, *l*⁵⁹, *l*⁶⁰, *l*⁶¹, *l*⁶², *l*⁶³, *l*⁶⁴, *l*⁶⁵, *l*⁶⁶, *l*⁶⁷, *l*⁶⁸, *l*⁶⁹, *l*⁷⁰, *l*⁷¹, *l*⁷², *l*⁷³, *l*⁷⁴, *l*⁷⁵, *l*⁷⁶, *l*⁷⁷, *l*⁷⁸, *l*⁷⁹, *l*⁸⁰, *l*⁸¹, *l*⁸², *l*⁸³, *l*⁸⁴, *l*⁸⁵, *l*⁸⁶, *l*⁸⁷, *l*⁸⁸, *l*⁸⁹, *l*⁹⁰, *l*⁹¹, *l*⁹², *l*⁹³, *l*⁹⁴, *l*⁹⁵, *l*⁹⁶, *l*⁹⁷, *l*⁹⁸, *l*⁹⁹, *l*¹⁰⁰, *l*¹⁰¹, *l*¹⁰², *l*¹⁰³, *l*¹⁰⁴, *l*¹⁰⁵, *l*¹⁰⁶, *l*¹⁰⁷, *l*¹⁰⁸, *l*¹⁰⁹, *l*¹¹⁰, *l*¹¹¹, *l*¹¹², *l*¹¹³, *l*¹¹⁴, *l*¹¹⁵, *l*¹¹⁶, *l*¹¹⁷, *l*¹¹⁸, *l*¹¹⁹, *l*¹²⁰, *l*¹²¹, *l*¹²², *l*¹²³, *l*¹²⁴, *l*¹²⁵, *l*¹²⁶, *l*¹²⁷, *l*¹²⁸, *l*¹²⁹, *l*¹³⁰, *l*¹³¹, *l*¹³², *l*¹³³, *l*¹³⁴, *l*¹³⁵, *l*¹³⁶, *l*¹³⁷, *l*¹³⁸, *l*¹³⁹, *l*¹⁴⁰, *l*¹⁴¹, *l*¹⁴², *l*¹⁴³, *l*¹⁴⁴, *l*¹⁴⁵, *l*¹⁴⁶, *l*¹⁴⁷, *l*¹⁴⁸, *l*¹⁴⁹, *l*¹⁵⁰, *l*¹⁵¹, *l*¹⁵², *l*¹⁵³, *l*¹⁵⁴, *l*¹⁵⁵, *l*¹⁵⁶, *l*¹⁵⁷, *l*¹⁵⁸, *l*¹⁵⁹, *l*¹⁶⁰, *l*¹⁶¹, *l*¹⁶², *l*¹⁶³, *l*¹⁶⁴, *l*¹⁶⁵, *l*¹⁶⁶, *l*¹⁶⁷, *l*¹⁶⁸, *l*¹⁶⁹, *l*¹⁷⁰, *l*¹⁷¹, *l*¹⁷², *l*¹⁷³, *l*¹⁷⁴, *l*¹⁷⁵, *l*¹⁷⁶, 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maxilla of first pair; m^2 , *ibid.* of second pair; m^3 , maxillipeds; n , o , parts below base of maxillipeds; t , lamellar processes of maxillipeds); h , same view, with the maxillipeds bent downward, out of place; i , process at base of inferior antennæ; k , part of flagellum of same; l , superior antennæ; l' , longer flagellum of same, from another specimen; m , part of leg of first pair; n , *ibid.* of fourth pair; o , *ibid.* of fifth pair; p , caudal segment.

Good Success Bay, Tierra del Fuego; collected in eight or ten feet water, being brought up on meat set as bait by Lieutenant Underwood.

Length, one-third to half an inch. Body very much compressed. Thoracic segments subequal. Third abdominal segment with the posterior apex rounded and prominent in a profile view; the last abdominal oblong and emarginate, and either side of the emargination it is acute, or bears a very minute spine.

The specimens had been put in alcohol before seen by the author and the natural colour could not be ascertained. Nearly all had a transverse band of bright red along the posterior margin of the thoracic and abdominal segments. The other characters of the specimens will be gathered from the figures, and the descriptions of them above.

Stenia magellanica, DANA, Proc. Amer. Acad. Sci., ii., 209. The genus *Stenia* is not sustained, on further examination of specimens. Moreover, as Edwards has named a *Lysianassa*, *L. magellanica*, (Ann. Sci. Nat. [3], ix, 398, 1848), we change the specific name to the more appropriate one of *fuegiensis*.

GENUS UROTHOE, Dana.

Epimeræ permagnæ, *5tis parvulis*. *Pedes 4 antici subchelati*. *Antennæ 1mæ breviores, appendiculatæ; 2dæ longæ*. *Maxillipedes longi et angusti, lamellis internis perparvis*. *Styli caudales postici biramei, prælongi, ramis foliaceis, ciliatis*.

Epimerals very large, fifth quite small. Feet of two anterior pairs subchelate. Superior antennæ shorter than inferior, appendiculate; inferior pair long. Maxillipeds narrow and long, with the inner lamellæ quite small. Caudal stylets of last pair two-branched, very long, branches foliaceous, ciliate.

The very small inner lamellar processes of the maxillipeds remove this genus widely from the other Lysianassinæ and ally them to the Leucothoinæ; yet the mandibles are of the Lysianassa type. The superior antennæ have the base considerably elongated, yet the first joint is rather stout. The large and long foliaceous posterior stylets distinguish the species readily from related genera. The feet of the second and third pairs, although not properly prehensile, are furnished with very stout finger-like spines on the penult and ante-penult joints; and the species have thus some relation to the *Pontoporeinæ*.

The caudal stylets of the first and second pairs have the branches straight subulate and naked. The caudal segment of the abdomen is elongate, and bisected longitudinally very nearly to its base. The six posterior legs are broad lamellar, especially the first, third, and fourth joints. The first and second pairs are similar to one another, and the hands are well made for prehension, although rather small.

UROTHOE ROSTRATUS.

Frons portentosè productus et lamellatus, apicem articuli antennarum 1marum 1mi attingens. Oculi rotundati. Articulus antennarum 1marum 1mus crassior, oblongus, 2dus paulo brevior, gracilior, flagello 12-articulato, appendice 8-articulato. Antennæ 2dæ dimidio corporis longiores, articulo basi penultimo setis crassis reversis armatis, flagello gracillimo, articulis longis. Pedes 1mi 2dique subæqui, manu paulo oblongâ, apice obliquè truncatâ. Pedes 3tii 4tique vix prehensiles, articulis penultimo et antepenultimo setis crassis fere digitiformibus armato. Pedes 7mi 6tis multo breviores. Styli caudales 2di breviores.

Front lamellately produced, even to apex of first joint of base of superior antennæ. Eyes round. First joint of superior antennæ rather stout, oblong, second joint more slender and a little shorter. Inferior pair longer than half the body, penult joint of base towards apex furnished with stout reversed setæ, flagellum very slender, joints long. Feet of first and second pairs subequal, hand a little oblong, obliquely truncate at apex. Feet of third and fourth pairs hardly prehensile, the penult and antepenult joint furnished with stout setæ a little like fingers. Feet of seventh pair quite short; much shorter than those of the sixth.

Plate 62, fig. 5 *a*, animal, enlarged; *b*, upper view of head; *c*, part of base of inferior antennæ; *d*, part of flagellum of same; *e, e'*, mandible in different positions; *f*, maxilla of first pair; *g*, maxillipeds; *g'*, same, more enlarged; *h*, leg of second pair; *i*, ibid. of third or fourth pair; *k*, ibid. of fifth pair; *l*, ibid. of sixth; *m*, ibid. of seventh pair; *n*, abdominal natatory; *o*, extremity of abdomen, upper view; *p*, stylets of second pair.

Sooloo Sea, Feb. 3, 1842.

Length three lines. The projecting front is rounded anteriorly, and the bases of the superior antennæ may be seen through it. The smaller branch of the superior antennæ is one-fourth shorter than the other. The flagellum of the second pair has the joint many times longer than broad and very slender; and near the apex of each there is a short process, a little vermiform in shape, which has an appearance of being three-jointed. The mandible is pointed at summit, and has two or three teeth. The palpus is three-jointed, the first joint very short, the second longer than the third, the third or last bears from an oblique space at apex a cluster of setæ nearly as long as the joint. The antepenult joint of the legs of the third and fourth pairs is quite short, being more than half shorter than the preceding. The bases of the last six legs are serrulate behind; and the joints below are serrate by the bases of the setæ, which setæ are stout and spiniform, but intermingled with long plumose hairs, on the fifth pair of legs especially. The claw of the fifth pair is a little nodulose along one side.

UROTHOE IRROSTRATUS.

U. rostrato similis. Frons non rostratus. Flagellum antennarum Imarum 6-7-articulatum basi brevius; appendix perbrevis, 2-3-articulata. Tarsi pedum 4ti et 5ti margine interno noduloso, fere arcuato.

Near the *rostratus*. Front not rostrate. Flagellum of the superior antennæ six or seven jointed, shorter than the base; appendage very short, two or three-jointed. Tarsi of feet of fourth and fifth pairs nodulose along inner side, this side somewhat arcuate.

Plate 62, fig. 6 *a*, anterior part of body, enlarged; *b*, part of the flagellum of inferior antennæ; *c*, extremity of leg of fourth pair; *d*, leg of fifth pair; *e*, extremity of same; *f*, extremity of body.

Sooloo Sea, with the preceding.

Length three lines. The occurrence of the individuals of this species with the preceding leads us to suspect that the two may be male and female. Yet the great difference in the front is not like any sexual difference hitherto noticed; moreover, the superior antennæ differ much.

SUBFAMILY LEUCOTHAINÆ.

GENUS STENOTHOE, Dana.

Epimeræ permagnæ, 4tæ maximæ, 5tis parvulis. Mandibulæ non palpi-geræ nec processu molari instructæ, apicali acie denticulatâ et alterâ accessoriâ. Maxillipedes angusti, oblongi, lamellis internis obsolescentibus. Pedes 4 antici manibus confecti, 2dis pervalidis. [Antennæ superiores paulo longiores.] Pedes 10 postici longitudine mediocres. Styli caudales 1mi 2dique biramei, ramis bene subulatis, 3tii simplicissimi, subulati.

Epimerals very large, the fourth largest, fifth small. Mandibles without palpi, or molar prominence, having a denticulate edge at summit, and another inside just below summit. Maxillipeds narrow, oblong, the inner lamellar processes obsolescent. Feet of four anterior pairs ending in hands, those of second pair very stout. [Superior antennæ a little the longer.] Feet of ten posterior pairs of moderate size. Caudal stylets of first and second pairs with two subulate branches; of third pair simple and subulate.

The slender maxillipeds without the inner lamellar processes and the non-palpigerous mandibles, are alone sufficient to mark this genus as distinct from others to which it is related. The third and fourth epimerals are peculiarly large, and the following three quite small. The terminal edge of the mandible is denticulated; just below it on the inner surface there is a second prominent, thin edge, or process, as

in the Gammarinæ, much more finely denticulated; and below this, to one side, there are a few spines, and an oblong cluster or line of setæ. The usual prominence exists on the outer side; but the palpus is wanting. The inner maxillæ have a two-jointed palpus. The first and second caudal stylets have the branches slender acuminate, and end in an acute point without a distinct spine for the termination. The third pair has but a single branch, and this is without hairs, rather short, subconical, a little reflexed at apex, and ending in two very short spines, only seen under a high magnifier.

This genus is near *Leucothoe* in its outer maxillipeds, the very short third joint of the superior antennæ, and many other characters; and the absence of mandibular palpi seems not in this case, to be a characteristic of so high importance, but that the genera may be placed in the same subfamily.

STENOTHOE VALIDUS.

Maris:—*Epimeræ permagnæ, 5tæ perparvulæ. Oculi parvi, rotundati. Antennæ quatuor subæquæ, basi 2darum quam flagellum longiore, et fere duplo longiore quam 1marum basis, articulis flagelli oblongis, fere nudis. Pedes 1mi manu confecti parvâ oblongâ, marginibus paulo arcuatâ, digito longo, palmâ non excavatâ, longitudinali. Pedes 2di manu portentosæ magnitudinis, oblongâ, marginibus fere parallelis, apice inferiore unidentato dente obtuso, digito longo et crasso. Pedes 5ti 6ti 7miquæ subæqui, 5tis minoribus, articulo 1mo lato, 3tio sat lato, reliquis sat angustis, setis brevissimis, latitudine articuli 5ti plus quadruplo brevioribus.*

Feminæ:—*Basis antennarum 2darum flagellum longitudine fere æquans. Pedes 2di manu validâ confecti, oblongâ, supra arcuatâ, infra (palmâ) rectiusculâ, versus apicem dente parvo instructâ.*

Male:—Epimerals very large, fifth quite small. Eye small and round. The four antennæ subequal, base of inferior pair longer than flagellum and nearly twice as long as base of superior pair, joints of flagellum oblong, nearly naked. Feet of first pair furnished with a hand, which is oblong, arcuate above, and rather more so below, the palm nearly longitudinal and not excavate; the hand of second pair of very unusual magnitude, oblong, mar-

gins nearly parallel, an obtuse tooth at lower apex, finger long and stout. Feet of fifth, sixth, and seventh pairs subequal, the fifth smallest, first joint broad, third rather broad, the rest rather narrow, setæ exceedingly short, not one-fourth as long as breadth of joint.

Female.—Base of second antennæ as long as the flagellum. Feet of second pair having a stout hand, which is oblong, arcuate below, with the palm nearly straight, and armed with a small tooth towards apex.

Plate 63, figs. 1 *a* to *e*, *male*; *f* to *o*, *female*.—*a*, *male*, enlarged; *b*, part of flagellum of superior antennæ; *c*, maxillipeds; *d*, leg of first pair; *e*, *ibid.* of sixth pair.—*f*, *female*, enlarged; *g*, mandible; *h*, maxilla of first pair; *i*, part of maxilla of second pair; *k*, maxillipeds; *l*, hand of first pair of legs; *m*, *ibid.* of second pair; *n*, leg of seventh pair; *o*, caudal stylets and extremity of abdomen.

Rio Janeiro.

Length, three to four lines.

Male.—The penult joint of the base of the inferior antennæ is rather longer than the last, and is more than half the length of the flagellum. The carpus (or fourth joint) of the first pair of legs is triangular, with the lower apex obtuse; the third joint is much longer than the fourth, but similarly triangular, the lower apex being quite prominent; the finger is full two-thirds as long as the hand, and applies itself against the outer two-thirds (or three-fourths) of the lower margin, which is a little oblique. The hand of the second pair is truncate somewhat obliquely at apex, and is but little narrower in this part than behind, owing to the prominent tooth forming the lower apex of the extremity. The under side of the hand is in part pubescent. The finger is curved, and has two slight projections towards base on inner side. The third joint of the six posterior legs has the posterior apex triangulately prolonged, nearly as far as to apex of the fourth joint. The fifth joint in the sixth pair has seven or eight very minute setules, or sets of setules, on the inner margin.

Female.—The carpus of the hand of the first pair is rather longer than the third joint; the third joint has the lower apex very

much prolonged beneath the fourth joint. The carpus of the second pair has a narrow prolongation below, between the hand and the third joint; the third joint is not longer than the carpus; the hand is a little pubescent below. The caudal stylets, as in the other sex, have the branches subulate, and the extremity appears almost to be the continuation of the stylet instead of a separate spine; the first pair extends farther back than the second, and the second farther than the third; the branches of the first pair have two or three spinules on the upper side. The inner maxillæ have nearly the usual form (fig. 1 *h*). The inner lamellæ of the maxillipeds are not half as long as the first free joint of the maxilliped; the five joints of these organs have a few very short setæ on the inner side; and on the penult joint on the inner side near tip there is a thick pubescence.

SUBFAMILY GAMMARINÆ.

The mandibles in the Gammarinæ, unlike those of the Lysianassinæ, have a multidentate summit, and also, a broad inner lobe or process, arising from just below the apex, which is similarly dentate above. Below this lobe there is an oblong line or crest covered with curving setæ, and in some instances this surface is furnished with a series of subparallel, dentate lamellæ, approximately parallel to the lobe above. Below this, there is a broad molar tooth, with a scabrous or striated surface.

The carpus of the second pair of legs in the true Gammarinæ, as far as examined, is not so narrow and small as to be intercepted below by the fourth joint (that preceding), as happens in all the Orchestidæ, excepting a few Allorchestes; and this character as well as the oblong posterior stylets and the mandibular palpi, will generally distinguish those species having the superior antennæ the shorter from the Allorchestes.

GENUS IPHIMEDIA (*Rathke*), *D.*

Epimeræ magnæ, Atæ maximæ, 5tis valde brevioribus. Maxillipedes lati, lamellis internis grandibus. Styli caudales postici biramei, ramis oblongis consimilibus, apice setigeris et non uncinatis. Antennæ 1mæ sæpius breviores.

Epimerals large, the fourth largest, fifth small. Maxillipeds broad, the inner lamellæ large. Posterior caudal stylets two-branched, branches oblong, similar, setigerous and not uncinatè at apex. Superior antennæ usually the shorter.

The species of Iphimediæ are mostly found in the colder seas, and among them, there is a tendency towards spinose or nodose forms. They have generally the inferior antennæ the longer, though not so in all cases; moreover, these organs seem commonly to be nearly naked. The epimerals are usually large, but unlike Amphithoe, the fourth is the largest, and the fifth is abruptly very much shorter, hardly exceeding the sixth in length, and anteriorly it occupies usually a concavity in the posterior margin of the fourth epimeral. These species are hence widely diverse from those of the following group, and approximate to the *Lysianassinæ*.

The outer maxillipeds have commonly broad joints, with a terminal claw. The tarsi of the legs have often an inferior seta.

IPHIMEDIA SIMPLEX.

Corpus compressum, nudum. Oculi orbiculares. Antennæ fere nudæ; 2dæ dimidii corporis longitudine, basi brevi, minus dimidio flagelli, articulis flagelli transversis; 1mæ paulo breviores, basi vix breviorè quam basis 2darum, articulis paucis inter se remotis processu infra productis. Pedes toti breves. Manus prima sat parva, angusto-ovata, apice subacuta. Manus secunda (an feminæ?) valde minor, sed formâ similis. Pedes 3tii 4tique 2dis longiores, subæqui; 4 postici subæqui, articulo primo latissimo, margine postico obsoletè serrulato.

Body compressed, naked. Eyes round. Antennæ nearly naked; inferior pair half as long as body, base short, less than half the flagellum, joints of flagellum transverse; superior pair a little shorter than inferior, base scarcely shorter than base of superior, a few joints at remote intervals produced below. Feet all short. Hand of first pair moderately small, narrow ovate, apex subacute. Hand of second pair (female?) much smaller, but similar in form. Third and fourth pairs longer than second, subequal. Last two pairs subequal, first joint very broad, its posterior margin imperfectly serrulate.

Plate 63, fig. 2 *a*, animal, enlarged; *b*, superior antenna; *c*, part of flagellum of same towards extremity; *d*, *e*, mandible; *f*, inner maxilla; *g*, maxillipeds; *h*, part of leg of first pair; *i*, *ibid.* of third pair.

Collected at Hermite Island, by Lieutenant Case.

Length, four to five lines. Head longer than next segment, anterior margin of head in upper view, with a low angle at centre; four anterior epimerals on either side rounded. The first joint of base of superior antennæ is slightly the longest, and the third shortest; the flagellum is about two-thirds as long as the flagellum of the other pair. The joints of the flagellum are very short and prominent, those towards the base transverse, and those towards the extremity oblong. The hand of first pair is about twice as long as the carpus. The first joint of seventh pair has the posterior apex acute; the same in the preceding two pairs is obtuse.

The third pair of stylets extends backward, much beyond the second, and somewhat beyond the first pair; the two branches are similar and acuminate. The caudal segment is oblong and deeply cleft.

Amphithoe (Iphimedia) simplex, DANA, Proc. Amer. Acad. Sci., Boston, ii. 217.

IPHIMEDIA NODOSA.

Oculi rotundati. Corpus crassiusculum, testâ subcalcareâ, fronte minutè rostrato, abdomine subcarinato. Segmenta thoracis 4 antica marginibus integra, 5ta postice sinuosa et sequentia paulo dentata. Abdominis tria segmenta dorso dentata et latere sparsim acutè nodosa, sequentia nuda. Epimeræ tres anticæ integræ, obtusæ, quarta lata, posticè bi-dentata, tria sequentia brevia et posticè acuta. Articulus pedum sex posticorum primus subquadratus, et postice unidentatus, angulo postico acutus. Antennæ inferiores longiores, dimidio corporis breviores. Pedes nudi; 4 antici parvuli, manibus primis secundisque minutis; 4 sequentes paulo majores; 6 reliqui parce longiores, subæqui, articulo tertio triangulato, apice postico producto et acuto.

Eyes round. Body rather stout, shell subcalcareous, front with a

short, slender beak, abdomen subcarinate. Four anterior thoracic segments entire at posterior margin, fifth sinuous behind, and sixth and seventh sparingly dentate; first three abdominal segments dentate on the back, and sparingly acuto-nodose on the sides, the rest naked. Three anterior epimerals entire, obtuse, fourth bidentate behind, three following narrow and posteriorly acute. First joint of last six legs subquadrate, unidentate behind, and posterior angle acute. Inferior antennæ the longer, shorter than half the body. Legs naked; four anterior quite small, hands minute; next four larger; remaining six a little longer, subequal, third joint triangular, posterior apex being prolonged and acute.

Plate 63, fig. 3 *a*, animal, enlarged; *b*, upper view of head.

Hermite Island, Tierra del Fuego. Collected by Lieutenant Case.

Length, four lines. Thorax inflated. Abdomen subcarinate; the first three segments have a triangular tooth at middle on the back, and behind this two larger teeth (side by side), with truncate top. The head has a short linear obtuse beak. Base of superior antennæ much the shortest, the whole length of antenna about three-fourths the inferior pair. The four anterior feet are slender and much smaller than the following. The six posterior are rather short, terminal joint to which claw is articulated nearly cylindrical, claw short; third joint having the shape of a very obtuse-angled triangle, the obtuse angle at its apex, and the prolongation of the posterior apex in seventh pair, nearly as long as the joint; posterior angle of fourth joint also acute. The posterior stylets extend back nearly to same line with the first.

This species is allied to the *Acanthosoma hystrix* of Owen (Sir John Ross's Second Voyage in Search of a Northwest Passage, 4to., London, 1835, Appendix, p. xci. Pl. B, figs. 4, 5, 6, 7).

Amphithoe (Iphimedia) nodosa, DANA, Proc. Amer. Acad. Sci., ii. 217.

IPHIMEDIA FISSICAUDA.

Corpus compressum, epimeris magnis. Oculi reniformes. Segmentum

caudale fere usque ad basin fissum, et ad apices ambos emarginatum. Antennæ subcæquæ; 1mæ parce longiores, dimidii corporis longitudine, basi valde brevior quam flagellum, et parce brevior quam basis 2darum, setis infra longiusculis; 2darum basis flagello multo brevior. Pedes antici parvuli, manu apice obliquâ et non latiore. Manus secunda mediocris, oblonga, infra ciliata, apice parce obliquo, digito brevi. Pedes 6 postici subcæqui, non longi, setis brevibus. Styli caudales postici longi.

Body compressed; epimerals large. Eyes reniform. Caudal segment divided nearly to base, and each part emarginate at apex. Antennæ subequal; the superior sparingly the longer, half as long as body, base much shorter than flagellum and a little shorter than base of inferior pair, setæ of under side of antennæ rather long; base of inferior pair much shorter than the flagellum. Anterior feet small, hand oblique at apex and not broader. Hand of second pair moderately small, ciliate below, apex sparingly oblique, finger quite short. Six posterior feet subequal, rather short, setæ quite short. Posterior caudal stylets long.

Plate 63, fig. 4 *a*, animal, enlarged; *b*, *b'*, views of mandible; *c*, *d*, maxillæ; *e*, maxillipeds; *f*, caudal extremity; *g*, branchia.

Near Viña del Mar, nine miles north of Valparaiso; from pools of water among the rocks of the sea-shore at low tide, where it occurs concealed among the stones of the bottom.

The head is longer than the following segment. The fourth epimeral is broad, but the fifth and following are quite narrow. The last segment of the body has in the emargination of each apex a minute spine, besides two or three on the outer margin; the length of the segment is a little greater than the breadth, and the form nearly rectangular. The fourth abdominal segment has an indentation on the back, and the fifth is shorter than the sixth or seventh. The third pair of stylets extends rather farther back than the first pair, and considerably farther than the second pair. Branches of third pair oblong lanceolate; of first and second, linear.

The flagella of the antennæ are very slender terete, and the joints are but little oblong. The first two joints of the inferior pair are

together nearly as long as the third joint. The third and fourth pairs of feet are equal, and not shorter than seventh pair. The sixth and seventh equal; the fifth a little shorter. Maxillipeds hairy within and at apex. Mandibles with palpus, molar prominence and setæ, as usual; palpus three-jointed, second and third joints with long hairs on margin and apex. Branchiæ linear, not ciliated at apex.

Swims with great agility.

Amphithoe fissicauda, DANA, Proc. Amer. Acad. Sci., Boston, ii. 214.

IPHIMEDIA CAPENSIS.

Feminae?—*Oculi fere reniformes. Antennæ subæquæ, fere nudæ; 1mæ parce longiores, dimidii corporis longitudine, basi perbrevis, triplo brevior quam flagellum, articulis flagelli parce oblongis, alternis apice parce latoribus et setas stricte appressas articulo parce longiores infra gerentibus, setis aliis brevissimis; 2dæ basi brevi. Pedes 4 antici parvuli, manu oblongâ, marginibus fere parallelis, inferiore hirsuto, apice oblique truncatâ palmam efficiente, digito palmâ non longiore, palmâ fere nudâ, carpo oblongo, dimidii manus longitudine, infra obtuso et hirsuto. Pedes 4 postici subæqui, tenues, setis perbrevibus, articulo 5to angusto, setarum 7 paribus infra ornata, latitudine articuli breviorum, setis supernis breviores. Styli caudales spinulis numerosis ornati, ramis 1morum styliformibus, posticorum longiusculis, foliaceis, acuminatis, marginibus cum spinulis multis armatis.*

Female? — Eyes subreniform. Antennæ subequal, nearly naked; superior pair sparingly the longer, about half as long as body, base very short, about one-third as long as the flagellum, joints of flagellum sparingly oblong, the alternate a little broader at apex, and bearing two or three setæ longer than the joint, and close appressed to it, other setæ very short; base of second pair quite short. Feet of four anterior pairs quite small, hands oblong, margins nearly parallel, under margin hirsute, apex obliquely truncate, forming the palm, finger not longer than the palm, palm nearly naked, carpus oblong, half as long as the hand, obtuse below and hirsute. Feet of four posterior pairs subequal, slender, setæ all very short, fifth joint slender, setæ of lower margin in seven sets, and about

half as long as breadth of joint, those of the upper margin shorter. Stylets with numerous spinules, the branches of the first pair styli-form, those of the last pair rather long and narrow foliaceous, acuminate, margins edged with many spinules.

Plate 63, fig. 5 *a*, part of animal, enlarged; *b*, part of flagellum of superior antennæ; *c*, part of mandibular palpus; *d*, part of leg of first or second pair; *e*, *ibid.* of sixth pair; *f*, caudal extremity, showing caudal segment and posterior stylets; *g*, stylet of first pair.

Cape of Good Hope.

Length, four lines. The setæ of the six posterior legs are in numerous sets along the joints, although very short, and so also those of the stylets. The caudal segment is oblong, rounded and denticulate behind, and deeply cleft. Tarsus of leg of sixth pair about one-third as long as fifth joint. The hairs of the under side of the hand are as long as half the breadth of the hand.

This species is very near the *Gammarus Othonis*, Edwards (Ann. des Sci. Nat., xx. 373, pl. 10, f. 11, 12, 13, and Crust., iii. 50); but there is no appendage to the superior antennæ.

IPHIMEDIA PUGETTENSIS.

Oculi vix reniformes. Manus 2da mediocris, elongato-ovata, apice subacuta, infra supraque fere æque arcuata, infra hirsutiuscula, digito longo, carpo tertiâ parte manus vix longiore, infra sat angusto, obtuso, hirsuto. Articulus 3tius parvis 7mi postice angusto-triangulate productus, 5tus gracilis, setis paucis, brevibus. Styli caudales longi, 1mi et 2di ultra 3tios paulo producti, ramis parvis 1mi setis supra armatis.

Eyes hardly reniform. Hand of second pair of moderate size, elongato-ovate, subacute at apex, below and above nearly equally arcuate, below hirsute, finger long, carpus about one-third as long as the hand, below rather narrow, obtuse and hirsute. Third joint of leg of seventh pair narrow-triangulately produced behind, fifth slender, setæ few, short. Caudal stylets long, first and second pairs

reaching backward beyond the first, branches of first pair having five rather distinct setæ above.

Plate 63, fig. 6 *a*, anterior part of body; *b*, mandible; *c*, part of maxilliped; *d*, hand of second pair; *e*, third joint of seventh pair; *f*, extremity of same pair; *g*, caudal extremity.

Puget's Sound.

Length, three lines. The hands of the second pair of legs are about as long as the head; and the finger is about two-thirds the length of the hand. The mandibular palpus is set with longish hairs along the last two joints. The third joint of the posterior legs has three small tufts of very short hairs on the anterior margin (including the apical), and four on the posterior; the setæ are not as long as the breadth of the fifth joint. The posterior stylets are quite long; yet, the second pair extends beyond them, and the first pair beyond the second. The mandibles have a denticulated summit, and an inner denticulated summit lobe, with a prominent crest of setæ, and a large molar prominence, which is abruptly elevated on the lower side.

GENUS *ÆDICERUS*, Kröyer.

Iphimediæ pedibus quatuor anticis, stylis posticis, antennisque superioribus affinis. Pedes septimi valde elongati, tenues, fere filiformes. Epimeræ magnitudine mediocres, 5ta 4tis paulo brevioribus, lobis subæquis.

Allied to *Iphimedia* in the four anterior feet, posterior stylets, and the superior antennæ. Seventh pair of feet very long and slender, nearly filiform. Epimerals moderately broad, the fifth a little shorter than the fourth, bilobate, the posterior a little smaller than the anterior.

This genus was instituted by Kröyer with the following characteristic, in which some particulars not of generic importance are included:—

“Frons in rostrum producta plus minus acutum obtusumve, semper vero nodo pellucente, ovali, flavo rubescente turgidum. Oculi

nulli? Pedunculi antennarum longi, superiorum flagelli longitudinem æquantés vel superantes; antennæ superiores flagello appendiculari destitutæ. Pedes primi et secundi paris manu armati subcheliformi permagna. Pedes tertii quartique paris validi, ungue instructi lato, laminari; quod quoque usu venit quinto sextoque pari, quorum coxa vel articulus primus dilatatus non est. Pedes septimi paris longissimi, tenues, fere filiformes (coxa vel primo articulo excepto). Epimera mediocris magnitudinis, multis longisque armata setis marginis inferioris simplicibus; margo posterior quarti paris integra (non sinuato-excisa)." *Tids.*, iv. 156, 1842, 1843.

The mandible in our species has a three-jointed palpus, a dentate apex, the usual setæ below, and a molar prominence. The maxillæ are like those of *Gammarus* and *Amphithoe*. The maxillipeds have a spine or claw at apex. The superior antennæ are the shortest. No claw exists at the extremity of the seventh pair of legs.

ÆDICERUS NOVI-ZEALANDIÆ.

Antennæ 1mæ dimidio corporis breviores, teretes, flagello 14-articulato; 2dæ fere duplo longiores, basi duplo longiore quam basis 1marum, flagello fermè 21-articulato, fere duplo longiore quam basis, setis per brevibus. Pedes septimi corporis longitudine, extremitate styliiformes. Pedes 4 antici inæqui, manibus similes; manu primâ brevior; secundâ mediocri, fere nudâ, subovatâ, obliquo-truncatâ, palmâ valde obliquâ, fere rectâ. Pedes reliqui articulo primo sat angusti.

Superior antennæ not half as long as the body, terete; inferior pair nearly twice the longer, base twice as long as base of superior, flagellum about twenty-one-jointed, twice as long as base, setæ very short. Seventh pair of feet as long as body, styliiform at extremity; four anterior feet unequal, hands similar; hand of first pair smallest; of second pair of moderate size, broad subovate, nearly naked, obliquely truncate, palm oblique, very slightly excavate or nearly straight. Remaining pairs having the first joint rather narrow.

Plate 63, fig. 7 *a*, male, enlarged; *b*, mandible; *c*, *d*, maxillæ; *e*, extremity of maxilliped; *f*, lip; *g*, hand of first pair; *h*, caudal extremity.

Bay of Islands, New Zealand; in small pools on the rocky shores near Cororatika. Collected in March, 1840.

Length, two lines. Colour, greenish. Males and females were found in contact. Eye nearly round. Flagellum of the superior antennæ with oblong slender joints, and each has two or three short setæ at apex, about as long as width of joint, and appressed to the joint. The third and fourth joints of base of inferior pair are subequal. The joints of the flagellum are not as long as in the other pair; the setæ are about as long as width of joints. In the females, the antennæ are a little shorter than in the figure (which represents a male), and the setæ are not as long.

The hand of the second pair has one or two minute setæ at apex, and a few others similar on the palm. The finger when shut leaves a small space between it and the hand. These hands have their back toward the observer in a side view of the animal (fig. 7 *a*), and only when detached is it possible to have the direct side view in figure *g*.

The caudal stylets are slender, and naked, except under a high magnifying power, when a few very minute setæ are distinguished. The posterior pair is somewhat elongate, and all the stylets extend back about the same distance. The third pair is about half as long as the first, and the two branches are subulate. The body is naked.

GENUS AMPHITHOE (*Leach*), *Dana*.

Epimeræ magnæ, 5tæ Atis non breviores, bilobatæ, lobo posteriore minimo vel fere obsoleto. Styli caudales postici biramei, ramis perbrevibus, uno (externo) sæpe subconico, apice bi-unguiculato, unguibus recurvatis, altero lamellato, apice sæpius paulo ciliato et non spinuloso.

Epimerals large, those of fifth segment not shorter than those of fourth, two-lobed, posterior lobe very small or nearly obsolete. Caudal stylets of posterior pair two-branched; branches very short, the outer often subconical, and at apex bi-unguiculate, claws recurved, other branch small lamellar, usually ciliate at extremity and not spinulous.

The epimerals in the true Amphithoe are large, the fifth the largest,

and the species thus differ widely from the Gammari and other related genera. The two branches of the first and second pairs of stylets in the species are usually very nearly similar, and are furnished nearly alike with spinules. But in the *A. brevipes* (in which the lower antennæ are subpediform), one of the branches is styliform, and the other lamellar, the latter being placed with an edge upward, and edged above with numerous spines.

The inner lamellar process of the second joint of the maxillipeds is usually very long, reaching sometimes nearly to the base of the last joint of these organs, and its margin is often furnished with a row of spinules. The mandibular palpi are three-jointed, the first joint short, and the last about as long as the preceding; there are longish setæ at apex and below, which setæ are setulose. The tarsus of the legs has often (if not always) the seta of the under side obsolete. Other characters will be gathered from the details given under some of the species.

The *females* may generally (always?) be distinguished by their having the fingers of the hands short (not shorter than half the hand), and the two pairs subequal.

It may be that species exist having the posterior stylets and epimerals of *Amphithoe* with the superior antennæ of *Gammarus*; and, if so, it may be a question whether the character of the antennæ should not be disregarded, and all be included with *Amphithoe*.

AMPHITHOE RUBELLA.

Corpus crassiusculum, epimeris latis. Antennæ 1mæ dimidio corporis longiores, articulo 2do valde longiore, flagello fere duplo longiore quam basis, fermè 14-articulato, articulis longis, setis perpaucis, brevibus; 1mæ 2dis breviores, basi valde longiore quam basis 1marum, articulo quarto longiore et flagellum fere æquante. Manus prima parva, oblonga, angusta, apice angustiore. Manus secunda valida, lata, subrectangulata, apice (palmâ) transverso, parce excavato, angulo infero prominulo et acuto, digito mediocri. Pedes 3tii 4tique breves; 6ti 7mique subæqui, 5tis valde brevioribus, setis sparsis, articulo primo latiusculo.

Body rather stout, epimerals broad. Superior antennæ longer than

half the body, second joint much the longest, flagellum nearly twice as long as base, about fourteen-jointed, joints long, setæ very few and short; inferior pair shorter than superior, base much longer than base of superior, fourth joint longest, and about as long as flagellum. Anterior hands small, oblong, narrow, narrower at apex. Hands of second pair stout, broad subrectangular, transverse at apex, the palm being apical, little excavate and unevenly so, inferior angle prominent and acute, finger moderately large. Third and fourth pairs of feet quite short; sixth and seventh subequal, fifth much shorter, setæ very few, rather short, basal joint a little broad, proportionably broadest in fifth pair.

Plate 64, fig. 1 *a*, animal, enlarged; *b*, part, more enlarged; *c*, extremity of sixth pair of legs; *d*, extremity of abdomen.

Sooloo Archipelago. Dredged up in six and a half fathoms water, February 2, 1842.

Length, three lines. Colour, reddish. The superior antennæ three-fourths as long as body; third basal joint half the preceding in length. The third joint of inferior pair is about one-third whole length of antenna. Joints of flagellum of superior antenna long; of inferior pair about half as long as in superior. The finger of the large hand shuts against the terminal transverse margin, not fitting close to it; just above the lower angle there is a small obtuse prominence, and about this angle and the palm there are a few very short setæ. The carpus has a very narrow process below, between the hand and the third joint. The small hand has the apex obliquely truncate to form the palm, and the finger is a little longer than this margin, so as to project beyond; the superior and inferior margins are about parallel. Apices of the caudal stylets nearly in same line.

The fifth pair of legs and also the sixth had the extremity inverted in the specimen figured.

A. rubella, DANA, Proc. Amer. Acad. Sci., ii. 215.

AMPHITHOE ORIENTALIS.

Antennæ 1mæ longiores, corpore paulo breviores, flagello prælongo, plus
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duplo longiore quam basis, articulis oblongis, setis paucis, inferioribus partim strictè appressis et articulo vix brevioribus, reliquis divaricatis et dimidio brevioribus; 2dæ paulo breviores, basi longo, parce breviorè quam flagellum, setis longiusculis, articulis flagelli non brevioribus. Oculi fere rotundati. Pedes 1mi parvuli, manu oblongâ, marginibus fere parallelis, apice (instar palmæ) truncato et infra obtuso, digito palmâ longiore, carpo manu paulo breviorè et vix latiore. Pedes 2di validi, manu subovatâ, supra arcuatâ, infra (palmâ) rectiusculâ, setis palmæ perbrevis, paucis, digito longo, carpo brevi, infra angustè producto, articulo tertio infra rectangulato. Pedes 6ti 7miquè articulo 3tio angusto, setis articuli 5ti longiusculis, dimidio articuli paulo brevioribus.

Superior antennæ the longer, a little shorter than the body, flagellum very long, joints oblong, setæ few, part on under side close appressed and but little shorter than the joints, others divaricate and much shorter. Inferior pair but little the shorter, base long, somewhat shorter than the flagellum, setæ longish, not shorter than joints of flagellum. Eyes nearly round. Anterior feet small; hand oblong, margins nearly parallel, apex truncated and forming the palm, finger longer than the palm. Carpus a little shorter than the hand and hardly broader. Hand of second pair very stout, subovate, arcuate above, straight below, this part (or the palm) a little raised towards apex and furnished with a few quite short setæ, finger long, carpus quite short, not oblong, a very narrow process below between hand and third joint, third joint rectangulate below. Feet of sixth and seventh pairs with the third joint narrow, setæ longish, those of fifth joint shorter than half the length of the joint.

Plate 64, fig. 2 *a*, head, much enlarged; *b*, leg of first pair; *c*, *ibid.* of second pair; *d*, *ibid.* of fourth pair; *e*, seventh pair; *f*, posterior caudal stylets, side view.

From floating kelp, off Manilla, Philippine Islands.

Length, two and a half to three lines. The third and fourth joints of the base of the inferior antennæ are subequal, the setæ of the fourth half as long as the joint. Carpus of the first pair of legs arcuate

below, and both the lower side of carpus and of hand hirsute; upper margin naked, excepting a hair or two on hand. The tarsus of the following legs has no seta below.

AMPHITHOE TONGENSIS.

Corpus compressum, nudum, epimeris latis. Antennæ 1mæ corpore breviores, basi fere duplo brevioribus quam flagellum, flagello fere 40-articulato, setis brevibus; 2dæ paulo breviores, basi longiore quam basis 1marum et flagellum 2darum fere æquantes, setis flagelli inferis longitudine articularum longioribus. Manus quatuor non multo inæquæ, fere semi-ellipticæ, dorso rectiusculæ; 1mæ paulo minores; 2dæ mediocres, apice angustæ, infra hirsutæ, palmâ obliquâ, digito dimidio manus brevioribus, carpo infra breviter producto et perangusto sed non acuto. Pedes 6 postici valde inæqui, sensim increscentes.

Body compressed, naked, epimerals broad. Superior antennæ shorter than the body, base nearly half shorter than flagellum, second joint longest, flagellum about forty-jointed, setæ short; inferior pair a little shorter, base sparingly longer than base of superior, and about half as long as the whole antenna, inferior setæ of the flagellum longest, longer than the joints. Hands but little unequal, and similar, nearly semi-elliptical, back almost straight; first pair the smaller; second pair more oblong, narrow at apex, hirsute below, palm oblique, finger small, not half as long as hand, carpus produced below, process short and quite narrow, but not acute. Posterior six feet very unequal, gradually increasing in length.

Plate 64, fig. 3 *a*, animal (in part), enlarged; *b*, *c*, portions of antennæ.

Tongatabu, Pacific; along the shores of coral islets, in shallow water, among sea-weed.

Length, six lines. Inferior antennæ two-thirds as long as superior. Second joint of superior antennæ the longest; joints of flagellum oblong, a little smaller towards base, setæ not as long as the joint and alike on the two sides. Joints of flagellum of inferior pair nearly

terete; the setæ of the outer side are shorter than the joints; those of the inner longer than the joints. The hands of the two pairs are very similar, and those of the first pair about half the length of those of the second. The finger is scarcely half as long as hand; the hand is densely hairy at apex and on the inner margin, the hairs being hardly longer than breadth of hand. The third and fourth pairs of feet are subequal. The fifth pair is small. The first joint of the last three pairs is quite broad. The abdomen is without a spine or acute process on the back.

The specimen was probably a female.

A. tongensis, DANA, Proc. Amer. Acad. Sci., Boston, ii. 216.

AMPHITHOE PEREGRINA.

Feminæ?—*Corpus gracile, epimeris latiusculis, margine sparsim ciliatis. Antennæ 1mæ fermè dimidii corporis longitudine, articulo primo longiore, flagello duplo longiore quam basis, 12-articulato, articulis parce oblongis, setis brevibus; 2dæ fere dimidio breviores, basi longiore quam basis 1-marum, articulo tertio longiore, flagello 6-articulato, subulato, paulo breviorè quam basis. Manus prima et secunda subæquæ, parvulæ, oblongæ, infra arcuatæ, digito minuto. Pedes tertii quartique subæqui, non breviores, articulo primo latissimo; reliqui 6 non longi, sensim parce increscentes, setis minutis, articulo primo lato.*

Female?—Body somewhat slender, epimerals rather broad, edged with four or five short setæ, fifth pair large. Superior antennæ about half as long as body, first joint longest, flagellum twice the length of the base, twelve-jointed, joints sparingly oblong, setæ short; inferior pair nearly half shorter, base longer than base of superior pair, third joint longest, flagellum six-jointed, subulate, a little shorter than base. Hands of first and second pairs of feet quite small and nearly equal, oblong, arcuate below, finger minute. Third and fourth pairs of feet subequal, not shorter than second, first joint very broad. Remaining six rather short, increasing slightly in length from fifth to seventh, setæ minute, first joint broad.

Plate 64, fig. 4 *a*, animal, enlarged; *b*, outline of eye.

Among the roots of floating *Fucus* (*Macrocystis*), at sea, thirty miles southwest of Valparaiso.

Length, three lines. Colour, greenish. The animal had generally its abdomen curved beneath and the dorsal line of thorax nearly straight (as in the figure). The eyes are round, and the circumferential row contains about twenty lenses. The anterior thoracic segments shortest. Abdomen seven joints, the third longest. Terminal stylets short, extending back beyond second pair, and the second pair slightly beyond the first. Third joint of superior antennæ very short and almost like one of the joints of the flagellum. First joint of third and fourth pairs of legs very broad; the next joint is articulated with the posterior apex of this joint, and the inner apex is prominent and rounded. The first joint of the following pairs is broad ovate, being broadest at base.

We suspect, from the position of the legs and a comparison with other species, that the fifth and sixth legs in the specimen examined were inverted at extremity, the tarsus being reversed; but the specimen was lost with the Peacock, and we cannot verify this suspicion.

AMPHITHOE BREVIPES.

Feminæ:—*Corpus compressum, epimeris latis, 5tis subquadratis. Oculi rotundati. Antennæ 1mæ dimidio corporis paulo longiores, articulo primo longiore, flagello plus duplo longiore quam basis, fere nudo, setis latitudine articuli vix longioribus; 2dæ 1mis fere dimidio breviores basi multo longiore quam basis 1marum, articulis tertio quartoque subæquis, flagello multo brevior quam basis, hirsuto. Manus quatuor subæquæ, parvulæ, subrectangulatæ, hirsutæ, apice transversæ, digito minuto. Pedes 5ti 6ti 7mi sensim incrementes, setis sat brevibus. Pedes tertii quartique subæqui, articulo primo latissimo.*

Maris:—*Manus secunda valida subovata, supra arcuata, infra (palma) rectiuscula setis paucis brevibus, prope apicem internum dentem minutum gerens, digito longo.*

Female:—Body compressed, epimerals broad, the fifth pair subquadrate. Eyes round. Superior antennæ about half as long as body, first joint longest, flagellum more than twice as long as base, nearly

naked, setæ hardly longer than breadth of joint; inferior pair half shorter than the superior, base longer than in superior, third and fourth joints subequal, flagellum much shorter than base, hirsute. The four hands subequal, quite small, subrectangular, apex truncate, finger minute. Feet of third and fourth pairs with the first joint quite broad; fifth, sixth, and seventh gradually increasing in length.

Male.—Hand of second pair large, subovate, above arcuate, below (palm) nearly straight, with a few setæ, and near apex a minute acute tooth, finger long.

Plate 64, fig. 5 *a*, female, much enlarged; *b*, *c*, side and front view of head (showing *a*¹, *a*², antennæ; *l*, labrum; *md*, mandible; *m*¹, *m*², first and second maxillæ; *m*³, maxillipeds); *d*, posterior caudal stylet; *e*, mandible; *f*, maxilla of first pair; *g*, *ibid.* of second pair; *h*, maxillipeds; *i*, hand of female of first or second pair; *k*, first pair of male; *l*, second pair of male; *m*, leg of seventh pair; *n*, caudal stylet of first or second pair.

Near Hermite Island, Tierra del Fuego; brought up with kelp, in five fathoms water, by Lieutenant Case, January 27, 1839.

Length, nine lines. In an upper view the front margin of the head is straight, in a side view there is a slight prominence just before the eye. The legs of the fifth pair have the tarsus inverted, and the following tarsi point usually outward. The last abdominal segment is short triangular and very obtuse. The posterior stylets project a little beyond this segment; the other pairs reach to the same distance backward. The flagellum of the inferior antennæ is tapering, and but little longer than fourth joint of base. The claw in the four hands of females closes against the terminal margin. In the male, the finger of the second pair shuts against the inferior surface, reaching nearly to base of hand; but the hands of the first pair are very nearly like those of the female. The carpus in the male second pair is very short, transverse, with the lower side prolonged and narrow, but not appressed at all to base of hand. The finger is much curved.

A female carried a large number of young between her legs, which

were perfect in the number of thoracic legs; the superior antennæ in them had *six* joints, and the inferior *four*.

A. brevipes, DANA, Proc. Amer. Acad. Sci., Boston, ii. 216.

AMPHITHOE BRASILIENSIS.

Tongensi affinis. Corpus compressum, epimeris latis. Antennæ 1mæ dimidio corporis multo longiores, flagello prælongo, tenuissimo, setis perbreuibus; 2dæ paulo breviores, hirsutæ, basi vix brevior quam flagellum, articulis flagelli versus basin vix oblongo, setis inferis plus duplo longioribus. Manus quatuor subæquæ, 1mæ paulo minores supra parce arcuatæ, infra rotundatæ, hirsutæ, palmâ obliquo-transversâ, digito dimidii manus longitudine; 2dæ mediocres, hirsutiores, apice obliquè truncatæ et infra acutæ, palmâ vix excavatâ, longe hirsutâ, carpo infra latiusculo dense hirsuto, articulo 3tio infra rotundato. Pedes 3tii 4tique setis sparsis articulo parce brevioribus.

Near the *A. tongensis*. Body compressed, epimerals large. Superior antennæ much longer than half the body, flagellum very long and slender, setæ quite short. Inferior pair a little shorter than superior, hirsute, base hardly shorter than flagellum, joints of flagellum towards base slightly oblong, setæ of lower side more than twice as long as those above. The four hands subequal; first pair the smallest, slightly arcuate above, rounded below, and hirsute, palm obliquo-transverse, finger half as long as hand. Hands of second pair of moderate size, more hirsute than preceding, obliquo-transverse at apex, palm hardly excavate, long hirsute, acute at lower limit, carpus broad, produced below, and densely hairy. Setæ of legs of third and fourth pairs few, nearly as long as joint.

Plate 64, fig. 6 *a*, animal, enlarged; *b*, part of flagellum of superior antennæ; *c*, ibid. of inferior, from basal half; *d*, ibid., from towards apex; *e*, *e'*, mandible, in different positions; *f*, maxilla of first pair; *g*, ibid. of second pair; *h*, maxillipeds; *i*, part of leg of first pair; *k*, ibid. of second pair; *l*, ibid. of fourth; *m*, outer branch of first pair of stylets; *n*, posterior stylet.

Rio Janeiro, Brazil.

Length of body, eight lines. This species is very near the *tongensis*, from the island of Tongatabu; but as our figure of that species was made on the spot, and the specimen is not in the collections, we cannot make a comparison throughout. The outer branch of the stylets of the first pair has seven spines above, besides the apical, and its basal part four or five. The leg of the fifth pair, in our specimens, has the tarsus turned upward, and in those of the sixth and seventh, it is turned outward.

AMPHITHIOE FILICORNIS.

Feminae:—*Antennæ corpore vix breviores, flagellis tenuissimis, setis perbreuibus et perpaucis, 1mæ paulo longiores, flagello plus triplo longiore quam basis, articulis oblongis, setis articularum alternantium inferis longioribus; 2darum basi flagellum duplo longius. Pedes 4 antici subæqui et consimiles; 2di paulo majores, manu mediocri, marginibus parce arcuatis et bene hirsutis, apice oblique truncato, angulo infero subacuto, palmâ vix excavatâ, digito brevi, carpo parce oblongo, infra latè producto et multo hirsuto, articulo 3tio apice inferiore triangulato. Pedes 10 postici pilosi, setis sat longis; 6ti 7mi subæqui.*

Female:—*Antennæ* hardly shorter than the body, the setæ few and very short, the flagella very slender, superior a little the longer, flagellum more than three times as long as base, joints oblong, setæ on under apex of every other joint a little longer than on the others. Inferior pair of antennæ having the flagellum twice as long as the base. Four anterior feet subequal and similar; hands of second pair a little the larger, of moderate size, margins sparingly arcuate and very hairy, especially below, apex obliquely truncate, inferior angle subacute, palm hardly excavate, finger short, carpus sparingly oblong, the part below, between third joint and hand, rather broad and dense hairy, third joint at inferior apex triangular. Ten posterior feet pilose, setæ rather long; sixth and seventh pairs subequal.

Plate 65, fig. 1 *a*, female, enlarged; *b*, part of flagellum of superior antennæ; *c*, mandible; *d*, leg of second pair; *e*, stylet of posterior pair; *f*, head and antennæ of a young individual; *g*, fifth leg of same.

Rio Janeiro.

The legs of the last three pairs have the claw turned outward; the setæ are very slender and fully as long as half the fifth joint; and at the apex of this joint there is a large cluster of them. The setæ on the upper apex of the joints of the superior flagellum are not longer than the breadth of the joint; and below, on alternate joints, they have the same length, while on the others they are twice as long. Both pairs of antennæ have a naked appearance.

GENUS GAMMARUS (*Fabricius*), *Dana*.

Antennæ superiores appendiculatæ. Styli caudales postici ac in Iphimediâ, sæpe longiores. Epimeræ 5tæ 4tis plus minusve breviores, bilobatæ, lobis subæquis.

Superior antennæ appendiculate. Caudal stylets of last pair as in *Iphimedia*, often longer. Epimerals of fifth segment more or less shorter than fourth, bilobate, lobes subequal.

All the following species have the superior antennæ the longer. The branches of the posterior stylets are without spines, and furnished with only a few hairs in all the species, excepting one from Puget's Sound; in this, one of the branches, the stouter one, bears spines, though still different from the branches of the preceding pairs; and the other or thinner branch, has only short hairs.

The true Gammari have generally smaller epimerals than the *Amphithoe*, and differ from them widely in the non-uncinate posterior stylets, and in the fifth epimerals not larger than the fourth, and subequally bilobate. They approach most nearly to the *Iphimediæ*, from which they differ mainly in the absence of the appendage from the superior antennæ in the latter. If this appendage is not accepted as a generic distinction, the groups may properly have a subgeneric relation. *Melita* and *Mæra* also will have a like relation.

1. *Abdominis segmenta dorso plus minusve spinulosa aut denticulata.*

GAMMARUS ASPER.

Corpus crassiusculum, epimeris latis, 5tis vix brevioribus quam 4tæ, seg-

mentis abdominis totis ad dorsum inæquè denticulatis. Oculi subrotundati. Antennarum bases longi, subæqui, articulis flagellorum oblongis, setis non brevioribus, articulo basis 1marum primo crasso, secundo tenui, fere duplo longiore, tertio valde brevior, appendice 3-articulatâ: antennæ 2dæ dimidio corporis parce longiores, basi tenuissimo, articulis 2 ultimis subæquis, flagello basi paulo brevior. Pedes primi parvuli, manu minutâ, oblongâ, attenuatâ; secundi plus duplo longiores, infra valde hirsuti, manu grandi, angusto-oblongâ, marginibus fere parallelis, palmâ valde obliquâ, digito dimidio brevior quam manus.

Body rather stout, epimerals broad, but fifth slightly shorter than fourth; abdominal segments unequally denticulate on back margin. Eye subrotund. Antennæ having the bases long, subequal, and the joints of the flagella oblong, and setæ not shorter than the joints; superior pair with the first joint of base quite stout, second slender, nearly twice as long as first, the third much shorter, appendage three-jointed. Inferior antennæ about half as long as body, base very slender, the last two joints subequal, flagellum a little shorter than base. Anterior feet very small, hand minute, oblong, attenuate. Second pair more than twice the length of the first, dense hirsute below; hand oblong, margins nearly parallel; palm much oblique, finger half the length of the hand; carpus shorter than the hand.

Plate 65, fig. 2 *a*, animal, enlarged, the superior antennæ, posterior feet, and posterior stylets mutilated; *b*, portion of superior antennæ; *c*, *ibid.* of inferior; *d*, part of hand of second pair; *e*, part of palpus of mandible.

Dredged up in six and a half fathoms, Sooloo Archipelago, February 2, 1842.

Length six lines. The denticulation on the back of the abdomen is irregular, and is not confined to the posterior margin of the segments. The first joint of the superior antennæ is twice as stout as the following. The first two joints of the inferior pair are very short, the first projects below the second to about half the length of the latter. The setæ of the organs are mostly about twice as long as the diameter of the joints. The hand of the first pair is nearly a fourth narrower than that of the second. The hand of the second is hirsute in many

tufts on both margins, but especially the lower. The third and fourth pairs of feet are about equal. The basal joints of the following are oblong, with the posterior margins serrulate, and a few minute setæ on the anterior margin. The setæ of the other joints are short, and in a few tufts, two or three to inside of joint.

The small size of the mandibular palpus in this species and the following is peculiar.

Gammarus asper, DANA, Proc. Amer. Acad. Sci., Boston, 209.

GAMMARUS SULUENSIS.

Feminæ:—*Abdominis segmenta primum secundumque dorso in marginem posticum 2-3-dentata, quartum etiam 2-acute. Oculi subrotundati. Antennæ 1mæ fere corporis longitudine, flagello longiore quam basis, articulis oblongis, setis non brevioribus, appendice brevissimâ, 3-articulatâ; 2dæ fere dimidio breviores, flagello plus dimidio brevioribus quam basis, basi parce brevioribus quam basis 1marum. Pedes 4 antici subæqui, parvi, 1mi minores; manibus paulo oblongis, apice recte truncatis, infra brevissimè pubescentibus, digito parvulo, marginibus manus 2dæ fere parallelis. Pedes sex postici paulo inæqui, setis paucis remotis, brevibus, ad pedis extremitatem longiusculis. Styli caudales æque producti. [An femina G. asperi?]*

Body rather stout. First and second abdominal segments having the posterior margin on the back two to three-dentate, fourth also two-acute. Eyes subrotund. Superior antennæ as long as body, flagellum longer than base, its joints oblong, the setæ as long as the joints, appendage very short, three-jointed; inferior pair nearly half shorter, flagellum not half as long as base, base hardly as long as base of superior pair. Four anterior feet subequal, small, first pair the smaller, hands a little oblong, straight, truncate at apex, below very short pubescent, margins of hand of second pair nearly parallel, finger very small. Six posterior feet a little unequal, setæ few, remote, rather long at the base of the claw.

Plate 65, fig. 3 *a*, animal, enlarged; *b*, *b'*, mandible, in different positions; *c*, *c'*, inner maxillæ, *ibid.*; *d*, second pair of maxillæ; *e*, maxillipeds; *f*, part of superior antennæ.

Sooloo Sea; from a small island off the harbour of Soung; among sea-weed floating off the shore.

Length, four to five lines. The flagellum of the inferior antennæ consists of about five joints, and is but little longer than preceding basal joint. The joints of the flagellum of the superior pair are about three times as long as their breadth, and the setæ have the same length nearly; the flagellum is neatly terete, and the number of joints fourteen or more. The first joint of base of inferior pair has the process of the lower apex projecting beyond the extremity of the second joint; this second joint is about as long as broad.

The finger in each hand is not longer than the transverse apical margin. [The hands of the second pair may be much larger and of very different characters in male individuals.] Third and fourth pairs equal, long and slender. Basal joint of remaining pairs oblong, and posterior margin serrulate.

The stylets are all long, and extend equally far backward; the last or seventh joint of abdomen is short and slender in lateral view, with a few setæ at tip.

It is barely possible that the *G. suluensis* may be female of the *asper*. They are alike in the very slender mandibular palpi without a ciliated arrangement of hairs on the apical joint.

Gammarus suluensis, DANA, Proc. Amer. Acad. Sci., ii. 210.

GAMMARUS ALBIDUS.

Feminæ:—*Epimeræ mediocres*. *Abdominis segmenta primum secundum quartumque dorso 1-2-spinosa*. *Antennæ 1mæ dimidio corporis valde longiores, basi brevioribus quam flagellum, articulo 2do paulo longiore; flagello fere 21-articulato, articulis oblongis, setis vix brevioribus, appendice brevi, 3-articulatâ; 2dæ tenuissimæ, fere dimidio breviores, flagello brevioribus quam basis, ferme 8-articulato. Pedes 4 antici subæqui, parvuli, manu oblongâ, apice fere rotundatâ, infra dense hirsutâ; manu secundâ paulo longiore, digito parvulo. Pedes 6 postici subæqui, setis numerosis, latitudine articuli 5ti paulo longioribus.*

Maris:—*Pedes 2di validi, manu oblongâ, basi paulo angustiore, marginibus fere parallelis, infra setis perbrevis paucis, apice oblique*

truncato palmam efficiente, palmâ paulo excavatâ et angulo infra finiente, digito dimidii manus longitudine.

Female.—Epimerals moderately large. A small spine or two on back of first, second, and fourth abdominal segments. Superior antennæ nearly three-fourths the body in length, base shorter than flagellum, second joint a little the longest, flagellum about twenty-one-jointed; inferior very slender, nearly half shorter than the superior, flagellum shorter than base, about eight-jointed. Four anterior feet subequal, hands quite small, oblong, apex somewhat rounded, rather dense hirsute below, and also on carpus, the second pair a little the longer, finger small. Six posterior feet subequal, setæ numerous, rather longer than the diameter of the fifth joint.

Male.—Feet of second pair stout, hand large, oblong, narrower at base but margins nearly parallel, lower margin with a few very short setæ, apex obliquely truncate forming the palm, palm a little excavate and ending below in an angle, finger half as long as hand.

Plate 65, fig. 4 *a*, animal (female), enlarged; *b*, *c*, portions of antennæ; *d*, hand of second pair in male.

Tongatabu, in shallow waters of the lagoon, among sea-weed.

Length, five lines. Colour of back, nearly white. The head is nearly as long as high, and about twice as long as first thoracic segment. The third joint of base of superior antennæ is half shorter than preceding; the last joint of base of inferior pair a little shorter than the preceding, and the prolonged lower apex of first joint extends to apex of second joint; this second joint is not longer than broad; the flagellum is about as long as last two basal joints. The hand of second pair in male has a few setæ at intervals on both upper and lower margin; the finger when closed leaves a space between it and the palm; the fourth joint is very small and narrow triangular, subacute below, situated between the lower part of the preceding, and the hand; this preceding joint is subtriangular, subacute above and below, and about as long as broad. The third and fourth pairs of feet are slender and rather long. The last three pairs have short setæ on margins of first joint; the setæ of the other joints are in tufts, of which there are three or four on the opposite sides of each joint.

The stylets are all long; the first pair extends a little beyond the others.

Gammarus albidus, DANA, Proc. Amer. Acad. Sci., ii. 210.

2. *Abdomen dorso non spinulosum nec dentatum.*

GAMMARUS TENUIS.

Gracilis, epimeris angustis. Caput fronte laterali prominulum. Oculi rotundati, parvi. Antennæ 1mæ corpore paulo breviores, teretes, tenuissimæ, articulo primo longo, secundo duplo longiore quam tertius; flagello basi parce longiore, 14-articulato, setis longioribus quam articuli, appendice brevissimâ. Antennæ 2dæ valde breviores, setis longioribus; basi valde longiore quam basis 1marum, articulis 2 ultimis longis, subæquis, precedentibus perbrevibus; flagello 5-articulato, non longiore quam articulus basalis ultimus. Pedes antici mediocres, manu oblongâ, apice paulo latiore et paulo obliquè truncatâ palmam efficiente, palmâ non excavatâ, angulo infra finiente, digito mediocri; secundi dimidio minores. Pedes sex ultimi valde inæqui, 7mi 6tis multo longiores, setis sparsis, longiusculis.

Slender, epimerals narrow. Front margin of either side of head a little prominent. Eye round, small. Superior antennæ somewhat shorter than the body, very slender, terete, first joint longer than third, and second twice longer, flagellum slightly longer than the base, fourteen-jointed, setæ longer than joints, appendage very short. Inferior antennæ much shorter, setæ longer, base much longer than base of superior, last two joints long and subequal, the preceding very short, flagellum five-jointed, not longer than last basal joint. Anterior feet of medium size, hand oblong, somewhat larger towards apex and obliquely truncate, margins setose in tufts, an angle at lower limit of truncation, palm not excavate, finger about half as long as hand. Second pair much smaller than first. Last three pairs of feet very unequal in length, seventh very much longer than sixth pair.

Plate 65, fig. 5 *a*, animal, enlarged; *b*, part of palpus of mandible; *c*, hand of first pair.

Sooloo Sea, in six and a half fathoms water. Collected, February 2, 1842.

Length, three lines. The epimerals are very short, the anterior not larger than the fifth pair, the fifth smaller than the fourth. The inferior antennæ are about three-fourths the length of the superior, and the setæ below are much longer than in that pair. The first basal joint has the inferior apex projecting and subacute. The hand of the second pair of legs is half shorter and narrower. The third and fourth pairs of feet are subequal. The fifth is less than half the seventh. The first and second pairs of stylets extend back the same distance; the third pair is furnished with some short hairs and no spinules.

Gammarus tenuis, DANA, Proc. Amer. Acad. Sci., ii. 211.

GAMMARUS FURCICORNIS.

Gracilis, epimeris angustis; sparsim pubescens. Caput fere oblongum, fronte laterali non prominente. Antennæ 1mæ corpore breviores, articulo 1mo crasso, oblongo, 2do paulo longiore, 3tio brevi; flagello terete, parce longiore quam basis, fermè 14-articulato, sparsim setuloso; appendice dimidio brevior, 5-articulatâ. Antennæ 2dæ valde breviores, basi vix brevior quam basis 1marum, articulis 3tio 4toque longis, subæquis; flagello parce longiore quam articulus 3tius, 7-10-articulato. Pedes 1mi parvuli, manu subovatâ; 2di validi, manu latâ et oblongâ, trapezoideâ, infra setigerâ, apice parce latiore et fere rectè truncatâ palmam efficiente, palmâ non excavatâ, carpo transverso, subrectangulato. Pedes 6 postici subæqui, 7mi paulo longiores, setis numerosis, breves. Styli caudales postici longissimi.

Slender, epimerals narrow; body sparsely pubescent. Head about as long as high; lateral margin in front not prominent. Superior antennæ shorter than the body, first joint very stout, oblong; second slender, a little longer; third short; flagellum terete, a little longer than the base, about fourteen-jointed, sparsely setulose, appendage half shorter than flagellum, five-jointed. Inferior pair much shorter than superior, the base of same length nearly as in that pair, third

and fourth joints long, subequal; flagellum but little longer than third joint, seven to ten-jointed. First pair of feet small, hand subovate; second pair stout, hand nearly trapezoidal, broad and oblong, a little broadest at apex, and truncate a little obliquely, below setulose, palm not at all excavate, finger half as long as hand. Three posterior pairs subequal, the last little the longest, tufts of setæ numerous, short. Posterior stylets quite long.

Plate 65, fig. 6 *a*, animal, enlarged; *b*, part of flagellum of superior antennæ.

Sooloo Sea; from shores of a small island off the harbour of Soung; collected, February 5, 1842.

Length, three lines. This species is peculiar in its very stout first basal joint of the superior antennæ, the long appendicular branch, and the long posterior stylets, which extend back much beyond the preceding. The setæ on the flagellum of the superior antennæ are about as long as the joints. The anterior hands are about as long as the joint next preceding (carpus), and both have short, stiff hairs on the margins. The finger of the hand of second pair folds against the terminal margin, and does not project below it. The third and fourth pairs of legs are slender and subequal. The basal joint in the last three pairs is narrow oblong, and serrulate behind. The first and second pairs of stylets extend nearly to the same distance back, the third pair much farther.

In a profile view, a few scattered short hairs are seen over the back of the animal.

Gammarus furcicornis, DANA, Proc. Amer. Acad. Sci., ii. 211.

GAMMARUS TENELLUS.

Maris:—*Gracilis, epimeris totis angustis. Oculi rotundati, parvuli. Antennæ 1mæ dimidii corporis longitudine, articulo primo non crasso, secundo valde longiore, flagello parce longiore quam basis, setis perbrevis; appendice fere dimidio brevior. Antennæ 2dæ tenuissimæ, breves, basi paulo brevior quam basis 1marum, flagello non longiore quam articulus precedens. Pedes 1mi parvuli, manu subovatâ, dorso*

rectiusculâ; 2di validi, manu latâ subrectangulatâ, basi paulo angustiore, apice fere rectè truncatâ, sparsim setulosâ, palmâ non excavatâ, angulo infra finiente; articulo 4to transverso, angustissimè triangulato. Pedes 6ti 7mique subæquis, 7mi parce breviores, setis inferis paulo sparsis, sat brevibus, supernis minutissimis. Styli caudales postici longi, ultra 2dos multo producti.

Slender, epimerals quite narrow. Eyes round, small. Superior antennæ about half as long as body, first joint not stout, second very long, flagellum little longer than base, setæ very short, appendage half shorter than flagellum. Inferior antennæ very slender, short, base a little shorter than base of superior pair, flagellum not longer than preceding joint. Anterior feet quite small, hand subovate, back nearly straight; second pair stout, hand broad, subrectangular, at base a little narrower, at apex nearly straight truncate, sparsely setulose, palm not excavate and ending below in an angle, carpus transverse, very narrow triangular. Sixth and seventh pairs subequal, the last little the shorter, setæ rather sparse, and shortish, those on upper margin of joints very minute. Last pair of caudal stylets quite long, extending much beyond second.

Plate 65, fig. 7 *a*, animal, enlarged; *b*, part of flagellum of superior antennæ; *c*, hand of first pair; *d*, part of leg of sixth pair; *e*, extremity of abdomen, with stylets of first and second pairs.

From coral reefs of Viti Lebu, Feejee Islands.

Length, four lines. The head is rather small, as long as broad, the mouth organs not prominent below. The caudal segment oblong, with two or three setæ at extremity, nearly as long as the segment. The hand of the anterior feet is ciliate below. The third and fourth pairs of feet are remarkably slender. The length of the hand of second pair is one and a half times the breadth. The setæ or hairs of the fifth joint of the sixth pair are in three tufts (exclusive of the apical), the tufts but little divaricate, longer than breadth of joint. The tarsus has a seta below, and another on one side towards apex.

Gammarus tenellus, DANA, Proc. Amer. Acad. Sci., Boston, ii. 212.

GAMMARUS FUEGIENSIS.

Feminæ:—*G. tenello affinis*. *Pedes tenues*. *Antennæ 1mæ graciles, dimidio corporis longiores, basi longo, longiore quam flagellum, infra setoso, articulo 2do multo longiore, flagello 16-articulato, articulis oblongis, setis paucis, non brevioribus, vix divaricatis, appendice 4-articulatâ; 2dæ breviores, basi non brevioribus quam 1marum basis, articulis 2 penultimis subæquis, flagello 5-articulato, vix longiore quam articulus precedens. Pedes 4 antici parvuli, subæqui; 1mi paulo majores, manu oblongâ, marginibus fere parallelis, hirsutis, apice obliquè truncato, digito 1morum parce longiore quam palma, carpo paulo brevioribus et non latiore quam manus. Pedes 6 postici valde inæqui, 7mi 6tis multo longiores, setis paucis brevibus, articulo 1mo angusto. Styli caudales postici apicem 2dorum non attingentes; 2di 1mique spinâ prælongâ ad basis apicem armati.*

Female:—Near *G. tenellus*. Superior antennæ slender, longer than half the body, base quite long, longer than flagellum, setose below, second joint much the longest, flagellum sixteen-jointed, joints oblong, setæ few, not shorter than joints, and hardly divaricate, appendage four-jointed; second pair shorter than first, base not shorter than base of first pair, its last two joints subequal, flagellum five-jointed, but little, if any, longer than preceding joint. Four anterior feet with the hands quite small, narrow oblong, the margins nearly parallel, hirsute, obliquely truncate at apex, finger of first pair slightly longer than palm, carpus shorter, and hardly broader than hand. Last three pairs of legs very unequal, seventh pair much the longest. Stylets of last pair not extending as far back as second or first pair; first and second with a very long spine at apex of base, which is a little shorter than branches.

Plate 65, fig. 8 *a*, animal, enlarged; *b*, part of flagellum of first pair; *c*, appendage of first pair; *d*, extremity of second pair; *e*, part of leg of first pair; *f*, *ibid.* of second pair; *g*, *ibid.* of third or fourth; *h*, caudal extremity in profile.

Feejee Islands.

Length, three and a half lines. The bases of the antennæ, which

are nearly four times as long as the head, have longish hairs below. The setæ of the ten posterior legs are few, and on the third or fourth legs, are about half as long as the fourth or fifth joints; on the fifth to seventh legs, half shorter. The hairs of the hands are as long as the breadth of the hand.

This species may possibly be the female of the *G. tenellus*. Yet this seems improbable, since, in that species, the sixth pair of legs is longer than the seventh, and the stylets of the last pair extend much beyond the second.

GAMMARUS QUADRIMANUS.

Gracilis, epimeris angustis. Antennæ 1mæ dimidii corporis longitudine, basi paulo longiore quam flagellum, articulis primo secundoque longis, subæquis, tertio perbrevis, flagello pubescente, setis longioribus quam articuli, vix divaricatis, appendice dimidio flagelli parce longiore. Antennæ 2dæ breviores, basi brevioribus quam basis 1marum, flagello perbrevis. Pedes 1mi parvuli, manu oblongâ, infra hirsutâ, basi angustiore. Manus 2dæ æquæ, validissimæ, subquadratae, apice transversæ, digito immobili spiniformi, acuto, palmâ transversâ, prominenter 3-dentatâ, digito palmâ vix longiore. Pedes 4 postici subæqui, 7mis parce brevioribus, articulis apice postico dense hirsutis, setis aliis brevibus.

Slender, epimerals narrow. Superior antennæ half as long as the body, base a little longer than the flagellum, first and second joints long, subequal, third very short, flagellum pubescent, setæ longer than joints, and hardly divaricate, appendage rather longer than half the flagellum. Inferior pair shorter, base shorter than base of superior pair, flagellum very short. First pair of feet quite small, hand oblong, hirsute below, narrower at base. Hand of second pair equal, very large, subquadrate, apex transverse, a spiniform acute immoveable finger, palm three-dentate, teeth prominent, finger hardly longer than palm. Two posterior pairs subequal, the seventh a little the shorter; the joints at their posterior apices densely hirsute, other setæ short.

Plate 65, fig. 9 *a*, animal, enlarged; *b*, portion of flagellum of superior antennæ; *c*, extremity of anterior pair of feet, more enlarged; *c'*, same, of size corresponding to fig. *a*; *d*, tarsus of leg of fourth pair,

much enlarged; *e*, leg of seventh pair; *f*, stylet of second pair; *g*, ibid. of third pair.

From the coral reefs, Feejee Islands.

The flagellum of the inferior antennæ is about as long as penult joint of base, it is hairy like the flagellum of the superior pair. The hand of the second pair of feet is naked, excepting a minute tuft of setæ on the lower margin near base of thumb. The third and fourth pairs of feet are very slender, and as long as the second. The fifth is about as long as the fourth, and shorter than the sixth. The sixth and seventh have a few setæ on the inner margin of the joints, and thick tufts at the posterior apices. The tarsus has a tooth above extremity, and a seta below.

The stylets extend but little backward of the apex of the abdomen. The first and second pairs have about four short stoutish setæ in a series along the abdomen, the upper side of each branch, and three or four at apex, one of which is half as long as the branch. The branches of the third pair are straight and equal, and furnished with longish slender hairs at apex.

GAMMARUS BRASILIENSIS.

Maris:—*Epimeræ sat magnæ, 5tæ 4tis multo breviores. Antennæ 1mæ 2dis duplo longiores, corpore fere dimidio breviores; basi paulo brevior quam flagellum, flagello multi-articulato, articulis transversis, setis numerosis, latitudine articulorum non brevioribus, appendice parvulâ; 2dæ basi 1marum parce longiores, flagello dimidio basis parce longiore. Pedes 1mi parvuli, manu subovatâ, infra hirsutâ, carpo non brevior; 2di pervalidi, manu subovatâ, infra plus arcuatâ et dense elongato-pilosâ, palmâ non excavatâ, carpo transverso, infra perangusto. Setæ pedum 10 posticorum breves, semilatitudine articuli 5ti vix longiores; pedes 4 postici subæqui, articulo 1mo perlato. Styli caudales 1mi 2di 3tiique subæqui.*

Feminæ:—*Pedes 2di parvuli, manu oblongâ, subovatâ, infra pilosâ, carpo vix oblongo, articulo 3tio infra rectangulato.*

Male:—*Epimerals large, fifth much shorter than fourth. First pair of antennæ twice as long as second, about half as long as body, base a little shorter than flagellum, flagellum consisting of numerous*

short transverse joints, setæ many and as long as diameter of joints, appendage very small and short; second pair but little longer than base of first, flagellum but little longer than half the base. Anterior feet quite small, hand subovate, hirsute below, carpus not shorter. Feet of second pair very stout, hand large, subovate, more arcuate below and densely furnished with long slender hairs, palm not excavate nor limited. Setæ of ten posterior pairs short, about half as long as width of fifth joint, rather numerous. The three pairs of caudal stylets subequal.

Female.—Hands all small, second pair a little the larger, subovate, below hirsute, carpus hardly oblong, third joint rectangulate below.

Plate 65, fig. 10 *a*, male, enlarged; *b*, part of flagellum of superior antennæ; *c*, part of mandibular palpus; *d*, part of leg of fourth pair; *e*, hand of second pair of female, much enlarged; *e'*, same, magnified to correspond with the male, fig. *a*.

Rio Janeiro, Brazil.

Length, four lines. Seventh pair of legs not shorter than sixth.

3. *Antennæ 1mæ breviores.*

GAMMARUS PUGETTENSIS.

Epimeræ magnæ, 5tæ 4tis multo breviores. Segmentum abdominis 4tum dorso acutum. Antennæ 1mæ 2dis multo breviores et tenuiores, articulo basis 2do brevior quam 1mus, flagello fere 20-articulato, nudiusculo, appendice brevi, 5-6-articulatâ; 2dæ crassæ, dimidio corporis breviores, basi longo, fere nudo, articulis 2 ultimis subæquis, flagello paulo longiore quam articulus precedens, fere 10-articulato, articulis non oblongis. Pedes 4 antici majusculi, manibus subæquis, latis, infra hirsutiusculis, apice oblique truncatis, palmâ parce excavatâ. Pedes 4 postici subæqui, setis brevibus, paucis. Styli caudales postici prælongi, ramo externo crasse styliiformi, brevissime spinigeri, altero tenuiore, piloso.

Epimerals large, fifth much shorter than fourth. Fourth segment of abdomen acute above. Superior antennæ much shorter and more slender than inferior, second joint of base shorter than first, flagel-

lum nearly twenty-jointed, almost naked, appendage short, five to six-jointed; second pair quite stout, not half as long as body, base long, nearly naked, last two joints subequal, flagellum a little longer than preceding joint, about ten-jointed, joints not oblong. Four anterior feet rather small, hands subequal, broad for the length, partly short hirsute below, apex obliquely truncate, palm a little excavate, lower angle rounded, finger not longer than palm. Sixth and seventh pairs of legs subequal, setæ few, short. Posterior caudal stylets quite long, projecting much beyond the second, outer branch very stout and bearing some very short spinules, the inner more slender and pilose.

Plate 66, fig. 1 *a*, animal, enlarged; *b*, part of flagellum of superior antennæ with the appendage; *c*, same flagellum, towards apex; *d*, part of flagellum of second pair, inner side; *e*, leg of second pair; *f*, part of hand in oblique position; *g*, part of palpus of mandible.

Puget's Sound, Western America.

Length of body, nine lines. The figure probably represents a female. In the natural position of the hands (shown in fig. 1 *a*), the back of the hand is towards the observer, and the actual outline shown in (fig. 1 *e*) is not easily obtained without separating the leg from the body. The mandibular palpus has the inner side of the last joint pectinate with short setæ. The inner side of the flagellum of the inferior antennæ is covered with short hairs, about as long as the joints. The second pair of stylets projects hardly as far as the first, and about to middle of branches of last pair. The legs of the fifth pair have the tarsus reversed in the specimen, as shown in the figure.

APPENDIX TO GENUS GAMMARUS.

GAMMARUS? PERUVIANUS.

Corpus compressum; epimeris latis, 5tis multo brevioribus quam 4tæ. Antennæ 1mæ corpore parce breviores, 2dis fere duplo longiores, basi brevioribus quam flagellum, articulis tribus subæquis, secundo paulo lon-

giore, setis brevibus; 2dæ basi 1marum parce longiores, basi paulo longiore quam flagellum, articulo quarto valde longiore. Manus prima parva, apice parce latior, obliqua. Manus secunda mediocris, subovata infra sparsim setosa, palmâ non excavatâ, digito breviusculo. Pedes 6 postici sensim parce increscentes, non longi, setis brevibus, articulo primo latissimo. Styli caudales secundi ultimos non superantes.

Body compressed, epimerals large, the fifth much shorter than fourth. Superior antennæ little shorter than body, nearly twice as long as the inferior pair, base shorter than flagellum, the three joints subequal, second somewhat the longest, setæ short; inferior pair hardly longer than base of superior, base longer than flagellum, fourth joint of base longest. Hand of first pair small, slightly broader at apex and oblique. Hand of second pair moderately large, subovate, base below sparsely setose, palm not excavate, finger rather short. Posterior six feet not long, slightly longer from fifth to seventh pair, setæ short, first joint very broad. Second pair of caudal stylets hardly reaching as far as first.

Plate 66, fig. 2 *a*, animal, enlarged; *b*, mandible, in a position not showing the molar prominence; *c*, maxilla of first pair; *d*, *ibid.* of second; *e*, maxillipeds.

Island of San Lorenzo, Peru; among sea-weed along the sea-shore.

Length, five to six lines. Colour, violet or violet-brown. The head but little longer than following segment. Caudal segment half as long as posterior caudal stylets, bifid, and very moveable. Base of inferior antennæ quite slender, and nearly as long as first two joints of superior pair. Joints of flagellum of either pair, a little oblong, setæ few and short. Hand of first pair of feet not twice longer than broad, finger hardly half as long as hand, preceding joint densely hirsute below, not shorter than hand. Hand of second pair more than twice longer than broad, a few short setæ at apex, as well as some slender hairs on inferior side, preceding joint subtriangular, hardly longer than broad, second and third joints slightly oblong, subequal. Third and fourth pairs of legs subequal, about as long as seventh pair, basal joint narrow; fifth pair shortest and basal joint nearly rotund. Inner apex of third joint in last three pairs prolonged and acute; a few short setæ at apex of joints; claw about one-third as long as pre-

ceding joint. First and third pairs of stylets, extend equally far backward, the second pair less far. The mandibles have a three-jointed palpus, and the last joint is falciform and short pectinate on the under side,—a common characteristic of the Gammarii. The appendage to the superior antennæ, if one exists (as we suspect), was overlooked. If absent, the characters are those of an Iphimedia, although more like Gammarus in habit. The maxillipeds are hairy within, and have a long spine or claw at apex. The species is near the *G. brasiliensis* in many characters.

Amphihoe peruviana, DANA, Proc. Amer. Acad. Sci., Boston, ii. 215.

GAMMARUS? PUBESCENS.

Corpus compressum, sparsim pubescens, epimeris sat magnis. Oculi subreniformes. Segmentum corporis caudale brevius, emarginatum. Antennæ 1mæ dimidio corporis longiores, 2dis fere duplo longiores basi vix breviora quam flagellum, articulis primo secundoque subæquis, longis, setis numerosis longiusculis; 2dæ densè hirsutæ, basi 1marum paulo longiores, basi fere duplo longiore quam flagellum. Pedes 1mi parvuli, manu angustâ, supra rectiusculâ, apice angustiore, infra hirsutâ. Manus secunda grandis, oblonga, supra rectiuscula, versus apicem angustans, infra hirsuta et obsolete erosa, palmâ fere longitudinali, non excavatâ, digito mediocri. Pedes 6 postici sat longi, subæqui, setis rigidis, articulo 1mo lato.

Body compressed, sparsely pubescent, epimerals large. Caudal segment small, emarginate. Superior antennæ nearly three-fourths as long as the body, and almost twice as long as the other pair, base hardly shorter than the flagellum, first and second joints subequal, long, setæ numerous, longish; inferior pair densely hirsute, base much longer than flagellum, and shorter than base of superior pair. Anterior feet small, hand narrow, nearly straight above, narrowing towards apex, hirsute below. Hand of second pair oblong, large, of same form as hand of first pair, hirsute below, palm nearly longitudinal, not excavate nor limited by a tooth or spine, finger of moderate length. Six posterior feet rather long, subequal, setæ rigid, first joint broad.

Plate 66, fig. 3 *a*, animal, enlarged; *b*, mandible; *c*, *d*, maxillæ; *e*, maxillipeds; *f*, lip; *g*, anterior feet, more enlarged.

Coral reef of Pitt's Island, the northern of the Kingsmills. Collected, April 30, 1841.

Length, four lines. Greenish or nearly colourless. The third joint of the superior antennæ is half as long as the second. The setæ of the joints of the flagellum are rather longer than the joints. As to the existence of an appendage, we are not certain. The inferior antennæ are little longer than half the superior, the base is about as long as first two joints of the superior. The upper side of this pair, to apex, is densely hirsute; the flagellum is but little longer than the last joint of base. The hand of the first pair of legs is hardly one-fourth the width of the hand of the second, but the form is nearly the same. The second has a few setæ at apex, and at a point above a short distance from the apex; and the finger closes against the under surface, which is a little uneven, and hirsute in tufts. The finger is half as long as the hand; the carpus is acute below, and hardly longer than broad. Third and fourth pairs equal and similar; sixth and seventh pairs about equal, the sixth shorter; there are tufts of short bristles on the edges; the basal joint is large, especially of seventh pair, and serrulate behind. The second pair of stylets extends a little farther back than the first. The third was mutilated in the specimen.

Amphithoe pubescens, DANA, Proc. Amer. Acad. Sci., ii. 214.

GAMMARUS? INDICUS.

Feminæ:—*Epimeræ mediocres*. *Segmentum abdominis quartum posticè acutum*. *Antennæ 1mæ inferioribus duplo longiores, corpore paulo breviores, basi breviorè quam flagellum, articulo primo longiore, setis numerosis breviusculis: 2dæ tenues, basi 1marum paulo longiores, basi vix longiore quam flagellum*. *Manus 1ma 2daque parvæ, oblongæ, supra rectiusculæ, apice angustiores, infra hirsutæ, digito mediocri*. *Pedes 3tii 4tiq̄ue tenues, 5tis vix breviores, 6ti 7miquè subæqui, 5tis longiores, articulo 1mo latissimo, setis brevibus præter apicales longas*. *Styli caudales postici 2dos vix superantes*.

Female.—Epimerals of moderate size. Fourth segment of abdomen acute behind. Superior antennæ twice longer than inferior, a little shorter than the body, base shorter than flagellum, first joint the longest, setæ numerous, rather short; inferior pair slender, but little longer than base of superior pair, base hardly longer than flagellum. Hand of first and second pairs of feet small, oblong, above nearly straight, narrowing to apex, hirsute below, finger of moderate length. Third and fourth pairs of feet slender, hardly shorter than fifth. Sixth and seventh subequal, longer than fifth, first joint very broad, setæ short, excepting the apical, which are long. Posterior stylets hardly extending beyond second pair.

Plate 66, fig. 4 *a*, animal, enlarged; *b*, portion of superior antennæ; *c*, leg of second pair; *d*, extremity of posterior pair.

Shores of a small coral island, in the Balabac Passage, north of Borneo. Collected, February 9, 1842.

Length, four lines. Body moderately slender, naked. Base of inferior antennæ shorter than first two joints of superior pair. Setæ of flagellum of superior pair about as long as joints, those of the inferior side a little the longest. Finger of four anterior feet about half as long as hands, shutting against inferior margin. Basal joint of fifth pair of legs nearly orbicular; setæ of the six posterior legs numerous, and rather long at apex of joints, especially at apex of joint preceding claw; setæ of inner margin in short tufts of three or four to each, not as long as diameter of joint. Caudal stylets rather long, all extend back the same distance.

GENUS MELITA (*Leach.*), *D.*

Epimeræ 5tæ 4tis multo breviores. Styli caudales postici ramo uno elongato alteroque perbrevis vel obsoleto instructi. Antennæ superiores sæpius longiores, non appendiculatæ.

Epimerals of the fifth segment much shorter than those of the fourth. Caudal stylets of third pair having one long branch, and another very small or obsolete. Superior antennæ usually the longer, not appendiculate.

In accepting of Leach's genus *Melita*, we do not include among its characters, that upon which it was especially based by Leach, the peculiarity of the hand, as this cannot be deemed a generic characteristic, unless sustained by other differences. The caudal stylets afford a much more important distinction. In this peculiarity, they are near the genus *Mæra*, of Leach, and would hardly be separated from that group, unless we esteem the absence of an appendage to the superior antennæ a generic distinction. The close similarity of the *Gammarus Dugesii*, Edwards, to the *Melitæ* throws some doubt on this point. Still, for the present, we follow the usual method, and keep them distinct. Leach's species is described as having no such antennary appendage, and we observed none on specimens of the species below, two of which were figured, one a male, the other a female (if not a different species); we have not the specimens for verification. The one supposed to be a female, has the hand of *Melita*, that is, the finger closes upon the lateral surface of the hand; in the other, the hand had the ordinary form, the finger being articulated with the apex, and closing against the inferior margin.

MELITA TENUICORNIS.

Maris:—*Epimeræ latiusculæ. Antennæ tenues; 1mæ dimidio corporis longiores, basi paulo breviorè quam flagellum, articulo secundo valde longiore, flagello terete, setis verticillatis, tenellis, articulos longitudine parce superantibus; 2dæ parce breviores, basi longiore quam flagellum et longiore quam basis 1marum, articulis tertio quartoque subæquis. Manus prima parvula, obovata, margine hirsuta, digito minuto sub apice affixo. Manus secunda oblonga, subelliptica, dorso rectiuscula, infra densè hirsuta, palmâ non excavatâ, digito majusculo. Pedes tertii quartique breves; sex postici subæqui, quinto parce minore, setis brevibus.*

Feminæ?—*Setæ antennarum bene divaricatæ. Manus 2da mediocris, elongato-obovata, apice parce obliqua, digito brevi, in manus superficiem lateralem claudente. Styli caudales 2di breves, postici simplices, elongati, ramo subcylindrico, setis brevibus ornato.*

Male:—*Epimerals rather broad. Antennæ slender; superior pair longer than half the body, base a little shorter than the flagellum,*

second joint much the longest, flagellum terete, setæ verticillate, slender, and slightly longer than the joints; inferior pair a little the shorter, base much longer than flagellum and also exceeding in length the base of the superior pair, third and fourth joints subequal. Hand of first pair very small, obovate, margin hirsute, finger minute, and articulated to the hand below the apex. Hand of second pair oblong, subelliptical, back much flattened, densely hirsute below, palm not excavate, finger rather large. Feet of third and fourth pairs short; posterior six subequal, the fifth pair a little the smallest, setæ short.

Female?—Setæ of antennæ very nearly at right angles with the joints. Hand of second pair of moderate size, long obovate, apex sparingly oblique, finger short, shutting against lateral surface of hand. Stylets of second pair short; posterior pair long, simple, the branch subcylindrical and furnished with short setæ.

Plate 66, fig. 5 *a*, animal (*male*), enlarged; *b*, *c*, maxillæ; *d*, part of flagellum of exterior antennæ; *e*, anterior foot; *f*, part of second pair.—*g*, *female*, enlarged; *h*, part of flagellum of superior antennæ; *i*, *k*, maxillæ; *l*, maxillipeds; *m*, hand of first pair.

Bay of Islands, New Zealand; found along the shores between low and high water level.

Male.—Length, four and a half lines. Second joint of superior antennæ full twice the length of the third. Flagellum evenly terete and joints oblong, the setæ forming a whorl at apex of each joint. Flagellum of inferior pair a little longer than third or fourth basal joint, hairs as in superior pair. Hand of first pair with the apex rounded, not longer than preceding joint, which is a little narrower and is hirsute below. Hand of second pair about twice longer than broad, and having the finger articulated with its apex, the preceding joint transverse, clasping base of hand, yet but little prolonged below and hirsute; the next preceding subtriangular, with the apical the broadest side of the triangle; this side has near centre an angle, and the lower apex is acute. The first joint of fifth pair of feet is rather narrow; of the two following much broader. The first pair of stylets extends a little beyond the second pair. The stylets of the last pair were broken off in the specimen examined.

Female?—Length, four lines. Colour, greenish. The flagellum of the superior antennæ is slender terete and consists of fifteen to twenty oblong joints, which have a whorl of setæ at apex a little longer than the joints, the setæ standing very nearly at right angles with the organ. The inferior antennæ are about three-fourths as long as the superior; the third and fourth joints are long, the third slightly the longer; the flagellum is hardly longer than this joint; the first joint is acute below at apex. The finger of the anterior hands is articulated with the middle of the apical margin, and the hand is naked or nearly so. The hands of the second pair have the apex slightly prominent; the finger is half as long as the hand; the hand is naked. The third and fourth pairs are very slender and about equal. The last pair of stylets is longer than the first, and the second pair is not half as long as either. The maxillipeds terminate as usual in a stout and long spine.

Amphithoe tenuicornis, DANA, Proc. Amer. Acad. Sci., ii, 215, male; *A. (Melita) inequistylis*, D., ibid., 214, female.

GENUS MÆRA (*Leach*), D.

Gammaro Melitæque affinis. Styli caudales postici sæpius valde elongati, ramo uno longo, altero brevissimo vel obsoleto. Epimeræ parvæ. Antennæ Imæ appendiculatæ.

Near *Gammarus* and *Melita*. Caudal stylets of last pair usually much elongate, one branch long, the other very short or obsolete. Epimerals small. Superior antennæ appendiculate.

The males in *Mæra* of Leach, as this genus is characterized by him, have one hand very much larger than the other. We do not regard this character as the prominent distinction, and adopt another one pertaining to the stylets.

In each of the three species here mentioned, the first four or five joints of the abdomen have the posterior margin more or less dentate.

MÆRA VALIDA.

Gracilis, epimeris angustis. Oculi rotundati. Antennæ tenuissimæ;

Imæ corporis longitudine, basi vix breviorè quam flagellum, articulo secundo valde longiore quam primus, appendice brevi, 3-5-articulatâ; 2dæ paulo breviores, basi parce longiore quam basis 1marum, flagello dimidio breviorè. Pedes antici parvuli; secundi paris manus dextra validissima, basi latè rotundata, apice superno non prominente, rectangulato, digito immobili longo, crasso; manus sinistra parvula, ciliata, angusta, acuminata. Pedes 6 postici subsetosi. Styli posteriores longissimi, setulosi, primis vel secundis fere duplo longiores.

Slender, epimerals narrow. Eyes round. Antennæ very slender; superior as long as body, base scarcely shorter than flagellum, second joint much longer than first, appendage short, three to five-jointed; inferior pair a little the shortest, base a little longer than base of superior pair, flagellum half shorter than base. Anterior feet quite small. Right hand of second pair very large, broadly rounded at base, upper apex not projecting, rectangular, immoveable finger long and stout; left hand very small, narrow and narrowing to apex, ciliate. Six posterior feet subsetose. Posterior stylets very long, nearly twice as long as either of the other pairs.

Plate 66, fig. 6 *a*, animal, enlarged; *b*, left hand of second pair; *c*, part of flagellum of superior antennæ.

Singapore; brought up with coral, in ten feet water.

Length, nearly three lines. This species has more slender antennæ than the following; the flagellum of the inferior pair is short; the large hand is very broadly rounded at base; the small hand narrows to apex, instead of being truncate. The setæ of the six posterior legs are in a few uneven tufts, and at apex of joints. The second joint of base of superior antennæ is much more than twice the length of the third. The hairs of the flagellum are as long as three diameters of the organ. The large hand is naked, except one or two minute setæ at the upper apex. The part of the hand with which the finger articulates is not at all raised, and the upper angle of the hand is rectangular. The preceding joint is very narrow and is much prolonged downward, close to the hand; the next preceding is prolonged upward, and also clasps the base of the hand, projecting above the following. The third and fourth pairs of legs are similar, slender, subequal.

G. (Mæra) validus, DANA, Proc. Amer. Acad. Sci., Boston, ii. 212.

MÆRA SETIPES.

Gracilis, epimeris angustis. Oculi rotundati. Antennæ corporis longitudine; 1mæ paulo longiores, basi brevior quam flagellum, articulo secundo parce longiore quam primus, appendice 5-articulatâ; 2dæ basi longiore quam basis 1marum, flagello brevior quam basis. Pedes 1mi parvuli; manus 2da dextra valida subtriangulata, basi angusta, manus sinistra parvula, apice parce latior, paulo obliquè truncata. Pedes sex postici subæqui, sextis parcè longioribus, setis brevibus, articulo tertio posticè serrato.

Slender, epimerals narrow. Eyes round. Antennæ as long as body, the superior a little the longer, base shorter than flagellum, second joint sparingly longer than first, appendage five-jointed; inferior pair with the base longer than base of superior pair, flagellum shorter than base. Anterior feet quite small. Right hand of second pair very large, subtriangular, narrow at base; left hand very small, narrow at base, with an obliquely truncate apex. Six posterior feet subequal, the sixth pair slightly the longest, joints with short setæ, the third joint serrate behind.

Plate 66, fig. 7 *a*, animal, enlarged; *b*, small hand of second pair.

Shores of Harbour of Rio Janeiro, among the sea-weed near the fort, not far from Praya Grande.

Length, four lines. The posterior thoracic segments are longer than the preceding. The first joint of base of the inferior antennæ has a prolonged lower apex, nearly as long as next joint. The small hand of second pair has the truncation of apex but little oblique, and slightly convex. The third joint of six posterior legs is stout, and has three distinct serratures on the posterior margin, where the setæ originate.

G. (Mæra) setipes, DANA, Proc. Amer. Acad. Sci., ii. 213.

MÆRA ANISOCHIR, Krøyer.

Plate 66, fig. 8 *a*, animal, enlarged; *b*, hand of second pair; *c*, leg of first pair in female; *d*, leg of second pair, *ibid.*; *d'*, same, of size to correspond with 8 *a*.

This species, from Rio Janeiro, is very near the *setipes*, but differs in having the setæ or hairs of the legs longer and more slender, and the third joint of the six posterior legs not serrated behind for the setæ; the superior antennæ are rather shorter than the body. Length nearly six lines. Some of the hairs of the six posterior legs are longer than the fourth joint.

Gammarus anisochir, KRÖYER, Tids. [2], i. 283.

G. (Mæra) pilosus, DANA, Proc. Amer. Acad. Sci., ii. 213.

GENUS DERCOTHOE, Dana.

Epimeræ mediocres, 5*tæ* subæquè bilobatæ, 4*tis* vix breviores. *Margo frontis lateralis juxta oculos sæpe valde saliens*. *Styli caudales postici simplicissimi, sat longi, ramo brevi, subconico, apice paulo reflexo e quo spinis duabus brevissimis exsertis*. *Antennæ superiores sæpius longiores, appendiculatæ*.

Epimerals moderately large, fifth nearly equally two-lobed, and hardly shorter than fourth. The lateral margin of the front which bears the eye often very salient. Posterior caudal stylets quite simple, rather long, branch short, with a reflexed apex bearing two very short spines. Superior antennæ usually the longer, appendiculate.

The posterior stylets are like those of *Pyctilus*, and unlike those of any of the preceding genera. The carpus in the legs of the first pair is often as long as the hand, and sometimes longer. The two very short spines at the apex of the posterior stylets are full half as broad as long.

The name of the genus, from *δερκω*, to look, alludes to the projection forward of the eyes on a prominence of the front margin either side of the head,—a frequent, if not universal, characteristic of the species.

DERCOTHOE EMISSITUS.

Corpus gracile. Caput oblongum, lateribus antice valde productum. Antennæ setosæ; 1mæ dimidio corporis vix longiores, articulis 1mo 3tioque subæquis, 2do longiore, flagello non longiore quam basis, fermè 7-articulato, terete, appendice 3-articulatâ; 2dæ breviores, basi vix breviorè quam 1marum basis, articulis 3tio 4toque subæquis, 2do brevi, flagello breviorè quam basis, fermè 7-articulato. Pedes 1mi parvuli, manu perangustâ; 2di validi, manu grandi subovatâ, sparsim setosâ, supra parce arcuatâ, palmâ non excavatâ, setarum fasciculis brevium ornatâ, digito mediocri. Pedes 6 postici sensim increscentes, setis paucis; 5ti 4tis breviores.

Body slender. Head oblong, with an ocular prominence on front margin either side. Antennæ setose; the superior hardly longer than half the body, first and third joints subequal, second longer, flagellum not longer than base, about seven-jointed, appendage three-jointed; inferior shorter, base about as long as base of superior pair, third and fourth joints subequal, second short, flagellum shorter than base, about seven-jointed. Anterior feet quite small, and hand very narrow; second pair strong, the hand large subovate, sparsely setose, above sparingly arcuate, palm not at all excavate, finger half as long as hand. Six posterior feet gradually increase in length, setæ few, the fifth pair shorter than fourth.

Plate 66, fig. 9 *a*, animal, enlarged; *b*, head, more enlarged; *c*, portion of flagellum of superior antennæ; *d*, leg of fourth pair; *e*, ibid. of fifth.

Sooloo Archipelago; in six and a half fathoms water. Collected, February 2, 1842.

Length, four lines. The projection on either side containing the eye is about half as long as first basal joint of superior antennæ. The flagellum of the superior pair consists of oblong terete joints; the setæ of the under side are longest, being three or four times as long as the diameter of the joints; and this is true also of the flagellum of the

inferior pair. The hand of the second pair has the finger folding against the very oblique under margin. There are small tufts of short hairs on inner and lower margin of hand as well as at apex, besides two or three setæ on the back margin. The penult joint is transverse, very narrow and obtuse below, and closely applied to the hand. The preceding is quite small, but a little oblong. The posterior six legs have the first joint subovate, with the posterior margin entire, but one or two minute setæ near apex. The legs are nearly naked. The stylets extend back, nearly the same distance.

Gammarus emissitius, DANA, Proc. Amer. Acad. Sci., ii. 211.

Female of D. emissitius?—Figures 10 *a, b, c, d, e*, Plate 66, represent parts of a female (a specimen with eggs below the venter), which we suspect may be of the above species. This is inferred from its occurrence at the same locality with the *emissitius*, and from the form of the legs of the second pair. Fig. 10 *a*, represents the anterior part of the body; *b*, fourth leg; *c*, part of seventh; *d*, caudal extremity with the three pairs of stylets; *e*, last pair in profile. The eye-projection of the lateral margin of the head is quite salient, but rounded. The anterior legs have the fourth joint as broad as the fifth and twice as long; it is broadest at middle and narrows regularly (not with a curve) towards base and apex, the under side being low triangulate, and the upper slightly arcuate. The fifth joint is narrow at base, and gradually widens, being also widest near middle or beyond it; the lower margin is rounded, the upper nearly straight. The lower side of both joints is hirsute. The finger is short, and the palm (or the margin against which it closes) is oblique transverse, and without any angle or spine at its termination. The leg of the second pair has the fourth joint broad like the fifth, but hardly half as long; the two are articulated with one another by the whole breadth of the extremity of the fourth or base of the fifth. The fifth is quite oblong, and has either margin a little arcuate, the lower the most so; the palm is oblique, and without a limiting angle below. The finger is about one-third as long as the hand. The fourth and fifth joints have tufts of setæ below, but none hardly as long as the breadth of the joints. The setæ of the following legs are few and short, hardly as long as breadth of fifth joint, and they are very slender. The third joint of the third or fourth pair is narrow. The caudal stylets have somewhat lamellar

branches; those of the first pair are a little unequal, the outer branch being the longer, and having three unequal stoutish setæ at apex and two near the inner margin, the shorter having a longish seta at apex; the branches of the second pair are subequal, with two or three unequal setæ at apex. The last pair has two or three spines on side of basal part, and none on the branch except the apical spines. The inner margin of the outer branch of the first pair of stylets is very minutely serrulate, and both margins of the inner branch, as well as inner margin of base.

The first joint of the last six pairs of legs is very broad, that of the fifth pair as broad nearly as long.

DERCOTHOE SPECULANS.

Gracilis; epimeris minoribus, margine sparsim ciliatis. Caput parce oblongum. Antennæ subæquæ, infra setosæ, dimidio corporis longiores, flagellis non longioribus quam bases, teretibus, articulis oblongis; 1marum articuli 2dus 3tiusque subæqui, 1mus brevior; 2darum articulus 4tus 3tio longior. Pedes 1mi 2dis paulo minores, manu carpoque simul sumtis ellipticis, et infra hirsutis, manu vix oblongâ, parce brevioribus quam carpus. Pedes 2di validi, manu angustè subellipticâ, infra supraque arcuatâ, apice basique angustâ, palmâ non excavatâ, hirsutâ, carpo triangulato, infra manum tenuiter producto, hirsuto, processu ad manum non appresso, digito longiusculo. Pedes 3tii 4tique æqui, breves, articulo 1mo fere rotundato; 5ti 4tis vix longiores; 4 postici subæqui, 7mis longioribus, articulo 1mo oblongo, setis sparsis.

Slender; epimerals small, margin sparsely hairy. Head slightly oblong. Antennæ subequal, longer than half the body, setose below, flagella not longer than the base, terete, joints oblong, second and third joints of superior pair subequal, the first shorter; fourth of inferior pair longer than third. Anterior feet but little smaller than second pair, the hand and carpus taken together elliptical in outline and below hirsute, the hand hardly oblong, slightly shorter than carpus. Second pair large, hand narrow subelliptical, above and below arcuate, at apex and base narrow, palm not excavate, hirsute, carpus subtriangular, slenderly produced below the hand, but process not appressed to hand, finger rather long. Third and

fourth pairs of legs equal, first joint nearly round; fifth pair scarcely longer than fourth; sixth and seventh long and subequal, the seventh somewhat the longest, first joint oblong, setæ few.

Plate 67, fig. 1 *a*, animal, enlarged; *b*, part of flagellum of superior pair; *c*, ibid. of inferior pair; *d*, side view of head; *e*, extremity of third or fourth pair of legs; *f*, caudal stylet of last pair; *g*, leg of second pair; *h*, mandible.

Sooloo Archipelago; dredged up in six and a half fathoms, February 2, 1842.

This species has some resemblance to the *D. emissitius*, from the same locality. But they differ in the four anterior legs, the two pairs of hands being peculiar in form, and nearly alike in size. The finger of the first pair of legs is about as long as the fifth joint, and this joint is but little longer than broad. The superior antennæ are about three-fifths as long as the body, and the inferior are of the same length, though having a longer base. The third and fourth pairs of legs are peculiar in having the basal joint nearly circular, and broader than the same joint in the following three pairs, which is oblong. The first pair of stylets extends beyond the apex of the second, and the second beyond the third. The eye projects nearly half the length of the first joint of the superior antennæ. The appendage to the superior antennæ was overlooked (if one exists), when the drawings were made in the Sooloo Sea; the specimens are now mutilated in this part.

Amphithoe peculiarans (by mistake for *specularans*), DANA, Proc. Amer. Acad. Sci., ii. 213.

DERCOTHOE? HIRSUTICORNIS.

Feminæ:—*Epimeræ sat magnæ*. *Caput lateribus anticè valde productum*. *Antennæ infra bene setosæ; 1mæ dimidio corporis breviores, flagello basin longitudine fere æquante, articulo basis primo vix brevior quam tertius, appendice 3-articulatâ; 2dæ paulo breviores, articulis basalibus quatuor subæquis, 4to longiore, 1mo brevior, flagello brevior quam basis. Pedes 4 antici parvuli, 4ti 3tiis crassiores; 6 postici sensim increscentes, setis brevibus, sparsis.*

Female:—Epimerals rather large. Head with each side in front produced into a prominence containing the eyes. Antennæ with rather long setæ arranged along the lower side; the superior not half as long as body, first joint of base not longer than third, flagellum nearly as long as the base, appendage three-jointed; inferior pair shorter, four basal joints subequal (the last longest, and the first shortest), flagellum shorter than base. Four anterior feet small; fourth stouter than third; three posterior pairs gradually increasing in length, setæ short, few.

Plate 67, fig. 2, animal, enlarged.

From the Island Enchados, Bay of Rio Janeiro, Brazil; found among the Serpulas of the shores.

Length, three to four lines. Colour, transverse bands of yellow and black or brownish black. The projection containing the eyes is two-thirds as long as the first basal joint of the superior antennæ. The first basal joint of the inferior antennæ has the lower apex prolonged and acute, the process being nearly as long as second joint. The second pair of stylets extends a little farther back than the first or third, branches of first pair a little shorter than base. The first joint of the legs of the fifth and sixth pairs is very broad, and nearly circular in form; that in the seventh pair is narrower. The tarsi are all short. The specimen appeared to contain eggs along the venter.

Gammarus hirsuticornis, DANA, Proc. Amer. Acad. Sci. Boston, ii. 210.

GENUS PYCTILUS, Dana.

Epimeræ sat breves. Pedes 1mi 2dique prehensiles, reliqui non prehensiles, secundarum digito 2-articulato, manu 1-articulatâ. Antennæ elongatæ, secundæ subtus primas affixæ. Styli caudales postici ac in Dercothoe.

Epimerals of moderate size. First and second pairs of feet prehensile, the rest not prehensile, finger of second pair two-jointed, hand one-jointed. Antennæ elongate; second pair inserted below the first. Caudal stylets as in *Dercothoe*.

The genus is near *Erichthonius* (Edwards), if not identical with it. The stress which is laid by M. Edwards on the rudimentary character of the epimerals of the anterior thoracic segments, and his reference of his species to the Corophidæ or gressorial Amphipods, lead us to doubt the identity. The posterior stylets have the same form as in *Dercythoe*, and the form of the head, the projecting eyes, and general habit, are nearly as in that genus. The approximation is so close, that the genera are evidently of one and the same group; we have no evidence in the antennæ, caudal stylets, or legs, that the species in any case are gressorial. The antennæ are slender, with long flagella. The epimerals are broader than in some Gammari. The caudal stylets are rather long.

Krøyer observes that a species of *Erichthonius* is male of a *Podocerus*, the *Podocerus* being the female form. If this be a fact, the *Erichthonii* are quite distinct from the *Pyctili*. For a female *Pyctilus*, bearing eggs, has been observed by the author, which has the same form of hands as is characteristic of the group *Erichthonius*. Moreover, the posterior caudal stylets of *Pyctilus* are unlike those of *Podocerus* and any related genus. The form in *Erichthonius* has not been particularly described.

In this genus as well as the preceding, the first joint of the legs of the fifth and sixth pairs is very broad, while that of the seventh is narrow.

The name of the genus *Pyctilus* is from *πυκτης*, a *boxer*, and alludes to the very large and well-formed hands of the species.

PYCTILUS MACRODACTYLUS.

Corpus gracile, epimeris mediocribus, capite oblongo, fronte laterali saliente. Antennæ elongatæ: 2dæ corpore breviores, articulis tertio quartoque subæquis, longis, flagello paulo brevioribus quam basis, fermè 10-articulato, setis perbreuibus. Pedes antici parvuli, manu carpoque simul sumtis angusto-ellipticis, breviter hirsutis, manu brevioribus quam carpus, digito parvo. Manus secunda validissima, paulo <-forma, digito immobili valde elongato, simplice, acuto, manu ultra hujus digiti basin elongate productâ, digito mobili longiore quam manus, articulis ejus elongatis, subæquis, intus sparsim et breviter hirsutis. Pedes 3tii 4tisque subæqui. Pedes 6 postici sensim incrementos, articulo quinti paris primo postice acutè producto.

Body rather slender, epimerals of moderate size; head oblong, the front margin of either side with a projection, containing the eye. Antennæ elongate, inferior pair shorter than the body, third and fourth joints long, subequal, flagellum a little shorter than base, about ten-jointed, setæ very short. Anterior feet small, the hand and carpus together narrow elliptical in outline, short hirsute, finger small. Hand of second pair very stout, <-shape, the immoveable finger being very much elongate, simple, and pointed, and the hand projecting very far beyond its base, moveable finger very long, longer than hand, the joints nearly equal in length, and sparsely short hirsute. Third and fourth pairs of feet subequal; fifth pair with first joint having a narrow acute prolongation behind.

Plate 67, fig. 3 *a*, animal, enlarged; *b*, hand of first pair of feet; *c*, hand of second pair.

East Indies, in the Sooloo Sea.

The large hand of this species with the closed finger is about as long as the head and three anterior thoracic segments. The immoveable finger is rather longer than the part of the hand projecting beyond its base. The moveable finger is twice as long as the other, and when closed, the apex of its first joint reaches to apex of immoveable finger, and the whole of the second joint extends back along the length of the immoveable finger. The setæ within are in a few tufts. The two hands of this second pair are equal.

The superior antennæ have the second joint of base longest. [The flagellum was mutilated in the specimen examined.] The base of the inferior pair much exceeds in length the base of the superior. The epimerals have the margins rounded. The first joint of fifth pair of legs has a tooth-like projection to posterior margin: this pair is about half as long as seventh pair. There are but few setæ.

Erichthonius? macrodactylus, DANA, Proc. Amer. Acad. Sci., Boston, ii. 218.

PYCTILUS PUGNAX.

Antennæ 1mæ basi flagellum longitudine fere æquante. Manus secunda validissima oblonga, marginibus parallelis, digito immobili brevi, et

apice bi-dentato, manu ultra hujus digiti basin parce productâ; digito elongato, articulo primo paulo longiore, intus parce eroso et sparsim breviterque setuloso.

Superior antennæ having the base about as long as the flagellum.

Hand of second pair of feet very large, oblong, dorsal and inferior margins parallel, thumb short and bi-dentate at apex, hand produced but little beyond base of this finger; finger very long, the first joint the longer, sparingly erose within, and bearing a few minute and short setæ.

Plate 67, fig. 4 *a*, hand of second pair, enlarged; *b*, part of mandible, in one view; *c*, caudal extremity of body; *d*, caudal stylet of last pair, in profile.

Same locality as last.

The moveable finger in this species is five or six times as long as the immoveable finger, and has a bi-dentate apex; the immoveable finger is not half as long as the distance from its base to the articulation of the hand with the carpus. The finger closes up nearly as in the preceding. There are a few short setæ upon the outside of the immoveable finger. The mandible has a three-jointed palpus, the last joint of which bears a few short, scattered hairs. The stylets of the first pair extend beyond the others; the outer branch is narrow lamellar, with three or four unequal setæ at apex, and one or two a little distance back; the inner branch is slender styliform, and has a single longish seta or spine at the extremity. The second and third pairs are subequal, the third the shorter and much stouter at base. There is a very short caudal segment (seventh abdominal) which has its medial portion protuberant and of a triangular form, the parts outside of this with a few very short stiff hairs. The form of the first joint of the fifth pair of legs is the same as in the *macrodactylus*.

Erichthonius pugnaz, DANA, Proc. Amer. Acad. Sci., Boston, ii. 213.

PYCTILUS BRASILIENSIS.

Feminæ:—*Epimeræ sat breves. Margo capitis lateralis saliens. Pedes*

antici majusculi, articulis 4to 5toque latis simulque sumtis elongato-ellipticis et infra hirsutis, 4to paulo longiore, apice inferiore rotundato, 5to parce oblongo, digito paulo brevior quam articulus 5tus (manus). Pedes 2di validissimi, manu (articulo 4to) crassissima, oblonga, digito immobili crasso, sat brevi (dimidio articuli 5ti brevior), bidentato, extremitate manus ultra hujus digiti basin non producta, articulo 5to percrasso, fere duplo longiore quam 6tus, infra multo piloso, pilis latitudine articuli non brevioribus. Pedes 5ti sat breves, pilis longiusculis, paucis, articulo 1mo fere orbiculari; 7mi articulo 1mo angusto.

Epimerals of moderate size. Lateral margin of head salient. Feet of first pair rather large, fourth and fifth joints broad, and taken together oblong oval, below hirsute, fourth joint a little the longer, rounded at lower apex, fifth a little oblong, finger a little shorter than fifth joint (hand). Feet of second pair very stout, the hand (fourth joint) very large, oblong, immoveable finger stout, rather short, bidentate, the extremity of the hand not extended beyond base of this finger, fifth joint thick, nearly twice as long as the sixth, below much hirsute, hairs as long as breadth of joint. Feet of fifth pair rather short, first joint nearly orbicular, hairs longish, few; first joint of seventh pair narrow.

Plate 67, fig. 5 *a*, part of body, enlarged; *b*, leg of first pair; *c*, *ibid.* of second pair; *d*, *ibid.* of fifth pair; *e*, *ibid.* of seventh pair; *f*, caudal extremity; *g*, stylet of second pair; *h*, *ibid.* of last pair, more enlarged.

Dredged with the anchor in the harbour of Rio Janeiro.

Length, three lines. The epimerals of the thorax are distinct, and the second and third are nearly as long (vertically) as broad. The finger of the first pair of legs is fine serrulate within, and at apex of hand there are hairs as long as the finger. The finger of the second pair has some hairs near its extremity, which are as long almost as the finger. The fifth joint, where it articulates with the hand, is more than half the breadth of the hand. The six posterior legs have longish hairs towards apex of joints, with some others on the inner margin, which are quite short. The tarsi have no seta below towards apex. The branches of the first pair of stylets have about four short, stoutish setae on the margin, besides the apical.

SUBTRIBE III. HYPERIDEA.

THE Hyperidea are oceanic species, and are mostly found remote from the land. They seldom have the body much compressed, and the epimerals are small. The variations they present have much wider limits than among the Gammaridea. In the latter, the head is almost identical throughout the groups, in general form as well as type; while, in the Hyperidea, this segment takes many shapes, among the species, and may even have a beak as long as the body. There is also a much greater diversity among the legs than occurs in other Amphipods. The five posterior pairs may be slender, and of the ordinary unguiculate character, or hands of strange shapes may be developed on either of these pairs excepting the last; or, again, the last three pairs of legs may be obsolescent, except the basal joint, which is extraordinarily enlarged, so as to become a kind of operculum for covering the venter. The abdomen also has its modifications: for besides the ordinary character, it possesses the power, in some species, of folding itself up against the venter, and acting unitedly with the operculiform basal joints of the three posterior pairs of legs, it closes up the under surface of the body, making it like a box, with every limb shut up within. The antennæ have, too, their diversities. The superior pair may be either obsolescent, or much elongated; and the inferior pair, although ordinarily extended in the usual manner, are sometimes folded up, and thus concealed either side of the head. The stylets are usually lamellar, and sometimes quite broad.

The large eyes are the most striking feature in the animals. They may cover with facets the whole head, with, perhaps, only a narrow medial line bare; and, in one genus, the rounded mass of pigment makes one large eye within. In some of the Hyperidea, there appear to be two spots of pigment, of different colour, either side of the middle, as in the *Anchylomera purpurea*, which has one mass of red, and another of green (fig. 9, Plate 68), the former narrow and acuminate below, the latter broad ovoidal.

The Hyperidea are, therefore, those species among the Amphipoda, in which nature indulges in her widest diversities of development, just as with the Maioids and Leucosoids among the Brachyura; and, on

the contrary, the Gammaridea, in analogy with the Cancroids, have a staid, uniform habit and structure. And we observe also, that the species are more numerous among the Gammaridea and Cancroids, than among the Hyperidea and Maioids or Leucosoids.

Many of the diversities mentioned are of subordinate importance in classification, as they do not affect the general grade or habits of the species. The distinction between the species which have the second pair of antennæ extended, and those with these organs folded up and concealed either side of the head or thorax—a characteristic nowhere else observed among Amphipods—is of high importance. The enlargement, also, of the first or second of the three posterior pairs of legs, and its modification so as to give one or both of them the power of grasping, bestow upon such species a character and habit quite diverse from those in which these legs are slender, vergiform, and unguiculate in the usual way. These legs appear to be used for grasping in coition. In consideration of these differences, we distribute the Hyperidea into three families.

Fam. I. HYPERIDÆ.—Antennæ 2dæ exsertæ. Abdomen in ventrem se non flectens. Pedes 5ti 6ti 7mique formâ longitudineque mediocres, 5tis 6tisve non percrassis nec prehensilibus.

Fam. II. PHRONIMIDÆ.—Antennæ 2dæ exsertæ. Abdomen in ventrem se non flectens. Pedes 5ti 6tive sive crassi sive elongati, sæpius prehensiles, quoque 3tii 4tique sæpe prehensiles.

Fam. III. TYPHIDÆ.—Antennæ 2dæ sub capite thoraceve celatæ et sæpius replicatæ. Abdomen in ventrem sæpe se flectens. Pedes 6 postici interdum abbreviati, articulo 1mo operculiformi, interdum longitudine mediocres.

The two families, Hyperidæ and Phronimidæ, correspond to the Hypérines Ordinaires, of Edwards (Crust., iii. 74), and the Phronimadæ, of Gray (Cat. Brit. Crust. Brit. Mus., p. 56); the Typhidæ to the Hypérines Anormales of Edwards (Crust. iii. 94), or Typhidæ, of Gray (Cat. Brit., etc.), and the Vibilinæ, to the Hypérines Gammaroides, of Edwards (Crust., iii. 72).

FAMILY I. HYPERIDÆ.

THE Hyperidæ pertain to three subfamilies:—one having the body Gammaroid in form, and the maxillipeds with a short palpus; in the others, the maxillipeds are wholly without a palpus; one has the body stout and tumid, and the mandibular palpus slender; another has the body more slender or narrow, and the mandibular palpus very broad and short. In the two former, the masses of pigments in the head are two or four in number; in the last, as far as observed, there is but a single mass.

The species in this family differ widely in the development of the antennæ, the superior pair being sometimes obsolescent, and often both pairs short, while sometimes each has a long slender flagellum exceeding the body in length. Species having a long flagellum when adults, are sometimes wholly destitute of the flagellum before reaching maturity.

These subfamilies and their genera may be distinguished as follows:—

SUBFAM. 1. VIBILINÆ. — Corpus formâ paulo Gammaroideum. Caput oculique mediocres. Maxillipedes palpo parvulo instructi. Palpus mandibularis tenuis.

G. 1. VIBILIA, *Edw.*—Antennæ quatuor breves, 1mæ obtusæ. Pedes 1mi 2dique subprehensiles.

SUBFAM. 2. HYPERINÆ. — Caput tumidum. Oculi pergrandes. Palpus mandibularis tenuis.

1. *Antennæ sive 1mæ sive 2dæ flagello longo confectæ.*

G. 1. LESTRIGONUS, *Edw.*—Antennæ 1mæ 2dæque flagello longo confectæ. Pedes 1mi 2dique paulo prehensiles.

G. 2. TYRO, *Edw.*—Antennæ 1mæ flagello longo confectæ; 2dæ perbreves, flagello nullo.

2. *Antennæ totæ breves. Caput oculique pergrandes.*

G. 3. HYPERIA, *Latr.* — Antennæ 1mæ 2dæque conspicuæ, 2dis gracilioribus.

- Pedes 2di sæpiusque 1mi subprehensiles, manibus multum imperfectis, articulo 4to ad apicem inferiorem paulo producto tantum.
- G. 4. METÆCUS, *Kröyer*.—*Hypericæ* affinis. Pedes 1mi 2dique perbreves, manibus melioribus didactylis bene confecti.
- G. 5. TAURIA, *Dana*.—Antennæ ac in *Hyperidæ*. Pedes 2di non prehensiles, articulo 4to apice inferiore non expanso nec producto; 7mi vix abbreviati.
- G. 6. CYLLOPUS, *Dana*. *Tauriæ* affinis. Pedes 7mi valde abbreviati vel rudimentarii. Antennæ 1mæ et 2dæ ad basin inter se remotæ.
- G. 7. DAIRA, *Edw*.—Antennæ 1mæ non conspicuæ, 2dæ exsertæ. Pedes 1mi 2dique plus minusve prehensiles: tarsi pedum reliquorum breves. Rami styliorum caudalium longi.
- G. 8. CYSTISOMA, *Guérin*.*—Antennis pedibusque 1mis *Dairæ* affine. Tarsi prælongi. Styli caudales longi, ramis brevibus.

SUBFAM. 3. SYNOPINÆ. — Corpus gracilius. Palpus mandibularis sat brevis, latissimus. Oculi grandes.

- G. 1. SYNOPIA, *Dana*.—Caput subtriangulatum, non oblongum. Pigmentum oculorum unicum. Pedes 1mi parvuli, prehensiles, 2di setis longiusculis confecti; 4ti subprehensiles; 5ti 6ti 7mique subæqui.

SUBFAMILY HYPERINÆ.

The large head, in this group, covered with facets and often nearly filled with the pigments of the eyes, give a wild aspect to the species, which is further enhanced by their ordinary attitude and motions—the head inclining downward upon the anterior legs, and the animal swimming with a diving motion and with great rapidity.

GENUS LESTRIGONUS, *Edwards*.

The thorax in this genus is short and tumid; often the first segment is more or less concealed, and the following two or three are quite short. The head is large and rounded, but usually obliquely truncated in front, about the base of the antennæ. Nearly the whole is covered with hexagonal facets, and the pigment constitutes a large

* *Guérin*, *Rev. Zool.*, i. 1842, p. 214. The species *C. neptunus* is three and half inches long.

dark-coloured mass, about half as long as the height of the head. The upper antennæ have the base rather stout and geniculated at the second articulation; the part of the base beyond is ciliate on the lower side. The flagella of both pairs of antennæ are long and very slender. The abdomen consists of seven segments; but the last three are more or less soldered together, being marked in outline by sutures. Of the three pairs of stylets, the first and third extend about equally far backward, while the second pair falls short of this distance. The six posterior legs are slender and subequal, and end in a slender claw; the third and fourth pairs are equally slender and subequal; the first and second are much the smallest.

These animals move with very quick motion, with head down, turning over and over.

LESTRIGONUS FERUS.

Thorax tumidus, segmentis anticis paulo indistinctis. Caput fronte rotundatum. Antennæ fermè corporis longitudine, 1mæ paulo breviores. Pedes 6 postici subæqui, coxâ ad apicem rotundatâ, ungue dimidii tarsi longitudine.

Thorax tumid, anterior segments indistinct. Head rounded in front and hardly flattened. Antennæ about as long as body, upper a little the shorter. Six posterior feet subequal, coxa rounded at apex, claw half as long as tarsus.

Plate 67, fig. 6 *a*, animal, enlarged; *b*, abdomen, side view; *c*, base of superior antennæ; *d*, exterior maxillipeds.

Atlantic; latitude 2° north to 1° south, longitude 18° to 17° west. Collected, 5 A. M., October 30, 1838; and also, November 3d and 5th.

Length, one-eighth inch. Colour, brownish, or brownish red in irregular spots, partly colourless; basal joints of six posterior legs, brownish red. Head about one-third of whole cephalothorax. Pigment of eye, deep brownish red, nearly black. Third joint of base of inferior antennæ oblong, two preceding short. First pair of legs smaller than second pair. Ciliæ of natatory legs as long as the lamellæ to which they are attached.

Figure 7, Plate 67, represents a young individual probably of the preceding species. The head is larger in proportion, and but one pair of antennæ could be distinguished; these were short, and had a styliform termination, which was shorter than cephalothorax, straight and acute. Length, one-eighth of an inch. Colours, as in the preceding. Taken the following day, October 31, 1838.

LESTRIGONUS FUSCUS.

Thorax 7-articulatus, segmento primo fere celato. Abdominis segmentum ultimum suturâ discretum, penultimo dimidio angustius. Antennæ Imæ corporis longitudine, 2dæ valde longiores; basi ad apicem inferiorem acuto. Coxa pedum 6 posteriorum apice obtusa et unguis dimidio tarsi brevior. Pedes 5ti 6tis 7misve paulo longiores.

Thorax seven-jointed, first segment nearly concealed. Seventh segment of abdomen separated by a suture from preceding, half narrower than the sixth. Superior antennæ as long as the body, inferior one-fourth longer, inferior apex of basal portion acute. Coxa of six posterior feet obtuse at apex, and claw less than half the tarsus in length. Feet of fifth pair longer than sixth or seventh.

Plate 67, fig. 8 *a*, animal, enlarged; *b*, base of superior antennæ; *c*, extremity of abdomen, excepting first pair of stylets.

Atlantic; latitude 1° south, longitude 17° to 18° west. Collected at 4 A. M., November 3d and 5th, 1838.

Length, two lines. Colour, dark reddish brown, pervading whole animal, verging in some parts towards pale reddish; but colour probably not constant. Greatest height of head about twice its length, rounded in front, but profile slightly flattened about the antennary area. Segments of thorax all very narrow, first hardly apparent. Base of inferior antennæ having the last joint longest. Claw of six posterior legs *not* half as long as preceding joint; coxa about as long as width of thorax; fifth joint rather longer than either of the preceding. Ciliæ of natatories about twice as long as the lamellæ. Lamellæ of stylets about one-third their whole length, subcultriform,

acute. Second pair of stylets extend about as far backward as middle of lamellæ of last pair.

LESTRIGONUS RUBESCENS.

Thorax paulo longior, segmento primo fere celato. Caput anticè truncatum. Abdominis segmentum ultimum suturâ discretum, penultimo parce angustius. Antennæ quatuor fere æquæ, corpore paulo longiores; basis antennarum 1marum ad apicem inferiorem non acutus; flagellum fermè 14-articulatum, articulo flagelli primo brevi, sequentibus oblongis. Coxa pedum sex posteriorum ad apicem posticum fere rectangularata et subacuta, et articulus quartus setam antice gerens (pedibus alioque nudis); unguis dimidii tarsi longitudine.

Thorax a little longer than in the preceding, first segment nearly concealed. Head flattened in front. Seventh abdominal segment separated by a suture from the sixth, sparingly narrower. Antennæ four, very nearly equal, a little longer than the body, base of the superior antennæ not acute at lower apex, flagellum about 14-jointed, first joint short, the others oblong. Coxa of six posterior feet nearly rectangular and acute at posterior apex, and fourth joint bearing a seta (these feet elsewhere naked); claw half as long as tarsus.

Plate 67, fig. 9 *a*, animal, enlarged; *b*, extremity of abdomen.

Pacific, lat. 18° south, long. 124° west. Collected several individuals, August 7, 1839.

Length, one-eighth of an inch. Colour, a little reddish in some parts. Coxæ of six posterior legs reddish. First joint of flagellum of superior antennæ not longer than last of base, other joints of flagellum slender, cylindrical. Last (seventh) abdominal segment triangular, obtuse. Two setæ on inferior side of fourth joint of fourth pair of legs. Fifth, sixth, and seventh pairs of legs very nearly equal.

LESTRIGONUS FABREII? *Edwards.*

Plate 67, fig. 10 *a*, animal, much enlarged; *b*, extremity of second pair of legs; *c*, extremity of abdomen, upper view showing stylets; *d*, profile of head, showing mouth organs in lateral view.

Sooloo Sea.

Length, one and a half lines. The specimen here described has many of the characters of the *L. Fabreii*; yet for want of a full description of that species, we cannot pronounce on an identity. The facets cover a very large part of either side of the head. The front of the head in profile is somewhat concave near or below the base of the superior antennæ, but much less so than in Edwards's figure. The four posterior segments of the thorax are distinct, and the first three are coalesced along the back. Antennæ longer than the body; two fringes of hairs on under side of third basal joint of the superior antennæ, very delicate and close; apex of next joint not acute; flagella very slender, consisting of very long joints, excepting part of flagellum of superior pair, near the basal portion of the antennæ; twenty joints or more to the flagellum of this pair. First and second pairs of legs nearly equal, terminating in an imperfect hand, the lower apex of the antepenult joint being prolonged to about half the length of the next joint, which is subcylindrical. Third and fourth pairs equal; seventh pair longer than either of the preceding; these legs naked, and without a longish seta on fourth joint, as in the *rubescens*; tarsus about one-third the length of the preceding joint. Basal joint in fifth, sixth, and seventh pairs narrow, rounded or obtuse at apex. Caudal segment of abdomen about half as wide as preceding, and nearly half as long as posterior caudal stylets, exclusive of the two terminal lamellæ. Posterior caudal stylets rather broad, the lamellæ equal, broad oval-lanceolate, about one-third as long as basal portion.

According to Milne Edwards, the legs of the first pair in the *Fabreii* are cylindrical, and differ from those of the second pair; but we suspect that this form was observed in consequence of the leg being turned with the upper margin to the eye. This is the natural position both of the first and second pairs, in a side view of the animal,

and when so situated, the projecting process (thumb-like) of the antepenultimate joint is not seen.

GENUS HYPERIA, *Latreille*.

The Hyperiæ occur principally in the colder temperate and frigid zones. The species have usually a tumid cephalothorax, rounded above; but, in one species, it is much compressed, and rises above to an edge. The four anterior thoracic legs are much shorter than in the others, and the second pair with usually the first, is subprehensile. This prehensile character is produced by a prolongation of the lower apex of the fourth joint, the fifth and sixth constituting the moveable finger. This finger, exclusive of the claw, or sixth joint, is commonly much longer than the process against which it plays; yet the transition appears to be so gradual to species in which the finger is short, and the hand well formed, that we have doubted the propriety of sustaining the genus *Metæcus*, of Kröyer, based on this distinction,—that is, on having well-formed hands terminating the second pair of feet. In our *Hyperia trigona*, the legs of the first pair are not at all prehensile, the lower apex of the fourth joint not projecting.

HYPERIA AGILIS.

Caput mediocre, pigmentis oculorum angustis. Thorax longus, epimeris totis brevibus, truncatis. Antennæ longiusculæ, dimidii thoracis longitudine, subæquæ; 2dæ parce longiores, 3-articulatæ, non teretes, articulo ultimo longo et remotè pubescente, interdum obsolete articulatæ; 1mæ 5-articulatæ, articulo 4to crasso longoque et infra ciliato, ultimo minuto. Pedes 4 antici subæqui, coxis angustis; 6 postici mediocres, setis brevibus et paucis.

Head of moderate size, pigment of eyes much smaller than usual. Thorax long, all the epimerals short, truncate. Antennæ rather long (half as long as thorax), subequal; inferior slightly the longest, three-jointed, not terete, last joint long, and remotely hairy; superior five-jointed, fourth joint stout, long, ciliate below, the last minute. Four anterior feet subequal, coxæ narrow; six posterior of moderate length, setæ short and few.

Plate 67, fig. 11 *a*, animal, enlarged; *b*, front view of head; *c*, inferior antennæ; *d*, extremity of leg of seventh pair, from New Zealand specimen.

In the Pacific, latitude 41° south, longitude 76° 25' west. Collected several specimens, April 5, 1839, some of which were in the water-cavity of Salpas; also between New Zealand and New Holland.

Length, three to four lines. Colour, mostly dirty purple, with purplish red in basal joints of legs.

The seven thoracic segments about equal. First three abdominal segments with the posterior angle on either side of each, prominent and acute. In front view of the head, the antennary area is large, nearly square, and the pigment occupies nearly all the space on the side of it. This pigment was black.

The inferior antennæ have two short basal joints, and then a long, compressed, subulate joint, which is a little hairy.

The four anterior legs have the last three joints, or the terminal portion straight, and apparently admitting of upward flexion alone; they terminate in a nearly straight spine.

While swimming, the legs are generally folded up across the venter; it swims by means of the abdominal legs, and the extremity of the abdomen.

HYPERIA TRIGONA.

Corpus valde compressum, dorso acie instructo. Antennæ capite longiores, 1mæ subulatæ, 2dæ longæ (segmentum thoracis 4tum fere attingentes), gracillimæ, flagello inconspicuè articulado. Pedes brevissime setulosi, 6 posticis longis, subæquis, 7mis parce brevioribus, articulo 4to 3tiorum 4torumve lato.

Body very much compressed, the back rising to an edge. Antennæ longer than the head; superior pair subulate, inferior long (reaching nearly to fourth thoracic segment), very slender, flagellum indistinctly jointed. Feet very short setulose; six posterior pairs long and subequal, the seventh pair a little the shortest; fourth joint of third or fourth pair rather broad.

Plate 67, fig. 12 *a*, animal, enlarged; *b*, outline section of thorax; *c*, outer maxillipeds; *d*, leg of first pair; *e*, leg of second pair; *f*, same, in oblique under view; *g*, part of leg of fourth pair; *h*, *ibid.* of fifth pair; *i*, extremity of abdomen, upper view; *k*, last pair of stylets.

Probably from the Lagulhas Bank, near Cape Horn.

Length, six to eight lines. The thin body, narrow triangular in its section, and sharp-backed, is unlike that of any *Hyperia* described. About fourteen indistinct joints may be counted in the flagellum of the inferior antennæ. The first pair of legs terminates in a small claw, and is not at all prehensile; the third joint is rectangular at lower apex. The second pair has a process to lower apex of fourth joint, nearly three-fourths as long as the finger (or fifth joint); along the back of the fifth joint, there are four or five short hairs, or pairs of hairs. The fourth joint of the fourth pair is more than twice the width of the fifth joint; and both joints, besides four to seven short hairs (not longer than diameter of fifth joint), have on the lower side exceedingly minute spinules, closely set, seen only with a high magnifier. The fifth joint of the legs of the fifth pair, has six or seven pairs of short hairs on lower margin, not longer than diameter of joint. The caudal stylets have the lamellæ of each unequal, the shorter nearly two-thirds as long as the longer, and both pointed.

GENUS TAURIA, Dana.

Antennæ quatuor breves, basi approximatae, 1mæ crassiusculæ. Pedes nulli subcheliformes nec subprehensiles, 7mi vix abbreviati.

Antennæ four, short, approximate at base, superior rather stout. Feet not subcheliform nor subprehensile, seventh pair hardly abbreviated.

TAURIA MACROCEPHALA.

Caput permagnum, oculorum pigmentis fere repletum. Thorax brevis et crassus, epimerâ quartâ margine productâ et acutâ, 3tiâ 2dâ 1mâ truncatis. Antennæ breves, altitudine capitis duplo breviores, subæquæ,

extremitate multiarticulatæ, subulatæ. Pedes antici bene pubescentes, breviores, articulo quarto lato, plus duplo longiore quam tertius et quintum longitudine valde superante, ungue minuto; decem postici subæqui, nudi. Styli caudales longi, 1mi apicem ultimorum fere attingentes, secundi breviores, apicem basis ultimorum attingentes.

Head very large and nearly filled with the pigment of the eyes. Thorax short and stout, the fourth epimerals produced below and acute, first, second, and third truncate. Antennæ short (hardly as long as half the height of head), subequal, subulate, extremity multiarticulate. Anterior feet shortest, quite pubescent, fourth joint broad, more than twice as long as the third, and much longer than fifth, the claw minute; ten posterior legs subequal and naked. Caudal stylets long, the first pair reaching very nearly to apex of last, the second pair only to apex of base of last.

Plate 68, fig. 2 *a*, animal, enlarged; *b*, same, natural size; *c*, antennæ, as they project from the head; *d*, extremity of leg of first pair, much enlarged; *e*, *ibid.* of second pair.

Antarctic Seas; taken from the cavity of a Medusa, near longitude 157° east, and latitude 66° south.

Length, nine lines. The height of the head is greater than half the length of the thorax. The antennary area on the front of the head is small, not half the height of the front. The epimerals are small, and excepting the fourth are truncate. The antennæ are short, and the subulate extremity is very closely multiarticulate. The four anterior feet have broad lamellar coxæ; the next two joints are small, and have not a projecting lower apex; the last joint and claw together are hardly as long as the fourth joint. The six posterior legs are nearly naked and rather short.

GENUS CYLLOPUS, *Dana*.

Tauriæ affinis. Pedes 7mi valde abbreviati. Antennæ 1mæ et 2dæ ad basin inter se remotæ.

Near *Tauria*. Feet of seventh pair nearly rudimentary. Antennæ of first and second pairs remote at base.

CYLOPUS MAGELLANICUS.

Caput subrotundatum, pigmentis fere repletum. Thorax elongatus, epimeris quartis grandioribus. Antennæ 1mæ summo fronte capitis insitæ, crassiusculæ, acuminatæ, infra ciliatæ, duobus articulis apicalibus minutis; 2dæ imâ parte capitis insitæ, tenues, 7-articulatæ. Pedes quatuor antici, teretes (coxa exceptâ); pedes 3tii 4tique paulo crassiores, 5ti 6tique longi, tenues, nudi, articulis quarto quintoque infra subtilissimè serrulatis; 7mi rudimentarii.

Head nearly round, and almost filled with the pigment. Thorax elongate, epimerals of fourth pair largest. Superior antennæ proceeding from upper part of head, and inferior from the lowest part; the former having the fourth joint long acuminate and ciliate below, and following this, two minute joints; the latter slender, seven-jointed. Two anterior feet terete (coxa excepted); third and fourth pairs a little stouter than four following; fifth and sixth long and slender, and having the fourth and fifth joints very delicately serrulate within; seventh pair rudimentary.

Plate 68, fig. 1 *a*, animal, enlarged; *b*, superior antenna; *c*, inferior antenna; *d*, mandible; *e*, maxilliped; *f*, leg of sixth pair, with branchia; *g*, extremity of abdomen, with stylets.

Orange Bay, Tierra del Fuego, on the *Fucus*. Collected, February 18, 1839.

Length, four lines. Nearly colourless; a little red in the abdominal joints and abdominal legs; pigment of eyes, black in the mass, but when pressed out, a deep reddish purple. The thorax has the fourth and fifth segments longest. The lateral margins of the three anterior abdominal segments serrulate, rounded; of fourth abdominal segment pointed. The superior antennæ are acuminate, and a little shorter than the inferior. The inferior has the articulation between

the third and fourth joints oblique, the fourth joint longer than third, fifth the longest joint, sixth and seventh short and equal. The mandible has a lateral process for manducation, which has a spinose surface, and the palpus is slender, three-jointed, the second joint longest, the third a little shorter, the first quite short. Four anterior feet have a short, nearly straight claw, the two joints preceding the claw subequal in first pair, but in second pair the first of the two much the longest. The third and fourth pairs of legs are much longer than the preceding and nearly equal. The tarsus of fifth and sixth pairs is nearly twice as long as preceding joint. Basal joint of fifth and sixth pairs oblong, finely serrulate on anterior margin. The branches of the caudal stylets are lanceolate; in the first pair they are rather longer than basal portion, and in the third shorter.

The great distance between the two pairs of antennæ at base is a very striking peculiarity.

GENUS DAIRA, *Edwards.*

DAIRA? DEBILIS.

Caput latere visum paululo oblongum et subtriangulatum, anticè obtusum, pigmento fere repletum. Thorax medio altior. Antennæ infra insitæ, breves, 5-7-articulatæ, articulis totis brevibus. Pedes 4 antici parvuli; manu paris secundi non oblongâ, infra subtiliter serrulatâ, apice inferiore producto, triangulato, acuto, carpo parce minore, non transverso, digito infra subtiliter setuloso. Pedes tertii quartique longi, subæqui, sequentibus vix breviores; quinti sextique subæqui; septimi abbreviati, coxâ mediocri, parte reliquâ vix longiore; unguibus brevissimi.

Head in profile a little oblong and subtriangular, obtuse in front, nearly filled with the pigment of the eyes. Thorax highest at middle. Antennæ inserted in lower side of head, short, five to seven-jointed, joints all short. Four anterior feet quite small; hand of second pair not oblong, finely serrulate below, lower apex produced and triangular, acute, carpus hardly smaller and not transverse, finger on inner side minutely setulose; third and fourth pairs of feet subequal, scarcely shorter than following pairs; fifth and

sixth pairs subequal; seventh very short, the coxa of moderate size, the following part but slightly longer.

Plate 68, fig. 3 *a*, animal, enlarged; *b*, under view of head; *c*, antenna; *d*, second pair of feet; *e*, termination of fourth pair; *f*, fourth pair; *g*, extremity of abdomen.

In the Pacific, latitude 2° south, longitude 175° west. Collected, March 30th, 1841, attached to Medusæ.

Length, three lines. The shape of the head is peculiar; it narrows forward to a rounded-obtuse front, as seen in profile. The antennæ are much shorter than the head, and project from its under surface; there are a few short setæ on outer side near middle. The setæ of the legs are all short, much less than the diameter of the joints, and the claws also are very short. The four anterior legs are but little more than half the length of the third and fourth pairs. The last abdominal segment is very small, short ovate, and the preceding is subquadrate, with the sides excavate. The stylets have lanceolate extremities, and the second pair extend hardly as far back as the extremity of the abdomen. The last pair has the branches much unequal, the inner nearly half the longer.

DAIRA ? DEPRESSA.

Corpus depressum, latum. Caput lateraliter supernèque visum transversum, hemisphericum. Thoracis segmenta subæqua. Antennæ duæ parvulæ, 4-articulatæ, articulo tertio longiore quam secundus. Pedes toti fere nudi; 4 antici parvi; secundi paris manus paulo transversa, infra serrulata, apice inferiore non prominente; paris manus primi subquadrata, infra serrulata, apice inferiore triangulatè producta, margine palmæ integro. Pedes secundi tertiique longiores subæqui; quinti sextique subæqui, coxis latis; septimi parvuli, coxâ multo brevior, valde angustâ, parte reliquâ minutâ (dimidio brevior quam coxa).

Body depressed, broad. Head seen in profile or from above, transverse, hemispherical. Segments of thorax subequal. Antennæ

two, very small, four-jointed, third joint longer than second. Feet all nearly naked, four anterior small; hand of second pair transverse, serrulate below, lower angle not prominent; hand of first pair serrulate below, nearly square, with the lower angle triangularly prolonged, palm entire. Second and third pairs longer, subequal; fifth and sixth subequal, coxæ broad; seventh small, coxa much shorter and very narrow, the following part minute (half shorter than coxa).

Plate 68, fig. 4 *a*, animal, enlarged; *b*, dorsal view; *c*, antenna; *d*, first pair of feet; *e*, second pair; *f*, termination of sixth pair; *g*, termination of abdomen; *h*, liver glands.

Fifteen miles west of Savaii, one of the Samoan Group, March 5th, 1841.

Length, three lines. Colour, yellowish. Posterior angles of abdominal segments obtuse. Sixth segment abruptly smaller near apex, and terminating in a small obtuse extremity corresponding to the seventh segment. All the stylets extend beyond the apex of the abdomen; the second pair very little the shortest. Antennæ very small, hardly one-fourth as long as the height of the head. Apical joint minute and terminating in a very short seta.

The hands of the four anterior feet have a few serrulations on the lower margin of the hand, but none on the palm, and are without setæ. The next four legs are nearly twice longer; the next four longer than the preceding. Seventh pair with the coxa about half as long as coxa of sixth pair, and hardly half as wide. The fifth joint of sixth pair is minutely serrulate along inner margin.

The liver glands (*h*) are oblong, and are attached to each side of the intestine, below the stomach.

DAIRA INÆQUIPES.

Caput subrotundatum. Thorax 7-articulatus, segmento primo brevior.
Antennæ parvæ, 5-articulatæ, supra parce brevissimeque setulosæ.
Pedes 4 antici parvuli; manus paris secundi subtriangulata, digito immobili late triangulato, intus et extus acutè serrato. Pedes tertii

quartique paulo majores, tenues. Pedes quinti longiusculi; sexti multo breviores, coxá latá, ellipticá, parte reliquá parce longiore; septimi parvi, coxá paulo minore, parte reliquá breviorē quam coxa.

Head subrotund. Thorax seven-jointed, first segment shortest. Antennæ small, five-jointed, upper side sparingly and very short setulose. Four anterior feet quite small; hand of second pair subtriangular, immoveable finger triangular, acutely serrate within and without. Third and fourth pairs a little larger, slender; fifth pair rather long; sixth much shorter, coxa broad, elliptical, the remaining part but little longer than coxa; seventh pair small, the coxa much smaller than coxa of preceding pair, and the following part shorter than coxa.

Plate 68, fig. 5 *a*, animal, enlarged; *b*, antenna; *c*, hand of second pair.

Off south end of Mindoro, January 24, 1842.

Length, two lines. The third joint of the antenna is longer than second or fourth; the terminal is short spiniform.

SUBFAMILY SYNOPINÆ.

GENUS SYNOPIA.

Frons subacutus. Antennæ 4 longæ, apertæ, 1mæ appendiculatæ. Pedes 2 antici subcheliformes; proximi duo vergiformes, quatuor sequentes subprehensiles, digito 2-articulato; reliqui mediocres, unguiculati.

Front subacute. The four antennæ long, and not concealed. Two anterior feet subcheliform; next two vergiform; next four subprehensile, finger two-jointed; remaining of moderate size, unguiculate.

These animals have compressed bodies like the Gammaridea, and a narrow head, a large part of which is covered with facets pertaining to a single large compound eye, almost or quite as broad as the head.

The head is narrow triangular and subacute in front. The thorax has the seven segments distinct and nearly equal. The three ante-

rior abdominal segments are quite large, and are much prolonged on either side, and the following are successively and rapidly smaller. There is a small seventh segment at the extremity. The six caudal stylets are very slender, more as in the Gammaridæ than in most Hyperidæ.

The inferior antennæ are the longest in the species examined. The superior have a short appendage to base. The bases in each pair are rather slender, and the flagellum terete and multiarticulate.

The legs from the second pair to the seventh inclusive have a branchial sac and a fouette. The first pair terminates in an imperfect hand of small size. The second pair is vergiform, and has a few longish setæ at apex; the fourth joint is furnished on the under side with rather long bent setæ, and appear as if they served for prehension in some way, in connexion with the terminal part of the leg. The third pair is smaller than the fourth, and is hardly prehensile. The fourth has the third and fourth joints broad, and the fourth seems to act as a hand, the fifth and a minute claw constituting a finger. The six posterior legs are vergiform and have broad coxæ.

The species are of a bright purplish blue colour, or nearly colourless. They occur sparingly in the tropical part of both the Pacific and Atlantic Oceans.

SYNOPIA ULTRAMARINA.

Caput compressum, anticè triangulatum, lateribus capitis ad frontem inter sese divaricatis 50°–60°. Antennæ 1mæ dimidio breviores, flagello ad basin setoso; 2dæ fere corporis longitudine. Pedes 8 antici infra ciliati; primi minores, articulo tertio parvulo, 4to lato et oblongo, manu breviter obovatâ; secundi tenues, setis duabus longiusculis confecti; quarti crassiusculi et tertiis crassiores, articulo quarto lato, paulo oblongo, ad apicem obliquo, digito brevi; 6 postici subæqui, remotè breviter setigeri, coxis paris quinti sextive latis, subrotundatis, paris septimi angustioribus et posticè ad apicem triangulatè productis et subacutis. Styli caudales tenues, 2di breviores.

Body compressed, triangulate in front, sides of the head diverging at an angle of 50° or 60°. Superior antennæ half the shorter, flagel-

lum setose at base; the inferior nearly as long as the body and very slender. Anterior eight feet ciliate below; the first pair smallest, third joint hardly longer than second, fourth broad and oblong, hand small and nearly obovate, finger minute; second pair slender, ending in two rather long setæ; fourth rather stout, stouter than third, fourth joint broad and a little oblong, oblique at apex, finger short; six posterior pairs nearly equal, setæ few and short, coxæ of fifth and sixth pairs broad, roundish, of seventh pair narrower, and apex behind triangulately prolonged, subacute. Caudal stylets slender, the intermediate pair shortest.

Plate 68, fig. 6 *a*, animal, enlarged; *b*, *b'*, different views of mandible; *c*, first pair of legs; *d*, second pair, with branchia and fouette; *e*, third pair, with the same, and also the epimeral; *f*, fourth pair, with same and epimeral; *g*, fifth pair, with same and epimeral; *h*, seventh pair, with branchia alone.

Atlantic, latitude 8° – 12° south, longitude 11° – $14\frac{1}{2}^{\circ}$ west; collected, May 5th to 9th, 1842; also, latitude 4° – 7° south, longitude 21° – 25° west; November 7th and 8th, 1838, 4 A.M.

Length, one-sixth to one-twelfth of an inch. Colour, rich blue, to nearly colourless with a tinge of rich blue along the venter or about the articulations. The specimen here described has the back of the thorax very slightly convex in a profile view. The head in the same position is very obliquely truncate, and the antennæ proceed from a small excavation at its lower angle. The eye occupies the whole breadth of the triangular head (as seen from above), and the facets are in a continuous surface; the pigment is round-elliptical in form.

The antennæ are very unequal in length. The superior are about half the shorter, and are much less than half the length of the body. They have a five-jointed flagellum, which is more than twice as long as the base; the first joint of this flagellum is much the longest and is hairy above. The appendage to this pair is about as long as this joint and is faintly three-jointed. The inferior pair has the base much longer than the base of the superior, and about half as long as the flagellum. The penult basal joint is much the longest, and the preceding one is as long as the last. The flagellum is very slender terete, and consists of about fourteen oblong joints.

In the first pair of feet, the short spatulate or obovate hand is about half the length of the preceding joint. The finger is a small claw, and applies against the rounded terminal margin. The ciliæ of the fourth joint are curved at apex.

The second pair has attached at base a branchia and a fouette, and these parts pertain also to all the following pairs, excepting the last, which wants the fouette, though having the branchia. The fifth joint of the second pair is shorter than the fourth and rather slender. The setæ of the fourth have a curved form, and appear as if they might be used, in connexion with the following part of the leg, for prehension.

The third pair has the third and fourth joints subequal, the former a little the larger, and the finger is slender, with a short claw, the whole about as long as the hand.

In the fourth pair the third joint is broad triangular and shorter than the fourth; the fourth is truncate at apex a little obliquely, and is rounded at the lower angle. The finger is sparingly longer than the oblique terminal margin; the claw is very short.

The fifth pair has a rotund coxa, and the third, fourth, and fifth joints are subequal. The claw is nearly half the length of the preceding joint.

In the seventh pair the coxa is straight along the anterior side and prolonged at apex behind.

The branchiæ are oblong sublinear, except for the last legs, which are obovate. The mandibles are like those of the Gammaridæ. The apex is denticulate, and there is a large molar prominence, with a tuft of short setæ above. The palpus is three-jointed; the first and third joints are quite small and subequal, the second is very large and broad, nearly circular. There are two setæ at apex, and two on the inner margin of second joint towards apex.

The abdominal natatories have the basal portion very large and truncate at apex. The stylets are long and slender. The first and third pairs are longer than the second, and the first extends nearly as far back as the last. They consist of a basal portion, and two terminal styliform branches, each acute at apex. The basal part of the first pair is as long as the terminal; but in the last pair it is about half as long as the terminal.

Figure 7, Plate 68, probably represents the male of the preceding,

with which it was found; *a*, the animal, enlarged; *b*, upper view of head and eye; *c*, basal portions of antennæ; *d*, terminal stylets; *e*, one of the first pair of stylets.

Length, one-sixth of an inch. Colour, more or less entirely ultramarine. The body is more slender than in the *ultramarina* above described, and has no convexity along the back, the dorsal line of thorax, as seen in profile, being straight, or even concave. The excavation in the lower part of the head, from which the antennæ proceed, is very large, being as broad as the part of the head immediately above. The thorax consists of seven segments, of which the first is shortest. The epimerals were not distinguished. The superior antennæ are sparingly shorter than the inferior; the inferior but little shorter than the body; flagellum of the inferior pair scabrous. The blue colour was deepest along the venter. The four anterior legs, and the base of the superior antennæ, had the same rich blue colour.

Under the idea that this was a distinct species (which it may still be), I had named it *Synopia gracilis* in my original manuscript.

SYNOPIA ANGUSTIFRONS.

S. ultramarinae similis. Caput angustius, ejus lateribus inter sese 40°-45° divaricatis. Antennæ 2dæ corpore breviores, flagello 10-articulato, articulis tenuibus, cylindricis; 1mæ basi inferiorum paululo longiores, flagello 5-articulato. Pars quarti manus ad dorsum recta, infra arcuata; digito tenui, articulis duobus subæquis.

Similar to the *S. ultramarina*. Head much narrower, the sides of the same converging forward at an angle of 40° to 45°. Inferior antennæ considerably shorter than the body, flagellum 10-jointed, joints slender, cylindrical; superior pair but a little longer than base of inferior, flagellum five-jointed. Hand of fourth pair straight along the back, and arcuate on the opposite margin, finger slender, consisting of two nearly equal joints.

Plate 68, fig. 8 *a*, animal, enlarged; *b*, upper view of head; *c*, superior antennæ; *d*, second pair of legs.

Pacific, latitude 18° south, longitude 122° west. Collected, August 6, 1839, at 5 A.M.

Length, one-eighth of an inch. Colour, intense blue, with a barely perceptible tinge of red.

The rows of facets of the eyes cross at right angles, and, therefore, are not hexagonal; they are round, however, instead of square, the interstitial spaces being occupied by a grayish cellular substance. The whole number of facets between forty and fifty.

The inferior antennæ about three-fourths as long as the body. The last two joints of base of superior are equal. Appendage to superior pair short and three-jointed, as in preceding species. The second pair of legs is slender, the joints cylindrical; the third and fourth pairs terminate in a moveable finger formed of the last two joints. Last three pairs very nearly equal, the sixth a little the longest, claw nearly straight.

A longitudinal vessel was observed in the thorax, along the back, which from its pulsations was evidently the heart.

The general form of this species is like that of the *S. ultramarina*, but the head is sharp and narrower, and the second pair of legs differs in its articulations, as well as the antennæ. The drawing represents the coxa of fifth pair of legs about half as broad as the same in sixth pair. The coxa of the seventh pair is similar to that of the *ultramarina*.

FAMILY II. PHRONIMIDÆ.

THERE is a wide diversity among the legs of the last three pairs in the Phronimidæ. The fifth may have a stout, well-formed hand, while the two following pairs have the usual unguiculate character;—or the hand may consist of a long, slender style, which has the power of folding against the two preceding joints, one or both of which is also elongated;—or the fifth pair may be very long and slender, without the power of prehension, while the sixth pair is unusually large

and stout, and although not properly prehensile, for it has no proper hand, its size fits it for prehension (or clasping in coition), and it is, probably, so used,—whence the propriety of placing the species with the Phronimidæ. The legs of the third and fourth pairs are usually prehensile.

The included genera and subfamilies are as follows:—

SUBFAM. 1. PHRONIMINÆ.—Abdomen versus basin sat gracile. Pedes 5ti magnâ manu didactylâ vel monodactylâ confecti, 3tii 4ti extremitate graciles, non prehensiles. [Antennæ breves.]

G. 1. PHRONIMA, *Latr.*—Manus pedis 5ti didactylæ. Segmentum thoracis 1mum oblongum.

G. 2. PRIMNO, *Guérin.*—Manus pedis 5ti monodactylæ. Segmentum thoracis 1mum non oblongum.

SUBFAM. 2. PHROSININÆ.—Abdomen versus basin sat crassum. Pedes 5ti prehensiles, monodactyli; quoque 3tii 4tique prehensiles. [Antennæ sat breves.]

1. *Manus pedis 5ti latæ, digito arcuato.*

G. 1. ANCHYLOMERA, *Edw.**—Manus pedis 5ti latè et crassè subtriangulatæ. Pedes 6ti non prehensiles.

G. 2. PHROSINA, *Risso.†*—Manus pedis 5ti latæ, oblongæ. Pedes 6ti prehensiles, 5tis fere similes, minores. Mandibulæ non palpigeræ.

2. *Manus pedis 5ti elongatè lineares, digito recto, longissimo, tenui.*

G. 3. THEMISTO, *Guérin.*—Pedes 3tii 4tique prehensiles, manibus latis.

SUBFAM. 3. PHORCINÆ.—Pedes 5ti 6tive valde elongati et crassi, sed manu non confecti. [Antennæ breves.]

G. 1. PHORCUS, *Edw.*—Pedes 1mi 2di 3tii 4tique graciles, unguiculati, 5ti 6tique prælongi, 5ti aciculares, 6ti crassissimi.

* *Hieraconyx*, *Guérin.*

† *Dactylocera*, *Latreille.*

SUBFAMILY PHRONIMINÆ.

GENUS PHRONIMA.

PHRONIMA ATLANTICA, *Guérin*.

Atlantic, latitude 7° or 8° north, and longitude about 24° west.

The figure of Guérin represents our specimens correctly in most respects. The moveable finger of the large hand has a low tooth on its inner side, one-third of the distance from its base to its apex; and the immoveable finger is longer, with a prominent angle near the articulation with the moveable finger.

GUÉRIN, *Iconogr. Crust.*, pl. 25, f. 41, and *Magasin Zool.*, 1836, pl. 8, f. 1.

SUBFAMILY PHROSININÆ.

GENUS ANCHYLOMERA, *Edw.*

ANCHYLOMERA PURPUREA.

Antennæ 4 corpore longiores. Manus tertia quartaque subtriangulatæ, digito immobili tertice brevissimo, acuto, quartæ elongato et tenui, digitis mobilibus (ungue excluso) palmâ paulo longioribus, ungue longiusculo. Pedes quinti maximi; coxâ oblongâ pentagonâ, versus extremitatem angustiore (articulum sequentem parce superante), integrâ, marginibus paulo excavatâ; manu oblongâ triangulatâ, intus dentatâ, digito (ungue excluso) manu parce longiore, ungue longo. Pedes 6ti longi, articulo 4to elongatè subcylindrico; coxâ apice acutâ et angulo basali postico rotundatâ. Pedes septimi debiles, coxâ parce longiore quam pars reliqua. Lamellæ caudales latè ellipticæ, nudæ.

Four antennæ about as long as body. Hands of third and fourth pairs subtriangular, third with an acute point as an immoveable

finger, fourth with this finger elongate and slender, moveable finger (without the claw) a little longer than the surface on which it closes, claw rather long. Feet of fifth pair very large, coxa oblong, pentagonal, with sides a little concave, narrowed towards apex, where it is but little wider than next joint, hand oblong, triangular, straight and dentate within, finger (claw excluded) longer than the hand, claw rather long. Sixth pair of feet long, fourth joint rather long subcylindrical, coxa acute at apex and posterior basal angle rounded. Seventh pair weak, coxa a little longer than the following part.

Plate 68, fig. 9 *a*, animal, enlarged; *b*, front view of head; *c*, inner maxillæ; *d*, second maxillæ; *e*, base of superior antennæ; *f*, base of inferior antennæ; *g*, first pair of feet; *h*, second pair of feet; *i*, third pair of feet; *k*, fourth pair; *l*, abdominal leg; *m*, extremity of abdomen.

Atlantic, latitude 27° south, longitude 45° 10' west, off the Brazilian coast. Collected, January 11, 1839, at 4 A. M.

Length, two lines. Colour, mostly purple, with some brown. Head subtruncate in front. Antennary area quadrate, height half the height of head; rest of the head covered with facets. There are four masses of pigment. In a front view, two of a crimson colour have a narrow lanceolate form, being rounded above and coming to an acute point below, each side of the antennary area. Just exterior to this pair, there is a second, of a green colour and subtriangular form, presenting bright metallic reflections in certain lights. In a lateral view the green area is in part projected upon the red one. I did not ascertain beyond doubt that both pairs were spots of pigment.

The thoracic segments are seven in number; but the first is nearly concealed under the second. The whole length of the thorax is less than that of the abdomen. Last segment of thorax a little longer than the preceding. Last abdominal segment broad triangular, obtuse. Preceding segment very short.

Mouth organs constitute a large triangular prominence below the head, a front view of which is seen in figure 9 *b*. The maxillæ are represented in figures 9 *c*, *d*. The outer terminates in two narrow imperfectly ciliated ensiform laminæ, and within, there is an oblong

process, stout and subcorneous, forming an elongate apex to the basal portion. The inner pair have a two-jointed base, bearing an inner oblong lamella sharply dentated along an oblique summit, and also a two-jointed branch, the second joint of which is the longer, and has a few slender short spines at apex.

The antennæ are very long, the superior rather longer than the body, and the inferior somewhat longer than the superior. The superior have a three-jointed base, with a flagellum which is very long and slender. The base is geniculate at the first articulation. The third joint is longest, and has a prominent ridge below, which is densely hairy. The first joints of the flagellum are very short.

The two anterior pairs of legs are similar. Both terminate in an oblong extremity, with a subulate apex, which is most slender and longest in the second pair. Only four joints were distinguished besides the straight claw which forms the apex.

In the third and fourth pairs the claw is more than half the length of the preceding joint, and is but little curved. The fifth and sixth pairs have the second and third joints very short. In the fifth pair, the third is slender and acute behind; the teeth of the hand are six in number and rounded; the claw is about half the preceding joint in length. In the sixth pair, the claw is two-thirds the length of the fifth joint or tarsus, and the fifth joint is shorter than the fourth. In the seventh pair, the coxa is nearly as large as in the sixth pair. The rest of the leg is often concealed by being thrown up against the surface of the coxa. The second joint is short; the third long and slender; fourth short; fifth still shorter and rounded. The abdominal legs consist of a broad nearly quadrate base, and two lanceolate terminations. The latter are finely lined transversely, and are thus divided into ten parts; they are furnished with long ciliæ. The fourth abdominal segment bears a pair of appendages each composed of two oval plates, the inner quite broad; they extend backward beyond the extremity of the abdomen. The appendages to the fifth segment consist each of a single large oval plate, which extends farther than the preceding. None of these plates are ciliated.

This animal darts through the water with extreme rapidity. When at rest, it lies with the six posterior coxæ folded across the venter.

Several individuals were obtained, and one of them, cut open between the third and fourth segments of the thorax, was found to

contain numerous eggs. The eggs were spherical, or nearly so, and within were subdivided into four equal parts.

The spots of red pigment in the head became a dull yellow soon after the death of the animal.

ANCHYLOMERA THYROPODA.

Caput transversum. Antennæ (an adultæ?) brevissimæ flagello carentes. Pedes secundi primis longiores, subulati. Manus tertia quartaque triangulatæ, margine inferiore palmæque subtiliter serrulatis aut spinulosis, digito (ungue excluso) palmâ non longiore. Pedes quinti maximi, coxâ oblongâ, pentagonâ, ad apicem quam articulus sequens parce latiore et integrâ, latere paulo excavatâ; manu oblongâ, triangulatâ, palmâ dentatâ, dente externo parce majore, digito (ungue excluso) multo brevior quam palma. Pedes sexti mediocres, articulis secundo tertio quartoque brevibus, subæquis; septimi obsoleti coxâ laminatâ exceptâ. Lamellæ caudales late ellipticæ, partim ciliatæ.

Head transverse. Antennæ (probably not adult) very short, without a flagellum. Second pair of feet longer than first, subulate. Hand of third and fourth pairs triangulate, inner margin and palm very finely serrulate or spinulous, finger (claw excluded) not longer than palm. Fifth pair of feet very large, coxæ oblong pentagonal, at apex but little wider than preceding joint and entire, sides a little excavate; hand oblong triangular, palm dentate, external tooth little the largest; finger, excluding claw, much shorter than palm. Sixth feet of moderate size, second, third, and fourth joints short, subequal; seventh pair obsolete, excepting coxa. Caudal lamellæ broad elliptical, some of them ciliate, entire.

Plate 68, fig. 10 *a*, animal, enlarged; *b*, front view of head; *c*, antenna; *d*, maxilla; *e*, sixth pair of legs; *f*, seventh pair; *g*, extremity of abdomen.

Atlantic, latitude 39° south, longitude 54° west; January 18, 1839.

Length, one line. Specimen probably not mature, judging from the antennæ, which were without flagella and very short; they were

closely applied to the surface of the head, and curved downward and outward. The first segment of thorax mostly concealed by second; the second segment longer than seventh. The antennary area narrow below and widening a little above. Abdomen terminates in a small triangular obtuse segment. Coxæ of three posterior pairs broad lamellar and often folded over the venter when the animal is at rest. No pediform termination to seventh pair of legs was observed. The proportional length of the joints of the sixth pair of legs is very different from the same in the preceding species.

Eyes, sepia brown. The two masses of pigment, of an oblong subulate form, had a reddish-brown colour, and became ochre-yellow after death. Ciliations of caudal lamellæ plumose; the largest of these lamellæ are not ciliated.

GENUS THEMISTO, Guérin.

THEMISTO ANTARCTICA.

Antennæ 1mæ capite longiores, fere nudæ, 3-articulatæ, articulis duobus basalibus parvulis, tertio longo, acuminato; 2dæ longiores et tenuissimæ, basi 4-articulato, articulis tertio quartoque tenuibus, quarto longiore, flagello articulum quartum paululo superante. Pedes 3ti 4tique prehensiles, manu latâ, triangulato-subovatâ, digito tenui, longiore quam manus, ungue fere recto. Pedes quinti crassiusculi, coxâ longâ, articulis 2 sequentibus brevibus, quarto longo, crasso, quinto longiore quam tres precedentes simul sumti. Pedes sexti septimique subœqui, tenues. Styli caudales longissimi.

Superior antennæ longer than the head, nearly naked, three-jointed, two basal joints small, the third long and acuminate; inferior pair longer and very slender, base four-jointed, third and fourth joints slender, fourth longer, flagellum a little longer than fourth joint. Third and fourth pairs of feet prehensile, hand broad, triangulato-subovate, finger slender, longer than hand, claw nearly straight. Fifth pair rather stout, coxa large, next two joints short, fourth long, stout, fifth longer than three preceding together. Sixth and seventh subequal and slender. Caudal stylets very long.

Plate 69, fig. 1 *a*, animal, enlarged; *b*, front view of head; *c*, superior antennæ; *d*, inferior antennæ; *e*, extremity of abdomen.

Antarctic Seas, latitude 68° south, longitude 94° west.

Length, eight lines. Thoracic segments seven, subequal. Fifth abdominal segment very short. Last segment quite small, triangular. Terminal caudal stylets longest, nearly as long as abdomen, first pair longer than second, but not extending as far back as third pair.

Antennary area rather small, broader above, occupies more than half the height of the head, and less than half its width.

Two anterior pairs of legs are cylindrical towards apex and pointed, fifth joint longer than fourth, and fourth longer than third; at apex a few short setæ. The hand in third and fourth pairs has a few very short setæ on the palm, and the finger one or two minute setæ on the inner side. The long tarsus or finger of fifth pair appeared to have a minute claw at apex. The sixth and seventh pairs are rather long and nearly equal; there are several short spines on inner margin of fourth joint, besides a few on the other joints. The third pair of abdominal legs is smaller than the preceding.

SUBFAMILY PHORCINÆ.

GENUS PHORCUS, *Edwards*.

PHORCUS HYALOCEPHALUS.

Caput fronte rotundatum et proclivum. Segmenta thoracis primum secundumque partim celata. Pedes 3ti 4tique tenues, æqui. Pedes 5ti fere corporis longitudine, articulo ultimo longiore, acuto, quarto brevior quam 3tius. Pedes 6ti elongati, 5tis breviores, articulo 1mo grandi, fere elliptico, 2do parvulo, 3tio subelliptico, ad extremitatem profundè excavato, apice postico acuto anticeque obtuso, 5to parce longiore quam 4tus, intus subtiliter serrulato; ungue brevi. Pedes 7mi tenues, coxâ valde brevior quam pars reliqua.

Head with the front rounded, and front surface oblique downward and outward. First and second segments of thorax nearly concealed. Feet of third and fourth pairs equal, slender. Fifth pair

nearly as long as body, last joint longest, acute, fourth shorter than third. Sixth pair long, but shorter than fifth, first joint large and nearly elliptical, second small, third large subelliptical, with the outer extremity deeply excavate (for articulation with next joint), posterior apex acute, anterior obtuse, fifth joint a little longer than fourth, and inner margin minutely serrulate, claw short. Seventh pair slender, the coxa much shorter than the following part.

Plate 69, fig. 2 *a*, animal, enlarged; *b*, anterior antenna; *c*, extremity of abdomen.

Atlantic, latitude 1° south, longitude 18° 20' west. Collected, November 5, 1838, at 4 A. M.

Length, two lines. Mostly colourless, excepting a few brownish spots, and a black spot at base of each of the ten posterior thoracic legs. Head placed obliquely, so that the buccal extremity is thrown somewhat forward; the whole covered with facets. Pigment of eyes angular in form, upper line straight and nearly horizontal, the whole situated low in the head, appearing just above the mouth. Anterior antennæ with a stout oval base, which is three-jointed, the last joint having five transverse lines or articulations, hirsute about apex, and a lateral appendage, which is quite small and three-jointed. Only five joints of the thorax are distinct, and these are nearly of equal length (the posterior slightly longest); only one was observed anterior to these, and this was partly concealed at its upper part, beneath the third segment; it appeared to correspond to first and second segments.

The anterior feet are a little shorter than second pair, and the claws turn downward, and the third and fourth pairs are much longer than second. The fifth is very slender and has an acicular extremity. The fourth and fifth joints of sixth pair are subcylindrical, and the claw is hardly a fourth as long as preceding joint. Seventh pair has the fourth joint longest. Abdomen five-jointed, the last oblong, broad, compressed, truncated at apex, and having an indistinct suture near base; bears second and third pairs of stylets. Stylets extend about equally far backward, last pair attached to apex of last abdominal segment, and having basal portion very short, not oblong; branches of stylets finely serrulated at one or both margins. In second pair of stylets the branches are a little shorter than basal portion.

This species has most of the characters mentioned for *M. Edwards's Phorcus Raynaudii*: but, he observes, that the antennæ are "un peu renflées vers le milieu;" while, in this species, the basal portion is stout ellipsoidal. Moreover, he states, that the second thoracic ring is very much developed, and the fifth pair of legs is shorter than the sixth.

FAMILY TYPHIDÆ.

THE peculiar character of the outer antennæ of the Typhidæ—their being folded up and concealed beneath the head or thorax—is considered a character of higher value than the flexing of the abdomen against the venter, which is observed in some of the species, although the latter produces striking peculiarities in the form and habits of the species. The antennæ are organs high in rank, from their connexion with the senses; and hence, a peculiarity of structure in them, prevailing through a group of species, is entitled to prominent consideration. On the contrary, this power of flexing the abdomen to the venter is deemed of small importance among the Oniscidæ and Spheromidæ, and does not even authorize in the latter case a subfamily division. The transitions, moreover, among the species which have the peculiarity alluded to and those without it, are very gradual. The species are, therefore, here retained in a single family, although the extreme forms are very diverse.

The subfamilies and genera of Typhidæ, are as follows:

SUBFAM. 1. TYPHINÆ.—Abdomen in ventrem se flectens.

- G. 1. *DITHYRUS*, *Dana*.—Pedes 5ti 6tique articulo 1mo latè lamellati, articulis reliquis omnino obsoletis. Antennæ 2dæ breves, sub capite celatæ, non replicatæ, articulo 1mo longiore quam 2dus.
- G. 2. *TYPHIS*, *Risso*.—Pedes 5ti 6tique articulo 1mo late lamellati, articulis reliquis paulo abbreviatis. Antennæ 2dæ biplicatæ, articulo 1mo longiore quam 2dus.
- G. 3. *THYROPUS*, *Dana*.—Pedes 5ti 6tique articulo 1mo late lamellati, articulis reliquis paulo abbreviatis. Antennæ 2dæ 4-5-plicatæ, sub thoracis latere celatæ, articulo 1mo multo brevior quam 2dus.

SUBFAM. 2. PRONONINÆ. — Abdomen in ventrem se non flectens. Caput non oblongum, antennis in capitis frontem insitis.

G. 1. PRONOE, *Guérin*.—Pedes 2di non prehensiles. Pedum 6 posticorum articuli 1mi lati, reliquâ parte paris 7mi fere obsoletâ.

G. 2. LYCÆA, *Dana*.—Pedes 1mi 2dique subchelati. Articuli pedum 6 posticorum 1mi angusti, subæqui, reliquâ parte paris 7mi paulo abbreviatâ.

SUBFAM. 3. OXYCEPHALINÆ.—Abdomen in ventrem se non flectens. Caput oblongum, antennis 1mis superficiem capitis inferiorem insitis.

G. 1. OXYCEPHALUS, *Edw.*—Caput breviter acuminatum. Styli caudales longitudine mediocres.

G. 2. RHABDOSOMA, *White*.—Caput rostro longo styliformi armatum. Styli caudales valde elongati.

SUBFAMILY TYPHINÆ.

GENUS DITHYRUS, *Dana*.

Abdomen ad ventrem optimè claudens. Caput transversum, pigmentis non grandibus. Antennæ 2dæ sub capite celatæ, breves, non replicatæ. Pedes 6 postici coxis latissimè clypeati, parte pedum reliquâ obsoletâ. Pedes 4 antici subcheliformes. Abdomen 5-articulatum, segmento ultimo triangulato.

Abdomen shutting well upon the venter. Head transverse, pigments not large. Posterior antennæ concealed beneath the sides of the head, not folded. Six posterior feet reduced to mere coxæ, which are very broad clypeate. Four anterior feet subcheliform. Abdomen five-jointed, last segment triangular.

This genus is peculiar in having the six posterior legs reduced to mere coxæ, which are broad plates adapted to close over the whole venter from the head some distance backward, and fitting well together. This leaves a triangular opening behind, which is filled by the abdomen, making as tight and neat a box as any work of art. The abdomen, unlike that of *Thyropus*, is shorter than the thorax, it

being fitted to fill (on closing up) only the space behind left by the clypeate coxæ.

There are two masses of pigment, which are of moderate size. The thorax is distinctly seven-jointed. The last abdominal segment carries the posterior stylets upon its under surface, as in the preceding genus, and they are short. The other abdominal legs are very broad, and the two branches are broad ovate.

When the animal is closed up, it has the appearance of a short bean. A large cavity is contained over the venter, which is filled with water, and serves to sustain the animal a long time when out of its element.

DITHYRUS FABA.

Caput transversum, tumidum, fronte rotundatum, pigmentis duobus, non grandibus. Antennæ 2dæ tenues, rectæ, 4-articulatæ, articulo 1mo longiore, articulis 2do 3tioque subæquis, quarto brevioribus. Coxa quinta apice valde obliquè truncata, acuta, margine postico arcuato; sexta duplo majore, lunato-ovata, apice obtusa, margine postico omnino arcuato, et antico æque excavato; septima parvula, tenuis, subensiformis. Segmentum abdominis ultimum triangulatum, lateribus prope apicem obsolete excavatum, apice subacuto. Styli postici inferiores, ramis valde inæquis, basi non longioribus.

Head transverse, tumid, rounded in front, pigments two, not large.

Posterior antennæ slender, straight, four-jointed, first joint longest, second and third about equal, fourth shortest. Coxa of fifth pair with a very oblique truncation of extremity, and apex acute, posterior margin arcuate; of sixth pair twice larger, obtuse at apex, ovato-lunate, posterior margin arcuate throughout, and anterior equally excavate; of seventh pair small and slender, subensiform. Last segment of abdomen triangular, sides towards apex obsolete excavate, apex subacute. Posterior stylets articulated with under surface of segment, branches very unequal, not longer than base.

Plate 69, fig. 3 *a*, oblique dorsal view of animal, closed up; *b*, ventral view, abdomen thrown back; *c*, ventral view of thorax (part of organs omitted), and showing three posterior coxæ of one side thrown

open; *d*, front view of head; *e*, antennæ; *f*, maxillipeds; *g*, first pair of feet; *h*, second pair of feet; *i*, one of third or fourth pairs; *k*, pair of natatory abdominal appendages; *l*, last abdominal segment, with second and third pairs of stylets; *m*, first pair of stylets.

Taken from the stomach of a Bonito, caught off the Canaries, September 27, 1838.

Length, when closed up, four lines; when extended, about six lines. All the organs of motion and manducation are concealed when the animal is not in motion. The coxal plates have motion back and forth, as well as laterally; and by retracting them a little, the animal exposes its mouth, and is also enabled to thrust out its legs to secure its prey. The head, in a front view, has a semicircular outline, with the lower side -shape. The thorax is broad and convex; the first two segments are each nearly half shorter than the following. The epimerals are narrow and distinct.

The exterior antennæ are inserted just below the eye, and lie along a narrow channel directed towards the beak.

The mouth is closed by small lamellar maxillipeds (fig. 3*f*).

The four anterior legs have a small hand, with the inner angle (corresponding to an immoveable finger) elongate and acute. The moveable finger is oblong, but, excluding the claw, does not exceed the other in length; the claw is quite short, and the fingers are very finely serrulate. The third joint is as broad as the hand, but not oblong; the preceding is half smaller; the first is oblong, nearly equaling the rest of the leg in length.

The legs of the third and fourth pairs are longer and more slender, and vergiform. The second joint is small and short (hardly oblong); the following three are each between two and three times the length of the second; the last terminates in a short, straight claw. The third pair is a little longer than the fourth.

The six anterior abdominal legs have the lamellæ ovate in form and ciliate (fig. 3*k*); these lamellæ are transversely marked by about twelve transparent lines. The setæ are plumose.

The fourth segment of the abdomen is much shorter than the preceding. It is provided with a pair of stylets, having each two narrow, elliptical plates, quite unequal, naked, on an elongate pedicel. The second pair of stylets has the lamellæ nearly equal; and, in the

third pair, one (the inner) is more than twice the length of the other; the larger is somewhat ensiform, and is minutely serrated on the margin.

The terminal abdominal segment evidently corresponds to the fifth, sixth, and seventh normal segments. The suture between the fifth and sixth is distinct; but none is perceived between the seventh and sixth.

The specimens procured from the Bonito were twenty to thirty in number. They were in a fine state of preservation, though dead. Excepting two or three which were dirt-brown, they were nearly colourless; the original colour could not safely be inferred.

GENUS THYROPIUS, Dana.

Abdomen ad ventrem claudens. Caput transversum. Pigmenta oculorum non grandia, quatuor. Antennæ 2dæ longæ, sub thoracis latere celatæ, 4-5-plicatæ, articulo 1mo multo brevioribus quam 2dus. Pedes 6 postici coxis late clypeati, articulis reliquis paulo abbreviati.

Abdomen closing upon the venter. Head transverse; pigments of eyes not large, often four in number. Antennæ of second pair long, and four to five-plicate, concealed under the sides of the thorax; first joint much shorter than second. Six posterior feet having the coxæ broad clypeate, the remaining part of the legs a little abbreviated.

The antennæ of the second pair in Thyropus, are much longer than in Typhis. They are folded at each articulation, excepting the last, and, may be, also at that; moreover, the first joint is much shorter than the second, a fact which (as we judge from comparing them with Dithyrus and Pronoe) appears to be connected with the position of the antennæ beneath the thorax, when retracted, instead of beneath the head. In Typhis, on the contrary, these antennæ are not folded between the first and second joints, and the first joint is much longer than the second. The general structure of the thoracic legs is as in Typhis. The coxa of the fifth pair bears the following joints at or near its extremity; that of the sixth, from the under surface remote

from the extremity; that of the seventh is narrow, and bears but one or two small joints near its apex. In *Typhis*, the coxa of the fifth pair bears the following joints upon its under surface a little distance from the extremity. In our species, there are *four* masses of pigment.

This genus includes the *Typhis ferox* of Edwards, Crust., iii. 96. The name is from *θυρα*, door, and *πους*, foot.

THYROPUS DIAPHANUS.

Caput transversum, fronte rotundatum. Abdomen thorace paulo longius, 5-articulatum, segmento postico triangulato, non oblongo, subacuto, stylis inferioribus. Pigmenta oculorum quatuor, parva. Antennæ 1mæ breves, basi crassæ, articulo basis ultimo ellipsoideo, subacuto, multi-articulato, appendice laterali parvulâ, 3-articulatâ. Antennæ 2dæ longissimæ, 5-articulatæ, ad articulationes quatuor flexæ, articulis secundo tertioque valde elongatis, æquis, primo plus triplo brevior, quarto fere triplo longiore quam primus, quinto primum fere æquante. Coxa quinta subelliptica, parte pedis reliquâ parce longior, apice vix prominente. Coxa sexta obliquè ovata, apice truncata, parte pedis reliquâ plus triplo brevior. Coxa septima angustissima.

Head transverse, rounded in front. Abdomen a little longer than thorax, five-jointed, last segment triangular, not oblong, subacute, stylets attached to under surface. Pigments of eyes four in number, small. Anterior antennæ short, at base stout, last joint of base oval, subacute, multiarticulate, lateral appendage small, three-jointed. Posterior antennæ very long, five-jointed, flexed at four articulations, second and third joints quite long, equal, first less than one-third the second, fourth three-fourths the second, fifth about equal to first. Coxa of fifth pair subelliptical, about as long as rest of leg, apex hardly prominent. Coxa of sixth pair obliquely ovate, truncate at apex, rest of foot not one-third as long as coxa. Coxa of seventh pair a slender lamina, a little curved.

Plate 69, fig. 4 *a*, animal, enlarged, ventral view; *b*, same, oblique dorsal view; *c*, inner antenna; *d*, outer antenna; *e*, one of third or

fourth pairs of feet; *f*, last segment of abdomen, under view; *g*, one of first pair of stylets.

Atlantic, latitude $4^{\circ} 25'$ south, longitude $21^{\circ} 30'$ west. Collected, November 7, 1838, 4 A. M.

Length, when extended, one-fourth of an inch; when folded up, one-eighth of an inch. Nearly colourless; diaphanous. Head large and broad, the whole covered with facets, excepting a small space in front. Within, four small black spots of pigment, the two outer of which are transversely oblong, and the two inner (between the outer) are acute-triangular, and longitudinal in position. Lower surface of head nearly all open, the antennary area being much broader than long; at the centre of its anterior margin, there is a slight triangular projection. Thorax broad, broadest posteriorly, seven-jointed; epimerals distinct. Abdomen about as long as head and thorax together. The last segment has no suture separating a seventh normal segment from sixth; but a faint one is observed separating the fifth and sixth. The last pair of stylets is articulated with the under surface, and extends backward as far as extremity of abdomen. The second pair reaches to base of third pair. The inner antennæ have the last joint of base crossed by fine lines (10?) indicating articulations, and the surface is short hairy; the preceding joint is equally stout, of nearly the same length, but is at right angles with the last. The first joint of the appendage is the largest of the three. Coxa of sixth pair with the outline sparingly undulate, being concave for the most part on the anterior side; rest of leg slender and short, and articulated on medial line of coxa farther than its length from the apex. The posterior stylets have a very short base, and subequal lanceolate branches.

Observed a palpitating longitudinal vessel (shown in fig. 4 *b*), situated in the third, fourth, fifth, and sixth thoracic segments.

Abdomen is generally applied to the venter, and, in connexion with the clypeate coxæ, it covers the whole of the ventral surface, including the antennary cavity.

[The first pair of legs was not made out.]

SUBFAMILY PRONAINÆ.

GENUS PRONOE, *Guérin*.

Anterior antennæ stout at base, the last basal joint oval, with a very small lateral appendage. Posterior antennæ folded up and concealed under the head, being 3-4-plicate. Pigments of the eyes two in number and very large, nearly filling the head, in our species. Coxæ of the fifth and sixth pairs of legs broad (sixth broadest) and bearing following joints by the margin and not by the under surface; posterior pair having but one or two rudimentary joints besides the coxa, which is quite narrow. Abdomen not closing against the venter; the last segment small triangular, and the posterior caudal stylets projecting in our species much beyond its extremity.

PRONOE BRUNNEA.

Caput subtriangulatum, non oblongum, fronte obtusum, pigmentis duobus fere repletum. Thorax apertè 5-articulatus. Abdomen 6-articulatum, segmento ultimo parce discreto, triangulato, subacuto. Antennæ 2dæ longæ, 5-articulatæ, articulis primo secundo tertioque longis, æquis, quarto fermè dimidio brevior, quinto parvulo. Coxa sexta latissima, obliquè subovata, apice prominulo, rotundato, parte, pedis reliquâ paulo brevior; coxa quinta dimidio angustior, fere elliptica, margine antico serrato; coxa septima obliquè sublanceolata, apice truncata, articulo sequente parvulo, subrotundato.

Head subtriangular, not oblong, obtuse in front, pigments of eyes nearly filling it. Thorax appearing in a dorsal view but five-jointed. Abdomen six-jointed, last segment small triangular, subacute at apex. Second antennæ long, five-jointed, first, second, and third joints long and equal, fourth about half shorter, fifth quite small. Coxa of sixth pair much the broadest, obliquely subovate, apex prominent, obtuse, remaining part of leg shorter than coxa; of fifth pair half narrower, subelliptical, anterior margin about apex serrate, remaining part of leg a little longer than coxa; of seventh

pair obliquely sublanceolate, apex truncate, next joint small and nearly round.

Plate 69, fig. 5 *a*, animal, enlarged, ventral view; *b*, same, dorsal view; *c*, inner (or anterior) antennæ; *d*, outer antennæ; *e*, leg of third or fourth pairs; *f*, fifth pair of legs; *g*, sixth pair; *h*, seventh pair; *i*, extremity of abdomen; *l*, *l'*, branches of first pair of stylets.

Atlantic, latitude 4° 25' south, longitude 21° 30' west. Collected, November 7, 1838, at 4 A. M.

Length, four lines. Colour, dark brown, with some brilliant green reflections or a kind of iridescence. Head covered with hexagonal facets; two oblong masses of pigments separated by a narrow line, and visible both in an upper and under view. Antennary area, seen in under view, small and narrow (not over one-third the width of head), anteriorly quadrate; pigment seen either side of the area. Thorax has seven joints, but first two very short and partly concealed; whole thorax but little longer than head. Abdomen not abruptly narrower than thorax. Last abdominal segment consists of an anterior part subquadrate, and a smaller posterior, which is triangular, and not longer than broad; this part is separated by a suture, and corresponds to normal seventh segment; there is also a suture near anterior margin of this last abdominal segment, separating fifth and sixth normal segments. The posterior stylets are attached to the margin of the last abdominal segment, either side of the triangular termination. They have a very short base, and extend more than half their length beyond the extremity of the abdomen, the branches are truncate at apex and equal in length. The other stylets about reach to extremity of abdomen, and have lanceolate branches. The branches of first pair of stylets are serrulate on the margins, excepting outer margin of outer branch. The apex of coxa of fifth pair is prominent, and the serratures of the margin extend from this apex around half way to base.

This animal swims rapidly. It remained swimming on the surface of the water while confined in a jar. On dying it became colourless.

GENUS LYCÆA (*Dana*).

Pigmenta oculorum grandia. Antennæ 2dæ sub capite celatæ et replicatæ et flagello longiusculo confectæ. Pedes 4 antici subcheliformes, reliqui mediocres; 2 ultimi breviores; coxæ sex posticæ angustæ. Abdomen in ventrem se non flectens.

Pigments of the eyes large. Posterior antennæ folded up beneath the head either side, and having the flagellum long. Four anterior feet subcheliform, the rest of moderate length; two last abbreviated; coxæ of six posterior legs rather narrow. Abdomen not folding against the venter.

This genus is near *Pronoe*, but has the four anterior legs alike subcheliform. In the only species seen, the antennæ are bent back and forth at three articulations, and the last portion is slender setaceous, and multiarticulate. The coxæ of the three posterior pairs of legs are not much flattened. The abdomen has but five distinct segments. The fifth consists of the fifth, sixth, and seventh normal segments, the first of these being indicated in its limits by a faint suture, and the last forming a triangular projection to the extremity. The head is rounded and is covered with facets, excepting a narrow medial line. The pigment is large and central, as seen in a lateral view. The thorax has the seven segments all distinct. The mandible has a dentate apex, and a three-jointed rather slender palpus.

The superior antennæ consist of a stout base, with the apex truncate, except the upper part, which is slightly prominent, and bears one or two minute joints in the same line with the upper margin of the basal joint.

LYCÆA OCHRACEA.

Caput subrotundatum. Thorax apertè 7-articulatus. Antennæ 2dæ nudæ, articulo primo brevi, secundo tertioque longis, æquis, quarto parvulo, non oblongo, parte reliquâ tenui, vix brevior quam articulus tertius, flexili. Abdomen extremitate triangulatum, obtusum. Pedes toti nudi, manu primâ vix oblongâ, apice inferiore triangulato, manu

secundâ paulo oblongâ, angustiore, subrectangulatâ. Pedes tertii quartique tenues. Pedes 5ti 6tis parce longiores, 7mi debiles, coxâ plus duplo longiore quam pars reliqua. Coxæ 6 posticæ subæquæ.

Head nearly round. Thorax distinctly seven-jointed. Posterior or second pair of antennæ naked, first joint short, second and third long and equal, fourth very small, not oblong, the following part slender and flexible, about as long as third joint. Abdomen with a triangular and obtuse extremity. Feet all naked. Hands of first pair broad, hardly oblong, inferior apex triangular; hands of second pair a little oblong, narrower, subrectangular. Feet of third and fourth pairs slender. Fifth pair longer than sixth. Seventh weak, coxa more than twice as long as following part. Six posterior coxæ subequal.

Plate 69, fig. 6 *a*, animal, enlarged; *b*, head, in upper view; *c*, inner antennæ; *d*, outer antennæ; *e*, mandible; *f*, first pair of legs; *g*, second pair; *h*, extremity of abdomen.

Pacific, near Sunday Island, north of New Zealand. Collected, April, 1840, from the cavities of Salpas.

Length, four lines. Colour, ochreous to brownish yellow. Body depressed. Head rounded, and in vertical view the front forms a very obtuse angle, and a narrow line is seen separating the facets of the two sides. Pigment black or brownish black, occupying about half the width of the head in a lateral view. First two thoracic segments much shorter than following. Last abdominal segment oblong, and its triangular apex longer than broad. The stylets hardly extend farther backward than extremity of abdomen, and the second pair falls short of it. The claws of the feet are very short. The hands of the four anterior feet are made of the fourth joint, and the finger of the fifth with a very minute claw (the sixth) at apex. The fifth, sixth, and seventh pairs decrease in length in order. The antennæ are seldom seen exerted. Coxæ of seventh pair of legs not smaller than of sixth; both are compressed but not very broad.

ORDER ENTOMOSTRACA.

THE grand subdivisions of the Entomostraca here adopted, are based on the character of the mouth, and are distinguished as follows:—

- I. GNATHOSTOMATA.—Os mandibulis maxillisque regularibus armatum, sessile et non rostriforme nec mobile.
- II. CORMOSTOMATA.—Os mandibulis tenuibus et sæpe spiculiformibus armatum, rostriforme sæpeque basi mobile; raro videtur inerme.
- III. MEROSTOMATA.—Os basibus pedum plurium in locis mandibularum et maxillarum instructum.

The propriety of this arrangement has been discussed on pages 12 and 13. The Limuli constitute the last section, being closely related to other Entomostraca. It may even be doubted whether this third subdivision should not be merged in the first, as the transition in the structure of the mouth from the first to the third, is very gradual, as will be shown beyond. We would here refer to a concluding chapter in this volume for some additional observations on the relations of the Entomostraca to the higher Crustacea.

SUBORDER I.

GNATHOSTOMATA.

THE Entomostraca with a mouth of the normal form belong to two series, and each includes three tribes, as presented in the earlier part of this volume. The following are these subdivisions, with their characteristics:—

LEGIO I. LOPHYROPODA.*

Pedes numero normales et non multiplicati.

Tribus I. CYCLOPOIDEA.†—Corpus elongatum, rectum, abdomine non inflexo. Cephalothorax et abdomen pauci-annulati. Membra buccalia pedesque thoracis numero 16–18. Pedes thoracis 6–10 postici biremes, foliacei, ultimis interdum prehensilibus.

Tribus II. DAPHNIOIDEA.‡ — Corpus breve, postice inflexum, testâ

* *Lophyroga*, Latreille, Cuv. Règne An., 1817; *Lophyropoda* (in part), Leach, Dict. Sci. Nat., xiv. 524; *ibid.*, Gray, Cat. Brit. Crust. Brit. Mus., 1850, 100; *ibid.*, Baird, Brit. Entomost., 138.

† *Carcinoida* (in part), Latreille; *Copépodes*, Edwards, Crust., iii. 411; *Copepoda*, Baird, Brit. Entomost., 182; *Crophyropoda*, Burmeister, Organiz. of Trilobites; *Copepodita*, Gray, Cat. Brit. Crust. Brit. Mus., 1850, 110.

‡ *Daphnides*, Strauss; *Cladocera*, Latreille, Cuv. Règne An.; *Daphnoïdes*, or *Cladocères*, Edwards, iii. 372; *Cladocera*, Baird, Brit. Entomost., 62.

grandi tectum, capite excluso suturâque discreto. Membra buccalia pedesque thoracis numero 12-16. Pedes thoracis 6-8 postici foliacei.

Tribus III. CYPROIDEA.* — Corpus breve, postice inflexum, testâ bivalvi omnino tectum capite incluso. Membra buccalia pedesque thoracis numero 10. Pedes thoracis postici in *Cyclopoideis* et *Daphnioideis* foliacei in *Cyproideis* obsoleti sunt.

LEGIO II. PHYLLOPODA.†

Pedes numero abnormales multum multiplicati.

Tribus I. ARTEMIOIDEA.‡ — Corpus fere rectum. Cephalothorax multiannulatus, testâ sive tectus sive non tectus. Appendices cephalothoracis plerumque foliacei. Oculi pedunculati.

Tribus II. APODOIDEA.§ — Corpus fere rectum. Cephalothorax testâ scutiformi tectus. Appendices cephalothoracis posteriores lamellatæ. Abdomen multiannulatum. Oculi sessiles.

Tribus III. LIMNADIOIDEA.|| — Corpus testâ omnino tectum capite abdomineque inclusis. Oculi sessiles. Habitu *Cyproideis* similis.

The first of these tribes, *Artemioidea*, includes *Chirocephalus* (or *Branchipus*), *Artemia*, *Eulimene*, and *Nebalia*, which agree in their pedunculate eyes, the divided posterior thoracic legs, and the straight abdomen with terminal stylets or plates. In the character of the abdomen they are related to *Cyclops* and the *Mysidæ*; the multiplied annulations in *Chirocephalus* constitute the main point of divergence.

* *Ostracoda*, Latreille, Hist. Nat. des Crust. et des Insectes, 1802; *Ostrapoda*, Strauss; *Cyproïdes* or *Ostracodes*, Edwards, Crust., iii. 393.

† Latreille, Hist. Nat. des Crust. et des Insectes, 1802, iv. 130; also, most subsequent authors.

‡ *Branchipiens*, Edwards, Crust., iii. 364; *Branchiopoda*, Leach; *Branchipodidæ*, Baird, Brit. Entom., 38.

§ *Apusiens* (in part), Edwards, iii. 353; *Apodidæ*, Burmeister; Baird., loc. cit. 18.

|| *Apusiens* (in part), Edwards, iii. 353.

Milne Edwards refers the four posterior pairs of natatory legs in *Nebalia* to the abdomen; but their close similarity to the thoracic natatories in *Cyclops*, and also the resemblance between the following part of the body in the two groups, satisfies us that these natatories in *Nebalia* are properly thoracic, and that consequently the abdomen of *Nebalia* is not abnormal in the number of its segments.* The structure in certain *Mysidæ* is strongly brought to mind.

Chirocephalus and *Artemia* constitute one family, the ARTEMIADÆ, among the Artemioidea, and the *Nebalia* another, the NEBALIDÆ.

The *Apodoidea* have sessile eyes, and although having a little of the *Nebalia* and *Cyclops* habit, yet they are quite remote in their characters, and more resemble the *Limuli* in structure, especially in the foliaceous appendages below, the appearance of the shell, and the position of the eyes, though not like them in the mouth. The abdomen is straight, as in *Cyclops*, but its extremity is unlike any species of that group.

The *Limnadioidea* have a close resemblance in form to *Cypris*, and the extremity of the abdomen is like that in *Daphnia*.

The *Phyllopoda* should properly be arranged after the *Lophyropoda*. The great number of joints and appendages, as shown by Agassiz, is a mark of inferior grade. It is a characteristic of larval forms among insects, as distinguished from the perfect animal. It is a peculiarity of the earlier Crustacean forms of the globe, when vegetative growth in animals often predominated over concentration.

The three tribes of *Lophyropoda* appear to rank in the order above given. The *Cyclopoidea* approach the nearest in general form and structure to the *Mysidæ*, and they may be considered their representatives among the Entomostraca. The *Cyproidea* are quite remote in structure from any of the higher Crustacea. Moreover, they resemble closely the immature forms of the *Anatifidæ*, also a low grade of Crustacea, a relation which indicates their own inferiority. The *Daphnioidea* are evidently intermediate between the *Cyclopoidea* and *Cyproidea*; for they have the large shell and habit of the latter, with the natatory legs and exsert head of the former.

* See our remarks on the homologies of *Nebalia*, page 41.

LEGION I. LOPHYROPODA.

TRIBE I. CYCLOPOIDEA.

THE Cyclopoidea have in general more the aspect of a Macroural Crustacean, than any others of the Entomostraca. A few depressed species look a little like Isopods, though without any other point of special resemblance to that group. They are all minute, the largest not exceeding one-third of an inch in length, and the size usually varying between a twelfth and a twentieth of an inch. Figure 7, Plate 70, represents one of the flattened species, a Sapphirina, and figure 8, one that is slender and compressed, the two extremes, into which the common type graduates.

The cephalothorax is transversely articulated, and the shell of the anterior segment never extends like a carapax over the following part of the animal.

The abdomen is extended in the same line with the thorax instead of being inflexed, and bears at its extremity two lamellar or styliform appendages. It is usually abruptly smaller than the thorax, as in figure 5, but in some species, as in figures 7, 8, the two are regularly continuous.

Cephalothorax.—The cephalothorax consists ordinarily of but *four* segments, *one* large *anterior*, and *three* short *posterior* (Plate 70, figs. 1 B, *Cyclops*; 1 A, *Calanus*; 6, *Corycæus*; 7, *Sapphirina*). But the number is often larger, being at times increased to *seven*. This increase takes place in four ways:—

1. By the addition of a fourth posterior segment to the extremity of the thorax (Fig. 3, *Calanus*; 4, *Euchæta*; 5, *Pontella*, Plate 70).

2. By an articulation crossing the anterior segment, just anterior to the mouth, separating a cephalic segment from the rest of the cephalothorax, as in many *Pontellæ*.

3. By another articulation across the anterior segment posterior to the mouth (*b*, fig. 5, *Pontella*), this articulation passing anterior to the first pair of legs.

4. By an articulation like the last-mentioned, but passing just anterior to the second pair of legs, that is, the first pair of natatories (*b*, fig. 2, *Laophon*).

The following table exhibits the relations of the segments to the normal annuli, showing those that are coalesced in the different varieties of cephalothorax. The normal annuli are each named by the pair of organs it bears, and we add also the normal number of the annulus, the first antennæ pertaining to the second normal annulus.

	Cephalo- thorax 7-jointed.	Cephalothorax 6-jointed.		Cephalothorax 5-jointed.			Cephalothorax 4-jointed.
		A.	B.	A.	B.	C.	
II. 1st Antennæ,	} I.	} I.	} I.	} I.	}	}	}
III. 2d Antennæ,							
IV. Mandibles,	} II.	} II.	} II.	} II.	} I.	} I.	} I.
V. Maxillæ,							
VI. Maxillipeds,	} III.	} III.	}	}	}	} II.	}
VII. 1st Feet,							
VIII. 2d Feet (1st Nat.),	} IV.	} IV.	} III.	} III.	} II.	} III.	} II.
IX. 3d Feet (2d Nat.),							
X. 4th Feet (3d Nat.),	} V.	} V.	} IV.	} IV.	} III.	} IV.	} III.
XI. 5th Feet (4th Nat.),							
XII. 6th Feet (5th Nat.*)	} VII.	0.	} VI.	0.	} V.	0.	

The last column represents the most common form, numbering but four segments, and the first the seven-jointed cephalothorax. The number *seven*, it is seen, is reduced to *six* in two ways:—

1. By the last segment becoming obsolete.
2. By the obsolescence of the articulation *b* (fig. 4).

There is a farther reduction to five segments in three ways:—

1. By the obsolescence of the articulation *b* and the last segment becoming obsolete.
2. By the obsolescence of the articulations *a*, *b* (fig. 3).

* Usually either obsolete or adapted for prehension.

3. By the obsolescence (fig. 2) of the articulation *a*, and the last segment becoming obsolete.

There is a reduction to four segments :—

By the obsolescence of *a* and *b*, and also, the last segment becoming obsolete (figs. 1 A, 1 B, 1 C, 6, 7, 8, Plate 70).

The *front* is often truncated or rounded without appendages below. In other species it has a short beak, which is either obtuse, or acute and simple, or furcate (figs. 9 *a* and 14 *a*, *Pontellæ*; 10, *Catopia*; 11, *Euchæta*). In others still, as the *Setellæ*, there is a pair of small moveable unjointed appendages (fig. 12) attached below to the front.

Eyes.—The *eyes* are of three kinds :—

1. A pair of simple internal eyes with spherical lenses. These are the common kind in this group. They are either united on a single spot of pigment, which appears like a mere point unless highly magnified (figures 1, 3, 8, and 13), or are more or less remotely separated (fig. 4, *Euchæta*, and 5 and 9 *b*, *Pontellæ*). They are usually situated close to the cephalic ganglion, and look upward or partly forward.

2. A pair constituting a prominence on the under side of the head between the antennæ.* They have a single mass of pigment. The prominence has a rounded or reniform contour in a vertical view, the latter shape indicating the existence of two (or more) lenses, in many, if not all cases,—a fact not distinctly made out by dissection. Figures 9 *a* and 14 *a*, Plate 70 (*Pontellæ*), represent this prominence in a lateral view, of different sizes. Figures 9 *b*, 14 *b*, represent the same, as appearing in a vertical view, visible through the head just behind, or directly beneath the other eyes. In 9 *b* the reniform shape is distinct. Figures 4 and 5, are other examples. Figure 10 (*Catopia*) represents a species, in which a spherical lens was very distinct, and only *one* could be made out. Figure 2 is an upper view of the same, in which view also only a single lens was distinguished.

The pigment is either blue-black (like a piece of solid indigo), or carmine.

These eyes may be designated, for distinction, the latter, the *inferior* eyes, and the former, the *superior*.

* The author follows Edwards in considering these organs eyes, who states that he dissected out the lenses and found that the eyes were compound.

3. A pair of simple eyes consisting of an internal prolate lens situated at the extremity of a vermiform mass of pigment, and of a large oblate lens-shaped cornea. The cornea is connected intimately with the exterior shell of the front or under side of the head (figures 6 and 15, *Corycæus*; 7, *Sapphirina*), and the two corneæ are like spectacles adapted to the near-sighted lenses within; their size is extraordinary, being often one-third the greatest breadth of the body in *Corycæus*. The lens (*l*, fig. 15) and the cornea (*c*) are often very distant from one another, being separated by a long clear space. The exterior surface of the cornea is spherical; but the inner is conoideo-spherical or parabolic. The texture is *firm*, and when dissected it breaks or cuts like a crystalline lens. The true lens is always prolate, with a regular contour, excepting behind, where it is partly penetrated by the pigment. The pigment is slender vermiform, of a deep colour, either red or blue, but at its anterior extremity usually lighter, and often orange or yellow. Other figures and illustrations are given among those of the *Corycæidæ*.

Antennæ.—There are two pairs of antennæ in all the Cyclopoidea.

a. First pair of antennæ.—The first pair of antennæ is always antenna-like in form and function in females; in males one or both are sometimes prehensile, for clasping the female in coition. The organs are either simple (figs. 16 to 41, Plate 70), or appendiculate (figs. 42, 43*). The number of joints varies from three to twenty-four, and perhaps, twenty-eight.

When appendiculate, there is a basal portion, consisting of two to five [rarely] joints; and this base bears at apex a slender flagellum, three- to seven-jointed, besides a small one- or two-jointed appendage or branch, which usually terminates in two setæ.

The figures 16 to 43, illustrate the principal varieties of these organs. They show that the few-jointed antennæ are sometimes short (figs. 16–18), and sometimes long; and farther, that in the same genus, antennæ of equal length, may consist of seven or twenty joints: also, in the same species, a male antenna may have but half the number of joints in the female, although scarcely different in

* Figs. 16, 17, from *Sapphirina* and *Corycæus*; 18 *a*, *b*, 19, 20, *Cyclops*; 21, *Calanus*; 22 ♀, 23 ♂, 24, *Euchaeta*; 25, *Undina*; 26, 27, 28, 29, *Pontella*; 30 to 36, *Pontella*; 37, 38, *Candace*; 39, 40, *Oithona*; 41, *Acartia*; 42 *a*♀, *b*♂, *Clytemnestra*; 43, *Setella*.

length; and in some males a like difference exists between the left and right antennæ. Among the genera with long antennæ, therefore, where the number of joints is few, it is so from a union of several joints that are in other cases separate. Figures 37, 38 belong to the same species; in the former several joints correspond to each of the longer ones in the latter. So in figures 18 *a* and *b*, 19 and 20, 26 and 27, 28 and 29, 30 and 31, 32 and 33, each of the longer joints of one antenna, in each species, corresponds to several joints in the other.

This is very evident from the occasional existence of the articulations, either complete or in faint traces, intersecting the longer joints. In figures 30, 31, the last three joints of 31 correspond to the last three of 30; the next of 31, to the next two of 30; the next (or fifth from apex) of 31, to the next two (sixth and seventh from apex) of 30; the next (or sixth from apex) of 31, to at least four, probably five, (eighth, ninth, tenth, eleventh, and twelfth) of 30. In figure 29, these joints are actually separate, as in 28, excepting the fourth and fifth from apex of 28, which are coalesced in 29; but the joint formed has one or two setæ at middle to indicate its compound character. In 26 and 27, the same principle is illustrated.

This is also obvious, from the relative positions of the setæ in the different antennæ. For example, in figure 37, the longer setæ have about the same distances apart as in 38, and there is a general correspondence in other respects, as is seen by making the comparison. It is plain, therefore, that the last four joints of 38, correspond to the last four of 37; the next of 38 to the next three of 37; the next of 38 to the next two of 37. Again, the longish seta on the broad joint of figure 31, obviously corresponds to a similar one at the apex of the *ninth* joint (from apex) of 30. Very often, too, the second joint at base is much longer in the male than in the female (as in 26 and 27), and faint lines are at times distinguished that show that this length arises from the non-separation of short joints from the apex of this second joint. This is the case in figure 33.

We therefore arrive at the general conclusion, that *the multiplication of joints takes place by the subdivision of pre-existing joints*. This appears to be a general law, not confined to Crustacea. The increase does not take place by the addition of joints at the base of the organ, or their seriate development at its apex. From the first stages of the

animal, the existing joints (of which there are but two or three in the earliest state of the young) gradually lengthen and undergo subdivision, and by this process the multiarticulate character is produced. These changes probably take place mainly in the process of moulting.

Towards the base of the simple antenna, the subdivisions are near the apex of the joints, and commonly from the *apical half* of the second joint. But about the medial portions the subdivision often *bisects* the joint. In the many-jointed antennæ these medial joints when much oblong have one or two setæ at middle, as in figures 28 and 36, which setæ indicate this tendency to central subdivision, although the bisection does not actually take place. Upon the second basal joint the setæ are usually clustered towards apex, this part being the portion that tends to become subdivided. Thus while development takes place symmetrically about the middle and outer portions of these organs, it is most active towards the outer extremity of the second basal joint, instead of its middle or basal portions.

These principles account for the fact that the first joint of the antenna is nearly alike in the different species of a genus, however different the length of the organs; this would not be the case if the multiplication of joints took place at the base. This first joint is, however, sometimes obsolete, a fact which should be noted, since ignorance of it might lead to incorrect inferences regarding homologous parts.

It would seem also to be true, that in the multiarticulate antennæ (species of Calanidæ), the last three joints do not change by subdivision; for these joints are furnished with *posterior* as well as *anterior* setæ (in which fact, with sometimes the next preceding joint, they are peculiar), and this is the case whatever may be the number of joints, which in some Calanidæ is but *nine*. If the apical or penult joint subdivided, this would increase the number of joints bearing posterior setæ; and the number actually found could be retained in such a case only by removal of one or more pre-existing setæ. This removal might take place, but we have no evidence of it. It is, therefore, probable, that after the organs are so far advanced as to have posterior setæ to the three or four terminal joints, these joints do not undergo subdivision. These setæ in fact appear often to precede the existence of separate joints for them, the separation (or development of an articulation) afterwards taking place. Thus in figure 40, the second joint from apex corresponds evidently to the

second and third in figure 39 and others. In some male antennæ, like figure 33, the articulations separating the last three joints are obsolete, and are only indicated as regards position by the setæ.

In the course of the preceding remarks it has been shown, that the right antenna, represented in 33, has the following relations in its articulations to 32, the left antenna of the same male individual. The joints are numbered from the apex.

Joints 1, 2, 3,	.	.	in 32, correspond to joints 1, 2, 3, in 33.
" 4, 5,	.	.	" " 4, "
" 6, 7,	.	.	" " 5, "
" 8, 9, 10, 11, and probably 12,	.	.	" " 6, "

In 33, the geniculating articulation is between joints 4 and 5 (joints five and six of 32); joints 5 and 6 of 33, constitute a kind of hand, against which, joints 1 to 4, finger-like, may be flexed for grasping.

Again: the following are the relations of figures 37 and 38:—

Joints 1, 2, 3, 4,	.	.	in 37, correspond to joints 1, 2, 3, 4, in 38.
" 5, 6,	.	.	" " 5, "
" 7, 8,	.	.	" " 6, "

The geniculating articulation is here between the joints five and 6 of 38, or 6 and 7 of 37. The joints preceding the eighth in 37, are somewhat enlarged, but are not coalescent.

Seven is the smallest number of joints to which the right antenna of a male is ever reduced. In that case,

Joints 1, 2, 3,	.	.	of the female correspond to joint 1 of male.
" 4, 5,	.	.	" " 2 "
" 6, 7,	.	.	" " 3 "
" 8, 9, 10, 11, 12,	.	.	" " 4 "
" 13 to penult inclusive,	.	.	" " 5, 6, "
" Last or basal,	.	.	" " 7 "

From a glance at figures 21, 22, 23, 24, 37, 38, it is seen that the antenna is marked off into parts by the positions of several long setæ. In figure 21, there are five of these long setæ besides those about the apex, and they thus divide the organ into six parts. In figure 23 (female), there are also *five*; and 22 corresponds, except that there

are two bent setæ in place of the second from the base. In figures 37 and 38, the longer setæ of the outer half of the organ correspond to those in figure 22, 23. The joints (counting from the apex) from which these setæ proceed, are in—

Fig. 21,	joints	5	8	12	17	22
“ 22,	“	4	7	11	16-18	21
“ 24,	“	4	7	11	17-18	21

or, counting from the base,

Fig. 21,	joints	20	17	13	8	3
“ 22,	“	20	17	13	6, 7	3
“ 24,	“	19	16	12	5, 6	2

Figure 21 has twenty-four joints, and figure 22, but twenty-three: the two organs, as seen by comparing, differ in the former having *four* terminal joints, corresponding to *three* in the latter. Again, figures 22, 24 (the former with twenty-three and the latter twenty-two joints), differ in the second joint from base, being divided in one species and not in the other.

If, then, twenty-four be the normal number of joints, the variations from perfect correspondence in the above arise from the obsolescence (or rather, non-development) of one or more articulations.

It does not follow necessarily, that whatever the number of joints, the longer setæ will correspond severally in position to the same normal joints of the organ. On the contrary, the facts as far as observed are otherwise, and tend to prove that the positions have rather a relation to the length or organogenic nature of the organ. Thus, in figures 32 to 36, the longer seta near the middle of the antenna is situated on the eighth, ninth, tenth, or eleventh joint (from apex), according to the species. The organ, in an important sense, has the character of a unit in its development, and the position of the seta has a relation to its unit character, rather than to particular joints in a normal antenna.

It seemed natural, at first thought, that the position of the longer setæ, in figures 21, 22, 37, 38, &c., should indicate the limits of the joints in the few-jointed antennæ. Yet this is by no means the case. Compare 37 and 38, left and right antennæ of the same individual:

the non-correspondence is obvious. Other examples proving the same are numerous.

The position of the anterior antennæ, or their angle with the medial line of the body, is sometimes (as in the Calanidæ) fixed and characteristic of species. In this case they have a power of rotation at the articulation with the head, by which the organ may be brought to the side of the body, but no free motion back and forward.

The setæ are either naked or plumose; and some when long are edged with short distant setules. They occasionally have free motion at base. The setules alluded to often move freely upon the seta to which they are attached.

b. Second pair of antennæ.—The antennæ of the second pair are very various in forms and functions. They are either simple (figs. 44–48), or have a lateral appendage, which though sometimes obsolescent, may be as long as the main portion (figs. 49–55).^{*} They often terminate in a few setæ (fig. 44), and in some genera by a long finger-like claw (figs. 46, 47). They have, therefore, at times a prehensile character; and even when furnished only with terminal setæ, the terminal setæ are generally (always?) moveable, so as to admit of being spread open or closed, in which case they act like fingers in enabling the animal to adhere to surfaces. It is not unusual to see a Cyclops thus resting with its posterior antennæ fastened to an object.

Comparing these two-branched organs with others of the Cyclopoidea, but more particularly here with the natatory legs, in which this structure is well exhibited,—we ascertain that the basal part of these organs consists normally of two joints, the second bearing the following main part of the organ, and the branch or lateral appendage. In figure 51, this constitution is apparent, and we have numbered the joints correspondingly, the joints of the branch being distinguished in the numbering by the addition of a dash ('). There are in the figure referred to, joints 1 and 2 as a base, then 3 and 4, for the main stem, and 3' and 4' for the branch. A small joint may sometimes be distinguished on the side of joint 4, as seen in figure 54, which makes the whole number of joints in the series, *five*. In this last-mentioned figure, however, the joints 1 and 2 were not observed to be distinct.

^{*} Fig. 44, from a Cyclops; 45, *Setella*; 46, *Sapphirina*; 47, *Corycæus*; 48, *Oithona*; 49, *Harpacticus*; 50, *Euchæta*; 51, 52, 53, *Calanus*; 54, *Pontella*; 55, *Candace*.

In figure 52, joints 1, 2, and 3, were united in one, or the first is obsolete. This is a common case. Figure 49 is another example.

When the branch is wanting, the whole five joints of the main stem are sometimes present, as in figures 44 and 46. But often one or more are not apparent. In figure 48, 1 and 2 are not disjoined. In figure 47, either the 5th, or apical, is wanting, or the joints 3 and 4 are united; the latter, we think the fact, since in some species an articulation crossing this joint is distinctly seen. In figure 45, there are but three joints in all. The numbers on the figures will aid in comprehending these normal relations.

Buccal area.—The buccal area is a low convex prominence, with the opening of the mouth on the posterior side (see figures on plate 75, which will be particularly described on a following page).

Mandibles or mandibular feet.—The mandibular feet vary in number of joints from one to five. When *more than one*, the basal is usually called the mandible, and the others a palpus,—a distinction which is without good foundation. The whole is properly a mandibular foot, of which the first joint is laterally prolonged, and constitutes the mandible.

This mandible has either a simple corneous extremity, Plate 71, fig. 56, more or less pointed; or it terminates in a dentate edge, and is furnished often with a seta on one side near apex (figs. 57–62).* The teeth are in general nearly equal, excepting one or two at one side, which are larger and longer (figs. 60, 61, 61 *a*), though not projecting beyond the line of the others. The mandible enters the buccal area from one side, and has some lateral play, through the action of powerful muscles.

The rest of the organ, when other joints exist, is either simple or two-branched. Figure 57 represents an example with a simple extremity, consisting of four joints, or *five*, including the basal or mandibular joint. In figures 58 to 61, there are two branches, the branches proceeding from the second normal joint, as numbered on the plate. In figures 58 and 60, the branches are one-jointed; in figures 59 and

* On Plate 71, fig. 56, from a Sapphirina; 57 *a, b*, Calanus, different views; 58, Calanus; 59, Euchæta; 60, 61, 61 *a*, Pontella; 62, Harpacticus; 63, Oithona.

61, each are two-jointed; in 62, one is one-jointed, and the other two-jointed.

By comparing the figures with those of the second pair of antennæ, and observing the numbers affixed to the joints (e. g. figs. 50 or 51 and 59), it will be seen that there are the same elements in both: viz., a two-jointed base (the first joint mandibular), and two branches of corresponding character. The difference consists mainly in the basal joint.

The mandibular feet when multiarticulate, are sometimes furnished with many long setæ at the extremity, and in other cases with only one or two setæ (fig. 63). There are many species in which only the mandibular (basal) joint exists.

First pair of maxillary feet or maxillæ.—These maxillary feet are one- to four-jointed, and as in the preceding there is sometimes a lateral branch.

When of the most simple form, there is a single lamellar joint with a lateral lobe, the whole edged about the apex and inner side with minute hairs, as in fig. 64; or, there is a one- or two-jointed organ, with a few short spines at apex (figure 65).

Other forms, more complex in general appearance, are represented in figures 66 to 73.* Figure 66 has three lamellar joints, of which the apex of the first and one margin of the second joint are furnished with spinulous setæ for maxillary purposes. There are also on the opposite apex of the first joint a cluster of long setæ, and another forms the apex of the third (or last) joint. In figure 67, the spinulous maxillary setæ belong all to the first joint; and from both apices of the same, there are several long setæ. The second joint is large and simply lobed, and bears a number of setæ in three clusters. Figure 68 in the main resembles 67. The second joint bears two others at apex, and on one side a single joint of another branch. Figure 69 is essentially like 68. Figures 70, 71, and 72, have the same parts as the preceding.

Thus among the above, two kinds may be made out; one in which the spinulous maxillary setæ are confined to the first joint, and the other in which they belong mostly to the second. The position of these setæ may be seen on Plate 75.

* Figure 64, Plate 71, from a *Corycæus*; 65, *Sapphirina*; 66, *Euchæta*; 67, 68, 69, *Calanus*; 70, 71, 72, *Pontella*; 73, *Oithona*; 73 bis, *Candace*.

Figure 73 represents another kind, in which the setæ belong to the basal joint and are very stout, instead of being capillary. There are two branches, one terminating in two rather short setæ, and the other in one very long naked seta.

The parallelism between the parts of these organs and the mandibles or posterior antennæ is apparent from the figures (which have the joints numbered to correspond) without farther explanation.

Second pair of maxillary feet or maxillipeds.—The maxillipeds are always simple, or have only a rudimentary second branch. They vary in number of joints from one to five. One of the simple uni-articulate forms is seen represented in figure 74 *a*.* It has an uncinatè apex; which in a lateral view, is seen to be furcate; and, besides, there are two obtuse setiform processes, which are short setulose.

In figure 75 (*Corycæus*), another variety, there are two joints, and the termination has much similarity to the preceding. Of the two setiform processes, one is closely ciliate, and the other has a short scopiform extremity.

In figure 76, there are the same elements, but with three joints, the uncinatè termination constituting a separate joint. There are three setiform processes on the inner side, which are furcate and short setulose.

In figures 77, 78, there are three stout joints in the same line, the last not uncinately prolonged, and all furnished on the same side with long, setulose, simple setæ; the setæ are acute, and those of the first of the three joints are the shortest.

In figure 79, the organ has four joints and is geniculate between the first and second. It resembles both figures 76 and 77, but it has not the uncinatè extremity of the former, and is not straight like the latter. The joints are furnished with long setulose setæ.

In figures 80 and 81, there is much resemblance to 79, but the long setæ are naked instead of being setulose.

It is plain here that there is but one type for the whole, and a comparison of figures 76 or 77 with figures 66 or 69, will exhibit a general correspondence with the maxillæ; and by a glance at figures

* From a *Sapphirina*; figure 74 *b* is the same, in a different position; 75, *a, b*, *Corycæus*; 76, *Harpacticus*; 77, *Pontella*; 78, *Euchaeta*; 79, *Oithona*; 80, 81, *Candace*.

47, 48 (inverting the latter), evident relations to the forms among the second antennæ will be observed. The joints are numbered so as to exhibit their normal relations.

Anterior pair of legs.—This pair is one of the most various in form, in the Cyclopoidea. In some species it is rudimentary, the preceding being in this case unusually enlarged. In others it is long and seven- or eight-jointed, with slender setæ to the joints (fig. 82). Still others, in which there are as many joints as in the last, have the last five short, so that the setæ form together a long thick pencil (f. 83.) In others, again, the organ is subcheliform (figures 84, 85, 86, Plate 71), or it terminates in a claw (figure 87), or in a few short setæ (figures 88, 89), or in one or two oval plates. The relations of figures 82 and 83 are obvious from the figures; and the passage into the cheliform variety takes place, in the same manner as in the posterior antennæ. In figures 84 and 85 there is a setose prominence on the large joint corresponding to the hand, to which the claw is opposed in grasping.

In figure 89, there is the same general structure; and if the last joint and the prolonged apex of the penult joint were both lamellar, the organ has a bilamellar termination, as above alluded to.

In figure 90, the organ is nearly rudimentary. Moreover, it is two-branched. And if we compare it with figure 77 or 78, which represents a maxilliped, we may infer that the maxilliped corresponds to one branch (3' 4'), and these feet we are describing, to the other branch. This appears from the setulose setæ of the branch, 3' 4', which are identical with those of the maxilliped referred to. Figure 91, is another rudimentary form (three or four times more magnified than figure 90), and the whole probably corresponds to the shorter branch of figure 90. Figure 92 is another example of the same. It is closely related to figure 79, and is actually from the same species; the organ is quite small, while the maxilliped, as is seen in figure 79, is comparatively large.

These organs sometimes differ in the sexes. Figures 84 and 85 are male forms, and figure 87 a female form of this organ, in one of the genera. The enlargement in the male takes place to enable it to use them for grasping in coition.

This pair of legs is often called a pair of *maxilla-feet*, *jaw-feet*, or *masticatory feet*. It is more correct and better sustained by analogies

to call it a pair of true legs. Its form is generally that of a pair of legs, being either elongate, pediform, or furnished with a monodactyle hand, and it differs as widely from proper maxillipeds as the anterior legs in *Astacus*, or the prehensile legs in *Tanais*. They are situated in some genera very close to the mouth, but not so in others; and in none nearer than the anterior pair in *Tanais*. This pair is normally the seventh in the body, while the first pair in *Tanais* and all Choristopods is the eighth; but this is no good objection, certainly no better than could be urged against calling the two anterior pairs in Isopods feet, these pair corresponding to pairs of mouth organs in the Decapods. The typical form in the Decapods is based on the existence of but five pairs of legs, the nine more anterior pairs of organs being devoted to the senses and mouth; in the Choristopods the senses and mouth have but *seven* of these pairs of organs; and in the highest Entomostracan type, the senses and mouth have but *six*.

The legs referred to, that is, the first pair of organs preceding the natatories, are a large stout pair in *Caligus* and *Argulus*, in which genera they are called legs.

Natatory legs.—The natatory legs do not differ essentially from these organs in most other Entomostraca. They are furnished with setæ for natation, excepting sometimes the first pair, which, in one or two genera has lateral play, and is imperfectly prehensile. They are always two-branched, and have a two-jointed base, excepting when one of the joints is obsolete. These branches are two- or three-jointed; rarely one of the branches consists only of a single joint.

There are four pairs of natatory legs of the kind here described, and sometimes also, posterior to these, a fifth pair. But this fifth pair when not rudimentary, has usually a prehensile or subcheliform character, fitting it for use in coition. Figures 93, 94, and 95 are examples of the rudimentary fifth pair. In figure 94, the leg is reduced to a single joint. In figures 96 to 100, several cheliferous forms are exhibited. Figures 96 and 97 represent each a pair, having the left leg rudimentary, and the right cheliform. Figures 98 and 99 are the right leg alone of other species. Figure 100 is the pair of still another genus; the left is much elongated and subulate, while the right is also long, and besides is subcheliform. Figure 95 is female to 96, and 93 is female in the same genus with 100.

The anterior pair of natatories is sometimes destitute nearly of

setæ, and takes a subprehensile character. In *Harpacticus* and the allied genera it varies much in the articulations, the highest number being three joints in both branches, and varying as regards one branch (the inner) from three to one; and this branch may even become obsolete or rudimentary, as in *Laophon* of Philippi. In the genus *Setella* this pair spreads laterally, and may serve for grasping the body of the female.

Abdomen.—The abdomen varies in number of segments from one to six, and is generally not half as long as the cephalothorax, though sometimes exceeding it in length. Figures 101 to 111, Plate 71, represent various forms; 101 has *four* joints, which is a common number; 102 and 104, have *three*; 103, *two*; 111, but *one*; 105, 106, 107, and 109, *six*; 108 has the joints very much elongated. The variations in number of joints is large in the same genus; and even may differ in a given species.

The first segment is often obsolete, and, as in the *Sapphirinæ*, fails in some males, when present in the females. Very often too it is united with the second, and distinguishable only by a faint suture. Frequently, also, the sixth is obsolete or is concealed beneath the fifth, as in many *Sapphirinæ*.

The first segment often bears a pair of appendages which are sometimes nearly as long as the abdomen, though in general, when present, quite short, or only represented by one or two setæ. These appendages are seen in figures 107 and 110, and the setæ corresponding to them, in figures 106 and 108. When of large size they lie over the bag of eggs in the female, serving to retain it in place; the male of such species usually have the same organs much shorter than the females. The bags of eggs are always connected with the second (normal) segment, which is the first apparent one, when the normal first is not distinct. This second segment, as in *Setella*, may also have a pair of appendages.

The *caudal stylets* are either lamellar or styliform, according to the form of the species. In many species they are furnished with six setæ; but in the different genera, the number varies through the obsolescence of some of the six. The six may be seen in figure 101; the inner of the six is always short, as in the species here represented, and it is often bent. In figures 102, 104, 105, 106, there are but *five*, the inner being wanting. In 107, both the inner and outer of the six

are absent, and there are only *four*. In 108 and 111, a second inner is wanting, and consequently there are but three setæ. In 109, one seta is very much elongated, so as to be much longer than the animal, and the others are very short.

The same variations take place with the setæ of the lamellar stylets, except that the number never exceeds *five*. This number is seen in 112. In 113, the inner of the five is wanting, and there are but *four*; and in 114, the outer as well as inner is wanting, leaving but *three*.

Circulatory system.—We have ascertained little regarding the circulating system, except recognising in most species the existence of a heart in the posterior half of the thorax. What we have on this subject will be presented in connexion with the descriptions of the genera and species.

Genital system.—The seminal duct of the male extends from the abdomen forward in the cephalothorax as far as the mouth, where there is a pair of ovoid or pyriform glands which are united together at the smaller apex. The ovarian ducts are much convoluted on either side of the cephalothorax, and often extend quite to the front of the animal. Figures will be referred to, and farther descriptions beyond.

Nervous system.—A large ganglion exists over the mouth and surrounds the œsophagus, the latter passing upward from below through it. In the species where it was studied, there was no other ganglion. The nerves of the eyes, anterior antennæ, and front portions of the animal, were distinct; and the cords passing to the posterior members start from this ganglion, and give off branches, without an enlargement in any part (see figures 2 *a, g*, Plate 88). In such species, therefore, the nervous system fails of presenting the important characteristic distinguishing the Articulata from the Mollusca,—that is, a succession of ganglia for the separate segments, although in its position and in the external structure of the animal, the articulate character is very distinct.

Further details will be given on these points in connexion with the description of particular species on the following pages.

Classification.—Among the Cyclopoidea, we distinguish *three* families. There are species in which the mandibles and maxillæ have a jointed,

palpiform appendage, of considerable size, which is furnished with setæ; the mandibular palpi (or, more properly, the pediform termination of the mandibular organ) extend laterally in such species like a pair of short legs. Moreover, the feet of the first pair never take the form of a monodactyle hand. These are the CALANIDÆ.

The remainder have the mandibular palpi small with few setæ, or obsolete, and the feet of the first pair often terminate in a monodactyle hand, or are in some way prehensile at the extremity. These species, may, as in the ordinary Cyclops, have only a single minute eye of two lenses, or there may be also a second pair consisting of a large prolate lens with a very broad oblate cornea in the shell, as in Sapphirina. Those of the former kind are the CYCLOPIDÆ, and those of the latter kind, the CORYCÆIDÆ. The flat or depressed, sub-cylindrical, and compressed forms of body may all occur in the same family, as such variations are of small importance; and the transitions are sometimes so gradual that it is difficult to divide off the depressed species from the others in a group.

The three families mentioned may be characterized as follows:—

Fam. I. CALANIDÆ.—Oculi duo simplices minutissimi, pigmentis sive coalitis sive discretis; interdum oculi quoque alii duo coaliti infra caput deorsum spectantes. Mandibulæ maxillæque elongatè palpi-geræ vel instar pedum productæ, palpibus bene setigeris. Sacculus ovigerus unicus. Antennæ 1mæ elongatæ, non appendiculatæ; antenna *maris* sive dextra sive nulla geniculans. Pedes 1mi extremitate nunquam subprehensiles.

Fam. II. CYCLOPIDÆ.—Oculi duo simplices minutissimi, pigmentis coalitis. Mandibulæ palpo parvulo vel obsolete et parce setigero. Sacculi ovigeri sive unicus sive duo. Antennæ 1mæ sæpe appendiculatæ, *maris* sive ambæ sive nullæ geniculantes. Pedes 1mi extremitate plus minusve subprehensiles.

Fam. III. CORYCÆIDÆ.—Oculi duo simplices minutissimi, pigmentis coalitis; alii quoque duo portentosæ magnitudinis, lenticulo prolato interno, corneâque magnâ oblatâ in testam insitâ instructi. Sacculi ovigeri sive duo sive unicus. Antennæ 1mæ nunquam geniculantes. Pedes 1mi extremitate sæpius subprehensiles.

We doubt somewhat as to which of these families takes precedence

in rank. The largely developed mandibular palpus is not proof of superiority; neither, as among the Macroura, can it be considered a mark necessarily of inferiority. The species of Cyclopoidea attain their largest size among the Calanidæ, some in this group being a fourth of an inch in length. There is also a strength and agility which may perhaps be additional evidence of their superiority. We commence, therefore, in our further consideration of the species of Cyclopoidea, with the family Calanidæ. They are pre-eminently oceanic species, while the Cyclopidæ are found mainly in fresh waters and along sea-shores. The Corycæidæ are also oceanic species, and among the Sapphirinæ there are species of comparatively large size.

The distinctive characters of many genera in these families depend largely on different modes of adapting the sexes to cling together in coition. These modes are as follows:—

1. Both male antennæ of the first pair with a geniculating joint, as in *Cyclops*, *Harpacticus*, &c.

2. The right male antenna alone of the first pair with a geniculating joint, and at the same time the right leg of the last thoracic pair being large prehensile for the same purpose, as in *Pontella*, *Candace*, &c.

3. Neither male antenna of the first pair with a geniculating joint, but both having a peculiar flexibility, which may fit them for the same end, as in *Setella*, *Clytemnestra*.

4. The male antennæ of the first pair unmodified and rigid; but the second pair of antennæ very large and stout prehensile, as in *Corycæus*, *Sapphirina*, &c.

5. Neither pair of antennæ adapted for the purpose, but the first pair of feet (sometimes called outer maxillipeds), much elongated, and having lateral play, as in *Calanus*. *Calanus* and *Pontella* pass into one another by very gradual transitions. As the geniculating joint of the right antenna in the *Pontellæ* becomes weak, and the size of the posterior thoracic legs small, this anterior pair of legs, which is rudimentary in the more characteristic *Pontellæ*, as gradually enlarges and takes on the *Calanus* form.

6. Neither pair of antennæ fitted for prehension; but both of the posterior thoracic legs (a pair posterior to the four pairs of natatories, and the same which on the right side is prehensile in *Pontia*) very much elongated, nearly to the length of the body, as in *Euchaeta*.

These forms are illustrated in the figures already referred to, Plates 70 and 71, and by others on the following plates.

FAMILY I. CALANIDÆ.*

THE relations of the Calanidæ to the other Cyclopoidea it is unnecessary to dwell upon at much length, after the remarks already made, and the illustrations given on Plates 70, 71. To this family belong figures 21 to 41, Plate 70, of the anterior antennæ; 50 to 55, Plate 70, with 48, of the posterior antennæ; 57 to 61 and 63, of Plate 71, the mandibles or mandibular feet; 66 to 73, of the maxillæ; 77 to 81, of the maxillipeds; 82, 83, and 90 to 92, of the anterior feet; and the various figures on the following Plates 72 to 82 illustrate farther their general characters and structure.

The cephalothorax varies in its segments, as explained on page 1024, and the number of joints is not a generic distinction; an attempt to use it as such would prove a vexation to science, besides dissevering natural associations of species. In nearly all the genera, the number of joints varies; and in some cases it does not appear to be altogether constant in a species.

The front is rostrate and either acute or furcate, as in figures 9, 10, 11, Plate 70. Only a few species (*Euchætæ*) have the emargination shown in the profile view in figure 11, Plate 70. The extremity is usually furcate and the divisions are sometimes slender setiform, and quite long.

The *eyes* are of two kinds, the *superior* and *inferior* (page 1025); the superior eyes are either united on a single point of pigment, as in the Cyclops, or they are distant, with separate spots of pigment. Both varieties are found among the Pontellæ.

The anterior *antennæ* vary in number of joints from seven to twenty-four (and perhaps twenty-eight), as explained on pages 1026-9. They are alike in both sexes in some genera, and in others the right has a geniculating joint and an enlargement, as in the figures referred to on Plate 70, and also Plate 82, fig. 6 *c*. These organs are long, and have no perfect flexion at any of the articulations excepting the basal, and the geniculating joint in certain males.

* The new species of Calanidæ beyond, are briefly described by the author in the Proceedings of the American Academy of Arts and Sciences, for 1849, vol. ii. pp. 10 to 34.

The posterior antennæ have usually two branches, and they terminate in setæ.

The mandibular feet have a dentate mandible for the basal joint, and a stout second joint, bearing commonly two short branches one- or two-jointed, each ending in a tuft of setæ.

The first pair of maxillary feet are irregularly lobed, as shown in the figures already referred to. The setulose setæ, especially used for maxillary purposes, proceed from one side of one or both of the first two joints. The other setæ are longer and generally plumose.

The *maxillipeds* are not branched. They are stout organs, either straight or flexed, furnished on one side and at apex, with long setæ either naked or setulose. They are sometimes obsolescent, when the following pair is much enlarged.

The first pair of feet are either obsolescent; or long and slender legs. When the former, they are sometimes two-branched, as in figure 90, Plate 71, but when the latter, one branch is wanting and the other is much enlarged, as seen in figures 82, 83. The last five joints are shorter, and the setæ, therefore, more crowded together in 83 than in 82.

The posterior pair of cephalothoracic legs when developed are either true natatory or subprehensile, as in figures 96 to 100, Plate 71. This prehensile character belongs only to the right leg of the pair in males. Figures 94 and 96 belong to the same species, female and male; 93 is female, and 100 male; 99 is another form of the prehensile leg.

The abdomen is always without appendages to the basal joint; the number of joints is rarely over *five* and oftener it is *four*. It varies somewhat even in the same species in its different states, and often differs in the sexes; and it is unsafe, therefore, to use it as a distinctive character of species.

Figures 101 to 104, and 108 to 110, Plate 71, are from different Calanidæ. The caudal stylets and setæ are specifically constant, and are an important means of distinction; their varieties of form will be observed in the figures alluded to, and in the various plates of species of this family.

The more prominent points of difference among the Calanidæ, suggesting a subdivision into subfamilies, are to be found in the first pair of antennæ and the eyes. The existence of an inferior eye, situated

on the under side of the head, distinguishes *Pontella*, *Acartia*, and *Catopia* from the other genera; and a geniculation in the right male antenna of the first pair, characterizes *Pontella*, *Catopia*, *Candace*, *Diaptomus*, *Hemicalanus*. The presence of the inferior eye, with commonly the geniculating right antenna, may, therefore, distinguish one subfamily, *Pontellinæ*, from the other related, *Calaninæ*, in which the inferior eye does not exist. The transitions among the genera of the two groups thus instituted, are, however, very gradual. An enlargement of the posterior thoracic legs in the males, and the existence of a prehensile form in the right leg of the pair is found in all the species that have the geniculating joint in the right male antenna. But there are two genera in which this enlarged posterior pair of legs exists, without the geniculating joint. One of them, *Undina*, closely resembles *Calanus* in most characters, but has a slight angle in the antennæ, not far from its middle, and probably this organ has the power of flexion, in the same manner as when a geniculating joint exists; the genus, therefore, is intermediate between the *Calaninæ* and *Pontellinæ*. The other, *Euchæta*, also, has nearly the habit of *Calanus*; although, differing from all the other *Calanidæ* in its beak, the long setæ of the female antennæ, and the anterior feet. *Calanus* and *Euchæta* are the only genera in which the feet of the first pair are stouter than the maxillipeds, the maxillipeds being generally the larger pair, and the first pair of legs in *Pontella* being sometimes even rudimentary.

A single genus, *Oithona*, differs widely from the others in having the abdomen very long linear, not shorter than the cephalo-thorax, and the maxillæ and mandibles of peculiar form, and it may be the type of a third subfamily, *Oithoninæ*.

Besides these, there is another subfamily quite distinct from the above, in having the antennæ of the second pair prehensile or monodactyle. It includes the genus *Notodelphys* of G. J. Allman.* The probable relation of the *Notodelphys* to the *Calanidæ* in the maxillipeds, maxillæ, and mandibles, will be seen on comparing these organs with those of the other *Calanidæ*; and to aid the comparison we have copied on Plate 71 the figures of these parts by Allman. Fig. 117 is the mandibular palpus; 118, maxillary palpus; 119, maxilliped; 120, first pair of legs. Figure 116 of the same Plate, represents the

* Ann. and Mag. Nat. Hist., xx. 1, Pl. 1 and 2; and Baird's Brit. Entomost., 1850, 237, Pl. 30.

antenna of the second pair; the form is nearly like that of *Corycaeus*, although the species is very unlike those of that genus and family in the mouth organs, and in the absence of the spectacle-eyes. It appears, therefore, to be a connecting link between the other Calanidæ and the Corycaeidæ.

The subfamilies indicated, and the genera they contain are characterized as follows:—

1. ANTENNÆ 2DÆ NON PREHENSILES.

SUBFAM. 1. CALANINÆ.—Abdomen longitudine mediocri. Oculi inferiores nulli. Antennæ 1mæ longæ, fere transversim porrectæ; dextra *maris* articulatione non geniculans. Antennæ 2dæ apice setigeræ. Maxillæ latere interiore setigeræ.

- G. 1. CALANUS, *Leach*,* *D.*—Cephalothorax 4–5-articulatus, capite non discreto. Frons sæpius rotundatus raro triangulatus, rostro infra tenuiter furcato. Oculi superiores minuti, conjuncti. Pedes antici maxillipedibus longiores, lateraliter porrecti; postici *maris* et *feminæ* sive regulariter biremes sive obsolescentes. Antennæ 1mæ fere transversim porrectæ, setis regularibus antice ornatae. Antennæ posticæ biramæ, ramo anteriore setis tribus confecto.
- G. 2. RHINOCALANUS, *Dana*.—*Calano* affinis. Frons elongatè productus, rostro breviter et crasse furcato.
- G. 3. CETOCHILUS, *Goodsir*, haud R. de Vauzème.†—*Calano* affinis. Oculi superiores remoti. Cephalothorax 5–7-articulatus, capite plus minusve discreto. Antennæ 1mæ et 2dæ et pedes 1mi ac in *Calano*. Pedes postici biremes precedentibus similes.
- G. 4. EUCHLÆTA, *Philippi*.‡—Frons triangulatus, acutus, rostro brevi transversim emarginato et non furcato. Oculi superiores minuti, conjuncti. Antennæ 1mæ *maris* non geniculantes sed angulo leviter flexæ, *feminæ* setis paucis longis et aliis brevibus antice ornatae. Pedes antici elongati, maxillipedibus longiores, duplo geniculati et sub corpore projecti, penicillum setarum nudarum reflexum ferentes. Pedes postici *maris* ambo valde elongati, subulati.
- G. 5. UNDINA, *Dana*.§ — *Calano* affinis. Pedes antici fere ac in *Calano*;

* Dict. Sci. Nat., Art. Entomostraca; Dana, Am. J. Sci. [2], i. 1846, p. 228; *Cetochilus*, Roussel de Vauzème, Ann. Sci. Nat. [2], i. 333; Edwards, Crust., iii. 421; *Temora*, Baird, Brit. Entomostraca, 1850, 227.

† *Cetochilus australis* of Roussel de Vauzème (Ann. Sci. Nat. [2], i. 333), does not differ essentially from *Calanus*. The *C. septentrionalis* of Goodsir (Jameson's Edinb. New Phil. J., xxxv. 339, pl. 6) has the two superior eyes remote; and unless a *female* of a *Pontia*, is a good genus, as all the true Calani have their eyes united on a single minute spot of pigment.

‡ Archiv für Naturg., ix. 55; *Euchirus*, Dana, Amer. J. Sci. [2], i. 228.

§ Proc. Amer. Acad. Sci., 1849, ii. 22.

postici *maris* crassi dextro prehensili ac in *Pontiâ*. Antennæ angulo leviter versus medium flexæ, *maris* articulatione non geniculantes.

SUBFAM. 2. OITHONINÆ.—Abdomen prælongum et lineare, cephalothorace vix brevius. Oculi inferiores nulli. Maxillæ latere interiore subdigitatæ. Antennæ 1mæ longæ, pauci-articulatæ; dextra *maris* non geniculans nec angulo flexa. Antennæ 2dæ apice setigeræ, simplices (?).

G. 1. OITHONA, *Baird*.*—Maxillipedes pedibus anticis majores, 4-articulati, geniculati, et prorsum flexi. Pedes postici parvuli. Seta grandis sæpe plumosa e basi pedum biremium interdum lateraliter porrecti.

SUBFAM. 3. PONTELLINÆ.—Abdomen longitudine mediocri. Oculi superiores sæpeque inferiores. Antennæ 1mæ longæ; dextra *maris* articulatione geniculans (genere *Acartia* forsitan excepto). Antennæ 2dæ apice setigeræ. Pedes postici *maris* crassi, dextro prehensili.

1. *Oculis superioribus instructi tantum.*

G. 1. DIAPTOMUS, *Westwood*.† — *Calano* antennis pedibusque affinis. Ramus antennarum 2darum minor 6–7-articulatus, articulo ultimo oblongo, articulis 4 ante ultimum medianis perbrevibus. Maxillipedes pedibus anticis vix minores interdum majores. Pedes postici *maris* crassi, dextro subprehensili; *feminæ* longi et crassi, precedentibus non similes. Sacculus externus ovigerus unicus.

G. 2. HEMICALANUS, *Dana*.‡ — *Calano* antennis pedibusque affinis. Antennæ 1mæ 2dæque ac in *Calano*. Ramus antennarum 2darum minor sine 4 articulis perbrevibus medianis. Maxillipedes pedibus anticis vix minores vel majores. Pedes postici *maris* crassi, dextro prehensili; *feminæ* sive biremes et precedentibus similes sive parvuli.

G. 3. CANDACE, *Dana*.|| — Frons quadratus. Antennæ 1mæ recte transversæ, antice regulariter et breviter setigeræ. Maxillipedes pedibus anticis majores,

* Baird, Zoologist, 1843; *Scribella*, Dana, Am. J. Sci. [2], i. 227, and Proc. Amer. Acad. Sci., 1849, ii. 19.

† J. O. Westwood, Partington's Cyclop. Nat. Hist., Art. Cyclops, 1836, and Entomologist's Text Book, 1838; W. Baird, Brit. Entomost., p. 219; *Cyclopsina*, Edwards (in part), Crust., iii. 427; Baird, Zoologist, i. 56, and Trans. Berw. Nat. Club, ii. 154; *Omethia*, Templeton, Trans. Ent. Soc., ii. 118, 1838; *Glaucea*, Koch, Deutschl. Crust.; *Broteas*, Loven, Kongl. Vet. Akad. Handl., for 1845, p. 436, pl. 6, and Ofvers. Vet. Acad., Förhandl., 1846, p. 57. Loven's species has the posterior antennæ, abdomen, and absence of inferior eyes of Diaptomus; and the first pair of feet are longer than the maxillipeds. The species *B. falcifer* is from marshes near Port Natal. The female is represented with a large bag of eggs attached.

‡ *Cyclopsina*, Dana, Proc. Amer. Acad. Sci., 1849, ii. 24.

|| Amer. J. Sci. [2], i. 1846, 227; Proc. Amer. Acad. Sci., 1849, ii. 22.

duplo geniculati et inflexi, 4-articulati, setis nudis longis. Styli caudales perbreves, setis strictè appressis.

2. *Oculis superioribus et inferioribus instructi.*

G. 4. ACARTIA, Dana.*—Frons rotundatus. Antennæ 1mæ longæ, rectiusculæ, flexiles, setis quaquaversum insistentibus ornatae, dextrâ maris non geniculante (?). Pedes postici *feminae* et *maris* (?) parvuli, uni-articulati, 2 setas divaricatas gerentes. Maxillipedes et pedes antici fere ac in *Pontellâ*.

G. 5. PONTELLA (*Pontia*, Edwards).—Frons sive rotundatus sive triangulatus, rostro infra rigide furcatum. Oculi superiores sive coaliti sive late disjuncti. Antennæ 1mæ longæ, sæpe oblique prorsus porrectæ, antice regulariter setigeræ. Antennæ posticæ biramæ, ramo anteriore setis quinque apice sæpius confecto. Cephalothorax 4-7-articulatus. Maxillipedes pedibus anticis majores, recti, setis longis setulosis antice instructi.

3. *Oculis superioribus carentes.*

G. 6. CATOPIA, Dana.†—*Calano* paulo affinis. Antennæ 1mæ fere transversim porrectæ, regulariter setigeræ. [In specie scrutatâ cephalothorax 4-articulatus, styli caudales oblongi et divaricati, caputque quadratum.]

The Calanidæ, when not colourless, are usually tinged either with reddish, bluish, or purplish shades. The red colour is often confined to the internal parts near the mouth, and to the sides covering the muscles of the legs. The blue colour is sometimes quite deep, and occasionally it passes into a rich green. In several species, the back has a silvery or pearly appearance. A few have the body, natatory legs, and the antennæ in part a rich black or brownish black.

The species are widely distributed over all oceans, both in the tropics, and far beyond, north and south. A hand-net of gauze thrown at any time, but especially at night, or before daylight in the morning, will almost invariably bring up some species. Calm weather is the most favourable. At times, they occur in swarms that cover square miles of ocean, giving the waters the bloody tint so often

* *Pontia*, Edwards, Ann. des Sci. Nat., 1828, xiii. 296, and Crust., iii. 417; *Pontella*, Dana, Am. J. Sci. [2], i. 228, and Proc. Amer. Acad. Sci., 1849, ii. 26. The genera *Anomalocera*, Templeton, Trans. Ent. Soc., ii. 35, 1837, and Baird, Brit. Entomost., p. 229; and *Irenæus*, Goodsir, Jameson's Jour., 1843, xxxv. 337, are here included, as they differ in no essential point from *Pontia* of Edwards.

† Proc. Amer. Acad. Sci., 1849, ii. 25.

described. When thus abundant, they are food for the right whale, whose arrangement of whalebone in the roof of the mouth serves to strain these minute animals from the water which it ejects by the spout-holes. The species never exceed a quarter of an inch in length, and rarely an eighth of an inch; as seldom also do they fall short of a twentieth of an inch.

SUBFAMILY CALANINÆ.

The Calaninæ pass into the Pontellinæ through *Undina*, of the former, which has the posterior prehensile leg in males like *Pontella*, but no geniculating joint in the antennæ, and no inferior eyes; and through *Hemicalanus* and *Diaptomus* of the latter, which have the geniculating male antenna of *Pontella*, without the inferior eyes; and through *Acartia*, which has the inferior eyes of *Pontella*, but without probably the geniculating antenna, or prehensile posterior legs.

The genus *Cetochilus* of Roussel de Vauzème,* is essentially identical with *Calanus*, if the right male antenna is not geniculating, and the inferior eyes are wanting, as would appear from the figures and descriptions. The posterior legs, moreover, are not prehensile, according to Milne Edwards, who states that he examined sixty specimens. The species *C. australis* is intermediate between the *Calani* and *Pontellæ*. The *Cetochilus septentrionalis* of Goodsir† may be the type, however, of a good genus, as recognised on page 1044. This species resembles the females of some *Pontellæ*.

GENUS CALANUS, *Leach*.

The species of *Calanus* are distinguished by having only a single pair of eyes united on a minute spot of pigment; the anterior feet prolonged and laterally extended, with long unequal setæ to each joint; the posterior legs obsolescent in both sexes; the antennæ alike in both sexes, and neither prehensile.

* Ann. des Sci. Nat. [2], i. 333, 1834.

† Jameson's Edinb. New. Phil. Jour., xxxv. 339, pl. 6, f. 1-11.

The cephalothorax has never a distinct cephalic segment, like many Pontellæ. The number of segments is usually *four*, one long anterior, corresponding to all the anterior members, as far as the second pair of natatories; and then three short posterior, each bearing a pair of natatories (the second, third, and fourth). Another segment posterior to these is sometimes observed.

The front has below a furcate beak, and in some species the furcations are long capillary (Plate 75).

The anterior antennæ project laterally, usually with a double curvature, the two bracket-like (—) in position, with the tips not anterior to the line of the front. A few have the antennæ straight, and these form an approximation to the Pontellæ. The number of joints is large, and the setæ are regularly arranged along the anterior margin, excepting two or three upon the terminal joints, which project backward. The relative lengths of the apical and subapical setæ, as well as the position of the antennæ, afford good characters for distinguishing species. The *subapical* setæ are those of the penult and antepenult joints.

The posterior antennæ have each branch terminating in setæ. In the longer branch, the first joint constitutes the greater part of its length; the following part is quite short, and bears its setæ in two clusters. The shorter branch is nearly equal in its two joints; the setæ at apex are three in number and they are bent; and besides these, there are several longish setæ on the side of the first of the two joints. In a few species, the second joint consists of five or seven very short joints.

The organs of the mouth and their position are shown on Plate 75.

The maxillipeds are like those of the Pontellæ, but smaller. They are straight, three-jointed, with several long setulose setæ on the anterior side.

The next pair of organs (the anterior legs) are long, and have a lateral play, and the species are thus distinguished from the Euchætæ, in which the five terminal joints are short, their setæ collected into a pencil, and the organs act only in the line of the body.

The natatories have the branches either two- or three-jointed, usually both the latter.

The abdomen is without appendages, excepting the stylets at the extremity. These are furnished with six setæ; the inner very short (sometimes obsolete?), the next, which we have called the *first* (being

the *first* of the longer setæ), is shorter than the *second*, which is always the longest seta of the stylets.

The position of the antennæ, mouth, and organs about the mouth, and immediately posterior to it, are shown on Plate 75. The buccal mass (*m*) is quite large, and has behind a ciliated lip. The nerves to the anterior antennæ are also shown.

A young individual, probably of a *Calanus*, is represented in figure 3, Plate 76. Length, one-thirtieth of an inch. There are three pairs of jointed organs; the first simple, and the other two, two-branched, each branch one-jointed. It was collected, in the harbour of Rio Janeiro, January, 1838.

The Calani are among the most common of the oceanic Cyclopoidea. Their colours are either a faint tinge of red, purple, or bluish purple, rarely a pure blue, like many Pontellæ.

The genus *Calanus* was instituted and incorrectly characterized by Leach. As the species here described are evidently congeneric with the *Calanus finmarchianus* (Leach), we adopt the generic name, without his generic description. The genus *Temora* of Baird, was instituted in 1850 (Brit. Entomost., p. 227), for the *Calanus finmarchianus* of Leach, and, therefore, upon the same type as that of Leach's genus.

I. SETÆ ANTENNARUM IMARUM APICALES SUBAPICALIBUS LONGIORES.

a. *Styli caudales vix oblongi.*

CALANUS ROTUNDATUS.

Frons rotundatus. Cephalothorax 4-articulatus, crassus, posticè obtusus. Antennæ anticæ corpore vix breviores, 24-articulatæ, duplo curvatæ, apicibus fronte paulo posterioribus, articulo ultimo elongato; setis apicalibus articulum ultimum longitudine æquantibus, anticis apice remotis, setis sub-apicalibus minutis. Styli caudales brevissimi; setis inæquis, secundis abdomine longioribus et apice divaricatis.

Front rounded. Cephalothorax four-jointed, stout, obtuse behind. Anterior antennæ about as long as body, twenty-four-jointed, doubly curved, apices behind line of beak, apical joint elongate; apical setæ

flexed backward, as long as the last joint, the anterior remote from the apex, subapical setæ minute. Caudal stylets very short, setæ unequal, the second longer than abdomen with the apex curved outward, the others a little shorter than the abdomen.

Plate 72, fig. 1 *a*, animal, enlarged; *a'*, natural size; *b*, extremity of anterior antenna, enlarged; *c*, side view of body, showing alimentary canal (*i*, *i'*) and position of heart (*h*); *d*, a young animal, possibly of this species; caught, April 9, 1840, at the same time with the preceding.

South of Tongatabu, in latitude 32° 24' south, April 9, 1840, when many specimens were caught; also, near Gilbert's Island, April 19, 1841; also, latitude 28° north, longitude 171° 30' east, May 17, 1841.

Length, one line. The body is stouter than usual; the beak is short, and in a side view is not incurved. The unequal setæ of the caudal stylets is a prominent characteristic. The setæ of the antennæ are short; those near the base scarcely longer than the diameter. The terminal joint has some appearance of being double, the setæ on the anterior side being at the apex of what might be thought the first of the two joints. The posterior setæ of the two subapical joints are nearly obsolete. The anterior seta of the fourth joint, counting from the apex, is a little elongated, and the same is true of that of the seventh joint, both being a little longer than the joint to which attached; while the setæ of the other joints in the same part of the antennæ are very short.

The posterior antennæ have the anterior branch much the longest. The setæ of the following organs are moderately short. Caudal setæ spread but little. The abdomen has four joints, of which the first is much the longest.

CALANUS COMPTUS.

Frons rotundatus. Cephalothorax 4-articulatus, posticè obtusus. Antennæ anticæ tenuissimæ, cephalothorace paulo longiores, fermè 24-articulatæ, duplo curvatæ, apicibus fronte posterioribus, articulo ultimo

elongato (forsan duplice); setis apicalibus posticis articulum fere æquantibus, anticis apice remotis, posticâ penultimâ articuli longitudine, anticâ penultimâ et antepenultimis minutis. Styli caudales breves; setis strictis, rectis, duobus paulo longioribus.*

Front rounded. Cephalothorax four-jointed, obtuse behind. Anterior antennæ very slender, a little longer than cephalothorax, about twenty-four-jointed, doubly curved and apex behind line of beak, short setigerous, last joint elongate (perhaps double); posterior apical setæ nearly as long as joint, anterior remote from apex, posterior penult as long as penult joint, anterior penult and both antepenult obsolescent. Caudal stylets very short; setæ straight, not spreading, two a little longer than the others.

Plate 72, fig. 2 *a*, animal, enlarged; *b*, extremity of anterior antennæ; *c*, abdomen, in profile.

Latitude 40° north, longitude 157° west, July 2, 1841; also, latitude 45° north, longitude 156° west, July 6, 1841; also, in latitude 27½° south, longitude 136° west, August 13, 1839.

Length, one-fifteenth to one-twelfth of an inch. The body has the usual proportions. The caudal setæ are peculiar in not being divergent, and the stylets are scarcely longer than broad, not exceeding, or scarcely so, the last segment of the abdomen. The setæ of the anterior antennæ towards the base are scarcely longer than the diameter of the antenna. The last joint of this organ has the same appearance of an oblique articulation under the apex of the preceding, as in the *C. rotundatus*. The anterior setæ of the apical joint are distinct but very short. Setæ of the following organs rather short.

Colour, a little purplish or reddish. A bag of eggs was attached to one individual, from latitude 45° north. It was a little torn, and contained ten eggs. In the specimens obtained in August of 1839, the abdomen appeared to be five- instead of four-jointed, there being a faint articulation across near its base, subdividing what is properly the first joint in the specimens obtained in latitude 45° north. The second joint in the former was the largest, and a little gibbous below.

* By this expression we mean, in this and other cases, *the particular joint which bears the setæ alluded to.*

CALANUS NUDUS.

Frons rotundatus, prominulus. Cephalothorax 4-articulatus, posticè subacutus. Antennæ anticæ cephalothorace vix longiores, fermè 18-articulatæ, articulo ultimo non longiore, apicibus fronte paulo anterioribus; setis totis brevissimis, apicalibus articulo non longioribus, et anticis ab apice vix remotis, subapicalibus minutis. Styli caudales paulum oblongi, setis rectis, strictis, abdomine non longioribus.

Front rounded, little prominent. Cephalothorax long elliptical, four-jointed, a little prominent in front and obtuse, subacute behind. Anterior antennæ shorter than the body, doubly curved, apices in advance of the line of beak, appearing naked, setæ all very short (shorter than breadth of joints), apical not longer than last joint, subapical minute. Caudal stylets somewhat oblong; setæ straight, parallel, not longer than abdomen.

Plate 72, fig. 3 *a*, animal, enlarged; *b*, second pair of antennæ.

Taken in great numbers, October 20, 22, 25, November 1, 3, 5, 8, 12, 1838, in the Atlantic, latitude 8° north to equator, longitude 21° to 18° west, and from the equator to 6° south, longitude 18° to 25° west.

Length, one-twentieth of an inch. Colourless, or a little red about the articulations. On account of the very short setæ of the antennæ, its even outline without very prominent articulations, the slender abdomen, and straight, not spreading caudal setæ, the individuals have a naked look. The last three joints of the cephalothorax are about one-third its whole length. The beak is short. In a vertical view the front margin between the antennæ is prominent, but obtuse. The abdomen is apparently three-jointed, yet the first articulation is somewhat uncertain. The antennæ when in position, have the apices a little in advance of the line of the beak, and in this respect, as well as others, the species differs from the preceding.

Other specimens were obtained in the Atlantic on October 13 and 15, in latitude 8°–9° 20' north, longitude 23° 40'–24° 15' west, which are believed to be identical with the *C. nudus*. Length, one-twenty-fourth of an inch. Colour, rose-red, a little purplish and deepest

along the venter. The setæ of the antennæ very short, not longer than diameter of joints, except at apex, where are two directed forward and two backward, which are as long as the last joint.

CALANUS MAGELLANICUS.

Frons rotundatus. Cephalothorax 4-articulatus, posticè obtusus. Antennæ anticæ corpore breviores, duplo curvatæ, apicibus fronte valde posterioribus, articulis quatuor ultimis brevibus, subæquis; setis totis per brevibus, apicalibus articulo brevioribus, anticis apice remotis, subapicalibus posticis minutis, anticis obsolete. Styli caudales perbreves, setis abdomen longitudine fere æquantibus.

Front rounded. Cephalothorax four-jointed, obtuse before and behind. Anterior antennæ shorter than the body, having a double curvature, apices behind line of beak; four terminal joints subequal, setæ all very short, those of last joint not longer than joint, two apical reflexed, the anterior near middle of front margin; the posterior of the subapical joints very short, the anterior obsolete. Caudal stylets very short, setæ about as long as abdomen.

Plate 72, fig. 4 *a*, side view, enlarged; *b*, position of antennæ; *c*, extremity of antenna.

Collected, March 27, 1839, in latitude 52° south, near Patagonia.

Length, one-twenty-fourth of an inch. Colourless, except sometimes a little orange about the centre of the cephalothorax. This species differs from the last in the position of the antennæ and their apical and subapical setæ. There is a longer set at intervals of three or four joints on the antennæ, but none are longer than the joint to which they are attached. The last seven articulations are about equal, and each is shorter than either of the six or seven preceding. The last joint has the anterior setæ situated some distance from the apex, and, although no subdividing articulation was distinguished, there is evidently an analogy between this joint, and the terminal in *C. comptus* and *C. rotundatus*. In these two species the terminal is as

long as the two preceding, while in the *C. magellanicus*, it is scarcely longer than the next one preceding.

The three posterior joints of the cephalothorax are nearly half the whole length. Beak directed a little inward. Abdomen four-jointed. There are four pairs of natatories with the fifth rudimentary. Setæ of the mouth organs of moderate length.

CALANUS CRASSUS.

Frons rotundatus. Cephalothorax crassus, 4-articulatus, posticè vix subacutus. Antennæ anticæ corpore breviores, apicibus fronte valde posterioribus, setis brevibus, apicalibus paulo longioribus, subapicalibus minutis, aut obsoletis. Styli caudales perbreves, setis subæquis, abdomine paulo brevioribus.

Front rounded. Cephalothorax stout, four-jointed, hardly subacute behind. Anterior antennæ shorter than the body, much reflexed, the apices therefore much behind the line of beak, last joint nearly half shorter than penult; setæ short, some near base a little longer, and curving, the posterior of apical joint as long as two terminal joints, the anterior half shorter, those of the subapical joints very short or obsolete. Caudal stylets very short; setæ subequal, not as long as abdomen, slightly spreading.

Plate 72, fig. 5, animal, enlarged.

Collected in the Atlantic, May 9, 1842, latitude 9° south, longitude 17° 30' west.

Length, one-sixteenth of an inch. Slightly reddish, with deeper red about the mouth and stomach. The antennæ have an oblong basal joint, and some of the setæ on the second or third joints are about as long as this joint. These organs curve near base and then extend obliquely backward, hardly curving again. The penult joint has a seta at anterior apex shorter than that on anterior apex of last joint, but none was observed at posterior apex; and the antepenult joint has neither anterior nor posterior setæ, or they are very short.

CALANUS FURCICAUDUS.

Frons triangulatus. Cephalothorax 4-articulatus, capite subito angustatus, posticè obtusus. Antennæ anticæ corpore paulo breviores, duplo curvatæ, apicibus fronte posterioribus, fermè 24 (26 ?)-articulatæ; articulo ultimo paulo longiore; setis brevibus, prope basin numerosis, apicalibus articulo paulo longioribus et anticis apice parçè remotis, subapicalibus minutis. Styli caudales setæque latè divaricati, setis inæquis, secundis abdomine longioribus.

Front triangular. Cephalothorax rather stout, four-jointed, head abruptly narrower, obtuse behind. Anterior antennæ a little shorter than the body, doubly curved, apex behind line of beak, twenty-four (twenty-six ?)-jointed; last joint (perhaps a double one) somewhat longer than either of the three preceding; setæ near base numerous and short (twice longer than diameter of joints), the anterior and posterior apical elongate (nearly as long as last two joints), the anterior remote from apex, subapical setæ minute. Caudal stylets and setæ widely divergent, setæ unequal, the second longer than the abdomen.

Plate 72, fig. 6 *a*, animal, enlarged; *b*, extremity of anterior antennæ; *c*, profile of abdomen.

Collected in the Pacific, a few miles southeast of Pitt's Island, the northern of the Kingsmills, latitude 3° north, longitude 173° east, April 28, 1841.

Length, one-twelfth of an inch. Nearly colourless. The subacute triangular front of this species and furcate caudal extremity, the setæ and stylets diverging with a curve, are striking characters of this species. In addition, at the apex of the anterior antennæ the posterior and anterior setæ are somewhat long and nearly in the same line, while the setæ of the preceding joints are quite short. At the apex, in addition to the longer anterior setæ a short distance back from the apex, there are two quite short anterior just at the apex. The anterior seta of penult joint is about as long as diameter of joint; the

posterior much shorter; anterior of antepenult, about as long as two diameters, and posterior equalling one diameter. The second pair of antennæ is rather short, with short setæ. The abdomen has three segments, of which the first is largest, and is gibbous below (fig. 6 c); this gibbosity is probably not a permanent character.

CALANUS ARCUICORNIS.

Frons obtusus. Cephalothorax 4-articulatus, capite angustatus, posticè subacutus. Antennæ anticæ cephalothorace vix longiores, leviter arcuatæ, apicibus fronte vix posterioribus, articulis 4 ultimis subæquis, setis perbrevis, apicalibus articulo valde brevioribus, duabus uncinatis, subapicalibus obsolete, prope basin paucis brevibus uncinatis. Abdomen angustum, lineare. Styli caudales perbreves, setis strictis, rectis, abdominis longitudine.

Front obtuse. Cephalothorax four-jointed, nearly obtuse behind, head narrower. Anterior antennæ hardly longer than cephalothorax, slightly arcuate towards base, and then straight and inclined a little back, tips nearly in line of beak; first and second joints a little oblong and nearly equal, the last four subequal; setæ very short, a few uncinata near base, the apical quite short, much shorter than apical joint, two uncinata, the subapical extremely short. Abdomen slender, four-jointed, second joint longest. Caudal stylets very short, setæ not spreading, straight, about as long as abdomen.

Plate 72, fig. 7 a, animal, enlarged; b, extremity of antenna.

Collected, April 9, 1840, in the Pacific, latitude 32° 24' south, longitude 178° 15' east.

Length, one-sixteenth of an inch. The antennæ bend outward, with a single curve, and incline a little backward. The abdomen is slender and rather long, being half the length of the cephalothorax; this, in connexion with the non-spreading setæ, makes the species resemble a Candace. The subapical setæ are nearly obsolete.

b. Styli caudales valde elongati.

CALANUS TURBINATUS.

Frons obtusus. Cephalothorax anticè crassus, posticè attenuatus (idcirco, segmentum posticum abdomine parèè latius) obtusiusculus. Antennæ anticæ duplo leviter curvatæ, corpore breviores, tenuissimæ, articulis 5 ultimis subæquis; setis totis perbrevibus, apicalibus (?) subapicalibusque articulo non longioribus. Styli caudales tennes, paralleli, setis dimidio brevioribus.

Front obtuse. Cephalothorax broadest anteriorly, obtuse in front, gradually diminishing posteriorly to breadth of abdomen, subobtuse behind. Antennæ slightly doubly curved, but tips not behind line of beak, shorter than body, very slender, last five joints subequal; setæ all short, subapical setæ not longer than either of the joints; apical of the same length, one perhaps longer (broken in specimen?) Abdomen three-jointed. Caudal stylets styliform, parallel, as long as abdomen, setæ half shorter.

Plate 72, fig. 8, animal, enlarged.

Collected in the Sooloo Sea, southwest of Panay, January 29, 1842.

Length, one-twelfth to one-fifteenth of an inch. Colour, red about mouth and in posterior part of thorax; alimentary canal, in part light green; a broad brown line either side of stomach and meeting nearly over the mouth, which is the ovary; other parts nearly colourless. The tapering body, the thorax diminishing to the abdomen, and without acute posterior angles, in addition to the long slender stylets, parallel in position, and bearing very short setæ, are striking characters. It is probable that the longest of the apical setæ of the anterior antennæ was broken off in the specimen examined; it may have been somewhat longer than the joint: those that remain entire on the joint, are about as long as the joint, and the anterior and posterior are nearly equal. The penult has the anterior and posterior about equal and as long as the joint; the same is true of the antepenult.

The antennæ of the second pair are short, and so also their setæ, and the setæ of the following organs.

CALANUS STYLIFER.

Frons truncatus. Cephalothorax curtus, posticè abdomine valde latior et elongatè acutus, 5-articulatus, segmento ultimo brevissimo. Antennæ anticæ duplo paululum curvatæ, apicibus fronte non posterioribus; setis perbrevibus, apicalibus et penultimâ posticâ fere articuli longitudine, penultimâ anticâ et antepenultimis brevissimis. Styli caudales tenues, fere abdominis longitudine, recti, paralleli, setis non longioribus, unâ valde externâ.

Front truncate. Cephalothorax short, behind much broader than abdomen, posterior angles acutely prolonged, five-jointed, the last segment very short. Anterior antennæ slightly doubly curved, apices a little in advance of line of beak; setæ very short, the apical and posterior penult nearly as long as joint, the anterior penult and antepenult very short. Abdomen three-jointed. Caudal stylets slender, not as long as abdomen, straight, parallel, setæ hardly longer than stylets, four apical, and one which is somewhat shorter, proceeding from the middle of the exterior side.

Plate 72, fig. 9, view, enlarged.

Obtained in the Atlantic, off the harbour of Rio Janeiro, in latitude 23°–24° south, longitude 41°–43° west, November 19, 1838, and January 9, 1839.

Length, one-twelfth of an inch. Colour, a little yellowish in front, with dirty brown along the centre, arising from the alimentary material within. The cephalothorax is not longer than two and a half times its breadth, and the prolonged posterior angles are wide apart and distant from the sides of the abdomen. There is a short prominence near the centre of the back, seen in a lateral view. The first joint of the abdomen is much longer than either of the others. The fifth or rudimentary pair of natatories is not half the length of the preceding; it is without setæ, and very slender. The last three or four

joints of the antennæ are rather longer; the basal joint is short, with the following oblong.

CALANUS CURTUS.

C. stylifero similis, sed curtior. Cephalothorax 5-articulatus, segmentis 4 posticis subæquis. Antennæ anticæ corpore paululo longiores, tenuissimæ, duplo paulum curvatæ, apicibus fronte vix anterioribus; setis perbreuibus, apicali anticâ longiore, articulum non superante. Abdomen 3-articulatum. Styli caudales tenues, fere abdominis longitudine, vix recti, setis non longioribus, flexuosis, unâ valde externâ.

Near *stylifer*. Cephalothorax shorter, five-jointed, the four posterior segments subequal. Anterior antennæ a little longer than the body (stylets being excluded, as usual), slightly doubly curved, tips in line of beak; setæ very short, anterior apical seta longest, but not exceeding length of joint. Abdomen three-jointed. Caudal stylets slender, nearly as long as abdomen, hardly parallel, setæ of same length nearly, spreading and crooked, one on outer side near middle remote from apex, which is a little shorter than the others.

Plate 72, fig. 10, animal, enlarged.

Collected in the Sooloo Sea, fifteen miles west of Panay, January 27, 1842; also, in Straits of Banca, east of Sumatra, March 2, 1842.

Length, one-twentieth of an inch. Nearly colourless; red about mouth and in thorax. This species differs from the preceding in its shorter body, its posterior thoracic segment as long as the preceding, its caudal stylets a little divergent, and the setæ crooked. The antennæ are more slender and the terminal joints are much shorter; the basal and following joints are as in the *stylifer*; the setæ of the following joints are short, hardly exceeding the diameter of the joints, excepting one on the eleventh (?) joint, which is more than twice longer; the four joints following are quite short, and the next are longer. The anterior apical and posterior penult setæ are about as long as the apical joint. The setæ of the second pair of antennæ

and following organs are short. The animals move through the water with a very rapid darting motion.

CALANUS SCUTELLATUS.

Latè depressus. Cephalothorax 4-articulatus, segmento antico anticè fortè arcuato, posticè latè producto et acuto, segmento postico utrinque elongatè acuto, et divaricato. Antennæ anticæ corpore paululo longiores, duplo curvatæ, apicibus fronte vix anterioribus, articulo apicali longiore; setis brevibus, apicali anticâ penultimâque posticâ articuli longitudine, aliis subapicalibus perbrevibus. Abdomen 3-articulatum. Styli caudales tenues, fere abdominis longitudine, parè divaricati.

Body much depressed and broad. Cephalothorax four-jointed, rounded in front; anterior segment scutellate, with the sides broadly produced posteriorly, and acute behind, last segment acutely and divaricately prolonged behind. Anterior antennæ a little longer than the body, doubly curved, tips about in line of beak; apical joint longer than preceding; setæ rather short, anterior apical and posterior penult as long as the joint to which attached, the other subapical very short. Abdomen three-jointed. Caudal stylets slender, nearly as long as abdomen, somewhat divaricate.

Plate 72, fig. 11 *a*, animal, enlarged; *b*, extremity of antenna.

Collected in the Sooloo Sea, east of Panay, January 27, 1842.

Length, one-sixteenth of an inch. Colourless, except a faint yellowish tint, and red about the mouth and in part of thorax. The legs scarcely project beyond the shield-like anterior segment. The form of this segment is nearly that of a half ellipse, with the angles lamellarly prolonged behind and acute; the length and breadth are about equal. The posterior angles of the cephalothorax are prolonged into long slender points, which are distant and divaricate. The caudal setæ were mutilated in the specimen examined, except the inner one of the four apical, which was about as long as the stylets.

The antennæ have the basal joint slightly oblong, but shorter than the following. At intervals (? on second, sixth, and eleventh joints) the

setæ are a little longer than on the intermediate joints. The posterior setæ of the penult joint are as long as joint, the anterior quite short; on the antepenult joint, the anterior is very short, the posterior less so; the præantepenult has the anterior seta as long as the joint.

II. SETÆ ANTENNARUM ANTICARUM APICALES SUBAPICALIBUS NON LONGIORES.

A. *Setæ caudales totæ mediocres. Frons obtusus, non elongatus.*

a. CEPHALOTHORAX 4-ARTICULATUS.

CALANUS PAVO.

Frons subtriangulatus, obtusus. Cephalothorax posticè obtusus. Antennæ anticæ corpore dimidio longiores, duplo curvatæ, articulo ultimo longiore, setis longiusculis. Abdomen brevissimum. Styli caudales breves, divaricati, setis fere corporis longitudine, latis, eleganter plumiformibus, flabellatim divaricatis.

Front subtriangular, obtuse. Cephalothorax rather stout, obtuse behind. Anterior antennæ one-half longer than the body, doubly curved, last joint as long as three preceding; setæ rather long. Abdomen very short, two-jointed; caudal stylets a little oblong, divaricate, furnished with elegant spreading plumes, the plumes broad and subequal, and nearly as long as body.

Plate 72, fig. 12 *a*, view, enlarged; *b*, second pair of antennæ.

Obtained in the Atlantic, latitude 12° north, longitude 24° west, October 9, 1838, at 9 A. M.

Length, one-twenty-fourth of an inch. Colourless, excepting a large reddish spot near the centre of the body, and a similar spot in each of the inner caudal plumes. Anterior segment of cephalothorax two-thirds whole length. Caudal plumes seen only spreading, as in the figure. The antennæ have the anterior margin towards the base uneven, and the clavate setæ alluded to, extend forward from several of the joints in the first quarter of the antenna; they have a

reddish-yellow colour, and one is full half as long as the body of the animal. The animal swims by saltations, with great agility. The position of the antennæ in the figure may not be exactly correct, as the drawing was made before the importance of this character was appreciated.

CALANUS LEVIS.

Frons obtusus. Cephalothorax mediocris, posticè subacutus. Antennæ anticæ corpore vix longiores, duplo leviter curvatæ, apicibus fronte non anterioribus; setis brevibus, 4-5 remotis longioribus, apicalibus et anticâ penultimâ fere articuli longitudine, posticis penultimâ antepenultimâ-que paulo longioribus, subæquis, anticâ antepenultimâ obsoletâ. Styli caudales parce oblongi, setis rectis, appressis, abdominis longitudine.

Front obtuse. Cephalothorax moderately stout, obtuse or subacute behind. Anterior antennæ fully as long as body, slightly doubly curved, tips not in front of line of beak; setæ short, four or five at intervals somewhat longer, apical and anterior penult nearly as long as respective joints, posterior penult and antepenult a little longer, subequal, anterior antepenult obsolete. Abdomen three-jointed. Caudal stylets sparingly oblong. Setæ parallel, about as long as abdomen.

Plate 73, fig. 1 *a*, animal, enlarged; *b*, extremity of anterior antenna.

Obtained off Rio Janeiro, January 7, 1839.

Length, one-twentieth of an inch. The cephalothorax is rather broader posteriorly. The three posterior segments are about one-third whole length; and the articulations between them are without a sulcus, so that the body in an upper view has apparently an uninterrupted surface. The last three joints of the anterior antennæ are longer than the preceding. The longer setæ of the anterior margin proceed from the second, sixth, eleventh, and fifteenth joints; of the apical setæ two are directed backward a little obliquely, and two forward, more obliquely.

Fig. 2 *a*, Plate 73, represents another individual, obtained a few

days afterwards in the harbour of Rio. It appears to be the same species; but it differs in having but two joints to the abdomen, the first quite short, the second oblong; and in having the subapical posterior setæ more nearly equal than in the preceding. Whether these differences are owing to a difference of sex, age, or species, I am unable to decide. 2 *b*, represents the extremity of the superior antenna; 2 *c*, the posterior antenna; 2 *d*, leg of first pair.

CALANUS MEDIUS.

Frons rotundatus. Cephalothorax posticè obtusus. Antennæ anticæ cephalothorace paulo longiores, duplo curvatæ, apicibus fronte posterioribus; setis perbrevibus, 4-5 remotis longioribus, posticâ apicali et anticâ penultimâ largè articuli longitudine, posticâ penultimâ paulo brevior, posticâ antepenultimâ duplo longiore. Styli caudales breves, setis appressis, abdomine brevioribus.

Front rounded. Cephalothorax obtuse behind. Anterior antennæ a little longer than cephalothorax, doubly curved, tips behind line of beak, setæ very short, four or five at intervals longer, posterior apical and anterior penult fully as long as joint to which attached, posterior penult a little shorter, posterior antepenult twice longer than the apical. Caudal stylets short, setæ shorter than abdomen, straight and not spreading.

Plate 73, fig. 3 *a*, animal, enlarged; *b*, extremity of antenna.

Collected in the Pacific, latitude 44° north, longitude 153° west, July 6, 1841.

Length, one-sixteenth of an inch.

This species is near the preceding. From the third joint of the antennæ there is a seta extending forward, which is as long as three diameters of the joint. The antepenult joint has no distinct anterior seta, or only a very short one; the præantepenult has a very short posterior seta. At the apex, there are, besides the posterior apical, one directed outward and two obliquely forward. Abdomen in specimen 4-jointed; first abdominal segment the longest. The caudal stylets

scarcely longer than broad. The animal carried, below, a bag containing six eggs.

CALANUS PLACIDUS.

Frons rotundatus. Cephalothorax posticè obtusus. Antennæ anticæ corporis longitudine, duplo leviter curvatae, apicibus fronte paulo posterioribus; setis apicalibus brevibus, posticis penultimâ antepenultimâque valde elongatis, anticâ penultimâ dimidio brevior. Styli caudales breves.

Front rounded. Cephalothorax obtuse behind. Anterior antennæ as long as body, slightly doubly curved, tips a little behind line of beak, apical setæ short, posterior penult and antepenult long, equaling last five or six joints of antenna, anterior penult half as long, apical and anterior antepenult short. Caudal stylets short, sparingly longer than broad.

Plate 73, fig. 4, animal, enlarged.

Collected abundantly near the Kingsmill Group, April 30, 1841; also, again in latitude 40° north, longitude 157° west, July 2, 1841.

Length, one-twelfth of an inch. Colourless, or a little purplish. Body moderately stout. Length of stylets not exceeding twice the breadth. Setæ of anterior antennæ mostly about twice as long as diameter of joints, much crowded towards base. First joint of the anterior antenna short; second oblong; last three nearly equal. Length of anterior seta of antepenult joint about equal to two diameters of joint. Second pair of antennæ rather short, with short setæ. Abdomen in specimen three-jointed.

CALANUS RECTICORNIS.

Frons obtusus. Cephalothorax posticè rotundatus. Antennæ anticæ corpore longiores, rectissimæ, apicibus fronte non anteriores, articulo primo (2do?) crassè oblongo, ultimo paulum demisso; setis brevibus, setâ

articuli secundi subelongatâ, articuli antepenultimi posticâ longiore (= 4 artic.), penultimis posticâ et anticâ paulo brevioribus, apicali posticâ minore, articulo longiore, duabus aliis apicalibus brevibus et subuncinatis. Styli caudales breves; setis mediocribus, parçè diffusis.

Front obtuse. Cephalothorax rounded behind. Anterior antennæ straight from the base, and the two lying in the same line, longer than the body, first joint stout and oblong, apical a little bent back, setæ short, on basal joint very short, on second joint, a long seta, as long as four diameters of joint; posterior seta of antepenult joint longest, as long as last four joints, posterior and anterior of penult a little shorter, posterior apical still shorter, longer than joint, two other apical very short and subuncinate or curved. Caudal stylets short, setæ little spreading, hardly as long as abdomen.

Plate 73, fig. 5 *a*, view, enlarged; *b*, extremity of antenna.

Collected in the Sooloo Sea, southwest of Mindanao, February 1, 1842.

Length, one-twelfth of an inch. Colour, orange, with some red blotches about the mouth and in the thorax. The body is rather slender, and is broadest posteriorly near the first articulation. The inner three caudal setæ of each stylet are nearly equal. The antennæ have a stout basal joint, which is placed a little oblique to the body; but beyond this the organ extends straight out, with scarcely any curve, so that both are in the same straight line. Last three joints of antennæ subequal, the apical a little the longest. The longish seta from the second joint of these antennæ, and the two setæ on either side of the cephalothorax posteriorly, are striking characters. The abdomen in the specimens was four-jointed.

δ. CEPHALOTHORAX 5-6-ARTICULATUS.

1. Cephalothorax posticè obtusus aut breviter subacutus.

CALANUS SETULIGERUS.

Frons rotundatus. Cephalothorax 5 (6?)-articulatus, posticè obtusus, segmentis 4 posticis subæquis. Antennæ anticæ corpore paulo longiores,

duplo curvatæ, setis prope basin plerumque duplo longioribus quam articuli et numerosis, setâ articuli sexti (forsan quinti) longiore, setis duabus posticis subapicalibus longis, subæquis, apicalibus brevibus, anticâ penultimâ longiore quam articulus. Styli caudales perbreves; setis mediocribus, parcè diffusis, secundis fere duplo longioribus.

Front rounded. Cephalothorax obtuse behind, four posterior segments subequal. Anterior antennæ a little longer than the body, doubly curved, setæ short, towards base mostly twice as long as the joints and numerous, a longer one from fifth or sixth joint, two posterior subapical quite long, apical short, anterior penult longer than the joint. Caudal stylets very short, setæ of moderate length, sparingly spreading, the second nearly twice as long as the others.

Plate 73, fig. 6 *a*, animal, enlarged; *a'*, profile of body, showing alimentary canal (*i*), and heart (*h*); *b*, second pair of antennæ; *c*, first pair of legs; *d*, second or third pair of natatory legs.

Taken in the Atlantic, October 13 to 16, 1838, latitude 6°–9° north, longitude 21°–24° west.

Length, one-sixteenth of an inch. Colour, faint purplish blue. The first two segments of the cephalothorax correspond to the first in many other Calani. The last four occupy about two-fifths the whole length of cephalothorax, and are about equal in length. Joints of abdomen short, and stylets not longer than last joint. The longer seta is about as long as the abdomen, and is a little curved. Of the posterior subapical setæ of the anterior antennæ, the inner one is the longest, and the outer margin of each is pectinate setulose. The second pair of antennæ have the branches unequal (the shorter two-thirds the longer); the last joint of longer branch more than one-third preceding; the two joints of other branch subequal. Natatories four pairs; the posterior shortest; the anterior next shortest. A fifth pair rudimentary. Abdomen in specimen four-jointed.

The heart is situated in the posterior half of the thorax, mostly within the fourth segment from the last, extending a little into the preceding.

CALANUS PELLUCIDUS.

Frons rotundatus. Cephalothorax 5-articulatus, posticè obtusus, articulo ultimo brevi. Antennæ anticæ corporis longitudine, setis subapicalibus posticis longiusculis. Styli caudales oblongi.

Front rounded. Cephalothorax five-jointed, behind obtuse, last segment short. Anterior antennæ about as long as the body, posterior subapical setæ rather long. Caudal stylets somewhat oblong.

Plate 73, fig. 7, animal, enlarged, the antennæ not quite accurate in the articulations or setæ.

Taken in the Atlantic, October 5, 1838, latitude $14\frac{1}{2}^{\circ}$ north, longitude 21° west.

Length, one twenty-fourth of an inch. Colourless. Length of cephalothorax about four times its greatest breadth, some appearance of an articulation is distinguished within, near middle of cephalothorax. Beak bears below two spines, extending downward, which are rather long. The eyes small; pigment deep reddish black, and nearly quadrilateral in form, rather larger than usual. Abdomen three-jointed; setæ of moderate length.

The stomach is a long oval sac; and the intestine beyond, which commences at the first articulation, is half its diameter. The heart gave two hundred and fifteen palpitations in a minute.

CALANUS AFFINIS.

Frons rotundatus. Cephalothorax 5-articulatus, posticè obtusus, articulis 4 posticis subæquis. Antennæ anticæ corporis longitudine, apicibus fronte posterioribus; setis brevibus, duabus posticis subapicalibus prælongis, anticâ penultimâ dimidio brevior, apicalibus brevibus. Styli caudales perbreves, setis diffusis, secundis fere duplo longioribus quam primæ.

Front rounded. Cephalothorax five-jointed, obtuse behind, four posterior segments about equal in length. Anterior antennæ as long

as the body, tips a little behind line of beak, setæ very short, two posterior subapical quite long and nearly equal, anterior penult nearly half as long, apical very short. Caudal stylets very small, not oblong; setæ of moderate length, the second about twice the first in length.

Plate 73, fig. 8 *a*, animal, enlarged; *b*, abdomen of another individual; *c*, extremity of antennæ of another individual.

Taken March 3, 1842, southeast of Sumatra.

Length one-twelfth of an inch. Nearly colourless. The setæ of the antennæ are all short except the subapical. The inner setæ of the caudal stylets are a little curved at the tips; the second seta is somewhat arcuated. Abdomen four-jointed, first joint longest, last very short.

CALANUS FLAVIPES.

Frons triangulatus, vix prominulus. Cephalothorax 5-articulatus, posticè attenuatus, obtusus aut subacutus. Antennæ anticæ corpore paulo longiores, duplo leviter curvatae, apicibus fronte vix posterioribus; setas vis affinis similes. Styli caudales oblongi, setis mediocribus, non diffusis. Abdomen 2-articulatum;—an adultum?

Front triangular, slightly prominent. Cephalothorax five-jointed, broadest anteriorly, narrowing much behind, and obtuse or subacute. Anterior antennæ a little longer than the body, very slightly doubly curved, tips hardly posterior to line of beak; setæ like those of the *affinis*. Caudal stylets somewhat oblong, setæ of medium length, not spreading. Abdomen two-jointed, the second oblong (possibly not adult).

Plate 73, fig. 9 *a*, animal, enlarged; *b*, extremity of antenna.

Taken, off the harbour of Rio Janeiro, January 7, 1838.

Length, one-tenth of an inch. Colourless, except the lateral organs and antennæ, which were part orange.

The front forms a low obtuse angle between the antennæ. The cephalothorax narrows posteriorly, and the last segment is about twice the breadth of the first abdominal. The last joint of the antennæ is longer than the preceding. The posterior subapical setæ are about twice as long as the last two joints; the anterior and posterior præantepenult are very short; the apical are short, two extending backward, and one or two obliquely outward and forward.

CALANUS TENUICORNIS.

Frons rotundatus. Cephalothorax 5-articulatus, posticè obtusus, segmentis 4 posticis subæquis. Antennæ anticæ sesqui corporis longitudine, tenuissimæ, duplo levissimè curvatæ, apicibus fronte vix posterioribus, articulis tribus ultimis subæquis; setis brevibus, articuli tertii setâ longiore, setis duabus posticis subapicalibus prælongis, anticâ penultimâ fere dimidio breviorè, apicalibus brevibus. Styli caudales oblongi (latitudine duplo longiores).

Front rounded. Cephalothorax five-jointed, posterior angles a little elongate, but obtuse, the last four segments nearly equal. Anterior antennæ nearly one and a half times as long as body, very slender, slightly doubly curved, tips nearly in line of front, last three joints subequal, setæ short, one a little longish on the third joint, two subapical, posterior quite long, anterior penult more than half shorter, apical short. Caudal stylets twice as long as broad.

Plate 73, fig. 10 *a*, animal, enlarged; *b*, extremity of antenna.

Taken, July 2, 1841, in the Pacific, latitude 40° north, longitude 157° west.

Length, one-twelfth of an inch. Nearly colourless. The posterior antepenult seta of the anterior antennæ is as long as last six or seven joints of the antennæ; the penult is a fourth shorter; the apical are shorter than the joint. At apex of seventh joint from the extremity there is a prominent seta, nearly as long as two joints of the antenna, and equalling the seta from the third joint. The caudal setæ were broken off in the specimen examined. The posterior antennæ have

the outer joint of one branch five- or six-articulate. Abdomen four-jointed, first segment oblong.

CALANUS SANGUINEUS.

Frons rotundatus. Cephalothorax 5-articulatus, posticè obtusus aut subacutus, articulis 4 posticis subæquis. Antennæ anticæ corporis longitudine, fere rectæ, apicibus fronte vix posterioribus; setis brevibus, unâ articuli tertii longiore, subapicalibus iis tenuicornis fere similibus. Styli caudales paulum oblongi, setis mediocribus, diffusis, secundis longioribus.

Front rounded. Cephalothorax five-jointed, last four segments subequal, posterior angles a little prolonged, obtuse or subacute. Anterior antennæ as long as body, nearly straight, the tips scarcely posterior to line of front, setæ short, one longer from third joint, subapical as in the *tenuicornis*. Caudal stylets a little oblong, setæ spreading, of medium length, the second a little elongate.

Plate 73, fig. 11 *a*, animal, enlarged; *b*, extremity of antenna.

Collected abundantly, May 28, 1841, in the Pacific, latitude 32° north, longitude 173° west; also, July 6, 1841, latitude 44° north, longitude 153° west; also, the same species, apparently, January 28, 1842, in the Sooloo Sea, east of Panay.

Length, one-tenth of an inch. Often deep red; also, colourless. On May 28, 1841, the sea was coloured red by this species over large areas. The blood-coloured areas mostly formed bands, two to four feet wide, extending as far as the eye could reach, at right angles with our track, the vessel heading east-northeast, with the wind at southeast by east. Anatifas were abundant at the same time.

The antennæ have, at intervals of a few joints, a seta two or three times as long as the others. The posterior subapical setæ are as long as the last five or six joints; the posterior apical about as long as apical joint; anterior apical much shorter; anterior penult as long as last two joints. Abdomen four-jointed, segments subequal.

Fig. 12 *a*, Plate 73, represents a specimen which may belong to the above species. I suspect that the setæ of the antennæ as well as caudal stylets were mutilated. The front (12 *b*) is a little flattened (instead of rounded); the posterior angles of the cephalothorax are subacute; antennæ longer than the body by two or three joints, and tips a little behind line of beak; four segments of abdomen subequal; posterior penult seta of antennæ (12 *c*) equals last six joints, and is two-thirds of antepenult in length. Collected, March 22, 1841, north of Depeyster's Island, Kingsmill Group, Pacific.

Var. *perspicax*.—Plate 74, figs. 1 *a, b, c*, illustrate another specimen, possibly a variety of the *sanguineus*. The following are its characters:

Cephalothorax rounded in front, obtuse behind, five-jointed, four posterior segments subequal. Abdomen about half as long as cephalothorax. Pigment of eyes transversely oblong, somewhat bilobate. Anterior antennæ a little longer than body, curved at base, but thence straight and both in same line, tips not behind line of beak; first joint short, second oblong, last three subequal, last acuminate; setæ short, a longer one from fifth joint, two posterior subapical very long (as long as last five or six joints), subequal, anterior penult a fourth shorter, apical short. Abdomen consisting of four subequal joints, none oblong. Caudal stylets short, slightly longer than broad, setæ much spreading, inner nearly half shorter than second.

Collected among the Feejee Islands, July, 1840.

Length, one-twelfth of an inch.

In habit, this species resembles some *Pontellæ*, and it may belong to that group.

CALANUS MUNDUS.

Frons rotundatus. Cephalothorax posticè obtusus, 5-articulatus, articulis 4 posticis subæquis. Antennæ anticæ corpore parè longiores, bene rectæ, apicibus fronte non posterioribus, articulo primò (2do?) crassè oblongo et setis inflexis instructo; setis perbreuibibus, articuli secundi longiore, apicalibus brevibus, posticâ antepenultimâ longâ, posticâ penultimâ dimidio breviorè, anticâ penultimâ paulo minore (articulum æquante),

anticâ antepenultimâ minutâ. Abdomen 4-5-articulatum. Styli caudales breves, setis appressis, secundis longioribus.

Front rounded. Cephalothorax five-jointed, four posterior joints subequal, obtuse behind. Anterior antennæ slightly longer than body, straight even from the basal joint, which is stout and oblong, tips in line of beak, first (or second) joint stout and oblong, and furnished with inflexed setæ, setæ very short, on second joint a seta three or four times as long as diameter of joint, apical setæ short, posterior antepenult seta nearly as long as last four joints, posterior penult half shorter, anterior penult still shorter (about as long as penult joint), anterior antepenult minute, apical shorter than apical joint. Abdomen four to five-jointed. Caudal stylets very short, setæ but slightly divergent, the second a little elongate (one-fourth longer than third).

Plate 74, fig. 2 *a*, animal, enlarged; *b*, extremity of antenna.

Collected, July 6, 1841, in the Pacific, latitude 44° north, longitude 153° west.

Length, one-tenth of an inch. Colour, slightly yellowish. The two anterior antennæ lie in the same transverse line. The basal joint is long and stout, with a few short uncinæ setæ; and on the following joints several of the setæ are curved or hooked. The antepenult joint is longer than either of the following, and the last is somewhat longer than the penult. At apex, one or two of the anterior setæ extend outward, and are uncinæ. The setæ of the posterior antennæ and following organs are rather short. The specimens were taken at the same time with the *C. sanguineus*, and they somewhat resemble that species, though different in the base and terminal setæ of the antennæ, and the abdomen and caudal setæ.

CALANUS INAURITUS.

Frons rotundatus. Cephalothorax posticè obtusus, 5-articulatus, articulo ultimo brevissimo. Antennæ anticæ fere rectæ, corpore paulo breviores, articulo primo valde elongato (an duplice?) tribus setis pendulis sub-

clavatis et aliis setis brevibus uncinatis instructo, setis apicalibus et anticis subapicalibus perbrevibus, subapicalibus posticis articulo viâ longioribus, inæquis. Styli caudales breves, setis parçè diffusis aut appressis.

Front rounded. Cephalothorax obtuse behind, five-jointed, last segment very short. Anterior antennæ nearly straight, a little shorter than the body, the first or basal joint elongate (probably double), furnished with three pendulous subclavate setæ, and others quite short, apical and anterior subapical setæ very short, posterior subapical setæ slightly longer than joint. Caudal stylets short, setæ not spreading.

Plate 74, fig. 3 *a*, animal, enlarged; *b*, bases of the same, more enlarged; *c*, extremity of antenna.

Collected, October 22, 1838, in the Atlantic, latitude 6° north, longitude 21° west.

This specimen had three or four setæ pendant from the anterior margin of the basal joint of the antennæ (fig. 3 *b*), which were coloured reddish orange, like the central portions of the cephalothorax. They were nearly as long as whole base. Besides these, there were on the base a few uncinatæ setæ. Cephalothorax a little broader posteriorly, and somewhat truncate behind. The abdomen linear; the stylets about as long as last joint of abdomen. The caudal setæ were mostly broken off. Apical joint of longer branch of posterior antennæ, about one-third the length of the branch; the other branch much the shortest. Four pairs of natatories. Abdomen five-jointed.

2. Cephalothorax posticè acutus, angulis posticis abdomenem appressis.

CALANUS SIMPLICICAUDUS.

Frons obtusus. Cephalothorax 5-articulatus, segmento postico angusto et posticè brevissimè acuto. Antennæ anticæ corpore paulo longiores, basi arcuatae, aliisque fere rectæ, apicibus fronte parçè posterioribus; setis brevibus, duabus subapicalibus posticis longis, inæquis, anticâ penul-

timâ dimidio brevior, apicalibus brevibus. Abdomen 2-articulatum (an adultum?). Styli caudales paulum oblongi.

Front obtuse. Cephalothorax five-jointed, the last segment of the thorax but little broader at extremity than the abdomen, and behind very short acute. Anterior antennæ a little longer than the body, arcuate at base, and then straight and slightly inclined backward, the tips a little behind line of beak; setæ mostly short, the two posterior subapical long, the longer equalling last four joints, anterior penult half shorter, the apical short, spreading, one anterior subremote from apex. Abdomen two-jointed (possibly not adult), second segment oblong. Caudal stylets twice their breadth in length.

Plate 74, fig. 4 *a*, animal, enlarged; 4 *b*, extremity of antenna.

Collected in the Pacific, July 7, 1841, latitude 45° north, longitude 153° west.

This species resembles the *flavipes* in the abdomen, and in the last thoracic joint being but little broader than the abdomen; also, in the stylets and antennæ. But the form of the cephalothorax is elliptical, the posterior angles are minute points, the front is rounded instead of triangulate. On these grounds the species are considered distinct. The anterior antennæ have the setæ of the fourth joint of the anterior from the extremity very short before and behind; on the next preceding, there is an anterior seta nearly as long as the joint. The basal joint is oblong, and a shorter anterior to the oblong joint was not observed.

CALANUS APPRESSUS.

Frons obtusus. Cephalothorax posticè angustior, angulis posticis elongatè acutis abdomen appressis, 5-articulatus, articulis posticis longitudine subæquis. Antennæ anticæ corpore paulo longiores, duplo leviter curvatæ, articulo ultimo valde graciliore quam penultimus; setis brevibus, duabus posticis subapicalibus prælongis, subæquis, strenuis, anticâ penultimâ dimidio brevior, apicalibus articulo non longioribus. Styli caudales breves, setis diffusis, mediocribus, secundis longioribus.

Front obtuse. Cephalothorax posteriorly narrowed, behind long-acute, the points appressed to abdomen, five-jointed, four posterior segments of nearly equal length. Anterior antennæ a little longer than the body, with a slight double curvature, tips behind line of beak, last joint much more slender than penult, setæ short, two posterior subapical very long and rather stout, subequal, the anterior penult half shorter, apical short, not longer than apical joint, spreading. Caudal stylets short, setæ spreading, of moderate length, second nearly half longer than the others.

Plate 74, fig. 5 *a*, animal, enlarged; *b*, extremity of antenna; *c*, caudal stylets and setæ of another individual.

Collected in the Pacific, latitude 25° north, longitude 167° east, May 14, 1841; also latitude 30° south, longitude 13° east, April 21, 1842; also March 4, 1842, east of Sumatra.

Length, one-twelfth of an inch. Colour, red in blotches, or about the articulations and mouth, and also in the palpi and posterior antennæ. The long posterior points of the cephalothorax close appressed to the abdomen give a peculiar appearance to the species. The caudal stylets are a little longer than broad. The antennæ are longer than the body by the apical joint. The setæ towards base of anterior antennæ are all very short, with an occasional one but little longer; the posterior subapical are as long as last five or six joints, and the penult articulates with the penult joint near the middle of its posterior margin. The longest of the apical setæ is about equal to the joint in length. Of the fourth joint from the extremity, the posterior seta is as long as breadth of joint, and the anterior is twice longer. The last joint of the antennæ is very much more slender than the preceding.

Plate 74, fig. 6, represents the antenna of an individual apparently of the above species; and if so, the organ is a monstrosity. The setæ are all short, and there is a tuft at apex, which looks quite abnormal, especially as there are no posterior subapical setæ to the organ, as in all other known species. It consists of twenty-one joints, instead of twenty-four, the entire number, evincing that probably the last three joints were abortive; its length was about equal to the cephalothorax and half the abdomen. It was taken southeast of Sumatra, March 3, 1842.

3. Cephalothorax posticè elongatè acutus, angulis posticis remotis.

CALANUS COMMUNIS.

Frons rotundatus. Cephalothorax posticè elongatè acutus, 5-articulatus, articulis 4 posticis subæquis. Antennæ anticæ corpore paulo longiores, duplo leviter curvatæ, apicibus fronte non anterioribus, setis apicalibus brevibus, duabus posticis subapicalibus longis, subæquis, anticâ penultimâ quadruplo brevior, setis totis aliis brevibus. Styli caudales breves, setis diffusis, secundis duplo longioribus.

Front obtuse. Cephalothorax posteriorly long acute and points distant, five-jointed, four posterior segments subequal. Anterior antennæ a little longer than the body, very slightly doubly curved, tips not anterior to line of front; apical setæ short, two posterior subapical long, nearly equal, anterior penult one-fourth as long, all the other setæ short, apical minute. Caudal stylets very short, setæ spreading, the second twice longer than the first.

Plate 74, fig. 7, view, enlarged.

Collected in the Atlantic, October 18, 20, 27, 31, and November 2, 3, 8, and 12, 1838, latitude 8° north to 5° south, longitude 23° to 15° west; also May 13 and 16, 1842, latitude 4° 30' to 1° south, and longitude 25° to 30° 30' west.

Length, one-tenth of an inch. Colour, purplish or reddish, faint.

The four posterior joints of the cephalothorax constitute more than two-fifths of its whole length. Among the caudal setæ the second is about half longer than the others. There are five pairs of natatories, of which the first pair is the shortest, and the fifth the next shortest. Eyes minute. Last joint of antennæ a little longer than the preceding. Abdomen four-jointed, first segment a little the longest.

CALANUS AMENUS.

C. communi quoad antennas anticæ setasque caudales affinis. Cephalo-

thorax 5-articulatus, articulo ultimo brevissimo, angulis posticis elongatè acutis.

Near the *C. communis* in the anterior antennæ and caudal setæ. Cephalothorax five-jointed, last segment very short, posterior angles long acute.

Plate 74, fig. 8 *a*, animal, enlarged; *b*, extremity of antenna.

Collected in the Pacific, near the island of Upolu, Samoan Group, February 26, 1841, at 9 P. M; also off southeast end of Mindoro, East Indies, February 1, 1842.

Length, one-tenth of an inch. Colour, a faint tinge of bluish purple, with some red blotches in posterior segments of cephalothorax.

The caudal setæ are much less spreading than in *C. communis*, and the second seta is longer in proportion to the others.

CALANUS BELLUS.

Frons rotundatus. Cephalothorax posticè elongatè acutus, 5-articulatus, articulis 4 posticis subæquis. Antennæ anticæ corpore paululo longiores, vix duplo curvatæ, apicibus fronte non anterioribus; setis brevibus, unâ tertii articuli longâ, duabus posticis subapicalibus longis, subæquis, apicalibus brevibus, anticâ penultimâ paulo longiore. Styli caudales breves, setis diffusis, secundis fere duplo longioribus.

Front rounded. Cephalothorax behind long acute, and points remote; five-jointed, four posterior segments subequal. Anterior antennæ very little longer than the body, scarcely doubly curved, nearly straight, tips nearly in line of beak; setæ short, one from third joint long, two posterior subapical quite long, subequal, apical short, with one seta remote from apex, anterior penult about as long as joint. Caudal stylets very short, setæ much and neatly spread, the second nearly twice as long as first.

Plate 74, fig. 9 *a*, animal, enlarged, lateral appendages omitted; 9 *b*, extremity of antenna.

Collected in the Sooloo Archipelago, February 2, 1842; also in Straits of Banca, March 2, 1842.

Length, one-eighth of an inch. Colour, a shade of rose, with red blotches; another specimen with a tinge of greenish yellow.

Resembles the two preceding, but differs from both in the long seta to third joint of antenna, directed straight forward, and the more widely spread caudal setæ. The abdomen is four-jointed, the first segment oblong. In some young individuals, the prominent posterior angles of thorax were much shorter than in the figure, and only subacute. The penult is the shortest of the five terminal joints of the antennæ; the long posterior subapical setæ about equal the last five joints, the anterior antepenult is about half as long as joint, apical less than length of joint. Caudal stylets not longer than broad.

From the *setuligerus* it differs in having the cephalothorax behind acute.

B. Setæ caudales 2dæ longissimæ. Frons sive obtusus sive triangulato-acutus; rostro elongatè furcato, brachiis setiformibus.

CALANUS GRACILIS.

Gracilis. Frons rotundatus. Cephalothorax elongatus, 5-articulatus, posticè obtusus, segmentis 4 posticis subæquis, ultimo parce brevior. Antennæ anticæ sesqui corpore longiores, rectæ, 160° inter sese divaricatæ; setis brevibus, duabus posticis subapicalibus longis, apicalibus et anticis subapicalibus brevibus. Abdomen curtum, 4-articulatum. Styli caudales breves, setis secundis dimidio corporis longioribus.

Slender. Front rounded. Cephalothorax elongate, obtuse behind, five-jointed, four posterior segments subequal, the last somewhat shorter than the others. Anterior antennæ more than one and a half times the length of the body, straight, slightly curved at base, the two diverging at an angle of 160°; first joint short, second a little oblong, penult abbreviate; setæ short, two posterior subapical long, apical and anterior subapical short. Abdomen short, four-jointed. Caudal stylets short, second seta much longer than half the body, the others of moderate length.

Plate 74, fig. 10, animal, enlarged.

Collected in the Atlantic, latitude 4° 30' south, longitude 25° west, May 13, 1842.

Length, one-eighth of an inch. Colourless, except some red about the mouth, the articulations of the thorax, and in the posterior antennæ and first pair of legs.

In the specimen, the setæ of the antennæ and caudal stylets were partly mutilated. The species is near the *C. elongatus* and *attenuatus* in habit, but the front is not at all triangulate. The body is slightly and gradually narrower anteriorly, it being broadest posterior to middle; there is no abrupt narrowing posterior to the first pair of antennæ, as in the species just alluded to. The antennæ are about one and two-thirds times as long as the body. The apical setæ are much shorter than the apical joint, and one quite short seta, directed forward, is situated some distance from the apex.

CALANUS ELONGATUS.

Elongatus. *Frons breviter triangulatus, subacutus, rostro elongatè et tenuiter furcato. Cephalothorax 4-articulatus, anticè angustatus, posticè obtusus. Antennæ anticæ sesqui corporis longitudine, rectæ, et latissimè divaricatæ, apicibus fronte vix anterioribus, articulo penultimo abbreviato; setis plerumque brevibus, paucis remotis longiusculis, apicalibus diffusis articulo longioribus, subapicalibus posticis longis, inæquis, anticâ penultimâ minus dimidio breviorè, anticâ antepenultimâ obsoletâ. Antennæ posticæ ramo minore 2-articulato. Abdomen curtissimum. Styli caudales brevissimi.*

Elongate. Front short triangular, subacute, rostrum long and slenderly furcate. Cephalothorax four-jointed, narrowed anteriorly, obtuse behind. Anterior antennæ one and a half times as long as body, very nearly straight quite to base, and very broadly divaricate, tips hardly anterior to line of beak; penult joint very short, setæ mostly short, those of the joints 3, 8, 9, 17, rather long, apical diffuse, longer than apical joint, posterior subapical long, unequal,

anterior penult less than half shorter, anterior antepenult obsolete. Shorter branch of second antennæ two-jointed. Abdomen very short. Caudal stylets extremely short.

Plate 75, fig. 1 *a*, animal, enlarged; *b*, under view of anterior part, more enlarged (*a*, base of anterior antennæ; *b*, posterior antennæ; *c*, mandible; *c'*, mandibular palpus; *d*, maxilla and palpus; *e*, maxilliped; *f*, first pair of legs, in part; *m*, buccal mass; *n*, furcate appendage to beak).

Collected in the Sooloo Sea, southwest of Mindanao, February 1, 1842.

Length, one-fifth of an inch. This species is much narrower for some distance posterior to the first pair of antennæ than across the middle, and the second pair of antennæ is remote from the first pair. The beak is very long and slender furcate. The abdomen is singularly short and but two-jointed; the last joint very short also, and bears the stylets at its truncate posterior angles, these stylets hardly projecting beyond the posterior margin of the joint.

The anterior antennæ have a barely perceptible curve towards base. The apical setæ are spreading and a little bent, and all are longer than apical joint; the penult anterior is half the posterior, and about as long as apical joint; the anterior antepenult appears to be obsolete; the anterior of next joint preceding is as long as the longest apical seta. The third joint of the antenna is in fact a part of the second; its seta is as long as first three joints, and it is directed straight forward. The setæ of the second pair of antennæ and following organs are rather short, the length scarcely equalling the greatest breadth of the cephalothorax. The branches of the second pair of antennæ are unequal; the shorter consists of two subequal joints, and the other of two quite unequal joints, the second being about half as long as the first.

CALANUS ATTENUATUS.

Elongatus. Frons triangulatus, acutus, rostro elongatè et tenuiter furcato. Cephalothorax anticè valde angustatus, posticè obtusus, 5-articulatus

articulo ultimo brevi. Antennæ anticæ corpore valde longiores, prope basin arcuatæ, alioque rectæ et latissimè divaricatæ, apicibus fronte paulo anterioribus, articulo penultimo abbreviato; setis vix brevibus, plerumque fractis, fere æquis, apicalibus et subapicalibus inæquis, longiusculis, anticâ antepenultimâ obsoletâ. Antennæ posticæ ramo minore multiarticulato. Abdomen curtissimum. Styli caudales perbreves, setis secundis dimidio corporis longioribus.

Much elongate. Front triangular, acute, rostrum long and slenderly furcate. Cephalothorax anteriorly narrow, obtuse behind, five-jointed, last joint very short. Anterior antennæ much longer than the body, arcuate towards base, then straight, the tips a little anterior to line of beak, the penult joint very short; setæ moderately short, mostly bent, subequal, apical and subapical spreading, unequal, rather long, anterior antepenult obsolete. Shorter branch of second pair of antennæ multiarticulate. Abdomen extremely short. Caudal stylets very short; second seta longer than half the length of the body, the others of moderate length.

Plate 75, fig. 2 *a*, view, enlarged; *a'*, extremity of antenna; *b*, mandible; *b'*, body of mandible in another position; *c*, maxilla; *d*, under view, more enlarged (*a*, first antenna; *b*, second antenna; *c*, mandible; *d*, maxilla); *e*, back view (showing the nerves to the antennæ (*a*), that to the eyes (*e*), and the glands over the stomach, which are ovarian or spermatoc; *m*, a muscle moving the abdomen).

Collected two individuals just south of the Kingsmill Islands, in the Pacific, April 1, 1841, 4 A. M.; also, April 13, 1841, in the Kingsmill Group; also in the China Sea, February 15, 1842.

Length, one-eighth of an inch. The anterior part of the body is proportionally much narrower than in the preceding species and more elongate; the breadth posterior to the first antennæ is hardly half that across the middle. The setæ of the first antennæ and caudal setæ are unlike those of that species; and the setæ of the second antennæ and following organs are much longer than in the *C. elongatus*. The first antennæ are one-fourth longer than the body; the last joint is longer than the two preceding. There is a seta a little longer than the others near, about one-third the length of the antenna from its base.

Abdomen three-jointed, first joint oblong. The long seta of the caudal stylets is two-thirds as long as the body, and is naked or not plumose. The furcate process of the beak is long and slender.

The multiarticulate character of the smaller branch of the posterior antennæ may authorize the institution of a new genus, or subgenus, for this and allied species, for which we propose the name *Eucalanus*. The above species will be *E. attenuatus*.

GENUS RHINCALANUS, Dana.

Calano fermè affinis. Frons valde angustèque productus, rostro breviter crassèque infra furcato.

Near *Calanus*. Front long produced and narrow, beak below short and stout furcate.

The species of this genus have the legs and antennæ of *Calanus*, with a narrow elongate, rostriform head, as in the preceding species, but with a stout furcate beak, directed downward from its extremity. The beak approaches that of some *Pontellæ*. The body is unusually long and slender. Among the caudal setæ, the second is probably very long: our specimens were mutilated in this part. The species below are referred to the genus *Calanus* in the *Proceedings of the Amer. Acad. Sci.*, ii. 19, as *C. rostrifrons* and *C. cornutus*.

RHINCALANUS ROSTRIFRONS.

Gracillimus. Frons valde elongatus, subacutus. Cephalothorax anticè paulo angustior, posticè rotundatus, 5-articulatus, articulo postico brevi, articulis penultimo antepenultimoque posticè acutis. Antennæ anticæ corpore valde longiores, leviter arcuatæ, latè divaricatæ, apicibus fronte anterioribus, setâ articuli secundi longiusculâ, setis apicalibus articulo vix longioribus, duabus subapicalibus posticis longis. Abdomen curtum. Styli caudales fere duplo longiores quam lati, setis latissimè diffusis.

Very slender. Front much elongate, subacute. Cephalothorax five jointed, penult and antepenult segments acute either side, the last

very short, obtuse behind. Anterior antennæ considerably longer than the body, gently arcuate, tips anterior to line of beak, first joint much oblong, four apical short; seta of second joint rather long, of sixth a little shorter, of sixteenth a little longer; apical setæ scarcely longer than joint, two posterior subapical long (others mutilated). Abdomen short. Caudal stylets oblong, about twice as long as broad, setæ widely spreading.

Plate 76, fig. 1 *a*, animal, enlarged; *b*, another individual.

Collected in the Sooloo Archipelago, February 2, 1842.

Length, one-eighth of an inch. The furcate processes of the front below are stout and rather short, and quite unlike the long slender processes of some Calani, and in one specimen, they were seen either side in an upper view. The abdomen is three-jointed. The caudal stylets are articulated obliquely to the abdomen, and the projecting part is but slightly oblong. The outer setæ are nearly at right angles with the side of the stylet; the second were broken off and are probably quite long; the third and fourth are about as long as the abdomen. The setæ of the second pair of antennæ and the following organs are rather short. The posterior subapical setæ of the anterior antennæ are as long as the last five or six joints of the antenna; the anterior antepenult is as long as the joint (other apical or subapical mutilated). These antennæ diverge at base at an angle of about 120°, but gradually curve more and more outward.

The animal often flexed its antennæ against its sides, quite unlike in this respect the ordinary Calani.

RHINCALANUS CORNUTUS.

Gracillimus. Frons valde elongatus, subacutus. Cephalothorax posticè rotundatus, 5-articulatus, articulo postico fere obsoleto, articulis tribus precedentibus posticè acutis. Antennæ anticæ sesqui corporis longitudine, fere rectæ, vix arcuatæ, apicibus fronte paululo anterioribus; setâ articuli tertii longiusculâ, setis apicalibus et penultimis brevibus, posticâ antepenultimâ longiore. Abdomen curtum. Styli caudales elongati; setis valde diffusis.

Very slender. Front much elongate, subacute. Cephalothorax rounded behind, five-jointed, last segment nearly obsolete, second, third, and fourth acute on either side behind. Anterior antennæ one and a half times as long as body, very nearly straight, hardly arcuate, tips anterior to front, setæ mostly very short, one on third joint rather long, apical and penult setæ short, posterior antepenult somewhat long. Abdomen short. Caudal stylets oblong, setæ much spreading.

Plate 76, fig. 2 *a*, animal, enlarged; *a'*, profile view of front; *b*, maxilla; *c*, a natatory leg; *d*, form of heart.

Collected four or five individuals in the Atlantic, November 3, 1838, latitude 1° north, longitude 18° west.

Length, one-eighth of an inch. Colour, reddish in spots about the articulations of the cephalothorax. This species is very near the preceding, but has the antennæ straight, and the abdomen four-jointed, besides other points of difference. The four posterior segments of the cephalothorax are scarcely one-third the whole length. The forks of the beak are seen in an upper view, as in the figure. The abdomen is four-jointed; first segment about as long as broad, the next two together about the same length. The stylets are much more oblong than in the *rostrifrons*. The caudal setæ were partly mutilated; the exterior one arises, as in the *rostrifrons*, on the outer side of the stylet near its base, the next, near its middle; neither of these two are quite as long as abdomen. There are four pairs of natatories, besides a pair of small feet.

This species approaches the *Pontellæ*, but appears to be nearer *Calanus*. The maxillipeds are large, nearly as in *Pontella*, but the following organs, the first pair of feet, have lateral motion, and are moderately long.

GENUS EUCHÆTA, *Philippi*.

The species of this genus collected by the author have the front in a vertical view pointed, and acute or nearly so; while in a lateral view it is transversely notched, so as to be two-toothed. The cephalic segment, as in the *Calani*, is never distinct from the following part of

the cephalothorax; and the number of posterior cephalothoracic segments is either three or four. The abdomen is linear, rather long, but not exceeding half the length of the cephalothorax; and the caudal stylets are quite short. The caudal setæ are straight; they are moderately short, excepting the second, which is much longer than the others, and in the females observed, not shorter than the body. The eyes are two on a single minute spot of pigment.

The antennæ extend outward either side with a double curvature, and the tips are not in advance of the line of the beak. In the *females*, several joints, including the apical, are furnished with one or more long setæ, and two towards the base are bent; but in the *males* examined, the same joints have setæ only moderately long. The two sexes thus do not agree in the setæ of the antennæ: moreover, they are unlike (if we are right in our reference of male to female in two species) in the basal joints of the antennæ; in the number of cephalothoracic segments, the male having a posterior segment which does not appear in the female of the species alluded to; and in the caudal setæ, the second seta being very much shorter in the male than in the female.

The anterior feet instead of extending laterally, as in the *Calani*, are thrown forward: the basal joint is long; the second is still longer; and the remainder, which is quite short, consists of five to seven minute joints, more or less distinct, each bearing a long naked seta, and the whole forming a pencil. The leg is thrown forward so that the apex of the second joint is under the mouth, and the apical portion with the pencil is directed downward.

The maxillipeds are nearly as in *Pontella*, but rather smaller. The base and other joints form a straight leg, and the rather long spinulous setæ are together directed forward.

The second pair of antennæ are as in *Calanus*. One branch consists of two nearly equal joints; it bears at apex three setæ, and on the under side of the first joint other setæ. The other branch is two-jointed, the second quite short, and bearing a number of long setæ.

The mandible is dentate at apex, and has a short seta on one side. The palpus is two-branched, and the two branches are nearly of equal length; the shorter has two short subequal joints; the longer has a short basal joint. Both are furnished at apex with several subequal setæ.

The posterior feet in the female are short, as in the *Calani*, and with-

out setæ. In the male they are long and straight, and extend forward, reaching as far as the mouth, or even beyond. The right terminates in an imperfect hand, consisting of a small arcuate thumb, or immoveable finger, and a long subulate finger, at least three times as long as the thumb. The left is two-branched; one branch is a single oblong joint; the other consists of two long joints, of which the second is long subulate.

The setæ of the antennæ of the females are quite similar in different species. The apical are four or five in number, there being two long posterior, of which one is one-third to one-half as long as the antenna, one anterior somewhat shorter, and one or two quite short extending outward. The posterior penult is about as long as anterior apical; the anterior penult very short. The posterior antepenult is sometimes as long as the joint, in other cases very short; the anterior antepenult very short. Counting from the apex, the fourth, seventh, eleventh, seventeenth, eighteenth, and twenty-first joints are furnished with very long setæ, and of these, the setæ of the seventeenth and eighteenth joints are bent, and have free motion in different directions; the others are directed straight forward in parallel lines, except the posterior apical, which point straight backward.

The species of this genus, though few in number, are very extensively distributed in the Atlantic, and but little less so in the Pacific Ocean.

Euchæta, PHILIPPI, Archiv für Naturgeschichte, ix. 55. In the figures given by Philippi, the mandibular palpus is separated from the rest of the mandible, and called a "kaufuss," or maxilla-foot. His fig. 5 *d*, is properly the mandibular palpus; 5 *c*, the maxilla; 5 *e*, the maxilliped; 5 *f*, the foot of first pair.

Euchirus, DANA, Amer. J. Sci. [2], i. 228, *Euchæta*; Proc. Amer. Acad. ii., 20, where the following new species are briefly described by the author.

EUCHÆTA COMMUNIS.

Cephalothorax nudus, 4-articulatus, posticè obtusus. Feminae:—*Antennæ anticæ corpore vix breviores, setis paucis remotis prælongis, rectis, et aliis duabus flexis longissimis, apicalibus prælongis, posticâ antepenultimâ fere articuli longitudine. Setæ caudales rectæ, secundâ sæpius corporis longitudine. Ova cærulea. Maris:—Antennæ anticæ corpore paulo breviores, angulo levissimè flexæ, setis brevibus, paucis, articulum apicalem vix superantibus. Setæ caudales abdominis longitudine.*

Cephalothorax naked, three-jointed, rounded behind. *Female*:—Anterior antennæ hardly shorter than the body, the last joint longer than the others; a few remote setæ very long and straight, besides two that are very long and bent. Apical setæ long, posterior antepenult about as long as the antepenult joint. Caudal setæ straight, the second usually as long as the body. Eggs blue. *Male*:—Anterior antennæ a little shorter than the body, slightly bent, setæ short, the longer scarcely exceeding the length of the apical joint. Caudal setæ about as long as the abdomen.

Plate 77, fig. 1'a, lateral view of *female*, enlarged; *b*, mandible, more enlarged; *c*, maxilla; *d*, maxilliped. Fig. 2 *a*, *male*, enlarged; *a'*, upper view of front; *b*, second pair of antennæ; *c*, one of the natatories; *d*, *e*, genital feet, *d* being the left.

The *females* were collected abundantly in the Atlantic, October 15, 18, 20, 24, 26, 27, 29, 30, 31, November 1, 3, 5, 9, 12, 1838, latitude 9° north to 0°, longitude 17°–23° west; and latitude 0°–13° south, longitude 17°–32° west; also, May 11, 1842, latitude 7° south, longitude 20° west. The *males* were collected October 18, and November 1, 1838. The hour of collection was usually at 4 A.M., before daylight.

Length, one-eighth of an inch. Some red about the thorax; eggs bright blue.

The propriety of uniting the two *Euchætæ*, here described as male and female, is still quite uncertain, and rests mainly on the fact that they were found in the same part of the Atlantic, and no other male corresponding to the female, or female corresponding to the male was obtained. Besides this, the anterior legs are similar in the size of the apical multiarticulate part.

In the *female*, the first of the four cephalothoracic segments sometimes appears divided by an imperfect articulation, near the centre of the cephalothorax. The first of the joints of the abdomen is a little the longest. The caudal stylets are shorter than the last joint, and their apices are generally nearer than their bases; the setæ are not as long as the abdomen, except the second; this is curved, and in one specimen was longer than the body, while in another it was a little shorter. The anterior antennæ are in general very even; the long posterior apical seta is nearly half as long as the antenna, and a shorter one

with it is straight and nearly half this length. The posterior antennæ have the branches nearly equal, the apical joint of longer branch about half the first joint of same, and the setæ at apex are not quite as long as branch. The joints of the shorter branch are subequal. The ovarian sac contained ten eggs, and was attached below to the first of the four abdominal joints.

In the male, the front is low triangular, there being a sub-obtuse angle in the margin at the posterior angle of the antennæ, and the centre of the front being prolonged a little and acute. The antennæ differ from those of the above, in being a little bent at the eleventh joint from the apex, but without a geniculating joint, and also slightly bent near base; the setæ at apex are hardly longer than the apical joint, and the posterior penult is very short. The genital feet are very long, extending as far as the beak. One is three-jointed; the first joint very broad and short; the second long, subcylindrical; the third long subulate; there is also articulated with the first, a straight and subcylindrical joint (the other branch), nearly as long as second joint. The other leg is five-jointed; the second joint longer than first or third; the third and fourth nearly equal, the former arcuate; the fifth long subulate.

Figure 3, Plate 77, represents the young of one of the oceanic Calanidæ, and we believe of the above species, as it was found abundantly in the ocean where that was common. The body is subacute at each extremity, with no distinction of abdomen, and the segments are indistinct. There are three pairs of appendages, each three-jointed. The anterior is stout, with the second joint longest; and the last have a few short blunt setæ on the posterior side, which have the appearance of longer hairs broken off. The second pair has a two-jointed base, and two one-jointed branches, with a few setæ at apex. The third pair is simple, and has a few setæ at apex.

Length, one-twenty-fourth to one-thirtieth of an inch. Colourless, or a little red about the joints. Abundant, November 3, 1838. Atlantic, latitude 0° 40' north, longitude 18° west.

EUCHÆTA CONCINNA.

Cephalothorax nudus, ellipticus, capite lateraliter arcuatus, angulis posticis paulum productus et obtusus; feminæ 4-articulatus, maris

5-articulatus segmento postico perbrevis. Antennæ anticæ corpore paulo breviores, feminæ marisque iis E. communis fere similes, setâ antepenultimâ posticâ brevissimâ. Setæ caudales abdomine breviores, secundâ feminæ fere corporis longitudine, maris abdomen paulo superantibus.

Cephalothorax naked, elliptical, sides of head arcuate, the posterior angles of thorax a little elongate, but not acute, in *male* five segments, in *female* four segments. Anterior antennæ a little shorter than the body, nearly similar to those of the *communis*, doubly curved, and tips posterior to beak, posterior antepenult seta minute. Caudal setæ straight, second nearly as long as body, in female slightly longer than abdomen in male.

Plate 77, fig. 4 *a*, *female*, enlarged; 4 *b*, abdomen of another specimen. Fig. 5 *a*, *male*, enlarged; *b*, genital or posterior feet; *c*, one of the same.

Male and female, collected in the Straits of Banca, east of Sumatra, March 1, 1842.

Length, one-tenth of an inch. Colourless, nearly; a little red about the mouth and posteriorly.

We make the same remark with regard to the male and female of this species as of the last. The species is near the *communis*: but the front is laterally arcuate; the setæ of longer branch of posterior antennæ are longer than the branch, the abdomen in the female has a short apical joint, making five in all. The ovarian sac of the female contained twelve eggs. The internal ovaries were distinct, and appeared as a convoluted mass, extending either side of the body as far as the mouth. The genital feet are nearly as in the preceding. The basal joint of the subulate branch is more than twice as long as broad, and the second is but little longer; the third abruptly narrows from one side a short distance from base. The other leg has the fourth joint, or thumb, quite thin in its thumb part, and there is an indentation, or possibly articulation, in the subulate finger, opposite the apex of the thumb or immoveable finger. The anterior antennæ of the male are slightly bent at the eleventh joint from the apex, and also at the second or third joint; the part beyond the eleventh joint is slightly arcuate.

EUCHÆTA PUBESCENS.

Feminæ:—*Cephalothorax pubescens, capite lateraliter angulatus, 5-articulatus, segmento postico perbrevis, subacuto. Antennæ anticæ corpore paulo breviores, quoad setas E. communi fere similes, setis antepenultimis brevissimis. Pedes antici apice 5-articulati et subelongati. Abdomen 4-articulatum, segmento primo secundum longitudine duplo superante. Seta caudalis secunda fermè corporis longitudine, plumosa.*

Female:—Cephalothorax pubescent, the front on either side forming an angle with the sides, and at middle acute, five-jointed, posterior segments four, the last very short, subacute behind. Anterior antennæ a little shorter than the body, setæ nearly as in the *communis*, the antepenult setæ both anterior and posterior, minute; anterior feet having the apical portion somewhat elongated and five-jointed. Abdomen four-jointed, first joint oblong, twice as long as second, last very short; caudal setæ straight, second about as long as body, plumose.

Plate 77, fig. 6 *a*, animal, enlarged; *a*, beak; *b*, posterior antennæ; *c*, mandibles; *d*, lip; *e*, maxilla; *f*, maxilliped; *g*, anterior feet.

Collected in the Paumotu Archipelago, Pacific, August 19, 1839, latitude 15° 45' south, longitude 144° 30' west.

Length, one-twelfth of an inch. Colour, slightly yellowish red in the posterior thoracic segments.

The abdomen was but four-jointed, with some indication of a very short basal segment. The first of the four segments was largest and gibbous below. The long caudal seta is plumose. The anterior feet have the long setæ about ten in number, and very finely pectinate; the five-jointed apical portion is more than a fourth the length of the second joint. The basal joint bears a few spinous setæ; on the second the longer setæ are finely pectinate, like the apical setæ—the pectination is so fine as to require a very high power to detect it; the shorter spines are more slender and numerous than in the *communis*.

EUCHÆTA DIADEMA.

Feminæ:—*Cephalothorax pubescens, capite lateraliter angulatus, 4-articulatus, posticè obtusus. Antennæ anticæ fere corporis longitudine, quoad setas E. communi fere similes, setâ posticâ penultimâ dimidium posticæ apicalis superante, setis antepenultimis brevissimis. Pedes antici apice 5-7-articulati et perbreves. Abdomen elongatum, segmento primo secundum longitudine paulo superante. Seta caudalis secunda corpore longior, nuda.*

Female:—Cephalothorax obtuse behind, pubescent, front on either side and at middle acute, four-jointed, a fifth behind sometimes apparent. Anterior antennæ almost as long as body, the setæ nearly as in the *communis*, posterior penult seta longer than half the posterior apical, antepenult setæ very short. Anterior feet having the apical jointed portion rather short, the long setæ seven in number. Abdomen elongate, four-jointed, the first segment oblong, a little exceeding the second in length. Caudal setæ straight, the second longer than the body, naked.

Plate 77, fig. 7 *a*, animal, enlarged; *b*, maxillipeds; *c*, anterior feet; *d*, posterior thoracic feet of female; *e*, an appendage attached below to abdomen near its base in some individuals.

Collected in the Pacific, March 23, 24, and 25, 1841, south of and near the Kingsmill Islands, latitude 6°–6° 30' south, longitude 175° 30'–177° east.

Length, one-seventh of an inch. Colour, yellowish, or reddish; also, colourless.

This species is near the preceding, but is different in having the long caudal setæ naked instead of plumose, and also in its anterior feet, and in the maxillipeds being much smaller in proportion. In the organs last mentioned, the setæ are not longer than the leg, while in the *pubescens* they are much longer. The abdomen varies somewhat, and although about half the length of the cephalothorax in the

specimen figured, in another it was shorter, and more resembled this part in the *pubescens*. The posterior thoracic legs represented on the Plate, were figured from this specimen.

- GENUS UNDINA, Dana.

Frons infra tenuiter furcatus. Antennæ anticæ longæ, angulo ante medium leviter flexæ sed articulo geniculante non instructæ. Maris pes posticus dexter grandis et prehensilis, ac in Pontellâ. Pedes antici subelongati, fere ac in Calano et non geniculati. Maxillipedes pedibus anticis vix minores. Oculi inferiores nulli, superiores coaliti.

Front below slender furcate. Anterior antennæ long, slightly bent at an angle, but not having a geniculating articulation. Right posterior feet of male large and prehensile, as in *Pontella*. Anterior feet subelongate, of same form as in *Calanus*. Maxillipeds nearly as large as the anterior feet. No inferior eyes, the superior coalesced.

The *Undinæ* have the general habit of the *Calani*. The anterior antennæ in the males have no geniculating joint, but in both males and females they are slightly bent, about one-third of their length from the base. Like the *Pontellæ*, they have the posterior thoracic legs large and prehensile, while unlike them, the anterior feet have lateral motion, and are not smaller than the maxillipeds. The antennæ have the usual position in the *Calani*, the tips not being anterior to the line of beak or but slightly so. They are also near the *Euchætæ*, from which they differ in the maxillipeds not being thrown forward nor geniculate. The cephalothorax consists of four or five segments. The beak is similar to the same in *Calanus*.

Undina, DANA, Proc. Amer. Acad. Sci., ii. 22, where the following new species are briefly described.

UNDINA VULGARIS.

Frons obtusus. Cephalothorax 4-articulatus, posticè rotundatus. Antennæ anticæ corporis longitudine, ad articulum octavum leviter reflexæ; setis brevibus, setâ articuli tertii longâ, flexâ, setis apicalibus

perbrevibus, unâ uncinatâ, posticâ antepenultimâ longiusculâ, penultimis anticâ posticâque paulo brevioribus, hâc ad extremitatem uncinulatâ. Abdomen 5-articulatum. Styli caudales breves, setâ secundâ ceteris duplo longiore.

Front obtuse. Cephalothorax four-jointed, rounded behind. Anterior antennæ as long as the body, at eighth joint slightly flexed, tips much behind line of beak; setæ short, a rather long bent one from the third joint, apical setæ very short, one uncinuate, posterior antepenult as long as last three joints, posterior and anterior penult one-third shorter, nearly equal, the posterior curved at apex, anterior antepenult very short. Abdomen five-jointed. Caudal stylets short, second seta more than twice the length of the first, the others of moderate length.

Plate 77, fig. 8 *a*, animal, enlarged; 8 *b*, extremity of antenna; *c*, right genital foot; *d*, profile of cephalothorax, showing alimentary cavity and spermatic gland, with the appearance of the beak.

Collected in the Straits of Banca, east of Sumatra, March 1, 1842; also, in the Atlantic, May 9, 1842, latitude 9° south, longitude 17° 30' west; also, May 13, latitude 4° 30' south, longitude 25° west.

Length, one-twelfth of an inch. Nearly colourless, a little reddish in some parts.

The body narrows a little anteriorly. The basal joint of the anterior antennæ is about twice as long as broad, and it is followed by seven short joints, after which these organs are flexed slightly backward. The apical joint is articulated with the preceding under its apex, or obliquely, and it is rather shorter than the penult. The posterior seta, directed straight backward, is not longer than the joint; there is a small uncinuate seta directed outward, and quite a short one directed forward, a short distance back from the apex. The longish bent seta proceeding from the third joint is as long as the first six joints of the antenna; this seta has motion in different directions. There is a seta a little longer than the others near by, at the flexion of the antenna. The caudal setæ are all plumose. The right of the genital or posterior thoracic feet, is large and doubly geniculate, consisting of a large oblong basal joint; a second slender, a little curving and rather longer

than the basal; a third and fourth, each half shorter than the second, and stout; the fourth, bearing a stout spine or claw (nearly straight) at apex, nearly or quite as long as itself; and the second giving origin within to a long, naked, and stout seta, which extends beyond the apex of the terminal spine or claw. The whole has nearly the shape of a letter N, the second joint constituting the oblique line in the letter, and the third and fourth joints together one of the legs. The left of this pair of feet is simple and unflexed.

UNDINA SIMPLEX.

Frons obtusus. Cephalothorax posticè rotundatus, 5-articulatus, segmento ultimo brevior. Antennæ anticæ corporis longitudine, articulo primo elongato; setis perbrevis, setâ articuli secundi longiusculâ, flexâ, setis penultimis rectis et articuli longitudine, posticâ antepenultimâ dimidio longiore, apicalibus minutis, unâ uncinatâ. Abdomen 5-articulatum. Styli caudales perbreves; setæ plumosæ, 2dæ duplo longiores.

Front obtuse. Cephalothorax rounded behind, five-jointed, last segment short. Anterior antennæ as long as the body, first joint oblong; setæ very short, on second joint a longish bent seta; the posterior antepenult setæ equalling last two joints of antenna in length, the anterior and posterior penult half shorter, straight; the apical shorter than joint, one uncinat. Abdomen five-jointed. Caudal stylets very short, setæ plumose, second more than twice the first.

Plate 77, fig. 9 *a*, view, enlarged; *b*, extremity of antenna.

Collected, March 25, 1841, in the Pacific, off El Gran Cocal, south of the Kingsmill Islands, latitude 5° 45' south, longitude 175° 30' west; also, May 14, 1841, latitude 25° north, and longitude 167° east.

Length, one-twentieth of an inch. Colourless.

This species is near the preceding, and may be the same. Yet it is retained as distinct, as there are four posterior joints to the cephalothorax and the setæ of the antennæ are different; the basal joint is longer, and the longish bent seta is attached to the second joint.

Plate 77, figs. 10 *a, b, c, d, e, f*, represent organs of a species found abundant in the Atlantic, from October 18 to Nov. 12, 1838, latitude 6° 30' north, to 12° 40' south, longitude 21° 40' to 31° 30' west, and it may be the same with one of the preceding species. The figure of the antenna may not be quite accurate, as it was made before the importance of attending strictly to the exact position of these organs and the comparative lengths of the joints was understood. There are four posterior joints to the cephalothorax.

Figure 10 *a*, represents the anterior antennæ; *b*, the posterior; *c*, the first pair of feet; *d*, the right genital foot; *e*, a lateral view of cephalothorax, showing position of beak and the alimentary cavity; *f*, abdomen.

As the species was figured, the tips of the anterior antennæ are a little anterior to line of beak. A specimen resembling it in this and other respects (or having the tips only a little posterior to line of beak), was obtained off the south end of Mindoro, East Indies, January 22, 1842.

UNDINA INORNATA.

Frons rotundatus. Cephalothorax posticè vix acutus, 5-articulatus, segmento postico brevi. Antennæ anticæ corporis longitudine, setis perbrevis, setâ articuli secundi (tertii?) longiusculâ, rectâ, setâ apicali posticâ articuli longitudine, anticâ penultimâ suboblongâ, posticâ brevi, posticâ antepenultimâ articulum vix superante. Styli caudales parce oblongi.

Front rounded. Cephalothorax subacute behind, five-jointed, last segment quite short. Anterior antennæ as long as body, second joint oblong; setæ very short, one from second or third joint a little long and straight, posterior apical seta as long as joint, anterior penult the longest of the subapical, the posterior antepenult next longest, the other subapical short. Abdomen five-jointed, segments subequal. Caudal stylets sparingly oblong; setæ spreading, not longer than the abdomen, the second twice as long as first.

Plate 77, fig. 11 *a*, animal, enlarged; *b*, extremity of anterior antennæ; *c*, one of the second pair of natatories; *d*, posterior natatories.

Collected several individuals, October 27, 1838, in the Atlantic, latitude 4° north, longitude 19° west.

Length, one-twelfth of an inch. Colour, in part orange or reddish orange.

The antennæ have the usual slight bend after the eighth or ninth joint, and the following part of the antenna consists of fifteen or sixteen joints. The beak is furcate below, and the furcation is directed downward and much inward. The cephalothorax is broadest posterior to centre. The first segment of the abdomen is a little the longest, and the last the shortest. The posterior antennæ have the first joint of the longer branch about twice the remaining portion in length; the setæ at apex are a little longer than the branch.

Posterior pair of thoracic legs nearly like the preceding, dissimilar; the left leg most slender, without hairs, and having very long spines at the apices of the joints, which are much longer than the joint. The spines at the apices of the joints of the right leg are shorter than the joint, and there are a few short hairs from the inner side of longer branch. The specimen described was probably a female, while those of the other species appear to have been males.

SUBFAMILY OITHONINÆ.

The Oithoninæ are related to *Calanus* more nearly than to *Pontella*. As in *Calanus*, the eyes are the superior alone, and these occupy a single minute spot. Moreover, the right antenna is not geniculating in the males, and the legs of the posterior pair are rudimentary. As in *Acartia*, the hairs of the antennæ are rather long and point in various directions, instead of being confined to the anterior side, like *Calanus* and *Pontella*. As in *Pontella*, the maxillipeds are longer than the first pair of legs, being much longer than in that genus, and geniculated and thrown forward, instead of standing at right angles with the body. The very long abdomen, the small mandibular palpus, the digitate inner side of the maxillæ, are characters in which the species are altogether peculiar. Such distinctive characters belong, at least, to the only genus of this family yet discovered. More particular descriptions are given beyond.

GENUS OITHONA, Baird.

Antennæ anticæ elongatæ, articulis paucis, prælongis, setis diffusis, longis. Antennæ posticæ simplices (?). Maxillipedes ad articulationem secundum geniculati, prorsus projecti, setis spinulosis validis instructi. Abdomen lineare, corporis longitudine. Styli caudales oblongi, divaricati, setis prælongis. Sæpius e basi pedum biremium seta grandis sæpe plumiformis lateraliter porrecta.

Anterior antennæ long; joints few but long, setæ pointed different ways and quite long. Posterior antennæ simple (?). Maxillipeds geniculate between the first and second joints, and thrown forward, furnished with long spinulous setæ. Abdomen as long as the body. Caudal stylets oblong, divaricate, setæ very long. Usually a long seta, often plumiform, projecting laterally from the base of the natatory legs.

The Oithonæ have a long slender abdomen, and are not over one-twentieth of an inch in their whole length. They are like a minute hair in the water, scarcely visible to the naked eye, because proportionally so narrow; under a microscope, they are remarkable for their spreading antennæ, with long diffuse setæ, the long divaricate setæ of the caudal stylets, and the plumes or coloured setæ along the sides of the body.

The *anterior antennæ* are about as long as the body, and have not far from seven unequal joints. Many of the setæ are more than half as long as the organ.

The *posterior antennæ* are three-jointed. The third oblong, and bearing at apex two long stout setæ, besides one or two shorter. The second is much shorter than the third, and also bears some setæ.

The *mandible* has a slender denticulate summit. The basal part projects at right angles with the mandible into an oblong process, having at apex two remotely spinulous setæ. The palpus is one-jointed, and has one or two naked setæ at apex.

The *maxilla* consists at its inner extremity of four stout digitiform or spiniform processes, which extend inward, nearly parallel and a little distant from one another. From this part, at right angles with it, there is an oblong process (like that of the mandible), having one

or two setæ at apex; and the palpus articulated with it is a single oblong joint, bearing a very long naked seta, many times longer than the joint.

The *maxillipeds*, which are longer than the anterior feet, have a long basal joint, which stands at right angles to the body; the organ is then flexed forward, and the remaining part is three-jointed, and together about as long as the basal joint. Each of the joints bears a few stout and long setulous setæ, which, in the natural position of the parts, reach forward to the mouth. At the inner apex of the basal joint there are two or three of these setulous setæ on a common base, and above, there are a few other setæ, which are naked.

The *anterior feet* are either straight, or flexed like the maxillipeds. They are three-jointed and bear a few short spinulous setæ (see Plate 76). The first or basal joint is longer than the third, and has in one species a naked spine on the inner margin near the middle, and another on the outer towards the apex.

The *natatories* have the usual form, except that in two species out of the three collected, there is a long seta extending outward from the second of the two basal joints, which is seen in an upper view projecting from the side of the body when the animal is swimming. There are thus four setæ either side (as there are four natatories), and in one species they were delicately coloured plumes. We did not succeed in ascertaining whether these plumes or setæ are peculiar to one sex alone, or belong to both; but are inclined to the former opinion.

The *abdomen* consists of four or five segments in the species observed. The basal bears one or two setæ on either side: it is not always distinct from the following.

The caudal stylets are styliform and divergent. The setæ are very unequal. One is much longer than the others, exceeding the length of the abdomen; the rest are short.

The cephalothorax in the species observed is only four-jointed, and is obtuse in front and behind.

The *Oithonæ* are best distinguished by the antennæ, the abdomen and its basal and caudal setæ, the lateral setæ of the natatory legs. They are very widely distributed in different oceans, yet pertain to few species.

Oithona, BAIRD, Zoologist, 1843.

Scribella, DANA, Amer. Jour. Sci. [2], i. 227, and Proc. Amer. Acad., 1849, ii. 19, where the following new species are briefly described by the author.

OITHONA PLUMIFERA, Baird.

Antennæ anticæ late (130°) divaricatæ, fere corporis longitudine, 7-articulatæ, articulis secundo quarto et duabus ultimis brevioribus, setis longissimis. Seta pedium biremium externa grandis, eleganter plumiformis. Abdomen 5-articulatum, cephalothorace longius, segmento 1mo perbrevis, setas basales duas longiusculas rectas dimidio inæquas gerente. Styli caudales tenues, setâ externâ fere styli longitudine.

Anterior antennæ widely divaricate (130°), nearly as long as the body, seven-jointed, second, fourth, and last two segments shortest; setæ very long, some exceeding half the length of the antenna; external seta of the natatory legs elegantly plumiform. Abdomen five-jointed, longer than cephalothorax, the first segment very short, bearing two unequal straight setæ, one about half the length of the other. Caudal stylets slender, divaricate, the external as long as the stylet.

Plate 76, fig. 4 *a*, animal, enlarged; *a'*, position of the antennæ in a specimen collected, May 16, 1842; *b*, imperfect view of posterior antennæ; *c*, maxillipeds; *d*, anterior feet; *e*, natatory.

Abundant in the Atlantic, October 22, 23, 24, 26, 1838, latitude 4½°–7° north, longitude 20°–22° west; also, taken May 16, 1842, latitude 1° south, longitude 30° 30' west; also, probably the same in the Pacific, among the Kingsmill Islands, April, 1841.

Length, one-twentieth of an inch. Colour, reddish orange, or orange-yellow; the lateral plumes and some of the plumose setæ of the antennæ of the same colour. This is a remarkably elegant species, under the microscope. The four coloured plumes are alluded to in Baird's specific name of this species.

The three posterior segments of the cephalothorax are about one-third the whole length. The second joint of the abdomen is a little longer than the following (which are subequal), and it is a little enlarged at base. The anterior antennæ diverge at an angle of

nearly 130°. The external seta of the stylets proceeds from near the middle of the stylet, rather nearer the base than apex. The other setæ were mutilated, and those of the antennæ also were often so. The plumes either side of the body were as long as the breadth of the body.

The position of the antennæ in figure 4 *a'* may be more correct (or, at least, more common) than that in 4 *a*.

Oithona plumifera, BAIRD, Zoologist, 1843.

Scribella scriba, DANA, Proc. Amer. Acad. Sci., ii. 20.

OITHONA ABBREVIATA.

Antennæ anticæ latè divaricatæ, 7-articulatæ, articulis duobus ultimis brevibus, tertio quarto quintoque subæquis. Setæ externæ pedium biremium obsoletæ (an distinctio sexus?). Abdomen 5-articulatum; setis basalibus dimidio abdominis valde brevioribus, subæquis, curvatis. Styli caudales paulum divaricati; setâ externâ perbrevis.

Anterior antennæ widely divaricate, much shorter than the body, seven-jointed, last two joints very short, second moderately short, third, fourth, and fifth subequal; setæ less than half the length of the antenna. External seta of the natatories wanting. Abdomen five-jointed; first segment usually nearly half the second, and having on either side two curved setæ, subequal, and of moderate length. Caudal stylets sparingly divergent, outer seta very short; second seta slightly longer than abdomen; third more than half same length.

Plate 76, fig. 5 *a*, animal, enlarged; *b*, maxilliped.

Collected abundantly, off Patagonia, in the Pacific, January 21, 1839, latitude 40° south, longitude 55° 30' west; also, April 21, 1840, one hundred miles southeast of Tonga; also, July 7, 1841, latitude 44° 15' north, longitude 153° west.

Length, one-twenty-fourth of an inch. Colourless.

A large number of specimens were taken and examined, but in none were the setæ entire. If the absence of the external setæ of the

natatories is sexual, it may be that the fact of the shorter setæ of the anterior antennæ is also so, as this difference in these antennary setæ occurs in the *Euchætæ*. On account of our being unacquainted with the sexual characteristics, we cannot lay down satisfactorily the distinctions between this species and the following.

The anterior antennæ are about as long as the cephalothorax and first two abdominal segments. The articulations are rather indistinct, which makes the number of joints somewhat uncertain.

The above may possibly be the female of the *setigera*; but we believe not. It was not ascertained that the specimens were female. Moreover, the localities are rather wide apart.

OITHONA SETIGER.

Antennæ anticæ fere corporis longitudine, latè divaricatæ, 7-articulatæ, articulis 3 ultimis brevissimis, tertio quartoque prælongis, setis longissimis. Seta pedium biremium externa longa, nuda, tenuissimè subclavata. Abdomen 5-articulatum, segmentis subæquis, setis basalibus duabus, unâ prælongâ, alterâ brevi. Styli caudales tenues, setâ externâ valde longiore quam stylus et prope basin styli insitâ.

Anterior antennæ nearly as long as body, widely divaricate, seven-jointed; the three apical joints quite short, third and fourth very long, some of the setæ longer than half the antenna. External seta of natatories long, naked, very slender subclavate. Abdomen five-jointed, segments subequal, setæ of first joint very unequal, one very short, the other longer than half the abdomen. Caudal stylets slender, divaricate, outer seta almost twice the length of stylet, and proceeding from near its base.

Plate 76, fig. 6 *a*, animal, enlarged; *a'*, extremity of anterior antenna, setæ partly cut off; *b*, posterior antennæ; *c*, mandible (not in natural position); *d*, maxilla; *e*, maxilliped; *f*, anterior leg.

Collected in the Pacific, latitude 3° north, longitude 173° east, south of Pitt's Island, Kingsmill Group, 4 A. M., April 28, 1841.

Length, one-twentieth of an inch. Colour, faint ochreous; lateral

thoracic setæ, and also those from base of abdomen, of an orange colour.

The cephalothorax was broadest just anterior to middle. The caudal stylets were nearly as long as last abdominal segment. The caudal setæ were broken off except the outer and two very short at apex, one the inner, the other the outer; there appears to have been only one long seta. The second pair of antennæ were apparently simple; whether the longer setæ were naked (as in the figure) or not, is not quite certain. The outer setæ of the base of the natatories are slender, and have very short hairs near their tips, which are seen only with a very high power; but the setæ are not plumose.

Another specimen was obtained by the author off Pitt's Island, in which the setæ of the base of the natatories were wanting; the cephalothorax was more evenly elliptical, and a little more slender, and the outer setæ of the caudal stylets were shorter than in the figure given.

SUBFAMILY PONTELLINÆ.

Many of the Pontellinæ (the Acartia, Pontellæ, and Catopiæ) are distinguished from all the other Calanidæ by the singular inferior eyes, which form a prominence on the under side of the head; and those not so characterized (the Diaptomi and Candaceæ) have the geniculating joint in the male right antenna, as well as a prehensile right leg at the posterior extremity of the thorax. The geniculating joint is wanting in one genus of the Pontellinæ alone, *Acartia*; but as it is possible that none of the individuals observed were males, this genus may be no exception, though we think it not probable. The antennæ in *Acartia* have an unusual degree of flexibility, and we suspect that they may therefore be used with the same facility as if the geniculating joint were present. Moreover, the legs of the posterior pair (one-jointed rudimentary appendages with two divaricate setæ), even if of females alone (instead of a form common to the sexes), are still unlike anything occurring in other genera; and this divergence is likely to be attended with other peculiarities.

The general form of the body is similar to that of the Calaninæ. The anterior antennæ, although they often project transversely, are very often thrown obliquely forward, a position rarely found among the Calaninæ. The cephalothorax also is more frequently divided into seven segments than in the preceding groups.

GENUS HEMICALANUS, Dana.

Rostrum infra furcatum. Oculi duo simplices tantum, pigmentis scæpissime coalitis, minutis. Antennæ anticæ maris parce impares, dextrâ cum articulatione geniculante, articulis raro coalitis. Antennæ posticæ biremes, ramis subæquis; ramo laterali 2-articulato, articulis duobus subæquis, apice 3 setas gerente et articuli primi dorso setigero. Maxillipedes recti, grandes, elongate setigero. Pedes postici maris impares, dextro crasse prehensili; feminæ sive precedentibus similes sive parvuli.

Beak furcate below. Eyes two, simple, the pigment of the two usually united, minute. Anterior antennæ of *male* sparingly dissimilar, the right having a geniculating joint, the joints in few cases coalescing. Posterior antennæ two-branched, the branches subequal, lateral branch often the longer, two-jointed, joints subequal, at apex of this branch three setæ, and several on the back margin of the first joint. Posterior feet in *males* dissimilar, the right stout prehensile; in *females*, either like the preceding, or obsolescent.

This genus, like *Undina*, is intermediate between *Pontella* and *Calanus*. It has the posterior antennæ of *Calanus* and *Undina*, and the anterior antennæ have a *Calanoid* position, the tips being behind or but little in advance of the beak. Moreover, the inferior eyes of the *Pontellæ* are wanting. But like the genus *Pontella*, the right male antenna has a geniculating joint, yet with but little modification of the organ, and also, the posterior thoracic legs are dissimilar, and one is large prehensile; besides, the maxillipeds are larger if not longer than the anterior feet, and the setæ extend forward beneath the mouth, as particularly described under *Pontella*. The genus *Undina* differs from this in having no geniculating joint in the male antennæ, these organs on both sides having instead a slight bend, one-third of the way from the base. *Diaptomus* of Westwood (including the *C. castor*, a fresh-water species) differs from *Hemicalanus* in having the posterior thoracic legs in the *female* quite large and stout, and the shorter branch of the posterior antennæ with several short joints at middle. As no species of *Hemicalanus* or of *Pontella* has been ob-

served by the author with a bag of eggs attached to the female abdomen, it is quite probable that no such bag exists; and if so, this would make a wider distinction between Hemicalanus and Diaptomus.

The particular character of the organs of the mouth and other parts in the Hemicalani, will be gathered from the figures and the descriptions beyond.

There are some species that have all the Calanoid characteristics of this genus, in which minute inferior eyes are distinguishable, as in Pontella. It may be doubted, whether the existence of these eyes should require us to place them with the Pontella, or whether we should regard as more important the characters of the posterior antennæ, and arrange them with this genus. The former course has been adopted. The character of the posterior antennæ more especially referred to, is their having only *three* setæ at the extremity of the shorter or anterior branch, *five* being the typical number for *Pontella*.

The species of this genus, here described, are all oceanic, occurring in the pure ocean waters, like the Pontellæ and unlike the Diaptomi.

HEMICALANUS LONGICORNIS.

Frons rotundatus. Cephalothorax posticè obtusus, 5-articulatus, articulis posticis æquis. Oculi coaliti, minuti. Antennæ anticæ sesqui corporis longitudine, rectiusculæ, setis brevibus, duabus subapicalibus posticis prælongis, subæquis, apicalibus perbrevibus, anticâ penultimâ articuli longitudine. Styli caudales breves.

Front rounded. Cephalothorax obtuse behind, five-jointed, four posterior segments subequal. Eyes united, minute. Anterior antennæ one and a half times as long as body, nearly straight, the tips nearly in line of beak; setæ short, two posterior subapical quite long, subequal, apical very short, anterior penult as long as penult joint. Caudal stylets very short, the setæ spreading, subequal, not longer than abdomen.

Plate 78, fig. 9, animal, enlarged.

Collected a few individuals, November 7, 1838, at 4 A. M., in the Atlantic, latitude 4° south, longitude 21° west.

Length, one-eighth of an inch. The furcate beak is quite long. The caudal setæ are nearly equal, the first being but little shorter than the second. The setæ of the anterior antennæ are short, the apical quite short; the long posterior subapical are furnished with short distant ciliæ on the outer side, which move on their base when the antenna is agitated in the water. The setæ on the longer branch of the posterior antennæ are longer than the antennæ. Natatories five pair and subequal; the posterior dissimilar. Two rows of large globular masses extend along nearly the whole length of the cephalothorax, which have a greenish colour and bright reflections; the posterior masses oblong, and largest. Abdomen four-jointed, first joint oblong.

This species is in some points near the *Cetochilus septentrionalis* of Goodsir, described in Jameson's Edinb. New. Phil. Jour., 1843, vol. xxxv. pp. 102 and 336.

Cyclopsina longicornis, DANA, Proc. Amer. Acad. Sci., ii. 24.

HEMICALANUS GALANINUS.

Gracilis. Frons triangulatus. Cephalothorax posticè obtusus, 6-articulatus, capite vix discreto, segmentis posticis æquis. Antennæ anticæ corpore longiores, tenuissimæ, rectiusculæ, apicibus fronte non posterioribus; setis brevibus, apicalibus anticis articuli longitudine, subapicalibus totis valde brevioribus; antenna maris dextra medio leviter incrassata. Styli caudales elongati, divaricati, setis subæquis, divaricatis.

Slender. Front triangular. Cephalothorax obtuse behind, six-jointed, the cephalic articulation not distinct, four posterior segments subequal. Anterior antennæ longer than the body, very slender, nearly straight, the tips not behind line of beak; setæ short, the anterior apical as long as the last joint, the subapical all much shorter, right of male nearly terete, the joints not blended, but little enlarged. Caudal stylets half as long as abdomen, slender, divaricate, setæ spreading, subequal.

Plate 78, fig. 10 *a*, animal, enlarged; *b*, extremity of antenna.

Collected in the Pacific, near El Gran Cocal, latitude 5° 30' south, longitude 175° east, March 25, 1841.

Length, one-sixteenth of an inch. Colour, bluish, with a reddish tint in the head and abdomen. The species is near the Calani in habit. The body is slender, narrower anteriorly. The eyes are approximate, but were not quite clearly seen. The male right antenna differs but little from the female, as the joints are all distinct, and a few only are a little enlarged, without affecting much the terete character of the organ. These antennæ are nearly in the same straight line, after the first curving at base; each inclines a little back of an exact line. The second joint is oblong, full twice as long as broad; the apical is a little longer than the penult. After the geniculating articulation there are five joints, the first and second hardly coalescent and very nearly straight, the last three but little longer than the other two. The setæ are all short, those towards the base about twice as long as the diameter of the joints, and much crowded. The second pair of antennæ is rather small; one branch consists of two nearly equal joints, and has three setæ at apex, like the Calani, and several on the back surface of the first joint. The setæ are rather small. The other branch is much the shorter.

Cyclopsina calanina, DANA, Proc. Amer. Acad. Sci., ii. 25.

HEMICALANUS TENUICORNIS.

Maris:—*Frons triangulatus*. *Cephalothorax posticè fere obtusus*, 7-articulatus, capite discreto, segmentis posticis æquis. *Antennæ anticæ corpore vix longiores, apicibus fronte vix anterioribus, tenuissimæ, rectiusculæ, setis brevibus, anticis apicalibus fere articuli longitudine, posticâ penultimâ paulo longiore*. *Antenna maris dextra parce incrassata, articulis nullis coalitis*. *Abdomen 3-articulatum*. *Styli caudales elongati, divaricati*.

Male:—Front triangular. Cephalothorax behind nearly obtuse, seven-jointed, head separate, four posterior segments subequal. Anterior

antennæ as long as the body, very slender, nearly straight, tips very slightly behind the line of beak; setæ short, anterior apical nearly as long as apical joint, the posterior penult quite as long as this joint, the anterior apical but little shorter, the other subapical still shorter. Right antenna of male nearly terete, the joints of the middle portion slightly enlarged, but not coalescent. Abdomen three-jointed, first joint longest and abruptly wider. Caudal stylets nearly as long as abdomen, divaricate, setæ subequal, about as long as abdomen.

Plate 78, fig. 11 *a*, animal, enlarged; *b*, extremity of antenna.

Collected, March 22, 1841, in the Pacific, north of Depeyster's Island, latitude $6^{\circ} 40'$ south, longitude $177^{\circ} 30'$ east; also, in Paumotu Archipelago, latitude $18\frac{1}{2}^{\circ}$ south, longitude 136° west, August 13, 1839.

Length, one-sixteenth of an inch. Colour, burnt sienna, more or less generally diffused. This species is very near the preceding. They differ in the subapical setæ of the anterior antennæ, in the abdominal stylets, and in the cephalic part of the cephalothorax.

The eyes constitute a very minute point or red spot. No inferior eyes were observed. The cephalic articulation is distinct. The beak is much incurved. The anterior antennæ are very slender, and are nearly in the same straight line, each falling but a little back. The setæ are all short; those towards the base are a little longer than the diameter of the joints and crowded; the posterior penult seta is the longest of those at the extremity. The part of the antennæ beyond the geniculating articulation in the right antenna of the male is four-jointed, the first joint being arcuate, and corresponding to two joints in the left antenna; moreover, it is much shorter than the three joints following. The anterior part of the body is not as narrow as in the *calanina*, and the posterior angles of the cephalothorax are more prolonged. The maxillipeds were larger than the anterior legs, and had the scoop-net form characteristic of *Pontella*.

The posterior antennæ are very short, and the branch which is usually the longer is the shorter; the longer has two nearly equal joints, with three bent setæ at apex and others on the back of the first joint. The setæ of the shorter branch and of the following organs are short.

A specimen was collected in the Paumotus, August 13, 1839, which is probably a female of this species. The head is narrow. Eyes on one and the same minute red spot. Cephalothorax obtuse behind. Antennæ distinctly longer than the body, the two nearly in a straight line, very slender, apical joint longer than penult. Abdomen four-jointed, the second large, inflated, gibbous below. Stylets about half the abdomen in length, divergent; setæ about as long as abdomen. Five pairs of natatories, the posterior pair much like the preceding, but a little smaller.

Cyclopsina tenuicornis, DANA, Proc. Amer. Acad. Sci., Boston, ii. 25.

HEMICALANUS GRACILIS.

Maris:—*Antennæ anticæ corpore valde longiores; abdomen 4-articulatum; aliis C. tenuicorni similis.*

Male:—Anterior antennæ much longer than the body. Abdomen four-jointed. In other characters near the *C. tenuicornis*.

Plate 78, fig. 12 *a*, animal, enlarged; *b*, extremity of female antenna, or of left of male.

Collected in the Pacific, May 14, 1841, latitude 25° north, longitude 167° east.

Length, one-sixteenth of an inch. Colour, in part reddish.

This species may possibly be only a variety of the *tenuicornis*. The length of the antennæ is not constant. In one specimen they were one and one-third times as long as the body, extending beyond the stylets as far as the whole length of the abdomen; in another they were one and one-fifth times as long as the body. The cephalothorax narrows anteriorly, as in the two preceding species, and has about the same form. The branches of the posterior antennæ are not as unequal as in the *tenuicornis*, yet the one with two subequal joints is the longer. The setæ of the anterior antennæ towards the base are generally three or four times as long as the diameter of the joints. The part of the right male antenna beyond the geniculating articulation

is four-jointed, the first (a double joint), being nearly as long as the other three, and very slightly arcuate. The apical setæ, both anterior and posterior, are but a little shorter than the joint. The eye-spot is very minute.

GENUS CANDACE, Dana.

Frons quadratus. Oculi inferiores obsoleti. Antennæ anticæ latissimè divaricatæ, regulariter breviterque setigeræ; dextra maris articulatione geniculans. Maxillipedes pedibus proximis majores, sub corpore projecti, geniculati et inflexi, 4-articulati, setis nudis, longis. Pedes postici maris impares, dextro subprehensili. Abdomen mediocre. Styli caudales breves, setis rectis et strictè appressis.

Front quadrate. Inferior eyes wanting. Anterior antennæ very widely divaricate, regular and short in the setæ; the right male antennæ having a geniculating articulation. Maxillipeds larger than the first pair of feet, having motion in the line of the body, geniculate and inflexed, four-jointed, setæ long and naked. Posterior feet of male unequal, the right subprehensile. Abdomen of moderate length. Caudal stylets quite short; setæ straight and close appressed.

The species of Candace are remarkable for their quadrate front, appressed caudal setæ, anterior antennæ, both falling after a basal outward curve, into the same straight transverse line, and in the colour being generally in part black. Often the apical portion of the antennæ, for six to eleven joints, is black, and the body is banded with black at each articulation; sometimes also the natatory feet are partly black. In some specimens of one species there were black lines in the anterior part of the thorax, and four black spots, as shown on Plate 78. One specimen of another species was black throughout, excepting the head, basal half of the anterior antennæ, and the abdomen. The colour is not constant for the species.

The cephalothorax has usually three or four posterior segments. In one species another articulation was observed across the middle; and in one of the following species the head was separated by an imperfect articulation. The posterior angles are either truncate, obtuse, or long

acute; and when acute, the right side is usually longer than the left, and sometimes inflexed or reflexed. The head is much narrower than the cephalothorax.

The eyes are situated on the anterior angles of a single spot of bright red pigment, which is rather large and nearly square.

The anterior antennæ of the species observed have seventeen to twenty-three joints, and they either curve as they leave the head, and so bend around till the two are in one transverse line; or they pass off straight, but obliquely, then bend abruptly outwards, so as to lie in one line. The tips in one species are a little forward of the general line.

The joints of these organs are short. The second is longer than the first. Generally, after the second, there are four joints (3, 4, 5, 6), nearly equal. Then the antennæ is commonly abruptly smaller, and joints 7, 8, 9, 10, 11, are small and short; 12, 13, 14, 15, 16, 17, gradually increase a little in length; 18, 19 are similar to 17; 20, 21, 22 are a little shorter; and 23, the apical, is longer, or nearly equal to 21 and 22 together. Where the number of joints is less than twenty-three, the order of sequence is of course different; this reduction in the number of joints arises apparently from a coalescence of some of the joints following the second.

In the right male antennæ the geniculating joint precedes the sixth joint from the apex, instead of the fifth, the usual place in the *Pontellæ*. The two joints next following the articulation are commonly united in one, yet are sometimes separate. The two preceding the articulation are one, and its apical half, or sometimes the whole, has the front margin very minutely pectinate. The four joints next preceding, or joints 12, 13, 14, 15, in the above enumeration, are slightly enlarged and distinct.

The setæ of the antennæ are not over three or four diameters of the organ in length.

The posterior antennæ are two-branched. The shorter branch, as in the *Pontellæ*, terminates in more than three setæ, and has no setæ on the outer side of the first joint. It is two-jointed, but the second joint is very short. The setæ at the extremity of the longer branch are similar to those of the other *Calanidæ*.

The mandibular palpus is essentially the same as in the *Calani*. The maxilla is three-jointed. The second joint is broad, and has a tuft of setæ near its base, and a long pencil at the outer angle. The third joint is small, and terminates in a tuft of setæ.

The maxillipeds are three-jointed, and they are flexed forward between the first and second joints. The second joint is stout and oblong. The third is very short. On the inner side of the third and second there are a few long naked setæ (as long as the first joint), forming together a pencil; and besides, there are on the second joint one or two shorter setæ, a little remote, and one or two still shorter on the inner side of the first joint.

The first pair of feet is small, and as far as examined, straight. They consist of three or four joints with very short setæ on the inner side at apex.

The first four pairs of natatories are similar to those of other Calanidæ.

The fifth pair, or posterior pair of feet, is quite small in females. But in males it is large, and of various forms, adapted more or less perfectly for prehension. The cheliform character is not as distinct as in most Pontellæ. There is usually a curved spine, corneous seta, or stout appendage, proceeding from one side of the main part of the right leg, and as far as observed from the penult joint.

The abdomen has from two to six segments. The first segment (or second, if there are six), has often a spinous process on the right side, projecting outward; but this is not constant for a species. In one individual there was a slender process projecting backward from either side. In some cases this segment or the second is strongly gibbous below.

The caudal stylets are quite short, and have the outer margin arcuate. The setæ form a close pencil, about as long as the abdomen; they are ten in number, and of nearly equal length.

The species of Candace occur within the tropics, and over the different oceans traversed by the Expedition; yet they are not numerous.

Candace, DANA, Amer. Jour. Sci. [2], i. 228; also, Proc. Amer. Acad., ii. 22, 1849, where the following new species are briefly described by the author.

CANDACE ORNATA.

Maris:—*Cephalothorax 5-articulatus, segmentis posticis quatuor, angulis posticis longè acutis, dextro longiore. Antennæ e basi arcuatæ, aliisque rectè transversæ, corpore parce breviores, articulo secundo paulum oblongo; setis brevibus, quorum paucis secundo articulo parce longio-*

ribus, apicali posticâ articuli longitudine, posticâ penultimâ paulo longiore, anticâ penultimâ brevior. Antennarum posticarum ramus minor tenuis, valde brevior. Pes posticus dexter mediocris, articulo ultimo subuncinato, appendice laterali subcorneâ, articulum uncinatum longitudine superante.

Male: — Cephalothorax five-jointed, there being four posterior segments, posterior angles long acute, right one the longer. Basal part of anterior antennæ arcuate, the rest straight, a little shorter than the body, twenty-two or twenty-three-jointed, the second joint a little oblong; setæ short, a few longer than second joint, posterior apical as long as apical joint, posterior penult a little longer, anterior penult shorter. Shorter branch of posterior antennæ slender, and about half as long as the other. Right leg of posterior pair of moderate size, last joint subuncinate, lateral appendage subcorneous, exceeding the uncinat joint in length.

Plate 78, fig. 1 *a*, animal, enlarged; *b*, second pair of antennæ; *c*, palpus of mandible; *d*, maxilla; *e*, maxilliped; *f*, one of the natatories.

Atlantic, latitude 7°–9° north, longitude 21° 40'–24° 15' west, October 13 and 18, 1838; latitude 6° south, longitude 24° west, November 8, 1838.

The specimens affording the above description, have also the following characters. Last four segments of cephalothorax about two-fifths of the whole length; the first articulation less distinct than the following. Right posterior angle much prolonged and very acute in an upper view. Abdomen four-jointed, last segment shortest. Antennæ a little unlike, the right being slightly incrassate at middle. In many specimens the last eleven joints were black; in one individual only seven were black, and in another only five. The posterior apical seta is about as long as apical joint; the posterior penult is a little longer and the anterior penult shorter. The posterior antennæ have the longer branch broad at base and tapering. Maxillæ furnished at the posterior apex of penult joint with a pencil of setæ half as long as the cephalothorax. Maxillipeds appear to be three-jointed. The first joint nearly twice as long as the second, the third

quite short. The last bears two long naked setæ; a similar seta proceeds from the inner apex of the second joint, and two others from the inner margin of the same joint; there is also one shorter near the inner apex of the first joint. The terminal setæ are about as long as the first joint. Anterior pair of natatory legs the smallest; the fourth pair a little shorter than the third. The longer branch in a natatory leg is three-jointed; there is a short spine at the apex of each joint, and also two on one margin of the last joint, besides minute serratures; the one at the apex is a little curved at its extremity. Shorter branch not half the length of the other, two-jointed. The posterior feet are slender, not longer than the posterior natatory. The last joint is hooked. The second bears at its apex a stout corneous seta, which extends beyond the apical hook.

The body is banded with black at each of the articulations. Besides this, part of the antennæ, the last joint of the longer branch of the natatory legs, and the right posterior angle of the thorax, are black. There were also black lines forming two concentric and nearly triangular figures in the anterior half of the cephalothorax above; and four black spots, two in advance of the lines just referred to, and two near the posterior angles of the anterior cephalothoracic segment. This arrangement of the colour is not constant.

CANDACE PACHYDACTYLA.

Maris:—*Cephalothorax* 4-articulatus, angulis posticis longè acutis et setâ minutâ extus instructis. *Antennæ* anticæ fermè corporis longitudine 23-articulatæ, e basi arcuatæ, deinde rectè transversæ; dextrâ 21-articulatâ, medio incrassulatâ, articulo geniculationem precedente valde elongato, et versus apicem subtilissimè pectinato, sequente non brevior. *Antennarum* posticarum rami longitudine subæqui. *Pes* posticus dexter crassus, apice rotundatus, appendice laterali crassè falcâtâ, obtusâ.

Male:—*Cephalothorax* four-jointed, posterior angles long acute and having a minute seta on the outer side. Anterior antennæ as long as the body, twenty-three-jointed, arcuate from the base, then straight; the right, twenty-one-jointed; joints twelve to fifteen, a little enlarged, the next, or that preceding the geniculation, quite long, very

finely pectinate on the apical half, the following of the same length, the following four short. Branches of the posterior antennæ nearly equal. Right leg of the posterior pair of feet quite stout, rounded at apex, lateral appendage very stout falciform, obtuse.

Plate 78, fig. 2 *a*, animal, enlarged; *b*, right posterior thoracic foot. Fig. 3 *a*, probably female of the same; *b*, extremity of anterior antennæ.

Atlantic, latitude 11° south, longitude 14° west, May 7, 1842; latitude 4½° south, longitude 25° west, May 13, 1842; May 9, latitude 8½° south, longitude 15° west; May 16, latitude 1° south, longitude 30° west; also, China Sea, three hundred miles northeast of Singapore, February 17, 1842.

Length, one-twelfth of an inch. Colour, smoky, with black bands about the cephalothorax; the extremities of the antennæ and some of the natatory legs also black. This species resembles the *ornata*. But the right leg of the posterior pair of the male is very different; the right male antenna differs in the joints either side of the geniculating articulation; the branches of the posterior antennæ are nearly equal. The abdomen is five-jointed; the first segment has a sharp spinous process on the right side.

The figure of the female is drawn from a specimen collected in the China Sea, with which the Atlantic specimens appeared to be identical. This specimen has also the following characters:—Tips of posterior angles of cephalothorax, bent outward a little (they are rather inflexed in the other figure). Posterior joints of cephalothorax four in number. Coloured nearly as the above.

Figure 4 *a*, Plate 78, represents a male specimen, from the Straits of Banca, east of Sumatra (collected, March 1, 1842), which may possibly belong to the same species with the last, and both may be of different species from the specimen first described above. It is rather slender, the abdomen very slender, five-jointed, segments without any lateral process; but first segment a little enlarged on the right side. Antennæ about as long as body, not thrown as far forward as in the female above, with second joint shorter, and not having so large a curvature at base. Apical joint (fig. 4 *b*) not as long as the two preceding.

Colour of specimen smoky, but not black in any part. Joint of anterior antennæ preceding geniculating articulation (fig. 4 *c*) as long as two preceding joints together, and minutely pectinate on apical half; following this, six joints distinct, short, the first and last of the six longest.

CANDACE ETHIOPICA.

Maris:—*C. ornata* *antennis anticis et cephalothorace affinis*. *Cephalothorax* 4-articulatus. *Antennæ anticæ e basi arcuatae, articulo antennæ dextræ articulationem geniculantem precedente omnino subtilissimè pectinato*. *Antennarum posticarum ramus minor parvus*. *Pes posticus dexter subclavatus, obtusus, setâ elongatâ, appendice laterali setaceâ, longâ, corneâ, flexâ*.

Male:—Near the *C. ornata* in the anterior antennæ and cephalothorax. Cephalothorax four-jointed. Anterior antennæ about as long as the body, twenty-three-jointed, arcuate from the base, then straight, the right twenty-one-jointed, as in the *pachydactyla*, sixteenth joint (or that preceding the geniculating articulation) throughout very finely pectinate. Branches of the posterior antennæ very unequal. Right foot of posterior pair rather stout subclavate, the last joint elongate, obtuse at apex, seta long, lateral appendage long and slender, setiform, a little sinuous, not acuminate.

Plate 78, fig. 5 *a*, view of animal, enlarged; *a'*, extremity of anterior antennæ; *b*, view of geniculating joint; *c*, eyes and pigment; *d*, maxillipeds; *e*, first pair of legs; *f*, posterior thoracic pair of feet, the right foot in front.

Pacific, latitude 18° south, longitude 124° 15' west, August 8, 1839.

Length, one-twelfth of an inch. Colour, mostly black; abdomen colourless; natatory legs and anterior antennæ, black, excepting the base; extremity of right posterior angle of cephalothorax, black. The posterior thoracic feet and anterior and posterior antennæ afford decisive distinctive characters for this species, although it is similar to the preceding in most other characters. The abdomen is six-jointed, the

first nearly obsolete. The right posterior angle of the cephalothorax is the longest. The beak has below two rounded prominences. The feet following the maxillipeds are small and slender, three-jointed, the last joint having very short reversed seta.

CANDACE CURTA.

Maris:—*C. ornatae similis*. Cephalothorax 5-articulatus, posticè acutus. Antennæ anticæ corpore parce longiores, e basi arcuatæ; articulis 13, 14, 15, 16, 17 antennæ dextræ incrassulatis, articulo 17 elongato apice prominulo, partim subtilissimè pectinato, sequentibus sex brevibus, et tenuissimis. Pes posticus dexter apice subulatus, appendice laterali curtâ, spiniformi.

Male:—Near the *C. ornata*. Cephalothorax five-jointed, last segment short, posterior angle long acute. Anterior antennæ a little longer than the body, twenty-two- or twenty-three-jointed, arcuate from the base, and then straight; the right one slightly enlarged at middle along the joints 13, 14, 15, 16, 17, seventeenth joint elongate, very finely pectinate on the apical half, apex slightly prominent, the following joints (following the geniculation) six in number. Right foot of posterior pair slender, acute, subulate, subuncinate at apex, lateral appendage having the form of a short spine.

Plate 78, fig. 6 *a*, animal, enlarged; *a'*, extremity of anterior antenna; *b*, maxilliped; *c*, right leg of posterior pair (not quite complete); *d*, left, ditto.

Pacific, about three hundred miles southwest from Valparaiso, latitude 50° 20' south, longitude 81° 30' west, April 10, 1839.

Length, one-twelfth of an inch. Nearly colourless, except the extremities of the natatory legs which are black, and also, the extremities of the antennæ, and of the acute posterior angles of the cephalothorax.

This species is near the preceding, but is peculiar in its posterior thoracic feet, and some other points. The right posterior angle of the cephalothorax is longer than the left and bent inward. The abdo-

men is five-jointed, the first segment with an acute spinous process on the right, and the last very short. The last four joints of the anterior antennæ increase in length to the last. The smaller branch of the posterior antennæ terminates in five setæ. The pencil of hairs of the maxillæ, directed backward, is much shorter than in the *ornata*.

The maxillipeds have two short stout setæ on the inner margin of the first joint, two on the inner margin and one at the apex of the second joint, and two to the last joint.

CANDACE AUCTA.

Feminæ:—*Cephalothorax* 5–6-articulatus, posticè subacutus aut obtusus. *Antennæ anticæ fere corporis longitudine* 17–18-articulatæ, e basi arcuatæ, apice prorsum parçè flexo, articulo secundo longo et crasso. *Abdomen* 2–3-articulatum.

Female:—*Cephalothorax* five- to six-jointed, head not separate, posterior angles obtuse or subacute. Anterior antennæ nearly as long as the body, seventeen- or eighteen-jointed, slightly arcuate from the base, tips bent a little forward, second joint long, stout. Abdomen two- or three-jointed.

Plate 78, fig. 7 *a*, animal, enlarged; *b*, extremity of anterior antennæ.

Pacific, latitude 9° south, longitude 174° west, near Duke of York's Island, January 26, 1841; also, near Hall's Island, Kingsmill Group. April 14, 1841; also, in the Sooloo Sea, January 28, 1842.

Length, one-twenty-fourth of an inch. Body, slightly brownish black; natatories, black or brownish black; antennæ, dark colour, except basal portion. The two antennæ, after the curve at base, are nearly in the same straight line, very slightly advanced beyond it; the apical joint is bent a little forward out of the line of the antenna; most of the setæ are three or four diameters of the joints in length; apical joint longest; penult three-fourths the apical in length; antepenult one-third the apical, and a little shorter than the next preceding. Length of second joint of the antenna three or four times its diameter.

CANDACE TRUNCATA.

Feminæ:—*Cephalothorax posticè truncatus*. *Antennæ anticæ corporis longitudine, e basi oblique projectæ, deinde prope articulum sextum flexæ, postea rectè transversæ et tenuissimæ; articulo secundo crasso, non longiore quam articulus tertius quartusve.*

Female:—Cephalothorax having the posterior angles truncate. Anterior antennæ very nearly as long as the body, twenty- to twenty-two-jointed, straight at base and oblique, then bent outward at an angle, quite straight and very slender; second joint stout, not longer than third or fourth.

Plate 78, fig. 8 *a*, animal, enlarged; *a'*, extremity of anterior antennæ; *b*, maxilliped; *c*, posterior thoracic leg; *d*, profile of abdomen.

In the Pacific, off Upolu, Samoan Group, February, 1841; near St. Augustine Island, March 25, 1841; just south of Kingsmill Islands, latitude 6° south, longitude 176° east, April 1, 1841; also, in the Sooloo Archipelago, February 2, 1842.

Length, one-twelfth of an inch. Nearly colourless; a slight ochreous tint, scarcely perceptible.

The first third part of the two antennæ diverge from one another at an angle of about 100°; after this, both are flexed outward, and the two lie in the same straight line. The joints of the basal part are uneven, rather stout, and the second, third, and fourth of nearly equal length. Joints at the extremity of the antennæ nearly as in the preceding species. The maxillipeds have two very short setæ on the first joint. The posterior thoracic legs are quite small, with a few short setæ at apex. The abdomen is four-jointed, the second segment much the longest, and stout gibbous below.

GENUS ACARTIA, *Dana*.

Quoad rostrum, oculos, cephalothoracem, maxillipedes, pedes anticos, antennas posticas, Pontellis affines. Antennæ anticæ irregulariter seti-

geræ, valde flexiles, setis sæpe longiusculis, quaquaversum insistentibus, antennâ dextrâ maris non (?) geniculatâ. Pedes postici obsolescentes, uni-articulati, duabus setis valde inæquis et divaricatis instructi. Setæ caudales mediocres.

Like the *Pontellæ* in the beak, eyes, cephalothorax, maxillipeds, anterior feet, and posterior antennæ. Anterior antennæ irregularly setigerous and very flexible; setæ often rather long, and turned different ways; the right of the male antennæ of first pair not (?) geniculate. Posterior feet obsolescent, one-jointed, furnished with two very unequal setæ, which are much divaricate. Caudal setæ moderately long.

The longish setæ of the antennæ and especially their pointing in different ways, instead of being arranged along the anterior margin, give these species quite a different aspect from the *Pontellæ*. Moreover, the longer seta of the rudimentary posterior legs is seen in a vertical view projecting from the extremity of the thorax, either side of the abdomen. The male right antenna is probably without a geniculation, this character being compensated for by these organs being quite flexible throughout. Yet, I am not altogether confident that any of the specimens examined were males. The inferior and superior eyes are the same as in the *Pontellæ*. The cephalic segment is often distinct. The species observed were found with the *Pontellæ* and *Calani* in the open seas of the torrid and temperate zones.

The name *Acartia* is from the Greek *ακαρτος*, *unshorn*, and alludes to the irregular arrangement of the setæ of the anterior antennæ.

Acartia, DANA, Amer. Jour. Sci., [2], i., 227, and Proc. Amer. Acad. Sci., ii. 25, where the following new species are briefly described by the author.

ACARTIA LIMPIDA.

Gracilis. Frons triangulatus. Cephalothorax posticè obtusus, 5-articulatus, capite discreto. Antennæ anticæ latè divaricatæ, rectiusculæ, vix corporis longitudine, 7-8-articulatæ, articulis ultimis tribus brevibus, precedentibus longis; setis prælongis, penultimâ posticâ dimidio breviorè quam apicales. Styli caudales oblongi, tenues, setis divaricatis.

Slender. Front triangular. Cephalothorax obtuse behind, five-jointed, head separate, unarmed. Anterior antennæ widely divaricate, nearly straight, scarcely as long as the body, seven- or eight-jointed, last three joints short, three preceding much elongate and subequal; setæ long, anterior penult short, posterior penult twice longer, and half shorter than apical. Caudal stylets oblong, slender, setæ spreading.

Plate 79, fig. 2 *a*, animal, enlarged; *b*, one of the posterior thoracic legs.

Collected several individuals off Patagonia, January 14 and 15, 1839, latitude $31\frac{1}{2}^{\circ}$ – 32° south, longitude $48\frac{1}{2}^{\circ}$ – $49\frac{1}{2}^{\circ}$ west.

Colourless and limpid, a little purplish along the venter. The three posterior segments of the cephalothorax are about one-third the length of the whole; the last longest. The posterior feet or appendages to this last segment are very short, and bear two setæ; one quite long and a little curved, the other less than a fourth as long. The inferior eyes have a light red pigment. The superior are either connate or approximate; it was difficult to see them, on account of the pigment of the inferior eyes directly below, on which they were projected in an upper view. The anterior antennæ have seven distinct joints, with an appearance of another near the base. The setæ are mostly a third the length of the organ. The last three joints are together hardly longer than the one next preceding, and they may be viewed as forming a single joint: there are two long setæ at apex, directed forward and outward, and two others directed straight backward; and one long seta proceeds from the posterior apex of the fourth joint from the apex. The long joints of the antennæ are indistinctly subdivided. The caudal stylets are longer than twice their diameter: the setæ are about as long as the abdomen. The abdomen is three-jointed; but the first segment is sometimes very short, or is quite concealed. Of the four pairs of natatories, the first and last are a little shorter than the others. There were two oval glands in the thorax, within the penult joint, and partly in the preceding, corresponding to the blue glands in the Pontellæ; they are probably ovarian.

ACARTIA NEGLIGENS.

Gracillima. Frons triangulatus. Cephalothorax angustus, posticè minutè apiculatus, capite fere discreto. Antennæ anticæ fere corporis longitudine, tenuissimæ, latissimè divaricatæ, apicibus fronte paulo anterioribus, 7-9-articulatæ, articulis tribus ultimis brevibus: setis prælongis, posticâ penultimâ apicales æquante. Styli caudales tenuissimi, oblongi, setis latè divaricatis.

More slender than the *limpida*. Front obtusely triangular. Cephalothorax narrow, obtuse behind but having a very minute point, the head faintly separated. Anterior antennæ nearly as long as the body, very slender, very widely divaricate, tips a little anterior to the beak, seven- to nine-jointed, last three joints short, setæ very long, the apical long, the penult anterior quite short, posterior penult as long as the apical, antepenult very short. Caudal stylets very slender oblong, setæ much spreading.

Plate 79, fig. 3 *a*, animal, enlarged; *b*, posterior part of body, in profile, the caudal setæ removed, enlarged; *c*, second pair of antennæ, more enlarged.

Pacific, near Hopper Island, Kingsmill Group, latitude 0° 30' north, longitude 174° east, April 15, 1841; also, May 17, 1841, in latitude 27½° north, longitude 171° east.

Length, one-tenth of an inch. Colourless.

This species resembles the preceding, but is more slender. The antennæ are thrown less forward, the two being nearly in the same straight line; the third joint from the extremity is the shortest; the preceding are long and slender. In one or two of the long joints there are appearances of an articulation, but so faint as to be quite uncertain. The setæ of the antennæ are in general above one-third the length of these organs; the seta at the posterior apex of the penult joint is of the same length; those of the antepenult joint are not longer than the joint. The short spine at either posterior angle of the cephalothorax is seen only under a high magnifying power.

ACARTIA TONSA.

Frons rotundatus. Cephalothorax posticè obtusus, 6-articulatus, capite discreto. Antennæ anticæ multiarticulatæ, rectæ, apicibus fronte non anterioribus, setis plerumque brevibus, paucis longiusculis (3-4 articulos simul sumtos longitudine æquantibus). Antennæ posticæ pertenues, ramo uno triplo longiore. Styli caudales perbreves.

Front rounded. Cephalothorax obtuse behind, six-jointed, head separate, posterior segments three, and subequal. Anterior antennæ many-jointed, straight, as long as the cephalothorax, the tips not in advance of the front, near the base bent at an angle, and from thence straight, apical joint minute; setæ mostly short, apical and two or three others nearly as long as one-fourth the antenna; posterior antennæ slender, one branch three times the longer. Caudal stylets very short, but a little oblong.

Plate 79, fig. 4 *a*, enlarged; *a'*, extremity of anterior antenna, more enlarged; *b*, posterior antennæ, ditto; *c*, palpus of mandible; *d*, maxill.; *e*, maxilliped; *f*, first pair of feet; *g*, eyes.

Collected in Port Jackson, New South Wales, March, 1840.

Length, one-eighteenth of an inch. Colourless. The front of the head is scarcely at all prominent between the anterior antennæ. These antennæ at the fourth joint bend directly out, and each falls slightly back of a common straight line. At the bend there is a longish seta, another on the fifth joint from the apex, one a little shorter on the anterior side of the second, and a much shorter one on the posterior side of the same joint. The setæ of the last and the penult joint are nearly equal, that of the posterior antepenult is of the same length or a little longer, but the anterior antepenult, and both on the joint next preceding, are quite short. The third joint from the apex is longer than the fourth or second. The caudal setæ are not quite as long as the abdomen. The length of the abdomen little exceeds one-third the cephalothorax. The eyes are situated on a single quadrate spot of pigment, which is rather large.

ACARTIA LAXA.

Gracilis. Frons rotundatus. Cephalothorax 4-articulatus, capite non discreto, posticè longè acutus. Antennæ anticæ rectiusculæ usque ad basin, corpore paulo longiores, nusquam fronte anteriores, multiarticulatæ, articulo primo longiore, setis longiusculis, valde inæquis. Abdomen breve. Styli caudales paulum oblongi, setis latissimè divaricatis, abdomine non longioribus.

Slender. Front rounded. Cephalothorax four-jointed, head not separate, long acute behind. Anterior antennæ a little longer than the body, nearly straight even from the base, tips not anterior to the front, many-jointed, first joint longest; setæ of moderate length, the longest about one-fourth as long as the antenna, others quite short, the apical rather long. Abdomen short, three-jointed. Stylets small, a little oblong, setæ very widely spreading, not longer than the abdomen.

Plate 79, fig. 5 *a*, animal, enlarged; *b*, outline of head, showing the superior eyes, and the two lenses with the pigment of the inferior eyes directly below; *c*, posterior thoracic appendages.

Several specimens were collected in the Sooloo Archipelago, February 2, 1842; also, in the Straits of Banca, March 2, 1842.

Length, one-fifteenth of an inch. Colour, bluish.

The anterior antennæ have a lax appearance, owing to a slight irregularity of direction, and the position and inequality of the setæ. They are in the same straight line nearly, even from the base. The first joint of the antennæ (or the first observed) is as long as the next four joints; the longer apical setæ about equal in length the last six joints. The thorax behind has a slender spiniform prolongation on either side. The caudal setæ are so widely spread, that the flabellum they constitute is much broader than long. The second pair of antennæ has the branches very unequal, the shorter and its setæ together but little exceeding in length the longer without its setæ. The eyes are situated quite close to the front, and the mass of pig-

ment is large; the two are nearly separate. The appendages to the posterior part of thorax (fig. 6) are as in the preceding species.

GENUS PONTELLA.

Rostrum infra rigide et acute furcatum. Oculi inferiores et superiores, pigmentis horum sive connatis sive disjunctis. Antenna antica maris dextra articulo geniculans. Antennæ posticæ birameæ, ramo minore setis quinque apicalibus sæpius confectum. Cephalothorax 4-7-articulatus. Maxillipedes crassi et recti, pedibus anticis majores, setis longis spinulosis antice armati. Pes posticus maris dexter crassus, prehensilis. Setæ caudales mediocres.

Beak short and acutely furcate below. Eyes both inferior and superior, the pigments of the latter either connate or disjoined. Anterior right antenna of male having a geniculating joint. Posterior antennæ two-branched, smaller branch ending, with rare exceptions, in five setæ. Cephalothorax four- to seven-jointed. Maxillipeds stout and straight, larger than anterior feet, armed anteriorly with long spinulous setæ. Posterior right foot of male prehensile. Caudal setæ of moderate length.

The Pontellæ are remarkable for the geniculating joint of the right antenna; the stout prehensile form of the right posterior foot; the straight and stout maxillipeds, with long setæ; the inferior as well as superior eyes, and the frequent disjunction and remoteness of the two superior; the frequent obliquely forward projection of the anterior antennæ.

Cephalothorax.—A cephalic segment—the part of the cephalothorax pertaining to the eyes and two pairs of antennæ—is usually separated by a suture. Closely similar species, however, may differ in this particular; and it is even probable that the sexes may be in this respect unlike. On this point, compare *P. hebes* with those related to it. The subdivisions of the cephalothorax posterior to the cephalic segment are illustrated on page 1024. The posterior angles may be obtuse or acute, and often the right point is longer than the other.

The beak is strongly furcate. A suture may be observed at its

base, as shown in figure 6 *a*, Plate 82, representing *P. valida*, and the beak admits usually of slight motion at this suture. In some species, the beak is very much inflexed, and in others it is directed downward simply; in the latter, the front in an upper view is more or less pointed or triangular.

Eyes.—The superior eyes have each a distinct spherical lens; the pigment is either blue-black or carmine-black. The pigment of the inferior eyes forms a circular or elliptical or reniform spot, behind or between the superior eyes, as seen in an upper view through the head. Sometimes it is so beneath the superior eyes as hardly to be distinguished in this view. The existence of this pigment seems to show that these are true eyes; yet, we cannot but recall the dark “eye-spot” in the front of a *Daphnia*, which has been shown by Schödler to contain otolites, and therefore to be the ear of the animal.*

In the Calanoid species, resembling *Calanus* in the transverse position of the anterior antennæ and the *three* terminal setæ of the smaller branch of the posterior antennæ, the inferior eyes are very small.

Anterior antennæ.—The *anterior antennæ* vary in the number of joints from nine to twenty-four, which last is probably the normal number. The setæ are arranged along the front margin, as in the *Calani*.

The *first* joint has usually a very short seta or two at apex. On the second there are a few quite short setæ on the front margin, and generally one or more longer at apex, varying from a length of *one* diameter of the joint to *three* diameters, seldom *four*. Beyond the second, for some distance, the setæ are often crowded (the joints being short), and they are a little longer than those along the middle of the antenna. There is sometimes a minute fringe on the posterior side of the antenna, extending from the second joint through half the length of the organ.

The *right male antenna* has a geniculating joint at the fifth or sixth articulation from the apex, as described in our general remarks on the *Calanidæ*, and illustrated on Plate 70, figs. 26 to 36.

In a few species resembling the *Calani*, the right antenna scarcely differs from the left, except in the geniculating articulation itself, and a very slight enlargement along the middle portion.

* Archiv für Naturgeschichte, 1846, p. 301.

The anterior antennæ in the more typical species are generally very nearly straight, excepting the outward curve at base, and sometimes a forward curve at tip; and they usually extend obliquely outward, with the extremities much in advance of the line of the beak. Sometimes the two make an angle between them less than 60° . The angle of divergence is an important characteristic of species.

In the few Calanoid Pontellæ the antennæ have the double curvature of the Calani, and the tips are behind the line of the beak.

The length of the antennæ varies from *three-fourths* of the length of the *cephalothorax*, to *one and a half times* the length of the *whole body*. In some species, with the antennæ shorter than the cephalothorax, the joints are few and rather long (9 to 13); but in others they are 18 to 24, and the joints are consequently short.

Posterior antennæ.—The posterior antennæ consist of a *basal* joint, stout and rather short, and two branches. The longer branch has the first joint oblong, and the second quite short, and often appearing double, or, at least, bilobate, each lobe bearing a tuft of long setæ; or, if the lobes are not distinct, all appearing as a single tuft. There are sometimes one or two setæ on the back of the first and second joints. The shorter branch is also two-jointed, but, unlike the Calani, the joints are commonly very unequal, and sometimes the apical is extremely short. The Pontellæ are further unlike the Calani in having about five long setæ at the apex of this branch, and none on the margin of the first joint.

In some Calanoid species, the joints of the accessory branch are nearly equal, the apical setæ are three in number, and the side setæ exist precisely as in the Calani. In those least Calanoid, the branches are very unequal. This inequality increases almost regularly with the more forward position of the anterior antennæ; and where these antennæ diverge at 60° or less, the accessory branch is but a fourth the other, or even less than this, becoming almost rudimentary.

These antennæ are used as in the Calani.

Mandibles.—The mandibles are stout and corneous, with a dentate edge. There appear to be *six* acute teeth on the cutting edge, besides a *seventh*, situated a little out of the plane of the others, and in the natural position of the parts, more interiorly. The remaining part of the organ, called the palpus, consists of a large oblong basal joint and

two short branches. The branches are one- or two-jointed, and long setigerous (figs. 60, 61, Plate 71).

Maxillæ.—The maxillæ are more or less lamellar. There is an irregular basal joint, bearing stout setulose setæ on the interior side, and also longer setæ on the opposite side. This basal portion bears a lamellar palpus, consisting of an oblong joint, broad at base, but abruptly narrowed near middle, where there is a one-jointed lateral branch, besides often having a single articulation near the extremity. The palpus has long setæ at apex.

Maxillipeds.—The maxillipeds consist of three very stout joints, forming a line at right angles with the body, slightly flexed, and admitting of motion only in the direction of the body. They are crowdedly furnished on the anterior side with a number of stout and long spinulous setæ, those of the third joint being the longest. They extend forward to the mouth or a little beyond it, and constitute a kind of scoop-net for collecting the food of the animal (fig. 77, Plate 71, and Plates 79, 80, 81).

First pair of legs.—These organs, so largely developed in the Calani, are here smaller than the maxillipeds. They have commonly two rather stout joints, bearing a few unequal spinulous setæ, resembling the setæ of the maxillipeds. Besides these, there is a second branch, which is slender, and consists of three to five naked joints. This branch is large in the Calani, and constitutes the organ, the other being obsolete. It appears to be the outer branch, while the other is the inner.

In the Calanoid Pontellæ, the maxillipeds are but little larger than the first pair of legs.

Natatory legs.—These are two-branched, from a stout base; the longer branch is two- or three-jointed, usually three in adults; and the shorter is one- to three-jointed (Plate 82, fig. 6 *d, e*). They are furnished with setæ at the extremity and on the inner side, while at the apex of each joint there are one or two short spines, besides one or two others on the outer side of the last joint.

The four pairs of natatories are similar in characters. The first is usually the shortest, and the second and third the longest.

Posterior feet.—The posterior pair of thoracic feet in the female is usually quite small or nearly obsolete and naked, though occasionally approaching the size of the first pair of natatories. The two are often a little unequal, with slight differences at times in the terminal spine or seta, but without anything very marked in form.

In the males, the left is small, something like those of the female. The right terminates in a large cheliform hand. The carpus is a stout oblong joint. The hand is large, and of a very different shape in different species. It is articulated with the inner apex of the carpus, and when at rest, it folds back against the inner margin, so as to lie between the carpus and the left leg. The basal extremity is prolonged outward into a spine, or bears a spinous process, which answers to a thumb or immoveable finger; it is short, or very long, according to the species. At the opposite extremity there is an oblong finger, sometimes very stout, sometimes like a long claw, and sometimes having a spoon-shaped or spatulate extremity. It closes against the thumb, and between the two when closed together there is usually a space of considerable size. The inner margin of the finger, and also of the hand, is at times furnished with one or two setæ or spines, or with short villi (Plate 82, fig. 6 *f*).

Abdomen.—The abdomen has from two to five segments. The number is not constant in the same species. It is probable, that it increases with the later metamorphoses, as we have observed only two segments in smaller individuals of a species, in which those of full size had four. The relative sizes also vary. In some species the female has but *two* or *three* joints, when the male has *four* or *five*; and the form of the abdomen in the female may be gibbous or ovoid, when it is regularly terete or decreasing in the male. Five is a common number for adult males, and is not frequent in females.

It is often the case also that the abdomen is distorted. Sometimes one of the joints is widened on one side by a process, and yet this character is confined to a few individuals of a species. This takes place usually on the right side, though not always so; and it is observed in both sexes. When there are five joints, it is commonly the *third* joint that is modified. Sometimes the abdomen is gibbous above, and occasionally so below.

On account of these strange variations, it is difficult to draw satisfactory specific distinctions from the abdomen. Yet, when we are

confident of having the adult form, the characters probably admit of being employed.

Caudal stylets.—The stylets are never as long as the abdomen, and are sometimes shorter than their breadth. In some species, they appear to be constantly diverged, while in others they are parallel. There is usually a slight pubescence on the inner margin. They bear at apex five plumose caudal setæ: the second is the longest, as in the Calani, being usually about as long as the abdomen, though sometimes exceeding it; occasionally it is nearly twice as long as the other setæ. In a few species, the outer seta proceeds from the outer side of the stylet, near its middle. There is also a minute inner seta, which is commonly bent, making the whole number six, as elsewhere stated.

Eggs.—Out of the thousands of Pontellæ, collected through the Atlantic, Pacific, and Indian Oceans, during three and a half years of investigation, I did not succeed in capturing one with a bag of eggs attached; and it is therefore probable, that the eggs are extruded directly from the body, without forming an external ovarian sac. Some of the females, however, contained internal ovaries which were very distinct. They extend up the cephalothorax on either side, from the abdomen to the mouth or beyond it, and the two lines, which are irregularly flexed or convoluted, are united just posterior to the mouth, after which they are disunited and continued on separate. Glands evidently seminal, having the same position, were observed in some males.

In many species, oblong blue-black glands occur either side of the medial line in the posterior part of the cephalothorax; and often there is a second pair, a little in advance; and in other species, the line is farther continued, with or without interruptions. These are evidently portions of the ovarian organs in females, or of the spermatogenic in males; although, differing in their depth of colour from glands distinguished in other cases as of this character. On the death of the animal, the blue colour after a while spreads, and gives an indigo tint to the adjoining parts of the animal.

Colour.—Sea-blue and purplish blue are the prevailing tints of the Pontellæ: yet, there are some colourless species. Moreover, some

individuals of a species may occur colourless, while others are deeply coloured. Some deep green and yellowish species were observed; also, a few reddish, or pale umber. Several have a silvery, or pearly white back, which presents a bright appearance in the water. One yellowish individual was crossed by an elegant crimson band of great breadth, presenting a beautiful effect. The blue species commonly have the alimentary canal green or greenish, which shows through along the middle of the cephalothorax; in a few species it has a brownish colour.

In some instances, the tips or bases of the anterior antennæ, the bases of the caudal setæ, and some other organs are coloured.

Size.—The adult Pontellæ usually vary in size, from one line to half a line. There are many species as long as an eighth of an inch, and a single one was found which measured one quarter of an inch in length. The length, as here given, includes the distance from the beak to the extremity of the abdomen, *exclusive* of the caudal stylets; and this is always our use of the term in the descriptions following. The common proportions between the length and breadth of the cephalothorax, is as 3 to 1. There are slender species with the ratio 4 to 1, and stout species with the ratio 2 to 1 and $1\frac{1}{2}$ to 1. The abdomen is commonly one-third to one-fourth the length of the cephalothorax, and never exceeds or hardly equals one-half its length.

Habitat.—The species of Pontellæ are widely distributed through the oceans. The hand-net was seldom used without bringing up some individuals, especially when the time just before daylight was devoted to this kind of fishing. In these respects, and also, in their greater abundance near the surface in calm weather, they are like the Calani. They are, however, much less common than the Calani in the higher latitudes, being mostly confined to the seas between the parallels of 30° either side of the equator.

The specimens often have the setæ of the antennæ and caudal stylets mutilated, especially the latter. In some instances, not more than one specimen in thirty had the caudal setæ entire. Sometimes all the setæ of the antennæ are broken off, and give a false character to these organs, calculated to lead to error in description.

Affinities.—The relations of the Pontellæ to the Calani have been

mentioned in the course of the preceding remarks. When the anterior antennæ have the double curvature of the Calani, falling back behind the line of the beak, the inferior eyes are quite small, the right male antennæ, though geniculant, is but little different from the others in form and number of joints, and in the posterior antennæ the accessory branch is but little the shorter, nearly equi-articulate, and terminates in but three setæ, with others along the side of the first joint. From this condition, there is a gradual change to those in which the antennæ are oblique forward in position, and all the *Pontella* characters are strongly brought out.

This genus was instituted by Milne Edwards, in 1828, under the name *Pontia*, by whom three species have been described. As this name was given by Fabricius long before to a genus of Lepidoptera, another branch of the Articulata, it becomes necessary to change it, and the word *Pontella* is therefore substituted. It was first proposed by the author in 1846 (*Amer. J. Sci.* [2], i. 228).

The genus *Irenæus* of H. Goodsir (*Jameson's J.*, xxxv. 337) is identical with *Pontia*. This author has given detailed figures, and he represents the inferior eyes, observing that the organ is an organ of vision, but not distinguishing, in his description, the superior from the inferior, although the former are figured in the back view given in Plate 6, figure 15. The species *Irenæus splendidus* is near *P. detonsa* and *P. margaritacea*, though evidently different. *Anomalocera* of Baird (*Brit. Entomost.*, 229) is another name given to the *Irenæus splendidus*.

This genus may be conveniently subdivided into three subfamilies:

1. CALANOPIA. — Including the Calanoid *Pontellæ*, in which the anterior antennæ are situated as in *Calanus*, with the tips not anterior to the line of the front; the anterior branch of the posterior antennæ have but three setæ at apex; the inferior eyes are quite small. This subgenus may include some species referred to *Hemicalanus*.

2. PONTELLINA. — Antennæ of second pair having five setæ at the apex of anterior or smaller branch; head either side unarmed.

3. PONTELLA. — Antennæ as in the last; head either side armed with a reversed spine. The *Pontia atlantica* of Edwards is of this kind. In this division, the second of the caudal setæ is considerably longer

(one-fourth at least) than the others (in most, if not all cases), which is not true of the preceding subgenus *Pontellina*.*

I. SUBGENUS CALANOPIA.

CALANOPIA ELLIPTICA.

Feminae : — *Frons rotundatus*. *Cephalothorax crassus*, 4-articulatus, capite inermis, angulis posticis acutis, remotis. *Oculi superiores remotiusculi*, inferiores minuti. *Antennæ anticæ duplo curvatæ*, corpore breviores, apicibus fronte valde posterioribus, setis brevibus, subapicalibus perbrevibus, apicalibus vix articuli longitudine. *Styli caudales oblongi*, setis valde inæquis.

Female :—Front rounded. Cephalothorax stout, four-jointed, angles behind acute and distant. Superior eyes small, a little separate; inferior minute. Anterior antennæ strongly doubly curved, shorter than the body, slender, tips much behind line of beak; setæ short, subapical very short, the apical scarcely as long as the last joint. Caudal stylets oblong, setæ unequal, somewhat spreading.

Plate 79, fig. 6 *a*, animal, enlarged; *b*, extremity of antenna.

Collected in the Straits of Banca, east of Sumatra, on the 2d of March, 1842.

Length, one-sixteenth of an inch. Colour, yellowish umber, with red each side of the alimentary canal.

The antennæ are quite Calanoid in position, and the cephalothorax has also but four segments. The eyes are however separate, and the inferior eyes were distinct, appearing in an upper view just behind the superior. Of the caudal setæ, the second is considerably the longest, and curves a little outward. The anterior antennæ have at tip an anterior setæ very nearly as long as the last joint, a posterior a little shorter, and one or two outer, which are quite short and uncinatæ. The apical joint of the antennæ is about as long as the penult. Abdomen two-jointed, segments oblong.

* The new species beyond are briefly described in the Proceedings of the Amer. Acad. Sci., ii. 26.

CALANOPIA BRACHIATA.

Maris :—*Frons subtriangulatus. Cephalothorax 6-7-articulatus, anticè angustior, angulis posticis acutis, remotis. Oculi superiores remotiusculi aut coaliti. Antennæ anticæ corporis longitudine, duplo curvatæ, setis brevibus, posticâ penultimâ articulum longitudine fere duplo superante, anticâ apicali breviorè, aliis apicalibus et subapicalibus brevioribus; antenna dextra medio paulum incrassata, fere 23-articulata, duobus articulis medianis anticè unidentatis, articulo antepenultimum præcedente elongato, duplice. Pes posticus dexter maximus, digito elongato, rectè inflexo. Styli caudales oblongi, non divaricati, setis abdomine non longioribus, vix divaricatis.*

Male :—Front triangular. Cephalothorax six- to seven-jointed, cephalic segment separate, four posterior segments subequal, head narrower, posterior angles of cephalothorax remote and prolonged acute. Anterior antennæ as long as the body, doubly curved; setæ short, the posterior penult the longest, nearly twice longer than its joint, the anterior apical a little shorter, the other apical and subapical short; right antennæ incrassate at middle, subterete, about twenty-three-jointed, two joints bearing a tooth on the middle of the front margin, joint preceding antepenult long, double. Right leg of last pair very large, finger long, inflexed. Caudal stylets long, not divaricate; setæ not longer than the abdomen, scarcely spreading.

Plate 79, fig. 7 *a*, animal, enlarged; *b*, posterior feet, more enlarged.

Collected, April 8, 1842, on the Lagulhas Bank, near Cape of Good Hope.

Length, one-twelfth of an inch. The left antenna consists of twenty-four joints, of which the second is much larger than the first, or the following. The anterior apical setæ are a little longer than the posterior, but hardly exceed the length of the joint. The posterior penult is one and a half to two times the length of the same joint. The posterior antennæ have the three apical setæ of one

branch, and the posterior setæ of the first joint of the same branch, characterizing the Calani. The right male antenna has four joints following the geniculating articulation, of which the first corresponds to two in the left antenna. Preceding this geniculating articulation there is a long joint, which appears to be subdivided at middle, and evidently corresponds also to two joints. The next two joints towards the base bear the dentations described; they are nearly cylindrical and the thickest of the antenna. The next preceding is a little smaller, and beyond this there are several joints much shorter; the second is oblong, and has a small prominence on the anterior margin. The inferior eyes are quite small, the pigment deep carmine, nearly black. The posterior feet are very dissimilar. One branch of the right terminates in a large hand, and the basal joint of this branch is small and has a prolonged spiniform apex. The next joint is stout and short, but is laterally prolonged at right angles to the line of the leg, and then this long process is again bent at right angles; there is a spine on the inner side of this process. The next joint is articulated with the basal portion of the preceding, and is elongated into a spine, which is nearly straight or but slightly curved. It has a small spine at base on the inner side. The other branch of this leg is simply three-jointed and furnished with setæ. The other leg of the pair resembles the natatories; the branches are three-jointed, and the inner bears a few setæ. Abdomen four-jointed.

Plate 19, fig. 8 *a*, represents a female probably of the above species; it was taken at the same place and time. The head, however, is more rounded in front; the posterior angles are divaricate and have an angle within in addition to the acute extremity; the abdomen is three-jointed, the first two quite large, the last very short, the first bearing a curved spinous process on the right side; the oblong stylets are divaricate, and the setæ spreading. The antennæ have the same position, but are more slender; the setæ are similar in relative length, except that the posterior apical are shorter, and the anterior apical a little longer. The last five joints are subequal; the setæ towards base are one to two diameters of the joints in length.

Plate 79, figs. 9 *a, b, c, d, e, f, g*, represent parts of a specimen supposed to be the same species with the *brachiata*, and to which our description above given applies. The right male antenna is similar,

except that the joint following the geniculating articulation is more slender and arcuate. Figure 9 *a*, represents the head of a male; *b*, the posterior part; *c*, part of the right antenna; *d*, the extremity of the left antenna; *e*, the right posterior foot; *f*, one of the female feet corresponding; *g*, a female abdomen, distorted (yet resembling the female above described in the divaricate posterior angles of the thorax and the divaricate stylets). The right male posterior foot is somewhat different, but it may be owing partly at least to the position of the organ when figured. Abdomen including stylets more than half the cephalothorax. Caudal setæ shorter than abdomen. It was found in the Pacific, April 3, 1839, in latitude 42° south, longitude 78° 45' west; also, April 10, at 5 A. M., latitude 36° south, longitude 74° west. At the latter date they were in immense numbers, and great quantities were collected. A solid cubic inch of them, in the net at one time, must have included forty thousand or fifty thousand individuals. The abdomen of the females were occasionally distorted, as in fig. *g*, in which the segments are irregularly enlarged, and on the left side, there is a broad elongate lamellar appendage.

SUBGENUS II. PONTELLINA.

a. Cephalothorax postice obtusus, aut brevissimè acutus.

PONTELLINA PLUMATA.

Feminæ:—Frons rotundatus. Cephalothorax curtus, obesus, 6-articulatus, capite discreto, segmento postico perbrevis, et posticè vix acuto. Oculi superiores parce disjuncti. Antennæ anticæ corpore paulo longiores, latè divaricatæ, fere rectæ, setis raris suboblongis, apicalibus articulo plus duplo longioribus, subapicalibus brevioribus. Antennæ posticæ ramis valde inæquis, setis ramorum et palporum sequentium fere corporis longitudine instar plumarum. Styli caudales parce oblongi.

Female:—Front rounded. Cephalothorax very short and thick, six-jointed, the head separate, rounded in front, behind hardly acute, posterior segment very short. Superior eyes a little separate. Anterior antennæ somewhat longer than the body, obliquely divari-

cate, nearly straight, a few longish setæ at intervals, the apical more than twice as long as the last joint, the subapical shorter. Posterior antennæ with the branches very unequal; the setæ of these and the following organs nearly as long as the body, elegantly plumiform. Caudal stylets sparingly oblong; setæ a little longer than the abdomen, spreading.

Plate 79, fig. 10 *a*, animal, enlarged; *b*, maxillipeds; *c*, one of the natatories; *d*, fifth pair.

Collected, October 20 and 23, 1838, in the Atlantic, latitude 5°–7° north, longitude 21°–22° west.

Length, one-twelfth of an inch. Colour, yellowish, with grayish or brownish yellow along the centre. The species is remarkable for its thick short form and the long plumes of the posterior antennæ and following organs. The length of the cephalothorax is about twice the width. Beak below long and straight. Second joint of abdomen longest; the whole abdomen not more than one-third the cephalothorax. Caudal stylets very little longer than the last abdominal segment; a plumose seta on the second joint of the anterior antennæ, which is longer than the joint; and another still longer on the fourth joint; another seta of nearly the same length from near the middle of the antenna; the anterior apical setæ a little shorter. Abdomen three-jointed.

PONTELLINA TURGIDA.

Frons rotundatus. Cephalothorax crassus, obesus, 5–6-articulatus, capite discretus, posticè obtusus. Oculi superiores approximati. Antennæ anticæ corporis longitudine, fermè 21-articulatæ, 60°–90° divaricatæ et prope medium obsoletè reflexæ; setis brevibus, penultimâ posticâ longiore quam apicales aut ceteræ subapicales. Antenna antica maris dextra 10–12-articulata, articulo submediano latè subovato et apicè acuto, articulis tribus sequentibus valde elongatis, ultimo triplice. Antennæ posticæ ramis valde inæqui, setis longis. Abdomen 4–5-articulatum. Styli caudales oblongi; setis mediocribus.

Front rounded. Cephalothorax short and stout, obtuse behind, five-

or six-jointed, posterior segments three in number, head separate. Superior eyes sparingly separated. Anterior antennæ as long as the body, divergent 60° – 90° , and near middle slightly bent outward, setæ rather short, a longer one towards the middle, posterior penult longer than apical or the other subapical setæ. Right anterior antenna of male not terete, containing near middle a large flattened ovate joint, bearing within a longish seta and others shorter, the three following joints slender linear, the last of the three, triple. Posterior antennæ with very unequal branches and long setæ. Abdomen four- or five-jointed. Caudal stylets a little more than twice as long as broad; setæ of moderate length, spreading.

Plate 79, figs. 11 *a*, *b*, and 12 *a*, *b*, different varieties, enlarged.

Collected abundantly in the Atlantic, October 15, 22, 23, 26, latitude $8\frac{1}{2}^{\circ}$ north to 0° , longitude 23° – 18° west, and November 5, 6, 7, latitude 1° – $4\frac{1}{2}^{\circ}$ south, and longitude $17\frac{1}{2}^{\circ}$ – $21\frac{1}{2}^{\circ}$ west; also, April 8, 1842, on the Lagulhas Bank, off Cape of Good Hope; also, in the Atlantic, May 13, 1842, latitude $4^{\circ} 30'$ south, longitude 25° west, and May 17, 1842, latitude $0^{\circ} 15'$ north, longitude 31° west; also, common in the Pacific, April 13 and 28, 1841, near Hall's and Pitt's Islands, Kingsmill Group, latitude 1° – 3° north, longitude 173° east.

Length, one-twenty-fourth of an inch. The specimen collected on the Lagulhas Bank is represented in figures 12 *a*, *b*; while the Pacific specimens are represented in figures 11 *a*, *b*. The latter is the form found in the equatorial Atlantic. They appear to be essentially the same. Yet in *one*, the abdomen has four segments, and the large joint of the right male antenna has an angle towards the base on the posterior side; and in the *other*, there are five abdominal joints, and the large antennary joint referred to is rounded on the posterior side.

In both, the length of the cephalothorax is about twice the width in a vertical view. The superior eyes are slightly separated. The antennæ are of the same length and position, and the setæ similar; the anterior apical setæ being longer than the apical joint, and directed obliquely forward; the posterior penult of same length or a little longer, the anterior penult short, the posterior seta of antepenult shorter than joint, the anterior antepenult much shorter. The last three joints of

the right male antenna are coalescent into a single slender joint. These antennæ diverge from the head at an angle of nearly 60° , and afterwards bend outward to 90° . The shorter branch of the posterior antennæ is not over half the length of the longer. The setæ of these and the following organs are long. Caudal stylets nearly half the length of the abdomen, in the Pacific and Atlantic species divaricate; and the same, or perhaps a little longer proportionally, in the specimen from the Lagulhas Bank. The caudal setæ are about as long as the abdomen. In the specimens from the former regions, the first, third, and fourth setæ are equal, the second one-third longer, the fifth shorter than the fourth.

PONTELLINA CURTA.

Frons rotundatus. Cephalothorax curtus, crassiusculus, 5-articulatus, capite discreto, angulis posticis brevissimè acutis. Antennæ anticæ corpore breviores, rectæ, 105° divaricatæ, setis brevibus, apicali anticâ longiore. Antennæ posticæ ramis valde inæqui, minore plus dimidio brevior. Styli caudales oblongi, non divaricati. Setis mediocribus.

Front rounded. Cephalothorax short and rather stout, rounded in front, very short acute behind, five-jointed, the head separate and unarmed, posterior segments three. Anterior antennæ straight, divergent 105° , much shorter than the body; setæ short, anterior apical longest, the subapical either half shorter or less. Caudal stylets a little oblong, not divaricate; setæ about as long as abdomen, somewhat spreading.

Plate 80, fig. 1 *a*, animal, enlarged; *b*, extremity of antenna.

Collected, January 24, 1842, off the south end of Mindoro, East Indies; March 4, 1842, at the eastern entrance of the Straits of Sunda; also, on the Lagulhas Bank, April 8, 1842.

Length, one-twentieth of an inch. Head blue, but body yellowish, with a green medial portion, proceeding from the alimentary cavity. This is another short and stout species, yet not as thick as the last.

It differs from that also in the acute points behind, and in the antennæ.

The anterior apical seta of the antennæ is as long as the last two joints of the organ, while the other apical are shorter than the joint. The penult setæ, anterior and posterior, are nearly equal, and about as long as the penult joint. The posterior antepenult has the same length; but the anterior is half shorter. The anterior of the next joint preceding is as long as the joint. The last joint of the antennæ is longer than the preceding. There is a longish seta to the eighth or ninth joint from the extremity.

The caudal stylets are nearly twice as long as broad; and the setæ are about as long as the abdomen. Abdomen short, four-jointed. The inferior eyes are quite small; the superior being directly over the former, in a vertical view they were not distinctly observed.

PONTELLINA CONTRACTA.

Frons rotundatus. Cephalothorax 6-7-articulatus, capite discreto, angulis posticis brevissimè acutis, segmento postico fere obsoleto. Oculi inferiores majusculi. Antennæ anticæ cephalothorace non longiores, 100°-110° divaricatæ, rectæ, fermè 17-articulatæ, setis brevibus, apicali anticâ longiore. Rami antennarum posticarum valde inæqui. Styli caudales elongati. Abdomen 2-articulatum.

Front rounded. Cephalothorax posteriorly very short acute, six or seven-jointed, head separate, posterior segments four, but the fourth nearly obsolete. Inferior eyes rather large. Anterior antennæ not longer than the cephalothorax, divergent 100° to 110°, about seventeen-jointed; setæ short, the anterior apical longest, about as long as joint, other apical a little shorter, the subapical short or very short. Branches of posterior antennæ very unequal. Abdomen two-jointed, the second joint oblong. Caudal stylets elongate, parallel; setæ about as long as abdomen.

Plate 80, fig. 2 *a*, animal, enlarged; *b*, side view of beak; *c*, extremity of antenna; also, fig. 3, view, enlarged.

Collected (fig. 2 *a*), August 7, 1839, 5 A. M., latitude 18° 13'

south, longitude 124° 30' west; also (fig. 3), November 6, 1838, latitude 2° south, longitude 20° west.

Length, one-eighteenth of an inch. Colour (fig. 2 *a*), deep blue, with pearly white reflections along the back; also (fig. 3), blue with red, and a yellowish band occupying the larger medial part of the cephalothorax.

The cephalothorax of fig. 2 *a* is rather broadest posterior to the middle. Furcation of beak long and flexed inward. Last thoracic segment very short and much narrower than the preceding. Abdomen, excluding stylets, not one-fourth the cephalothorax in length. Caudal stylets more than half as long as abdomen. Caudal setæ four, subequal, with a minute spine exterior to the four, and another within. The basal joint of the anterior antennæ is directed more directly forward than the following part of the organs. Near the middle, or about seven joints from the apex, the antenna is abruptly smaller than the part below. The posterior subapical setæ are shorter than the anterior penult, and the latter is less than the length of penult joint. The four pairs of natatories are nearly equal, the posterior a little the smallest; the fifth pair is very minute.

The specimen figured in fig. 3, differs from the preceding in not having the back pearly white. Moreover the antennæ are shorter, being about three-fourths as long as the cephalothorax, and containing only about fourteen joints. It agrees with the preceding in form, in the position of the antennæ, the terminal setæ, the short two-jointed abdomen (less than one-fourth the cephalothorax), minute points to the posterior extremity of the thorax, and in having the setæ of the longer branch of the posterior antennæ so long as to extend to the penult segment of the thorax (counting only three, instead of four posterior segments). The pigment of the inferior eyes is also large. The shorter branch of the posterior antennæ is about half as long as the other. Length, one-twelfth of an inch. It may be distinct.

Plate 80, fig. 4 *a, b*, represents another species, unless it may be young of the last. It was collected on the same day, November 6, 1838. I have it named in my manuscript *Pontia curticornis*. The body is slender; head separate and rounded in front. There are three posterior thoracic segments, of which the last is quite short, narrow and obtuse behind, and appearing as if it belonged to the abdomen. The abdomen is two-jointed, the second segment longest; whole length not

one-fourth the cephalothorax. Caudal stylets oblong, about as long as last abdominal segment; caudal setæ not longer than abdomen, somewhat divergent. Anterior antennæ two-thirds the length of the cephalothorax, nine or ten joints; the first very short, the second, third, and fourth rather long and nearly equal. Setæ short, the longest at apex directed forward, but not longer than the joint; posterior subapical very short; anterior antepenult, obsolete. Two pairs of natatories, the last two thoracic segments having none; both branches one-jointed. Length, one-sixteenth of an inch. Colour blue, having a long central area of a dirty yellowish colour, with red either side.

PONTELLINA MEDIA.

Frons rotundatus. Cephalothorax 5-articulatus, segmento postico brevissimo et valde angusto, non acuto, capite vix discreto. Oculi superiores remotiusculi, inferiores parvuli. Antennæ anticæ corporis longitudine, parum duplo curvatæ, fere transversæ, apicibus fronte anterioribus, setis brevibus, rectis, apiculibus articuli longitudine, posticâ penultimâ parce longiore, aliis subapicalibus brevioribus. Styli caudales oblongi. [Abdomen 2-articulatum.]

Front rounded. Cephalothorax a little slender, segments five, the last short and quite narrow, subobtuse behind. Superior eyes somewhat remote, the inferior quite small. Anterior antennæ as long as the body, somewhat doubly curved, nearly transverse, the tips a little anterior to line of beak, setæ short, the apical not longer than the apical joint, posterior penult a very little longer, the other subapical shorter. Caudal stylets half as long as abdomen, not divaricate. [Abdomen two-jointed, the second segment longest.]

Plate 80, fig. 5 *a*, animal, enlarged; *b*, extremity of antenna.

Sooloo Sea, fifteen miles west of Panay, January 27, 1842.

Length, one-twentieth of an inch. A little smoky brown near the middle of the thorax; and also one branch of posterior antennæ presenting the same tint. The posterior thoracic segments diminish in breadth successively, and the last is but little broader than the abdo-

men; there were small points behind. The caudal setæ were mutilated. The setæ of the antennæ towards the base were about as long as three diameters of the joints; of the apical and subapical, the anterior antepenult is the shortest, being half as long as the joint.

PONTELLINA CRISPATA.

Feminæ:—*Frons subtriangulatus, obtusus. Cephalothorax 7-articulatus, segmento postico brevissimo, obtuso aut subacuto. Oculi superiores remotiusculi, inferiores mediocres. Antennæ anticæ vix corporis longitudine, latè divaricatæ, apicibus fronte valde anterioribus et prorsum curvatis; setis brevibus, prope basin confertis et paucis uncinatis, apicalibus et posticâ antepenultimâ articulo parce longioribus, posticâ penultimâ paulo longiore. Styli caudales parce oblongi, setis 5, subæquis. [Abdomen 4-articulatum.]*

Female:—Front subtriangular, obtuse. Cephalothorax rather slender, seven-jointed, last segment very short, obtuse behind or short subacute. Superior eyes a little separate; inferior of moderate size. Anterior antennæ a little shorter than the body, widely divaricate, extremities anterior to line of front, and tips curving forward; setæ short, towards base crowded and several uncinuate, apical hardly longer than the joint, the posterior penult a little longer, the posterior antepenult shorter than penult, the anterior penult scarcely as long as joint, anterior antepenult much shorter. Caudal stylets slightly longer than broad, five subequal setæ. [Abdomen four-jointed, segments a little unequal, the first largest.]

Plate 80, fig. 6 *a*, animal, enlarged; *b*, extremity of antenna.

Collected, near the Kingsmill Islands, in the Pacific, March 22 and 26, 1841, latitude 5° – 7° north, longitude $174\frac{1}{2}^{\circ}$ – $177\frac{1}{2}^{\circ}$ east; also, in the Atlantic, October 15, 1838, latitude $8\frac{1}{2}^{\circ}$ north, longitude 23° 45' west.

Length, one-twelfth to one-sixteenth of an inch. Colourless or bluish. The anterior antennæ about as long as the cephalothorax and half the abdomen; the second joint is oblong, and several following

are very short; the last joint of these antennæ is slightly longer than the preceding, and the penult is a little shorter than the antepenult. The anterior of the apical setæ is a little the longest. The last segment of the thorax is less than one-third the length of the preceding, and is also considerably narrower. The caudal stylets are slightly divergent. Colour of pigment of inferior eyes carmine-black; seen in a vertical view usually just behind the superior eyes. In the posterior part of the cephalothorax there are four oblong glands of a deep blue colour.

The description above given is drawn from the Pacific specimens. The Atlantic specimens present essentially the same characters. The posterior extremity of the cephalothorax has very short acute points. The curved hairs towards the base of the antennæ are the same as above mentioned, and so also, the apical setæ and the position of the organs. The longer caudal setæ may be only four in number; of this I am not certain. The spot of pigment corresponding to the inferior eyes, is smaller in my figure than for the Pacific specimens. The apical joint of longer branch of posterior antennæ is hardly one-fourth as long as the preceding joint; the setæ of the same are as long as the branch. Natatories four pair, the posterior longest. The blue glands in the posterior part of the cephalothorax are only two, but are much elongated, as if proceeding from the coalescence of the two on each side in figure 6 a. After death, these spots diffuse a blue colour through the surrounding parts.

PONTELLINA DETRUNCATA.

Frons obtusus. Cephalothorax 5-6-articulatus, capite discreto, angulis posticis rectè truncatis et extus brevissimè acutis. Oculi superiores sæpius disjuncti, inferiores mediocres. Antennæ anticæ 22-24-articulatæ, vix corporis longitudine, late divaricatæ, apicibus fronte valde anterioribus et prorsum curvatis; setis brevibus, rectis, posticâ penultimâ longiore quam apicales vel alia subapicales. Antenna dextra maris medio incrassata, subteres, 12-13-articulata, articulo tertio elongato, obsoletè articulato, septimo (octavo?) brevi et subtriangulato, duobus sequentibus tenuibus, longis. Pes posticus dexter maris crassissimè cheliformis, manu subovatâ, digito immobili laterali, obtuso, dimidio brevior, digito mobili elongato, tenui et curvato. Styli caudales breves, setis 5 subæquis.

Front obtuse. Cephalothorax five- or six-jointed, the head separate, only three posterior segments, the fourth obsolete, posterior angles transversely truncate and exteriorly very short acute. Superior eyes usually separate, the inferior of moderate size. Anterior antennæ twenty-two- to twenty-four-jointed, a little shorter than the body, very widely divaricate, the tips curving a little forward; setæ short, straight, posterior penult longer than apical or other subapical, the apical not longer than the joint, the anterior subapical very short. Right antenna of *male* incrassate at middle, subterete, twelve- to thirteen-jointed, third joint elongate, obsoletely jointed, seventh (eighth?) short and subtriangular, next two slender and long. Right leg of posterior pair of male very stout cheliform, hand subovate, immoveable finger lateral, obtuse, moveable finger elongate, twice longer, slender and curved. Caudal stylets short, five subequal setæ.

Plate 80, fig. 7 *a*, male, enlarged; *a'*, part of right male antenna; *b*, profile of head; *c*, maxillipeds (magnified twice as much as fig. 7 *a*); *d*, anterior feet; *e*, posterior thoracic feet, in male; *f*, same, in female; *g*, under view, showing the organs of the head and mouth; *h*, *i*, different views of a distorted female abdomen.

Collected several specimens in the Pacific, two hundred and fifty miles southwest of Tongatabu, latitude 26° 8' south, longitude 178° west, April 18, 1840; also, March 25, 1841, south of the Kingsmill Islands, latitude 5° 20' south, longitude 175° 30' east; and afterwards, north of the equator in this group, near Hall's Island.

Length, one-twelfth to one-sixteenth of an inch. Colour, bluish. The truncate posterior extremity of the cephalothorax, with the outer angles still acute, afford a striking character. In the antennæ and the eyes, this species is much like the preceding. The anterior antennæ curve forward and outward from the head, and the two afterwards are very nearly in the same straight line. The maxillipeds are much larger than the following pair of organs. The last five joints of the anterior antennæ are subequal and short. The setæ towards the base of the antenna are rather crowded, and longer than the diameter of the organ.

The right antenna of the male has the third joint rather longer

than the second, and with one or two obsolete articulations towards its apex. The next joint is rather short and enlarges outward; the next three make a single joint, the largest one in the antenna, and from the first of the three there is a seta; the following two are the pectinated joints. The geniculating articulation is between the fourth and fifth joints from the apex, or normally the fifth and sixth joints. Both the fourth and fifth just referred to, correspond to two normal joints. The posterior thoracic feet of the male are large: the right consists of three joints; the first oblong and stout; the second much larger, subovate, with a long thumb-like process from one side near base; the third a curving hook, longer than the preceding. In the female these organs are small, simple, and naked, the right a little larger than the left.

The beak is flexed much inward.

In some females the abdomen was distorted, as represented in figures 7 *h, i*. Only a few of those seen were of this character.

PONTELLINA SIMPLEX.

Frons obtusiusculus. Cephalothorax subgracilis, capite obsolete discreto, segmento postico brevi et perangusto. Oculi superiores subremoti, inferiores mediocres. Antennæ anticæ cephalothorace breviores, 9-articulatæ, 100° divaricatæ; setis totis brevibus. Styli caudales elongati. [Abdomen 2-articulatum. An specimen adultum?]

Front rather obtuse. Cephalothorax somewhat slender, head imperfectly separate, posterior segments four, the last very narrow and short. Superior eyes remote, inferior of moderate size. Anterior antennæ nine-jointed, much shorter than the cephalothorax, divergent about 100°, straight, all the setæ very short. Caudal stylets elongate and slender. [Abdomen two-jointed. Adult?]

Plate 80, fig. 8 *a*, animal, enlarged; *b*, posterior antenna.

Collected, April 9, 1840, in the Pacific, latitude 32° 24' south, longitude 178° east, northeast of New Zealand.

Length, one-twentieth of an inch. Colour, blue. This may be a

young individual. The caudal stylets are more than half the length of the abdomen; the setæ were mostly broken off; the inner one was entire, and was about as long as the abdomen. The first three joints of the anterior antennæ are longest and nearly equal, and the fourth and fifth together about equal the third; the next four are subequal and each is a little longer than the fifth. The setæ hardly exceed the diameter of the joints, except one at the apex, which is shorter than the joint. The superior eyes are distant. The pigment of the inferior pair is seen in a vertical view just behind the superior eyes, and is reniform in shape. The posterior antennæ have the smaller branch one-fourth shorter than the longer; the longer has the second joint one-fourth shorter than the first; the setæ are scarcely longer than the branches. Posterior feet very short.

PONTELLINA EXIGUA.

Gracilis. Frons obtusus. Cephalothorax 6-articulatus, capite discreto, segmento postico brevi, obtuso. Oculi inferiores maximi, valde elongati, subclavati. Antennæ anticæ corpore valde breviores, 120° (?) divaricatæ, setis perbrevibus, apicali anticâ longiore, subapicalibus brevibus. Antennæ posticæ tenues, ramo majore plus duplo longiore. Styli caudales oblongi. [An adultum? Abdomen 2-articulatum.]

Slender. Front obtuse. Cephalothorax six-jointed, head separate, posterior segments four, the last short, obtuse behind. Inferior eyes large, much elongate, the pigment subclavate. Anterior antennæ three-fourths as long as the body, 120° (?) divaricate, setæ very short, the anterior apical setæ longest, the subapical not longer than the joint. Branches of the posterior antennæ slender and very unequal, the smaller half the larger in length; the setæ of the longer branch exceeding the branch in length. Caudal stylets oblong, setæ subequal. [Abdomen short, two-jointed, second segment the longer. Adult?]

Plate 80, fig. 9 *a*, animal, enlarged, the antennæ removed; *b*, profile, showing outline of head.

Abundant in the Atlantic, October 16, 1838, latitude 7½° north,

longitude $23^{\circ} 45'$ west; also, October 24, latitude $4\frac{1}{2}^{\circ}$ north, longitude $19\frac{1}{2}^{\circ}$ west.

Length, one-thirtieth of an inch. Colour, greenish along the medial line (intestinal), reddish either side, and sides and head mostly bluish. The length of the cephalothorax is about four times the breadth. The pigment of the inferior eyes, as seen in a vertical view, forms an oblong spot extending forward to the front. The abdomen is very short; the caudal stylets about as long as the second joint. The longer apical setæ of the anterior antennæ is as long as two or three terminal joints. Natatories four pair, the two medial largest; the longer branch two-jointed; the shorter having but one joint, and not half the length of the longer.

b. Cephalothorax posticè productus et acutus.

* Seta antennarum anticarum apicalis subapicalibus brevior.

PONTELLINA AGILIS.

Feminæ: *P. crispata* quoad antennas similis. Anguli postici cephalothoracis acuti. Frons rotundatus. Setae antennarum anticarum fere rectae, prope basin confertae.—[Forsan *P. crispata* cephalothorax interdum posticè acutus et species non differt.]

Female:—Like the *crispata* in the antennæ and most characters. Cephalothorax rounded in front, acute behind, posterior segments three, besides the fourth which is very short. Setae of anterior antennæ nearly straight, crowded towards the base of the antenna.

Plate 80, fig. 10 *a*, animal, enlarged; *b*, side view of head; *c*, posterior antennæ; *d*, one of the third pair of natatories; *e*, one of the posterior thoracic feet.

Very abundant, November 17, 1838, 4 A. M., latitude $19\frac{1}{2}^{\circ}$ south, longitude $38^{\circ} 45'$ west.

Length, one-eighth of an inch. Colour blue, especially anteriorly,

yellowish posteriorly. The cephalic segment is very distinct. The posterior acute angles of the cephalothorax are rather short. The position and general characters of the anterior antennæ are nearly as in the *P. crispata*, and if it is possible that the *crispata* has in its most advanced state, acute angles behind, the two species may perhaps be identical. The hairs towards the base of the antennæ are crowded as in that species, but none I believe are uncinatæ; the apical setæ are also shorter.

The pigment of the inferior eyes, as seen in a vertical view, is a nearly round blue-black spot behind the superior eyes. The abdomen has four segments, the first of which is a little the largest, and the fourth the smallest; but they vary in relative proportions. The caudal setæ are about as long as the abdomen; the stylets are a little longer than broad. There are about eighteen joints to the anterior antennæ; the five terminal are short and subequal; the anterior subapical setæ are hardly longer than the diameter of the joints. The second joint of longer branch of posterior antennæ is one-third to one-fourth the preceding in length. There are four pairs of natatories, the anterior smallest. The longer branch, in all four pairs, three-jointed, the shorter two-jointed. There is also a fifth pair, much smaller and naked, with two minute spines at apex of longer branch.

In the posterior part of the cephalothorax, either side of the intestine, there is an oblong deep blue gland.

Specimens were collected in the Atlantic which are probably identical with the above. The abdomen is only two-jointed, the second very short: but this organ varies much in the same species. There are only three posterior segments to the cephalothorax; a posterior fourth was not distinctly observed; yet the posterior angles were acute, as above. Pigment of superior eyes carmine-black, separate. Anterior antennæ about as long as body; setæ as above described. Posterior antennæ have the second joint of longer branch not one-fourth the length of the first joint; the setæ are nearly as long as the branch.

The maxillipeds were observed to be employed in giving the body a leaping motion, while the animal was under the microscope without sufficient water to swim. First pair of legs two-branched, one branch consisting of five slender joints; the other of two stout joints, and bearing three or four long spinulous setæ. Natatories four pairs;

longer branch three-jointed, shorter two-jointed, and half the length of the longer. Colour, bluish; spots in posterior part of cephalothorax of a deep blue colour. Length, one-tenth of an inch.

Collected, October 12, 1838, latitude 9° 20' north, longitude 24° 18' west.

PONTELLINA ACUTIFRONS.

Maris:—*P. crispatae et agili similis*. *Anguli postici cephalothoracis acuti*. *Frons acutus et prominens; rostro longissimè furcato et valde inflexo*. *Oculi superiores approximati; inferiores parvi*. *Setæ antenarum anticarum rectæ, prope basin fere articuli secundi longitudine, posticâ penultimâ plus duplo longiore quam apicales*. *Antenna dextra medio incrassulata, subteres, 12–13-articulata; articulis secundo et quinto æquis, septimo brevissimo, octavo valde elongato, subattenuato, recto, fere duplo longiore quam nonus; nono ad apicem anticum instar spinæ valde producto; articulis sequentibus (ultimis) tribus normalibus*. *Pes posticus dexter latissimè cheliformis, manu subquadrata, digito immobili breviter spiniformi, digito mobili recto, apice minutè inflexo, valde brevior quam manus*.

Male:—near the *crispata* and *agilis*. Cephalothorax acute posteriorly. Front acute and prominent, beak very long furcate, and much inflexed. Superior eyes approximate, inferior small. Anterior antennæ nearly as long as the body, very widely divaricate, tips curved a little forward; setæ short, crowded towards base and a little long, apical not longer than the joint, posterior penult as long as last four joints, antepenult not longer than joints, anterior subapical quite short; right antenna of male subterete, a little incrassate at middle, twelve- to thirteen-jointed. Second and fifth joints equal, seventh very short, eighth much elongate, subattenuate, straight, nearly twice as long as ninth, ninth at apex produced into a spine, following three joints (the last), as in the left. Posterior right foot in male large cheliform, hand subquadrate, immoveable finger short, spiniform, moveable finger straight, apex minutely inflexed, much shorter than hand.

Plate 80, fig. 11 *a*, animal, enlarged; *a'*, extremity of antenna; *b*, male right antenna; *c*, side view of head; *d*, mandible and palpus; *e*, maxilla; *f*, first pair of legs; *g*, posterior thoracic feet; *h*, natatory leg, one of three posterior pairs.

Collected near El Gran Cocal, latitude $5\frac{1}{2}^{\circ}$ south, longitude $175^{\circ} 45'$ east, March 25, 1841; and in the Kingsmill Group, $1^{\circ} 13'$ south, longitude $174^{\circ} 50'$ east, April 1, 1841.

Length, one-seventh of an inch. Colour, blue. The beak is long, and very much incurved. The front is a little prolonged at middle and acute. The superior eyes have large spots of pigment, which are in contact. The length of the caudal stylets a little exceeds the breadth. The longer hairs towards the base of the anterior antennæ are two or three times as long as the diameters of the joints, and one of them curves forward and inward. In the right antenna of male, after four or five oblong joints at base, there is a tri-articulate stout joint, as long as the part of the antennæ following it; the two articulations intersecting it are towards its base; and near its middle there is a minute spine and a seta, beyond which the margin is very finely pectinate; beyond this long joint there is the geniculating articulation. Then follows a long joint, whose apex is lineally prolonged nearly to the apex of the following joint, and the margin is very finely pectinated. The posterior margin of this and the preceding joint is very nearly straight. The last three joints are nearly like the same in the female.

The mandible has six teeth, and a two-branched palpus, as in the figure. The right posterior foot has the second joint very large and broad, the form approaching subquadrate, with the outer angle broadly and deeply removed; it has articulated with it a finger, hardly exceeding half its length and uncinatè at apex, which finger is opposed to a short spine from the basal portion. The large second joint folds back against the side of the preceding. The other leg is simple and naked.

PONTELLINA ACUTA.

Frons elongatè acutus, rostro brevi, vix inflexo. Cephalothorax 5-articulatus, capite discreto, angulis posticis elongatis, acutis. Oculi supe-

riores remoti, inferiores parvi. Antennæ anticæ subtransversæ, fere corporis longitudine, fermè 21-22-articulatæ, apicibus fronte paulo anterioribus et prorsum leviter curvatis, setis prope basin confertis, longiusculis, posticâ penultimâ duplo longiore quam articulus, apicalibus et aliis subapicalibus brevioribus. Antenna dextra maris subteres, fermè 13-articulata, articulo secundo longo, 6 sequentibus brevibus, proximis duobus elongatis et tenuibus, parce arcuatis, subæquis, 3 proximis (ultimis) normalibus. Pes posticus dexter maris latus, manu apice late orbiculatâ, digito immobili nullo, digito mobili vix manus longitudine, paulum inflexo. Styli caudales oblongi. [Abdomen 4-articulatum.]

Front long acute, beak short, hardly inflexed. Cephalothorax long acute behind, five-jointed, head separate, three posterior segments besides a fourth behind very short. Superior eyes subremote, inferior quite small. Anterior antennæ very nearly as long as the body, very widely divaricate, the tips curving forward a little, but not much in advance of the line of the beak; setæ towards the base longish and crowded, posterior penult as long as last two joints together, the subapical and apical not longer than a joint, the anterior antepenult very short. Right antenna of male subterete, thirteen-jointed, incrassate at middle, second joint long, six following short, next two long and slender, sparingly arcuate, subequal, last (next) three joints as in the left antenna. Right posterior foot of male broad, hand at extremity broad orbiculate, no immoveable finger, moveable finger hardly as long as hand, a little inflexed. Caudal stylets oblong, setæ five, spreading. [Abdomen four-jointed.]

Plate 80, fig. 12 *a*, male, enlarged; *a'*, front of head, in profile; *b*, right male antenna; *c*, posterior feet.

Abundant in the East Indies, off the southeast end of Mindoro; January 24, 1842; also, in the China Sea, February 15, 1842, latitude 6° 40' north, longitude 111° east.

Length, one-tenth of an inch. Colour, blue. Remarkable for its prolonged acute beak in a vertical view, but singularly short beak in a lateral view. The pigment of the inferior eyes is not larger than that of one of the superior eyes; and in a vertical view it is seen a

short distance posterior to them. The right of the two spinous processes at the posterior extremity of the cephalothorax was abruptly bent outward in the male. The caudal stylets are about twice as long as broad; and the setæ are as long as the abdomen. The anterior antennæ extend laterally (after the basal curve) nearly in the same straight line, the tips curving a little forward. The longish setæ at the apex of the second, third, and fourth joints are three or four times as long as the diameter of the joints. The last three joints of the antenna are very nearly equal. The posterior antennæ are a little stout; and the shorter branch hardly exceeds half the longer. The right posterior foot of the male is geniculate; it has the first joint oblong, the second narrow at base, and then abruptly enlarged, so as to be in the following part of a Pecten shape. The third joint or finger is stout, bent, and articulated with the lower angle of the Pecten-shaped joint.

† Seta antennarum anticarum apicalis subapicalibus longior.

PONTELLINA RUBESCENS.

Feminæ:—*Frons rotundatus. Cephalothorax 6-articulatus, capite discreto, segmento septimo obsoleto, angulis posticis acutis. Oculi superiores remoti; inferiores quoad pigmentum bilobati. Antennæ anticæ cephalothorace non longiores, fere 120° divaricatæ et rectæ; setis brevibus, apicali vix longiore quam articulus. Ramus major antennarum posticarum fere triplo longior. Styli caudales elongati, paralleli. [Abdomen 3-articulatum.]*

Front rounded. Cephalothorax acute behind, six-jointed, head separate, posterior segments three, besides a fourth which is very short. Superior eyes remote. Pigment of inferior eyes bilobate. Anterior antennæ scarcely as long as the cephalothorax, very nearly straight, divergent about 120°; setæ short, apical seta not longer than the apical joint, subapical shorter, the posterior penult shortest. Shorter branch of posterior antennæ hardly one-third the length of the other, the longer slender, with long setæ. Caudal stylets parallel, rather longer than half the abdomen. [Abdomen three-jointed.]

Plate 78, fig. 13 *a*, animal, enlarged; *b*, extremity of the antenna.

Collected in the Pacific, six miles north of Upolu, one of the Samoan Islands, February 24, 1841; also, near El Gran Cocal, March 25, 1841, latitude $5\frac{1}{2}^{\circ}$ south, longitude $175^{\circ} 45'$ east.

Length, one-fifteenth of an inch. Colour, pale reddish with greenish along the intestine. The acute extremities at the posterior part of the cephalothorax appear to belong to a fourth posterior segment, of which only this part is seen. Counting this as one, there are seven segments to the cephalothorax. The above character, in addition to the rather long stylets, the bilobate pigment (deeply indented behind) of the inferior eyes, and the characters of the two pairs of antennæ (the anterior shorter than the cephalothorax), serves to distinguish the species. The beak has the usual character. The fourth and fifth joints of the anterior antennæ are much longer than those immediately preceding or following. A seta on the tenth or eleventh joint from the extremity is longer than the others near by. The setæ of the longer branch of the posterior antennæ, when thrown back, extend as far as the fifth segment (out of the seven) of the cephalothorax.

PONTELLINA EMERITA.

Feminæ:—*Crassa*. *Frons obtusus*. *Cephalothorax 6-7-articulatus*, *capite discreto*, *angulis posticis elongatè acutis*, *segmento postico brevi*. *Oculi superiores remoti*, *inferiores sat parvi*. *Antennæ anticæ cephalothorace vix longiores*, *fermè 100° divaricatæ*, *rectæ*. *Ramus major antennarum posticarum fere quadruplo longior*. *Styli caudales breves*. [*Abdomen 2-articulatum*, *segmentis subæquis*.]

Female:—Stout. Front obtuse. Cephalothorax long and remotely acute behind, six- to seven-jointed, head separate, posterior joints four, the last short. Superior eyes remote, inferior rather small. Anterior antennæ scarcely longer than the cephalothorax, divergent 100° to 110° , straight, setæ short. One branch of the posterior antennæ hardly one-fourth the other in length. Caudal stylets short, setæ of moderate size (rather short), much spreading. [*Abdomen two-jointed*, *segments subequal*.]

Plate 80, fig. 14 *a*, animal, enlarged (a joint of the anterior antennæ

probably wanting); *b*, posterior thoracic legs, enlarged to correspond.

Collected off the Cape of Good Hope, April 12, 1842, latitude 35° 20' south, longitude 20° east.

Length, one-tenth of an inch. Colour, grass-green; head, deep blue in front. The specimen, although perfect in every other respect, appears to have the last joint of the anterior antennæ wanting. The posterior seta of the joint, which was the terminal (supposed to be the penult), is a little longer than the joint, the anterior quite short; the posterior of the next preceding is about as long as the joint, and the anterior very minute. The second joint of the antenna is oblong, and has a few curving setæ, the longest of which is hardly twice the diameter of the joint in length. The shorter branch of the posterior antennæ is very small, not exceeding a sixth the length of the other. The longer branch is long, and the setæ extend back as far as the sixth cephalothoracic segment. The posterior angles of the cephalothorax are long acute, distant, and somewhat divergent.

PONTELLINA REGALIS.

Feminæ:—*Crassissima*. *Frons rotundatus*. *Cephalothorax 5-6-articulatus, angulis posticis elongatè acutis, capite discreto, brevi*. *Oculi superiores remoti, inferiores parvi*. *Antennæ anticæ cephalothoracæ breviores, 100°-110° divaricatæ, duplo leviter curvatæ, setis brevibus, subapicalibus articulo non longioribus, apicali anticâ triplo longiore, aliis apicalibus perbrevibus*. *Ramus major antennarum posticarum quadruplo longior*. *Styli caudales brevissimi*. [*Abdomen 2-articulatum, segmento secundo brevi*.]

Female:—Very stout. Front rounded. Cephalothorax five- to six-jointed, posterior angles long acute and remote, head separate, short, posterior segments three. Superior eyes remote, inferior small. Anterior antennæ shorter than the cephalothorax, divergent 100° or 110°, slightly curved, setæ short, subapical not longer than the joint, anterior apical nearly three times longer, the other apical very short. Short branch of posterior antennæ minute, hardly

one-fourth the other in length. Caudal stylets very short, setæ nearly as long as abdomen, spreading. [Abdomen two-jointed, the first joint gibbous and elongate, the second short.]

Plate 81, fig. 1 *a*, animal, enlarged; *b*, extremity of antenna.

Collected in the Sooloo Sea, fifteen miles west of Panay, January 27, 1842.

Length, one-seventh of an inch. Colour, greenish yellow, with the head in front blue. This is a remarkably large and stout species. The anterior antennæ leave the head at right angles with one another, then bend outward a little, and then again forward, so that the tips are also in lines at right angles with one another. The setæ are generally one to three diameters of the organ in length. The penult setæ, anterior and posterior, are nearly as long as the corresponding joint, the antepenult are shorter, and the anterior antepenult is very short. The pigment of the inferior eyes in a vertical view forms a small short oval spot behind the superior eyes; and the latter are quite remote, appearing nearly marginal. The caudal stylets are very short, and the articulation with the abdominal oblique. The shorter branch of the posterior antennæ *with its setæ*, is but little longer than half the other branch.

The specimen is a female; and the eggs form two irregular series either side of the body, which appear to meet over the mouth or near it, and then separate into four branches extending towards the head. The colour of the ova was yellowish. The lines did not extend into the abdomen.

There is also laterally, a blue spot near each of the three posterior articulations of the thorax, on either side.

PONTELLINA PERSPICAX.

Frons rotundatus. Cephalothorax 6-articulatus, capite discreto, segmento postico non breviorè, angulis posticis elongatè acutis. Oculi inferiores grandes et prorsum valde elongati. Antennæ anticæ corpore valde breviores, 100°-110° divaricatæ, fermè 21-articulatæ, ante medium obsoletè flexæ. Antenna antica maris dextra 9-10-articulata, articulo

quarto lato, subovato, apice spiniformi. Pes posticus maris dexter vix crassus; manu angustâ, breviusculâ, digito mobili vix longiore, acuminato, digito immobili setiformi, longissimo, reflexo. Styli caudales elongati, setis mediocribus. [Abdomen 5-articulatum.]

Front rounded. Cephalothorax six-jointed, posterior angles long acute and remote, head separate, posterior segments three. Inferior eyes large and very much elongate. Anterior antennæ much shorter than the body, divergent 100° to 110° , the left below middle very slightly bent, and beyond abruptly more slender, twenty-one- or twenty-two-jointed; setæ short. Right antenna of *male* nine- to ten-jointed, the fourth joint broad subovate, the apex a stout spine, the following joints slender. Right leg of posterior pair in *male* hardly stout, hand narrow, shortish, moveable finger acuminate, hardly longer than hand, immoveable finger setiform, very long, reflexed. Caudal stylets elongate, setæ of moderate length. [Abdomen five-articulate, joints short, subequal, the third having a process on the right side.]

Plate 81, fig. 2 *a*, animal, enlarged (the posterior antennæ omitted); 2 *b*, one of the six posterior natatories; 2 *c*, right foot of genital pair; 2 *d*, left foot, ditto.

Collected in the Atlantic, 4 A. M., November 3, 1838, latitude $0^{\circ} 40'$ south, longitude 18° west; perhaps the same, latitude $7^{\circ} 25'$ north, longitude 20° west, October 17, 1838.

Length, one-twelfth of an inch. Colour, blue, with a broad yellowish band across the cephalothorax; middle portion of the extremity of the antennæ, red. The inferior eyes are much prolonged, and in a vertical view, the pigment extends forward to the front. The posterior acute angles of the cephalothorax are much prolonged, and the right, in the *male* specimen examined, was nearly as long as the abdomen. The caudal stylets are rather longer than half the abdomen; and the margin from which the setæ proceed extends from the middle of the outer side to the inner apex. The inner seta is but slightly shorter than the second. The left anterior antenna has a seta to the eleventh joint from the extremity, a little longer than others near. The right has the first joint short; the second much

oblong, with a few setæ hardly as long as the diameter of the joint. The third joint is half shorter, and smaller at base; the fourth at base is about two-thirds its length, and has the posterior side nearly straight, and there is a stout spinous prolongation of the anterior apex. The fifth and sixth joints are quite slender, and each not longer than the fourth; the following part appears like a single joint, though consisting normally of three joints, and having the setæ of three, like the left antenna.

The second (or third?) joint of the right posterior foot is stout and oblong subterete; and from the basal part proceeds a long spine, bent at first backward, and then around and forward, three times as long as the joint. At apex, this joint is articulated with an acute spini-form finger, but little longer than the preceding.

Natatories four pairs, the anterior half smaller than the others, which are nearly equal. The longer branch three-jointed, the shorter in all, two-jointed.

Pontellina pulchra.—Figs. 3 *a, b, c, d, e*, on Plate 81, represent a species which in many respects resembles the preceding. The position of the antennæ in the figure may not be accurate, as in a few earlier drawings made, the importance of strict accuracy in this point was not appreciated. It has the antennæ of a female; yet the posterior thoracic feet are large and the right is prehensile, as in fig. 3 *e*. The hand of the right foot is made of a large broad joint, nearly quadrate, articulated with the preceding near one angle, and bearing towards the other of the same side a long stout spine, which projects first backward and then bends around forward, and is incurved at apex. The moveable finger is arcuate, and is articulated with the large joint directly opposite the base of the spine described. The species has the inferior eyes large and very much elongate as in the *P. perspicax*. The longer branch of the posterior antennæ is more than twice the length of the shorter, and its setæ are longer than the branch. The anterior apical seta of the anterior antennæ is a little longer than the joint. The posterior angles of the cephalothorax are much prolonged and acute, being longer than half the abdomen. The abdomen is five-jointed. The caudal stylets are shorter than in the *perspicax*, being about as long as the last joint of the abdomen; and there are four subequal setæ, with an outer much shorter. Natatories four pairs,

the first smallest; shorter branch of each two-jointed. Length, one-tenth of an inch. Collected in the Atlantic, October 17, 1838, latitude 7° north, longitude 23° 45' west.

PONTELLINA STRENUA.

Maris:—*Frons acutiusculus*. *Cephalothorax* 5–6-articulatus, angulis posticis elongate acutis, capite discreto. *Oculi superiores remoti, inferiores mediocres*. *Antennæ anticæ fere corporis longitudine, 80°–90° divaricatæ, 17–18-articulatæ, ad medium obsolete flexæ, setis brevibus, anticis apicalibus articulo duplo longioribus*. *Antenna antica dextra 12–14-articulata, articulo mediano subovato, apice antico acuto*. *Ramus major antennarum posticarum fere triplo longior*. *Pes posticus dexter crassiusculus, manu ellipticâ, brevior quam carpus, digito immobili tenuissimo, acuto, parce longiore, digito mobili mediocri, subulato, rectiusculo*. *Styli caudales breves*. *Styli caudales paulo oblongi*. [*Abdomen 5-articulatum*.]

Male:—Front rather acute. Cephalothorax five- to six-jointed, posterior angles long acute and remote, head separate, posterior segments four, the last very short. Superior eyes distant, inferior of moderate size. Anterior antennæ about as long as the body, diverging 80° at base, and apical half about 90°, seventeen- to eighteen-jointed, near middle a slight flexure; setæ short, the anterior apical more than twice as long as the joint. Right antenna twelve- to fourteen-jointed, a median joint broad subovate, with an angle on the posterior side near base, and the anterior apex acute. Posterior antennæ having one branch nearly three times longer than the other. Right posterior leg rather stout, hand oval, shorter than the carpus, immoveable finger very slender, acute, sparingly the longer, moveable finger of moderate size, subulate, nearly straight. Caudal stylets a little oblong. [*Abdomen five-jointed*.]

Plate 81, fig. 4 *a*, animal, enlarged; *a'*, extremity of left antenna; *b*, part of male antenna; *c*, profile of head; *d*, posterior feet.

Collected at 4 h. A. M., April 2, 1841, in the Pacific, south of the Kingsmills, latitude 3° south, longitude 175° east.

Length, one-twelfth of an inch. Colour, blue, with the abdomen wine-yellow and yellowish carmine; base of caudal setæ, wine-yellow. The head is shorter than broad. The pigment of the inferior eyes in a vertical view appears just behind the superior eyes. The caudal stylets are short; the length not twice the breadth. The large joint in the right male antenna is scarcely twice as long as broad; it is prominently convex on the anterior side, and angled on the posterior side near base; the next joint is oblong terete, with the margin minutely pectinate; the following joint shorter and more slender.

The right posterior foot has the second joint oblong, subterete; the third stout suboval, with a stout spine as long as second joint, proceeding from one side near base; the fourth a finger nearly straight, as long as the third, and having one or two minute spines on the inner margin. The segments of the abdomen are transverse, and the third had a process on the right side.

This species resembles the preceding, but differs widely in the size of its inferior eyes, its shorter caudal stylets, the posterior feet, &c.

PONTELLINA PROTENSA.

Maris:—*Crassa*. *Frons rotundatus*. *Cephalothorax* 5-6-articulatus, *capite discreto, brevi, angulis posticis elongatè acutis*. *Oculi superiores remoti, inferiores mediocres*. *Antennæ anticæ corpore breviores, basi vix 60° divaricatæ et medio fere 70°, setis brevibus, apicali anticâ articulo longiore, posticâ penultimâ paulo brevior, aliis subapicalibus perbrevis*. *Antenna antica dextra fere ac in P. strenuâ*. *Ramus antennarum posticarum major plus quatuoruplo longior*. *Styli caudales oblongi*. [*Abdomen 5-articulatum*.]

Male:—Stout. Front rounded. Cephalothorax five- to six-jointed, posterior angles long acute and remote, head separate, posterior segments three. Superior eyes remote, inferior rather small. Anterior antennæ shorter than the body, diverging less than 60°, near middle very slightly bent and then diverging about 70°; setæ short, anterior apical longer than the joint, posterior penult a little shorter, other apical short, other subapical very short. Right antenna very nearly as in the *P. strenua*. Longer branch of posterior antennæ four times as long as the other branch. Caudal stylets elon-

gate, setæ five, of moderate length. [Abdomen five-jointed, third segment having a small process on the right.]

Plate 81, fig. 5 *a*, animal, enlarged; *a'*, extremity of antenna; *b*, posterior part of cephalothorax in one specimen.

Collected in the Straits of Banca, east of Sumatra, March 1, 1842; also, March 4, at the east entrance of the Straits of Sunda.

Length, one-tenth of an inch. Colour, yellowish, clouded with red either side of intestine. This is a short and thick species, having the thorax broad behind and long acute, and the antennæ thrown very much forward. The right male antenna is similar to that of the preceding species.

The pigment of the inferior eyes in a vertical view forms a blue spot, of reniform shape, just posterior to the superior eyes. The caudal setæ are subequal and nearly as long as the abdomen. The anterior antennæ have the apical joint a little longer than either of the two preceding. In the right antenna, the geniculating articulation is just anterior to the last four joints, or normally the last five, the first of the four being a double joint. The joint preceding the articulation is a little longer than the following one, and both are straight. The minute pectination is nearly as in the *P. strenua*. The right posterior angle of the cephalothorax is more prolonged than the left, and is incurved; and in one specimen there was a tooth on the inner side. The shorter branch of the posterior antennæ is very short, not one-fourth the longer.

III. SUBGENUS PONTELLA.

PONTELLA HEBES.

Feminae:—*Frons truncatus. Cephalothorax 4-articulatus, posticè rotundatus. Oculi superiores disjuncti, inferiores parvi. Antennæ anticæ fere corporis longitudine, transversæ, apicibus fronte paulo anterioribus, prorsum parce curvatis, prope basin setis confertis longiusculis, et unâ sublongâ mobili, setis apicalibus articuli longitudine, posticâ*

penultimâ paulo longiore, aliis subapicalibus brevibus. Styli caudales vix oblongi. [Abdomen 3-articulatum.]

Female.—Front truncate. Cephalothorax four-jointed, rounded behind. Superior eyes a little separate, inferior quite small. Anterior antennæ nearly as long as the body, the two after the curve at base in the same straight line, the tips curving forward, yet but little anterior to line of front, setæ rather short, a crowded tuft towards base, and one seta longer than the others proceeding from the second joint, apical setæ as long as joint, posterior penult a little longer, other subapical setæ short. Caudal stylets short, hardly longer than broad. [Abdomen three-jointed, first segment elongate.]

Plate 81, fig. 6 *a*, animal, enlarged; *a'*, view of front and base of antenna; *b*, superior eyes.

Collected, March 3, 1842, latitude 4° 20' south, longitude 106° east, southeast of Sumatra.

Length, one-sixteenth of an inch. Colour, pale brownish. The cephalothorax is broadest posterior to middle, and the front is strikingly truncate between the antennæ. The anterior antennæ are in the same straight line, excepting the curves at base and apex. The longer seta near base is moveable in every direction; its length is about equal to the first three joints of the antenna. The shorter branch of the posterior antennæ is hardly a fourth shorter than the other. The pigment of the inferior eyes is quite small, and is seen in a vertical view, sometimes behind and sometimes beneath the superior eyes. There are metallic reflections from the pigment of the superior eyes. The caudal stylets are but little longer than broad.

This species is near *Pontella crispata*, but has the head laterally armed, the antennæ not thrown so much forward, and other differences.

Pontella frivola.—Plate 81, fig. 7. This may be only a variety of the last, as the general form is the same, the laterally armed head, the length, position, form, and terminal setæ of the anterior antennæ, the posterior antennæ, the position and size of the eyes. Yet, the posterior angles of the cephalothorax are rather long acute, while there are

no angles in the specimen of the *hebes* examined; the abdomen is four-jointed, instead of three, the longish seta near the base of the anterior antennæ was not observed, or not one nearly as long. It may be that this is the result after an additional moulting, and that both are thus related.

The following may possibly be *male of this species*.

Cephalothorax rather slender, posterior angles long acute; head separated by an imperfect suture, laterally armed; posterior segments three. Abdomen four-jointed. Caudal stylets short, setæ unequal, the second half longer than the others. Superior eyes separate, inferior quite small. Anterior antennæ a little shorter than the body, divergent about 170° , tips curving forward a little; the right few-jointed, subterete, joints 2, 3, 4, 5, 6, oblong, the third rather stout, 7, 8, 9 (the terminal) short; setæ rather short, apical and posterior antepenult not longer than the joint, the posterior penult one-half longer, the anterior antepenult very short. Posterior antennæ very slender, branches about equal, the setæ not longer than the branches.

Plate 81, fig. 8 *a*, animal, enlarged; *a'*, extremity of antenna.

Collected in the East Indies, west of the Island of Panay, January 28, 1842.

Length, one-twelfth of an inch. Nearly colourless; caudal setæ and anterior antennæ, brownish yellow; alimentary canal, light green. This resembles the preceding; but the posterior antennæ are remarkably slender, and the branches are about equal. Owing to this last character, I have doubted its being the *male* of the preceding. The caudal stylets are a little longer than broad. In the right antenna of the male, near the base of the third joint, there is a seta about as long as the second joint; on the fourth joint, which is the longest and largest of the antenna, there are two longish setæ distant from one another; this joint has two transverse sutures towards its base; at the apex of the next joint there is a seta as long as the last joint of the antenna. The pigment of the inferior eyes is quite small, and is seen in a vertical view behind the superior eyes.

PONTELLA DETONSA.

Caput discretum, subtriangulatum, fronte obtusiusculo. Cephalothorax 7-articulatus, segmento septimo brevissimo, posticè obtuso aut obtusiusculo. Oculi superiores remoti, inferiores majusculi, vix elongati. Antennæ anticæ cephalothorace breviores, rectæ, fere 100° divaricatæ, 20-22-articulatæ, setis totis perbrevis. Antenna dextra maris paululum incrassata, teretiuscula, fermè 20-articulata. Styli caudales elongati, vix divaricati. [Abdomen 3-articulatum.]

Head separate, subtriangular, front rather obtuse. Cephalothorax seven-jointed, short and subobtuse behind, head separate, posterior segments four, last very short. Superior eyes distant; inferior of moderate size. Anterior antennæ shorter than cephalothorax, straight, divergent about 100°, twenty- to twenty-two-jointed, joints very short, setæ all very short, neither apical nor subapical as long as the joints. Right antenna of *male* a little incrassatè, nearly terete, about twenty-jointed. Caudal stylets elongate, longer than half the abdomen, hardly divaricate. [Abdomen three-jointed, second segment the shortest.]

Plate 81, fig. 9 *a*, animal, enlarged; *b*, profile of head; *c*, extremity of left antenna of male, or of either in female; *d*, supposed to be right antenna of another specimen; *e*, front view of beak; *f*, mandible and palpus; *g*, maxilla; *h*, maxilliped; *i*, upper view of head, in another specimen. Also, fig. 10 *a*, view, enlarged; *a'*, extremity of antenna.

Collected a few individuals in the Pacific, latitude 18° 10' south, longitude 125° 20' west, August 8, 1839 (fig. 9 *a, b, c, e, f, g, h*, from the specimens of this date); also, specimens supposed to be the same species, just north of the Navigator (Samoan) Islands, latitude 12° 45' south, longitude 171° west, February 5, 1841 (fig. *d* from this specimen); also, latitude 5½° south, longitude 175° 50' east, near El Gran Cocal, March 25, 1841 (fig. 10 *a, a'*); also, probably the same, off the south end of Mindoro, in the East Indies, January 24, 1842 (fig. 9 *i*).

Length, one-tenth to one-fifteenth of an inch. Colour, deep blue. This is rather a stout species, with a triangular head laterally armed, and very short points (if any) at the posterior extremity of the cephalothorax, the fourth of the posterior segments being extremely short. The joints of the antennæ are all very short except the second; the setæ are all remarkably short, and those at apex are straight. The abdomen sometimes shows in addition to the three segments mentioned, a short basal segment; the length of the whole is scarcely one-fourth that of the cephalothorax. The stylets are longer than half the abdomen, and a little divergent.

The superior eyes have a deep carmine pigment. The pigment of the inferior eyes, as seen in a vertical view, forms a rather large spot, a little oblong transversely, and is seen just behind the superior eyes. The segments of the abdomen are variable.

The right antenna (fig. 9 *d*), in a specimen collected February 5, 1841, differed from the left; but as the posterior feet were quite small, there was no reason to consider the specimen a male. It had the same number of joints as the left, but was slightly enlarged along the middle.

Figure 3, Plate 82, represents a specimen obtained in the Pacific, north of the Samoan Islands, February 1, 1841, which is probably a variety of the *detonsa*. The anterior antennæ diverged about 115° ; the setæ were all short, the apical and subapical very nearly equal, the anterior apical barely exceeding the joint in length.

The *Pontia Savignii* of Edwards (Ann. des Sci. Nat., xiii. 1828, 296, Pl. 14), has the short antennæ and some other characters of the female of *P. detonsa*. But the hairs of the anterior antennæ as represented differ, being much longer, those of the joints about the middle of the organ being twice as long as the joints, and these joints more than twice as long as broad; moreover, the apical and subapical setæ are very different; and the maxillæ are also of different form.

PONTELLA ARGENTEA.

Caput discretum, subtriangulatum, fronte obtusum. Cephalothorax
5 (-6)-articulatus, posticè brevissimè acutus, segmentis tribus posticis sub-
æquis. Oculi superiores remoti, inferiores majusculi non elongati.

*Antennæ anticæ cephalothorace breviores, fere 90° divaricatæ et levis-
simè incurvatæ, 18-20-articulatæ, setis totis perbrevibus, duabus apica-
libus subuncinatis, articulo brevioribus. Styli caudales parce oblongi.
[Abdomen 3-articulatum.]*

Head separate, subtriangular, front obtuse. Cephalothorax short, short acute behind, five- or six-jointed, posterior segments three, abruptly smaller. Superior eyes very remote, inferior of moderate size. Anterior antennæ shorter than the cephalothorax, nearly 90° divaricate, slightly incurved, 18-20-articulate, setæ all very short, the apical two sparingly unciniate, shorter than the joint. Caudal stylets sparingly oblong. [Abdomen three-jointed, the third segment oblong.]

Plate 81, fig. 11 *a*, animal, enlarged; *a'*, extremity of antenna; *b*, base of the same; *c*, beak, nearly in profile; *d*, under view of inferior eyes.

Collected several specimens in the Atlantic, latitude 45° 35' south, longitude 60° west, January 24, 1839, just before reaching Rio Negro, Patagonia.

Length, one-twelfth of an inch. Colour, bright copper-green, with silvery or pearly reflections from the back, sides dirty orange. Some large deep blue glands posteriorly in the cephalothorax. This is a stout species like the last, and has also short, many-jointed antennæ. It differs in the posterior extremity of the thorax and the slightly incurved antennæ, as well as the unciniate setæ at apex. The sides of the cephalothorax are nearly parallel. The caudal stylets are rather stout, and the outer margins of the two are divergent. The segments of the thorax are abruptly smaller, each than the preceding. There are four pairs of natatories, the anterior of which is much the smallest. The mass constituting the inferior eyes has a subreniform shape, and appears to show by its form and appearance that there are actually two eyes. The shorter branch of the posterior antennæ is about three-fourths the length of the longer.

PONTELLA SPECIOSA.

Caput discretum, subtriangulatum, fronte obtusum. Cephalothorax 5-7-articulatus, posticè acutus aut obtusiusculus. Oculi superiores remoti, inferiores mediocres. Antennæ anticæ cephalothoracis longitudine, fere rectæ, prope 110° divaricatæ, 21-22-articulatæ; setis brevibus, apicali anticâ et penultimâ posticâ longioribus, articulum paulo superantibus, apicali posticâ et antepenultimâ posticâ brevioribus, anticâ penultimâ perbrevis. Antenna dextra maris pauciarticulata, articulo quinto latè ovato. Pes posticus dexter maris crassus, manu latâ, apice truncatâ et obtusè dentatâ, digito immobili e basi manus producto, elongato, spiniformi, digito mobili prælongo, incurvato. Styli caudales oblongi.

Head separate, subtriangular, front obtuse. Cephalothorax five- to seven-jointed, posterior angles acute or subobtuse, posterior segments three (sometimes four and obtuse behind). Superior eyes remote, inferior of moderate size. Anterior antennæ about as long as the cephalothorax, nearly straight, about 110° divergent, twenty-one- to twenty-two-jointed; setæ short, anterior apical and posterior penult rather longer than the apical joint, the posterior apical and antepenult shorter, the anterior penult very short. Right antenna of *male* few-jointed, fifth joint large and broad ovate, the following five (or last) slender. Right posterior leg of male stout, hand broad, truncate at apex and obtusely dentate, immoveable finger produced from base of hand, elongate, spiniform, moveable finger very long, incurved. Caudal stylets oblong, second seta nearly half the longest. Abdomen four-jointed.

Plate 82, fig. 1 *a*, view, enlarged; *a'*, profile of head in some individuals; *b*, posterior feet, enlarged two diameters more than fig. *a*; *c*, extremity of thorax and abdomen in some small individuals.

Abundant, March 4, 1841, at the eastern entrance of the Straits of Sunda.

Length, one-twelfth of an inch. Colour, deep green, with a broad silvery band (as long as broad) across the middle of the cephalothorax.

The pigment of the inferior eyes is seen in a vertical view just behind the superior eyes, and is transverse, being slightly oval. The antennæ have the setæ towards the base numerous, and but little longer than two diameters of the joints. The male right antenna is bent outward a little at the large joint, and again forward at the third articulation from the extremity. The character and colour presented in figure 1 *a*, were constant for the larger specimens. But some smaller individuals had the cephalothorax obtuse behind, with a very short posterior segment (as in fig. 1 *c*), and the abdomen was only two-jointed. The length of the caudal stylets is more than twice their breadth.

The beak in many individuals was large ventricose at base, as shown in figure 1 *a'*.

The right posterior leg of male is very large. The second joint is stout oblong. The next is very broad, subtrapezoidal, with the upper side arcuate, and the two others nearly straight, the one opposite the articulation with the second joint dentate, the other bearing two remote setæ; the base of this joint is prolonged outward into a long, curving spine, into which the joint diminishes. The fourth joint is a long arcuate finger articulated with the more distant angle of the dentate side of the third joint. The left leg of the same pair is simple, and terminates in a short joint, bearing four bent unequal spines.

The males and females contain within a deep blue glandular mass, which extends along either side, somewhat irregularly, nearly to the base of the posterior antennæ, and two spots of similar colour appear through the silvery back, one behind the other.

Var. formosa. (Plate 82, fig. 2 *a, a'*).—The individual here figured closely resembles the preceding, and was collected at the same time. The anterior and posterior antennæ, the eyes, and the caudal stylets, are similar to the above; so also the general form of the body, except that there were four posterior segments to the cephalothorax, the last very short, and the posterior angles were less prominent; also, the abdomen was three-jointed. The anterior antennæ were a little shorter than the cephalothorax; the second joint shorter than in the preceding, owing apparently to articulations across its apical portion, which thus make twenty-three or twenty-four joints to the antenna. The colour strikingly differs, the body being clear yellow, verging to

orange, with a broad crimson band across the middle. Only this one specimen was seen, while of the former, having a green colour and silvery back, there were great numbers uniformly alike in colour, both male and female. A pair of oblong blue glandular masses were observed in the posterior part of the cephalothorax, and also in the anterior part, either side of the mouth; also, two small spots of the same colour were situated near the middle of the cephalothorax, on the medial line.

PONTELLA PRINCEPS.

Feminæ:—*Caput discretum, subtriangulatum, fronte obtusiusculum. Cephalothorax 6-articulatus, posticè elongatè acutus, articulis tribus posticis subæquis. Oculi superiores remoti; inferiores mediocres, parce elongati. Antennæ anticæ cephalothorace parce breviores, rectiusculæ, fermè 110° divaricatæ, setis brevibus, apicali anticâ articulos duos æquante, ceteris apicalibus et subapicalibus brevioribus. Styli caudales perbreves. [Abdomen 4-articulatum, distortum.]*

Female:—Head separate, subtriangular, front rather obtuse. Cephalothorax stout, posterior angles long and divaricately acute, posterior segments three. Superior eyes remote, inferior a little elongate. Anterior antennæ slightly shorter than cephalothorax, nearly straight, divergent 110°; setæ short, anterior apical about as long as two joints, the other apical and the subapical not longer than a joint or shorter. Shorter branch of posterior antennæ about half the other in length. Caudal stylets very short; setæ spreading. [Abdomen four-jointed, gibbous.]

Plate 82, fig. 4 *a*, animal, enlarged; *a'*, extremity of an antenna; *b*, beak, in profile; *c*, posterior part of cephalothorax and abdomen, in profile.

Collected, March 29, 1840, in the Pacific, two hundred and fifty miles south by west from Tongatabu, on a calm day.

Length, one-fourth of an inch. Colour, deep blue, with a pearly white back. This is the largest *Pontella* seen by the writer. The

antennæ have a seta a little longer than others at the apex of the fourth joint from the apex; those setæ near the base were mostly about two diameters of their joints in length. The four terminal joints are short, and so also their setæ, except the anterior apical seta, which is as long as two joints.

The posterior of the cephalothorax has a tooth either side of the abdomen, some distance within the long acute points. The abdomen appears distorted, it having an angle on the left near the middle, and an acute process above (see fig. 4 a and c). The beak is short and directed downward, or is but a little inflexed.

PONTELLA FERA.

Caput vix discretum, subtriangulatum, fronte rotundatum. Cephalothorax 6-7-articulatus, posticè obtusus aut obtusiusculus, segmento postico brevissimo. Oculi superiores remoti, inferiores grandes, non elongati. Antennæ anticæ vix cephalothoracis longitudine, fermè 21-articulatæ, 130° divaricatæ, setis prope basin sublongis, confertis, aliis brevibus, apicali anticâ et penultimâ posticâ articulo vix longioribus. Antenna antica dextra maris subteres, 11-12-articulata, articulo secundo longo, tertio brevissimo, quarto sub quinto producto, proximo spinam reversam ferente. Pes posticus dexter maris tenuis, manu subcylindricâ, ad apicem breviter acutâ, ad medium spinam longam uncinatam gerente, digito mobili tenuissimo, ad apicem spatulato et concavo. Styli caudales elongati, divaricati.

Head hardly separate, subtriangular, rounded in front. Cephalothorax six- to seven-jointed, behind subacute or obtuse, posterior segments four, the last very short. Superior eyes remote, inferior of moderate size. Anterior antennæ nearly as long as the cephalothorax, about twenty-one-jointed, diverged 130°; setæ towards base crowded, anterior apical longer than the joint, posterior penult a little shorter, the other terminal short. Right antenna of male subterete, eleven- to twelve-jointed, second joint oblong, third very short, fourth extends along the posterior side of the fifth, sixth bearing a short reversed spine, the following one slender, anteriorly excavate, the remaining four slender. Right posterior foot of male slender, hand subcylindrical, short acute at apex, having a long

uncinate spine near middle, finger very slender, spatulate, and concave at apex. Caudal stylets long, divaricate.

Plate 82, fig. 5 *a*, animal, enlarged; *a'*, extremity of female antenna; *b*, part of male right antenna; *c*, profile of head; *d*, front view of beak; *e*, abdomen of a male; *f*, profile of female abdomen; *g*, another female abdomen, upper view; *h*, lips; *i*, view of mandible; *j*, mandible (in another position) and its palpus; *k*, maxilla; *l*, right posterior foot.

Collected several individuals, February 1 and 5, 1840, in the Pacific, north of the Samoan Islands, latitude 11°–12° 45' south, longitude 170°–171° west.

Length, one-twelfth of an inch. Colour, deep blue, sometimes a little pearly white along the back. This species has the antennæ more divergent than the preceding, and the long caudal stylets are divaricate. The male is not quite as stout as the female. The setæ towards the base of the antennæ are two or three diameters of the joints in length, and are somewhat curved. The smaller branch of the posterior antennæ is about as long as the longer, exclusive of the last joint. The pigment of the inferior eyes forms a rounded spot, slightly transverse, posterior to the superior eyes. The abdomen is five-jointed in the males, diminishing gradually from the first. The female abdomen has but three segments, the second large ovate, occupying more than half its whole length; the apical is short. In one female there was a recurved process on the right side. The stylets are about half as long as the abdomen, or a little exceed half in females. The longest of the caudal setæ is about as long as the abdomen and stylets.

Mandibles and maxillæ as in the figures.

The male right antenna has no ciliation on the posterior side along the basal half, like the left antenna. The second joint is also much longer; the fourth and fifth together form properly a single joint, the fourth being short, except that it is prolonged below the fifth; the fifth has two or three long setæ at apex, directed outward in the line of the antennæ. The last three joints are like those of the left antenna, but are together somewhat arcuated.

The right posterior foot has the third joint oblong and articulated

with the preceding below its middle; one extremity is bent, and terminates in a stout but short spine, the other is articulated to a long very slender joint, which has a spatulate or spoon-shaped extremity that plies against the spine alluded to. On one side of the third joint there is nearly at right angles with it, another spine, longer and more slender, and bent; also, on the inner side there are one or two dentations.

PONTELLA VALIDA.

P. feræ affinis. *Caput discretum. Cephalothorax postice breviter acutus. Oculi superiores remoti. Antennæ anticæ cephalothorace non breviores, setis brevibus, apicali anticâ longiore; maris dextra subteres, medio (articulis 5-8) incrassata, parte crassâ postice leviter subtriangulatâ vel arcuatâ, transversim 4-articulatâ, articulo sequente longo, ad basin spinâ reversâ antice armato. Pes posticus dexter maris latus et crassus, manu oblongâ, ad apicem inferiorem spinam longam parce arcuatam gerente, digito crasso.*

Near *P. fera*. Head separate. Cephalothorax short acute behind. Superior eyes remote. Anterior antennæ as long as cephalothorax, setæ short, the anterior apical seta longest. Right antenna of *male* subterete, incrassate at middle, the incrassate part subtriangular or arcuate behind, transversely four-jointed, the next joint long, and having a reversed spine at base on anterior side. Right posterior foot in *male* stout and broad, hand oblong, at lower apex bearing a long somewhat curved spine or immoveable finger, finger stout.

Plate 82, fig. 6 *a*, front, showing beak in profile, and lens of one of the superior eyes; *b*, right antenna of male; *c*, part of same, more magnified; *d*, natatory of first pair; *e*, *ibid.* of fourth pair; *f*, posterior legs of male; *g*, abdomen of a male (abnormal form).

North of New Zealand, towards Tongatabu.

Length of body, one and a half lines. Although this species resembles the *fera* in its male antennæ, it still differs in the articulations of the incrassate part; and the posterior feet in the male are

very unlike those of that species; in this, the long spiniform immoveable finger extends transversely; the moveable finger is terminal, while in the *fera* it is medial; moreover, the moveable finger is quite stout and does not enlarge towards the extremity. The spiniform immoveable finger has on its inner side a rasp-like surface. Of the last three joints of the male right antenna, the antepenult is much the longest; the posterior penult seta is a little longer than the apical joint; the other subapical setæ are shorter.

GENUS CATOPIA, Dana.

Quoad antennas posticas et habitum antennarum anticarum Calano affinis; antennam maris anticam dextram Pontellæ affinis. Oculi superiores nulli. Oculus inferior unicus (?).

Allied to the *Calani* in the posterior antennæ and the position of the anterior; and to the *Pontellæ* in the right antenna of the male. Superior eyes wanting. Inferior eye single (?).

The species of this genus observed, has the habit of a Calanoid Pontella (*P. elliptica*, &c.); the anterior antennæ having a double curvature with the tips not in advance of the line of the front, and the posterior having three setæ to apex of one branch, and several setæ on back side of first joint of same branch. Like the Pontellæ, it has the right male antenna geniculating. The setæ of these antennæ are short, and are arranged along the anterior margin. It differs from the species of all other Calanidæ observed, in having no superior eyes. The lens of only one inferior eye was observed, although the specimen was examined with much care. It presented a distinct spherical lens, of unusually large size, with deep red pigment behind. The pigment was deepest in colour at a distance from the lens, and anteriorly about the inner portion of the lens there was an orange-yellow colour.

Catopia, DANA, Proc. Amer. Acad. Sci., ii. 25, where the following new species is described by the author.

CATOPIA FURCATA.

Gracilis. Caput quadratum, non discretum. Cephalothorax 4-articulatus, posticè 4-spini-dentatus, dentibus externis longioribus. Antennæ anticæ corpore longiores, duplo curvatæ, multi-articulatæ, graciles, medio parce incrassatæ, apicibus fronte non anterioribus: setis totis brevibus, anticâ apicali et posticâ penultimâ articulo non longioribus, anticâ penultimâ et antepenultimis valde brevioribus. Antennæ posticæ parvulæ. Abdomen 5-articulatum. Styli caudales elongati, dimidio abdominis longiores, divaricati, setis inæquis.

Slender. Head quadrate, not separate. Cephalothorax four-jointed, posterior extremity with four spinous processes, the two inner smaller than the outer. Anterior antennæ longer than the body, doubly curved, tips in the line of the front, many-jointed, slender, at the middle sparingly incrassate; setæ all short, the anterior apical and posterior penult as long as the joint of each, the anterior penult and the antepenult much shorter. Posterior antennæ quite small. Abdomen five-jointed. Caudal stylets slender, more than half the length of the abdomen, divergent; setæ unequal.

Plate 79, fig. 1 *a*, animal, enlarged; *a'*, side view of head, more enlarged; *b*, extremity of left antenna; *c*, enlarged view of geniculating articulation in right antenna; *d*, base of antenna, showing short stout spines.

Straits of Banca, March 2, 1842.

Length, one-sixteenth of an inch. Colourless, or nearly so.

The view of the head in fig. 1 *a*, shows the spherical lens under an exterior hemispherical cornea, and connected within with a mass of pigment. A filament, supposed to be nervous, connects with a mass just behind; while another, apparently muscular, extends upward, although lax, and is attached to the shell. The lens was observed to be in constant vibration beneath the cornea. The beak is very short.

The geniculating joint of the right antenna is situated just anterior to the last five joints; the first and second of the five, however, are

coalesced in one. The six joints preceding the geniculating joint are a little enlarged to contain the flexor muscle. Near the base of the antennæ there are three short stout spinules.

FAMILY II. CYCLOPIDÆ.

THE Cyclopidæ are closely related to the Calanidæ. In some species, the mandibular and maxillary palpi are considerably developed, and show forms similar to those of the preceding family, although these parts are always much less prominent and the setæ less spreading. The subprehensile character of the first pair of legs, at times becoming perfectly prehensile with a well-formed monodactyle hand, is the more striking characteristic of the family; for in the Calanidæ these legs never have this character. In this peculiarity, they resemble the *Corycæidæ*. They also often have appendages to the first or second abdominal segment, which do not occur in any Calanidæ.

The eyes are situated on a single spot of pigment, which is sometimes subquadrate in form. The inferior eyes are not found in this family.

The cephalothorax is either four- or five-jointed. These segments, as shown in figures 1 B, 2, and 8 (Plate 70) never include the seventh, which is common in *Pontella*, neither is the first or cephalic segment separated from the following by the suture *a* in any observed species of the group; and it is rarely the case that a suture *b* is present, shown in figure 2, by which method alone the number of segments becomes *five*. In this case, according to a figure by Philippi, of a species of his genus *Laophon*, the anterior of the five segments bears the two pairs of antennæ, the mandibles, one pair of maxillæ, one pair of maxillipeds, and the anterior feet; the second segment and the following three bear each a pair of legs. There does not appear to be the same variations in the number of thoracic articulations among closely similar species in this family as in the Calanidæ: on the contrary, there is a remarkable constancy among the species of a given type; and, consequently, the number of segments may be used as a generic character.

The anterior antennæ never attain the length found in some Calanidæ, and are generally quite short, though occasionally as long as the body. Unlike those of the Calanidæ, they are frequently furnished with a lateral appendage (figs. 42 *a*, 43, Plate 70). In males, either both of these antennæ are furnished with a geniculating joint for grasping in coition, or else neither is so modified. (Figures 18 *a* and 18 *b*, are male and female, so also, 19 and 20, and 42 *a* and 42 *b*.) And when not thus modified, these organs have often an unusual degree of flexibility, as in *Setella* and *Clytemnestra*.

The posterior antennæ terminate in setæ which act like fingers, and generally they have a small accessory branch.

The mandibles may have a distinct two-branched palpus, as shown in figure 62, Plate 71 (of a species of Harpacticus); it is but sparingly furnished with spreading setæ, though sometimes ending in one or two long hairs.

The maxillæ are small and lamellar, with a minute one- or two-jointed palpus.

The maxillipeds (fig. 76, Plate 71) sometimes approach the form in *Pontella*, or more nearly that of *Oithona*; they are armed anteriorly with setulous setæ and terminate in a nearly straight claw. In other cases, they are hardly flexed three-jointed organs, and have but few setæ.

The first pair of feet, often called jaw-feet, have a prehensile character. They may have the form of a monodactyle hand (figure 86), as in *Setella*, *Harpacticus*, &c., and have no accessory branch; or the structure may be imperfectly didactyle, as in *Cyclops* (fig. 89) where a small joint, ending in one or two stout setæ, acts against a projecting part of the preceding joint. In this genus, the leg has an accessory branch, which is one- or two-jointed and setigerous.

The second pair of feet is usually two-branched and setigerous, like the natatories following. But they may be nearly naked, excepting some short setæ or spinules, and sometimes one branch is obsolescent; and they are thereby fitted imperfectly for prehension. They have when thus modified, some lateral play, and appear at times to be used for grasping in coition. The natatories have the usual character. The posterior thoracic pair, pertaining to the twelfth normal segment, is obsolete or nearly so.

The abdomen is five- or six-jointed, and may or may not be abruptly smaller than the cephalothorax. The first joint is sometimes

concealed by the last thoracic segment or is obsolete. The first or second segment, or both, may bear appendages below, and the latter segment gives exit to the eggs, supporting the external ovarian sac or sacs.

The Cyclopidæ, like the Corycæidæ, include both subcylindrical and depressed species.

The species of the genus *Cyclops* carry two bags of eggs beneath the abdomen, while those of *Harpacticus* and the allied have but one. Two subfamilies are thus indicated, the CYCLOPINÆ and HARPACTICINÆ. The former species swim freely in the water, but are incapable of making any progress out of it. The latter, as far as examined by the author, have a much more flexible body, and with a sort of wriggling motion they move themselves readily over a wet surface. They often thus crawl out of the field of view, when upon a piece of glass under the microscope, although the water may be barely sufficient to keep the body wet. A *Cyclops* in the same condition could not crawl off, but might throw itself to a distance by a spring or leap, by means of the abdomen.

There appears also to be another group, containing some species with depressed bodies, described by H. D. S. Goodsir.* But the descriptions are too meagre and unsatisfactory for us to determine from them the characteristics of the group. The form is somewhat like that of *Sapphirina*; but the eyes are minute, and they are in general situated within a short projecting beak or prominence of the front. The superior antennæ are short, and in one species, they are represented with *two* branches, while in the Corycæidæ, the superior antennæ are always simple or without an accessory branch. The caudal stylets as represented by Goodsir are short subcylindrical, and in one species three-jointed.

Several new genera have been added to the family Cyclopidæ, by Philippi.† In some cases, we are left by this author in uncertainty, as to whether the genus is characterized by having two bags of eggs or one, and it is therefore doubtful to which subfamily they should be referred. His genera *Euryta*, *Idomene*, and *Psammathe*, we are therefore unable to refer to their true place. From the anterior antennæ being appendiculate, *Euryta* may be related to *Harpacticus*; yet both this and *Psammathe* appear to have the habit of *Cyclops*.

* Ann. and Mag. N. H., xvi. 1845, 325.

† Archiv f. Naturgeschichte, vi. 186, 1840, and ix. 54, 1843.

Dr. W. Baird, the author of the learned work on British Entomotraca has also added to the family a genus, called *Alteutha*, which is a depressed form of Harpacticus. His work also recognises the genus *Canthocamptus* of Westwood, which was instituted, as he shows, in 1846, for a group with *Cyclops minutus* of Müller for its type. Milne Edwards, in the third volume of his *Histoire Naturelle des Crustacés*, published in 1840, referred the species *Cyclops minutus*, Müller, to his new genus *Cyclopsina*, which was instituted also for the *C. castor*, one of the Calanidæ. Moreover, this author introduced the genus *Harpacticus* for the *Cyclops chelifer*, a related species. The same year Philippi proposed the name *Nauplius* (*Archiv f. Naturg.*, vi. 189) for a genus identical with Harpacticus; and in 1844, M. Koch, in his *Deutschl. Crust.*, gave the name *Doris* to a group having the *Cyclops minutus* for its type. Baird, in his recent work, adopts the genus *Canthocamptus* of Westwood, with the type *C. minutus*, and also, *Harpacticus*, with the type *C. chelifer*, distinguishing the two mainly by the size of the first pair of legs, this pair being very small in the former, and moderately large in the second. In form, these legs are essentially the same, although Dr. Baird's description seems to imply a difference besides that of size; and the distinction he adduces seems not to be important. The groups may, however, be distinct, if, taking the same types, we disregard the size of these legs, and look for a better characteristic to the next pair of legs. In the *C. minutus* and several species allied, the branches of this pair of legs are three-jointed, while in the *C. chelifer* they are two-jointed. On this ground, the genera may both be retained. The body is commonly nearly linear, or narrows gradually backward in *Canthocamptus*, with little or no interruption at the abdomen; while it narrows abruptly, as far as we have observed, in Harpacticus. The *Harpacticus nobilis* of Baird has one branch reduced to a single joint, and the thorax is very much thicker than the abdomen. This may be the type of another genus, for which we suggest the name *Westwoodia*.

These explanations prepare the way for the following synopsis of the subfamilies and genera of Cyclopidæ.

SUBFAM. 1. CYCLOPINÆ.—Sacculi ovigeri duo.

- G. 1. CYCLOPS.—Cephalothorax 4-articulatus. Pedes 1mi articulo penultimo ad apicem internum elongato instar digiti immobilis, et digito mobili parvulo setigero. Corpus subcylindricum. Appendix abdominis basalis parva. Antennæ anticæ feminæ non appendiculatæ; maris articulatione geniculante confectæ.

An hujus sedis? PSAMMATHE, *Philippi*.* — Cephalothorax 4-articulatus. Pedes 1mi lamellis duabus confecti. Corpus subcylindricum. Antennæ anticæ non appendiculatæ.

Quoque (?). IDOMENE, *Philippi*.†—Cephalothorax 5-articulatus. Pedes 1mi ac in *Cyclope*. Corpus subcylindricum. Appendix abdominis basalis sat magna, 2-articulata, setulosa.

Quoque (?). EURYTE, *Philippi*.‡—Cephalothorax 5-articulatus. Pedes 1mi unguibus duobus confecti. Corpus subcylindricum. Abdomen angustum. Appendix abdominis basalis nulla.

SUBFAM. 2. HARPACTICINÆ.—Sacculus ovigerus unicus.

1. *Cephalothorax 4-articulatus*.

G. 1. CANTHOCAMPTUS, *Westwood*.§—Corpus vix depressum, sæpius lineare vel sensim angustans. Pedes 1mi sæpissime parvuli; 2di biramei, ramis 3-articulatis. Antennæ 1mæ *feminæ* appendiculatæ, *maris* articulatione geniculantes. Appendix abdominis basalis sat parva.

G. 2. HARPACTICUS, *Edwards*.||—Corpus vix depressum, sæpius quoad abdomen subito angustius. Pedes 1mi monodactyli, sæpe majusculi; 2di biramei, ramis 2-articulatis. Antennæ 1mæ ac in *Canthocampto*.

G. 3. WESTWOODIA, *D*.¶—*Harpactico* affinis. Pedes 1mi monodactyli sat magni; 2di biramei, ramo uno perbrevis, 1-articulato.

G. 4. ALTEUTHA, *Baird*.**—Corpus valde depressum. Pedes et antennæ ac in *Canthocampto* vel *Harpactico*. Appendix abdominis basalis valde elongata, falci-formis.

G. 5. METIS, *Philippi*.††—Corpus subcylindricum. Frons appendicibus non instructus. Pedes 1mi ac in *Cyclope*. Antennæ 1mæ 2dis minores, appendiculatæ. Abdomen 5-articulatum.

* Philippi, *Archiv für Naturgeschichte*, vi. 1840, 189.

† *Ibid.*, ix. 1843, 63.

‡ *Ibid.*

§ *Canthocamptus*, *Westwood*, *Partington's Cyclop. Nat. Hist.*, Art. Cyclops, and *The Entomologist's Text Book*, 115; *Baird*, *Trans. Berw. Nat. Club*, i. 97, ii. 154, and *Mag. Zool. and Bot.*, i. 326; *Cyclopsina* (in part), *Edwards*, *Crust.*, iii. 427; *Nauplius* (in part), *Philippi*, *Archiv f. Nat.*, vi. 1840, 189; *Doris*, *Koch*, *Deutschl. Crust.*, 1841; *Harpacticus* (in part), *Dana*, *Proc. Amer. Acad. Sci.*, i. 151, 1847.

|| *Arpacticus*, *Edwards*, *Crust.*, iii. 430; *Nauplius* (in part), *Philippi*, *Arch. f. Nat.*, vi. 1840, 189.

¶ *Arpacticus* (*A. nobilis*), *Baird*, *Trans. Berw. Nat. Club*, ii. 155, 1845, *Ann. Mag. N. H.*, xvii. 416, and *Brit. Entomost.*, 214.

** *Alteutha*, *Trans. Berw. Nat. Club*, ii. 155, 1845, and *Ann. Mag. N. H.*, xvii. 416, and *Brit. Entomost.*, 216.

†† *Metis*, *Philippi*, *Archiv f. Naturg.*, ix. 59, 1843.

- G. 6. *CLYTEMNESTRA*, *D.**—Corpus paulo depressum. Pedes 1mi portentosæ magnitudinis, monodactyli. Antennæ 1mæ *maris* articulatione non geniculantes, flexiles, longiores.
- G. 7. *SETELLA*, *Dana*.†—Corpus perangustum, setis caudalibus prælongis, rectis. Frons appendices duas falciformes infra gerens. Antennæ 1mæ *maris* articulatione non geniculantes, appendiculatæ. Pedes 1mi monodactyli, mediocres. Appendices abdominis quatuor setigeræ.

2. *Cephalothorax 5-articulatus* (*Corpus subcylindricum*).

- G. 8. *LAOPHON*, *Philippi*.‡—Pedes 1mi mediocres, monodactyli; 2di ramo uno sat longo, 2-articulato, altero rudimentario. Abdomen 5-6-articulatum, appendice basali majusculâ instructum.
- G. 9. *ONCÆA*, *Philippi*.§—Pedes 1mi prægrandes, monodactyli. Abdomen 6-articulatum, appendice basali carens.
- G. 10. *ÆNIPPE*, *Philippi*.||—Pedes 1mi mediocres unguibus duobus confecti; 2di ramis duobus 3-articulatis. Abdomen 5-6-articulatum, appendice basali carens.
- G. 11. *IDYA*, *Philippi*.¶—Pedes 1mi setis plurimis instar digitorum armati. Antennæ 2dæ ramo accessorio.

SUBFAM. 3. STEROPINÆ.—Habitu *Sapphirinis* paulo similes, sed oculis superioribus minutis conjunctis in processum rostriformem sæpe insitis, stylisque caudalibus vix lamellatis discrepant. Pedes 1mi monodactyli, ac in *Corycæo*. Antennæ breves.

- G. 1. *ZAUS*, *Goodsir*.**—Antennæ 1mæ biramæ. Styli caudales 3-articulati.
- G. 2. *STEROPE*, *Goodsir*.††—Antennæ 1mæ simplices. Styli caudales uni-articulati.

Mr. Goodsir describes also another genus, which he calls *Carrillus*; but no satisfactory distinctive characters are mentioned. The antennæ are a little peculiar in having a clavate termination. These species, although like *Sapphirina*, are readily distinguished (if they are correctly figured by the author), by the caudal stylets, which have in that genus a character that cannot be mistaken.

Philippi has also described three genera of depressed or subfoliaceous species, which are of uncertain relations.

* *Clytemnestra*, *Dana*, Proc. Amer. Acad. Sci., i. 153, 1847.

† *Setella*, *Dana*, Amer. J. Sci. [2], i. 227, 1846.

‡ *Philippi*, Archiv f. Naturg. vi. 189, 1840.

§ *Ibid.*, ix. 62, 1843.

|| *Ibid.*, ix. 61, 1843.

¶ *Ibid.*, ix. 58, 1843.

** Ann. Mag. Nat. Hist., xvi. 1845, 326. In figure 6, Pl. xi., the antennæ of the first pair is represented as two-branched.

†† *Ibid.*, 325.

His *Peltidium** closely resembles Sapphirina in habit and external form, and may be of that genus. The spectacle-eyes, or conspicilla, are not represented; but it was true also of the original description of Sapphirina, that they were overlooked.

Hersilia† is in all probability related to the Caligidæ, as Milne Edwards observes; and as the specimen was but one and a half lines long, it may have been young.

Thyone‡ is very peculiar in its appearance, differing much from the known genera of both the Cyclopoidea and Caligoidea. The outline on Plate 71, fig. 115, from Philippi, gives its general form. The body consists of but five segments, and the caudal stylets fill up a space in the extremity of the body, as in some Spheromidæ, instead of projecting beyond. The natatory legs have the usual Cyclops form, and are but six in number. The first pair of legs, or the pair anterior to the natatories, end in two small lamellæ, somewhat like those of Psammathe.§

SUBFAMILY I. CYCLOPINÆ.

GENUS CYCLOPS.

As in the preceding family, we number the caudal setæ 1, 2, 3, 4, 5, beginning with the inner one of each side. The first is shorter than the third, and the fourth is shorter than the first; the second is the longest; the fifth is quite short, and is situated on the outer side of the stylet.

The species of Cyclops swim freely, and with a saltating motion.

* Philippi, Archiv für Naturgeschichte, iv. 1839.

† Ibid., p. 128.

‡ Philippi, Archiv für Naturgeschichte, iv. 1839. His description is as follows:—

“Corpus depressum, scutiforme, ovatum, segmentis 5 constans, segmento 1mo maximo. Cauda e lamellis duabus formata. Oculi duo confluentes. Antennæ 4; anteriores multiarticulatæ; inferiores 3-articulatæ, apice setis uncinatis, basi seta pectinata munitæ. Pes masticatorius [nobis pes 1mi] apice lamellis duabus laminatus. Pedes sex natatorii birami. Pedes spurii duo, lamellares, spatium inter segmentum penultimum caudamque opplentes.”—Sp. *Th. viridis*, $\frac{1}{4}$ ''' long.

§ The new species of Cyclopidæ beyond, are briefly described in the Proceedings of the Amer. Acad. Sci., i. 1847.

In a view from above the jointed appendages are often concealed from sight excepting the two pairs of antennæ. The anterior antennæ extend laterally from either side of the head, usually with a double curvature, like either half of a bracket (—). The posterior pair are either projected laterally, just behind the posterior, or else anteriorly, so as to appear in front of the head; and by means of the setæ, which may be spread or closed like the fingers of a hand, the animals may attach themselves to objects.

CYCLOPS BRASILIENSIS.

Cephalothorax posticè obtusus, abdominem longitudine superans. Antennæ anticæ in utroque sexu elongatæ (cephalothorace longiores), articulis primo secundoque majoribus et setis oblongis apice instructis, setis antennarum aliis brevibus; maris 7-articulatæ, articulis tribus basilibus crassissimis, reliquis teretibus; feminæ, 14-articulatæ, teretes. Styli caudales oblongi, tres articulos abdominis ultimos simul sumptos fere æquantes; setâ secundâ fere abdominis longitudine, primâ dimidio brevior.

Cephalothorax having the posterior angles obtuse, longer than the abdomen. Anterior antennæ of both sexes longer than cephalothorax, first and second joints largest and furnished with oblong setæ at apex, other setæ of the antennæ short. Antennæ of *male* seven-jointed, three basal joints very stout, the rest terete. Antennæ of *female* fourteen-jointed, terete. Caudal stylets oblong, as long as the last three abdominal joints; second seta nearly as long as abdomen, the first one-half shorter.

Plate 83, fig. 1 *a*, male, enlarged; *b*, lateral view, showing the beak and alimentary canal; *c*, second pair of antennæ; *d*, extremity of maxillipeds; *e*, one of the natatory legs; *f*, female antenna; *g*, abdomen, with external ovaries of female.

At Rio Janeiro, in stagnant pools, December, 1838.

The specimens of this species collected were colourless. Eyes placed on a large spot of pigment, of a reddish black colour. Abdo-

men six-jointed; the first or basal segment short, having two very short setæ on either side at apex of this segment and the following one. Anterior antennæ of the *male* have the first three joints quite stout, with a few short setæ on the front margin, and one or two at apex of first and second joints, which are as long as the first joint, or rather exceed it; other setæ of the antennæ much shorter.

The fourth joint of the anterior antennæ in the male corresponds to four joints in the female, as is apparent from indistinct articulations; the fifth corresponds to three, and the sixth to two joints in the female; so that the relation of the two may be expressed as follows:—

Female,	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Male,	1	2	3		4			5			6		7	

In the female, the first two and the last three joints are the longest; the setæ of the three terminal joints are about as long as the joints, or a little shorter; the posterior seta of the antepenult joint is longer than the anterior of the same; the terminal joints are more slender than in the male. In the male, the extremity of these organs may be flexed upon the basal portion, and there is a geniculating joint, though it is not very distinct.

The maxillipeds terminate in a small moveable finger, having a claw and two or three short setæ at the extremity. The preceding joint is stout and has a projecting angle on the inner side, which is tipped with a minute spine, and the moveable finger folds against the surface below this spine. The stomach occupies nearly the whole cephalothorax, the intestine commencing in the segment before the last.

The ovarian sacs, in the females examined, were much elongate, a little divergent, projecting behind and some distance beyond the apex of the stylets. The number of eggs was quite large.

CYCLOPS CURTICAUDUS.

Feminæ:—*Nudus*. *Cephalothorax* posticè obtusus, *abdominem* longitudine valde superans. *Antennæ* anticæ dimidio cephalothorace valde longiores, 13–14-articulatæ, articulis brevibus, quinque basalibus non oblongis;

setis inæqualibus, posterioribus articulorum penultimi et præantepenultimi longioribus (quatuor articulos ultimos simul sumtos longitudine æquantibus), anterioribus perbrevibus. Styli caudales prælongi, dimidio abdomine vix breviores, setis brevibus, secundâ tertiâque subæquis et stylo paulo longioribus.

Female.:—Naked. Cephalothorax having the posterior angles obtuse, much longer than the abdomen. Anterior antennæ two-thirds the length of the cephalothorax, thirteen- or fourteen-jointed, joints short, five basal not oblong; setæ of antennæ quite unequal, the posterior of the penult and præantepenult joints longest, equalling the last four joints together in length, anterior of same joints very short. Caudal stylets very long, nearly equalling half the abdomen, setæ short, the second and third nearly equal and slightly longer than the stylets.

Plate 83, fig. 2 *a*, female, enlarged; *b*, extremity of antennæ; *c*, extremity of posterior antennæ; *d*, extremity of maxillipeds.

Brackish water, Valparaiso, May, 1839.

Length, one-twentieth of an inch. Second pair of antennæ quite slender. Maxillipeds have a finger-like joint at apex, terminating in three or four setæ, and the preceding joint is largest near apex, with the inner margin setulose. Anterior pair of natatory legs a little the smallest. External ovarian sacs oblong, purple; nine or ten eggs in each, in the specimens examined.

CYCLOPS PUBESCENS.

Cephalothorax pubescens, abdomen longitudine vix superans, posticè subacutus. Antennæ anticæ feminæ dimidii cephalothoracis longitudine, 8-9-articulatæ, setis totis brevibus; maris breviores, tribus articulis basalibus perbrevibus, quarto crassissimo subovato, dimidii antennæ longitudine, ultimo (forsan duplice) tenui brevique, digiti-formi. Styli caudales abdomine quadruplo breviores; setâ secundâ abdomine longiore, primâ brevissimâ.

Cephalothorax pubescent, but slightly longer than abdomen, subacute

at the posterior angles. Anterior antennæ of *female* half as long as cephalothorax, eight- or nine-jointed, setæ all short; of *male* shorter, three basal joints very short, fourth very stout, subovate, half as long as the antenna, last joint (perhaps a double one) a slender finger, half as long as the fourth. Caudal stylets scarcely a fourth the length of the abdomen, second seta longer than the abdomen, the first a short spine.

Plate 83, fig. 3 *a*, male, enlarged; *b*, female antenna; *c*, caudal setæ, magnified; *d*, bag of eggs, enlarged.

Fresh-water pools, Valparaiso, May, 1839.

Length, one-twenty-fourth of an inch. Colourless and nearly transparent. Caudal stylets scarcely three times their breadth in length. Third seta of the stylets about half the length of the second. In anterior antennæ of female the two terminal joints are longer than the two preceding, and the fifth from the apex is the longest. External ovarian sacs, dark purple, and each containing five or six large eggs; they extend as far back as base of stylets.

CYCLOPS MAC LEAYI.

Feminæ:—*Cephalothorax abdomine valde longior. Antennæ anticæ longæ (cephalothoracem æquantēs), ad basin paulo crassiores; articulo secundo oblongo, 5–6 sequentes brevissimos simul sumtos longitudine fere æquante, 10 reliquis paulum oblongis, septimo longiore; setis articuli secundi et septimi parum elongatis, duorum subultimorum totis brevibus, ultimi articulum longitudine vix superantibus. Styli caudales tenues, duos articulos abdominis longitudine æquantēs, setâ secundâ abdomine breviorē, primâ fere styli longitudine.*

Cephalothorax much longer than the abdomen. Anterior antennæ as long as cephalothorax, rather stout at base, many-jointed, second joint oblong, nearly as long as the five or six following together, which are each very short, remaining ten a little oblong, the seventh longest, setæ of second and seventh joints somewhat elongate, on the two subultimate joints all shorter than the joints, on

the terminal one a little longer than the joint. Caudal stylets slender, as long as last two abdominal segments, the second seta shorter than the abdomen, the first not longer than the stylets.

Plate 83, fig. 4 *a*, female, enlarged; *b*, extremity of antenna.

Fresh-water pools, near Sydney, New South Wales, December, 1839.

Length, one-twenty-fourth of an inch. Nearly colourless. Abdomen together with the caudal stylets nearly as long as the cephalothorax. Antennæ having the penult joint a little longer than the apical or antepenult; the longest seta at the apex of the anterior antennæ is but little longer than the apical joint; on antepenult joint, the posterior seta is longer than the anterior, but does not exceed the length of the joint. External ovarian sacs longer than abdomen, not divergent in position.

CYCLOPS VITIENSIS.

Feminæ:—*Cephalothorax* posticè fere obtusus, abdomen longitudine vix superans, nudus. *Antennæ* anticæ longæ, cephalothoracis longitudine, multiarticulatæ; articulo primo crasso, oblongo, secundo dimidio minore, 6 sequentibus perbrevibus; setis antennarum inæqualibus, articularum primi secundique paulo longioribus, ultimi et 3 subultimorum posterioribus subæqualibus, articulo penultimo paulo longioribus, setis anterioribus articularum subultimorum perbrevibus. *Styli* oblongi, vix duorum articularum abdominis longitudine; setâ secundâ abdomine paulo longiore.

Female:—Cephalothorax rather obtuse at the posterior angles, but little longer than the abdomen, naked. Anterior antennæ as long as the cephalothorax, multiarticulate, first joint stout, oblong, the second one half smaller than the first, the six following very short; setæ of anterior antennæ unequal, of first and second joints elongate, of the last and the posterior of the three subultimate subequal, and rather longer than the joint to which attached; anterior setæ of same joints very short. Stylets oblong, scarcely as long as two abdominal segments together, second seta a little longer than the abdomen.

Plate 83, fig. 5 *a*, female, enlarged; *b*, extremity of antenna.

Fresh-water pools, Vanua Lebu, Viti Islands, July, 1840.

Length, one-twenty-fourth of an inch. Colour, faint yellowish. The anterior setæ of the two subultimate joints of the anterior antennæ scarcely exceed in length the diameter of the joints; while the posterior of these and also of the preceding joints are rather longer than the penult joint. The first or inner seta of the caudal stylets equals half the second, and the third is of intermediate length; the fourth is a little shorter than the stylets. The joints of the abdomen are variable. External ovarian sacs are as long as abdomen or nearly so, and divergent in position; the eggs were rather large and of a dull bluish colour.

SUBFAMILY HARPACTICINÆ.

GENUS CANTHOCAMPTUS, *Westwood*.

In the first species of this genus, here described, the legs of the first pair are not smaller than in some Harpactici, and have a similar form. The legs, however, of the second pair have three-jointed branches, the distinguishing characteristic of the Canthocampti as the genus is here adopted. The two following species are placed in this genus because of the form of the body, the abdomen being continuous in outline with the thorax and not abruptly smaller; our notes and drawings contain no information as to the character of the second pair of legs, and it is possible that farther investigation may require a different arrangement.

CANTHOCAMPTUS VIRESCENS.

Cephalothorax ovatus, anticè rotundatus et breviter rostratus, segmentis posticè non acutis. Abdomen paululum subito angustius et posticè sensim decrescens, 5-articulatum. Antennæ anticæ breves, dimidii cephalothoracis longitudine, 9-articulatæ; articulis basalibus quatuor, crassiusculis, secundo maximo, setis perbrevibus. Pedes antiqui parvi, digito dimidii articuli secundi longitudine. Styli caudales brevissimi,

paulum divaricati; setâ secundâ caudali corporis longitudine, primâ tertiâque subæquis, abdomine valde brevioribus.

Cephalothorax regularly ovate, rounded in front, and having a short beak, segments not appearing acute at their posterior angles in an upper view. Abdomen somewhat abruptly smaller than last thoracic segment, and gradually decreasing in breadth, five-jointed. Anterior antennæ short, scarcely exceeding one-half the length of cephalothorax, nine-jointed, basal joints four in number, rather stout, second largest, setæ very short. First pair of feet small, movable finger rather more than half the length of the preceding joint. Caudal stylets very short, a little divaricate, second seta as long as the body, first and third subequal, much shorter than abdomen.

Plate 83, fig. 6 *a*, female, enlarged; *a'*, eyes; *b*, anterior antenna of female; *c*, posterior antenna; *d*, mandible (without the palpus); *e*, part of maxilliped; *g*, first pair of feet; *h*, second pair of feet; *h'*, extremity of longer branch; *i*, figure of young animal, a day or two old; *y*, young.

Island of Madeira, in pools on the rocky shores, containing seaweed, below high water mark.

Length, one-twentieth of an inch. Colour, light greenish, or colourless. Length of cephalothorax, about twice its breadth. Abdomen as broad at base as one-third the breadth of anterior part of cephalothorax. Eyes with the spot of pigment large, red. Anterior antennæ not as long as the first segment of the body; last five joints minute, setigerous appendage one- or two-jointed, and bearing setæ, which included make it as long as the main branch. Posterior antennæ five-jointed, last three joints oblong, the last a little clavate. Mandible having an obliquely truncate summit, which is furnished with four or five teeth on the edge above, and two sharp processes at the commencement of the truncation. Only the last three joints (all?) of the maxillipeds were observed; these organs terminate in a slightly curved claw of rather large size, and have a setulose jointed appendage to each side of third joint, one of which extends as far as apex of claw; when projecting over the claw, the claw appears to be ciliated, and it was so viewed at first. Branches of second pair of

feet quite unequal, and just beneath a prominently projecting apex there appeared to be two short claws.

Ovarian appendages to first joint of abdomen. Ovarian sac is nearly oval, and projects some distance beyond the extremity of the abdomen. Eggs few, of a grayish or light brownish red colour.

The animals live ten days without changing the water, and produce numerous young in that time, which were one-seventy-second of an inch in length, and colourless.

Harpacticus virescens, DANA, Proc. Amer. Acad. Sci., i. 151, 1847.

CANTHOCAMPTUS LINEARIS.

Corpus fere lineare, abdomine non subito angustiore, posticè parum attenuatum. Antennæ anticæ brevissimæ, 7-articulatæ; articulis basalibus duobus crassissimis, primo majore, secundo perbrevis, setis totis brevibus. Styli caudæ styliformes, articulo abdominis ultimo longiores, parum divaricati, setâ secundâ longitudine fere dimidii corporis.

Body nearly linear, the abdomen not abruptly narrower than thorax, posteriorly a little narrower. Anterior antennæ very short, seven-jointed, basal joints two, very short, the first larger, the second very short, the setæ throughout short. Caudal stylets styliform, longer than last segment of abdomen, a little divaricate, second seta nearly half as long as body.

Plate 83, fig. 9 *a*, female, enlarged; *b*, antenna.

From the sea, among the Feejee Islands, July, 1840.

Length, one-twentieth of an inch. Anterior antennæ scarcely longer than breadth of cephalothorax. Anterior legs short and small. Moves rapidly over a wet surface, with a wriggling motion, like other species of this genus.

Harpacticus linearis, DANA, Proc. Amer. Acad. Sci., i. 152.

CANTHOCAMPTUS ROSEUS.

Corpus fere lineare, abdomine non angustiore. Antennæ anticæ perbreves et tenuissimæ, basi non crassiores, setis totis brevibus. Styli caudales breves, non divaricati; setâ secundâ corpore longiore, spinulosâ.

Body nearly linear, abdomen not narrower than the thorax. Anterior antennæ very short and very slender, not stouter at base, setæ throughout short. Caudal stylets short, not divaricate, second seta longer than the body, spinulose.

Plate 83, fig. 10, female, enlarged.

From the Sooloo Sea, southwest of the island of Panay, January 29, 1842.

Length, one-thirty-sixth of an inch. Colour of body, a tinge of purplish red. Appendages to base of abdomen rather long, and terminating in long setæ, extending nearly as far as the extremity of the abdomen. Ovarian sacs large. Antennæ about one-fourth the length of the body; the exact number of joints not ascertained.

Harpacticus roseus, DANA, Proc. Amer. Acad. Sci., i. 152.

GENUS HARPACTICUS, Edwards.

HARPACTICUS CONCINNUS.

Feminæ:—Cephalothorax elongatè ovatus, segmentis posticè acutis. Abdomen subito paulo angustius, latum, lateribus bene rectum, 6-articulatum, parçè decrescens, segmento primo brevissimo. Antennæ anticæ breves, 9-articulatæ; articulis basalibus quatuor attenuatis, setis brevibus, ad apicem paulum longis (flagellum longitudine æquantibus). Pedes antici parvi, articulo secundo infra obtuso-angulato et digitum longi-

tudine duplo superante. Styli caudales brevissimi, parum divaricati; setâ secundâ corpore paulum brevior, tertiâ fere dimidio minore, reliquis brevissimis.

Female:—Cephalothorax oblong ovate, segments (in an upper view) acute at the posterior angles. Abdomen abruptly narrower than last segment of thorax, broad, six-jointed, sides regularly a straight line and breadth a little diminishing posteriorly, first segment very short. Anterior antennæ short, nine-jointed, basal joints four in number, attenuate; setæ short, a little longer at apex, and equalling in length the last five joints together (the flagellum). First pair of feet small, second joint having an obtuse angle within and the finger hardly half its length. Caudal stylets very short, somewhat divaricate, second seta about three-fourths the length of the body, third nearly one-half shorter, the others minute.

Plate 83, fig. 7 *a*, female, enlarged; *b*, extremity of posterior antenna; *c*, extremity of a maxilliped (?); *d*, first pair of feet; *e*, second pair of feet; *f*, bag of eggs.

Found at sea, thirty miles off Valparaiso, on floating sea-weed, May, 1839.

Length, one-twentieth of an inch. Beak small, semicircular. Eyes on a large spot of deep red pigment. First segment of body longer than broad. Abdomen rather broad, and slightly but very irregularly tapering, with straight sides. Stylets scarcely longer than broad. Anterior antennæ curve a little forward and then directly outward, so that the two are nearly in the same straight line; they admit of flexion and even curl up at times; the third and fourth joints are rather longer than the preceding. First pair of legs have the stout claw-shaped finger applied against the lower part of inner surface of second (or preceding) joint. There is a pair of short appendages to the first abdominal joint. Ovarian sac broad and large, as long as abdomen and light flesh-coloured.

This species was abundant on the *Fucus*, over which, while it is wet, it creeps with rapidity, showing great flexibility of body. It swims with a nearly steady motion. It often attached itself to the

sides of the vessel in which it was placed, and worked its way up above the surface of the water.

Harpacticus concinnus, DANA, Proc. Amer. Acad. Sci., i. 152.

HARPACTICUS SACER.

Cephalothorax ovatus, anticè subdeltoideus, dimidio longitudinis latior, segmentis posticè obtusis. Abdomen subito multo angustius et brevius quam cephalothorax, 6-articulatum, segmento primo brevi. Antennæ anticæ breves; feminæ 9-articulatæ, articulis basalibus quatuor, setis totis brevibus; maris articulo quinto (sexto?) crassissimo, subovato, margine anteriore rectiusculo, digito 2-articulato duabus setis minutis ad apicem instructo. Pedes antici parvi, digito tenui, largè dimidii articuli secundi longitudine. Styli caudales brevissimi, parum divaricati; setâ secundâ corporis longitudine, tertiâ dimidio brevior, primâ perbrevis.

Cephalothorax ovate, with the front subdeltoid, length hardly twice the breadth; segments (in upper view) obtuse behind. Abdomen abruptly much narrower than cephalothorax and also much shorter, six-jointed, first segment short. Anterior antennæ very short, in female nine-jointed, basal joints four, the setæ throughout quite short, in male the fifth joint (sixth?) very stout, subovate, with the anterior margin nearly straight, articulating with this joint a two-jointed finger, stout, and having two small setæ at apex. Anterior feet rather small, finger slender and longer than half the second joint. Caudal stylets very short, a little divaricate, second seta as long as the body, the third half shorter, the first minute.

Plate 83, fig. 8 *a*, male, enlarged; *b*, eyes; *c*, hand of male anterior antenna; *c'*, female anterior antenna; *d*, extremity of posterior antenna; *e*, first pair of legs; *f*, second pair.

Abundant in salt-water pools, on rocks, along the shores of the harbour of Valparaiso, May, 1839.

Length, one-sixteenth of an inch. Colour, a little reddish. Anterior antennæ of male not longer than breadth of cephalothorax, hand

very large and stout, with the finger not over half the length of the hand; setæ of finger as long as the finger. Anterior antennæ of female have the last five joints minute, and the setæ at apex shorter than these five joints together; second joint from base longer than third. Abdominal segments, excepting the sixth, equal. The second pair of legs has the apical joint of the longer branch longest at apex, the shorter branch is little longer than the basal joint of the longer branch, and has the apical joint short; both branches terminate in two minute claws. The caudal stylets are scarcely longer than broad, and the setæ are nearly as in *H. concinnus*. In coition, the female is grasped around the cephalothorax by the cheliform antennæ of the male. Many were observed thus in connexion.

Harpacticus sacer, DANA, Proc. Amer. Acad. Sci., i. 152, 1847.

HARPACTICUS? ACUTIFRONS.

Maris:—*Cephalothorax* angustè ellipticus, anticè acutus, posticè obtusus. *Abdomen* subito angustius, 6-articulatum, posticè valde attenuatum, segmento ultimo angustissimo. *Antennæ* anticæ breves, 5-articulatæ; 3 articulis basalibus non oblongis, tertio minimo, quarto crassissimo et cylindrico, fere dimidii antennæ longitudine, quinto (forsan duplici), digitiformi, parvulo; *antennis* juxta basin et ad apicem breviter setigeris. *Styli* caudales minuti, non divaricati; *setis* strictè appressis, setâ majore dimidio corporis parum longiore, nudâ.

Male:—*Cephalothorax* narrow elliptic, acute in front, obtuse at the posterior angles. *Abdomen* abruptly narrower than cephalothorax, six-jointed, much attenuate posteriorly, last segment very narrow. Anterior antennæ short, five-jointed, three basal joints not oblong, the third smallest, the fourth very stout cylindrical, as long as the three preceding together, the fifth (perhaps a double one) digitiform, small; the antennæ near base and at apex bearing short setæ. Caudal stylets minute, not divaricate, setæ closely appressed together, the longest a little longer than half the body, naked.

Plate 83, fig. 11 *a*, male, enlarged; *b*, extremity of a maxilliped or perhaps of the mandibular palpus.

Abundant at sea, off Rio Negro, east coast of South America, January 25, 1839, 5 h., A. M.

Length, one-twenty-fourth of an inch. Colourless. Length of cephalothorax, much more than twice its breadth or nearly three times; last three segments nearly half the anterior. Antennæ have usually a double curvature and extend laterally with the tips hardly in advance of the beak; setæ on anterior margin near base short, and stout, and crowded; large joint naked (?). An extremity of a maxilliped, or perhaps the mandibular palpus, was observed, as shown in fig. *e*; it terminates in one or two straight setæ. Abdomen much shorter than cephalothorax. The abdominal segments decrease in width from the basal, the last being hardly one-fourth as broad as the first. The appendage to base of abdomen below is short, and has one or two short setæ at extremity.

Harpacticus acutifrons, DANA, Proc. Amer. Acad. Sci., i. 153.

GENUS CLYTEMNESTRA.

Frons subrostratus, appendicibus nullis. Antennæ anticæ flexiles; maris non subcheliformes nec articulatione geniculantes. Pedes antici permagni, subcheliformes.

Front subrostrate, appendages none. Anterior antennæ flexible; in *male* not subcheliform, not having a geniculating joint. Anterior feet very large, subcheliform.

This genus embraces such of the Harpacticinæ as have the male antennæ not distinctly geniculating, and the first pair of legs very large subcheliform.

The genus *Harpacticus* may contain species with large subcheliform anterior feet, like *Clytemnestra*. But the anterior antennæ of males are always geniculating. These organs are very similar in form to those of *Setella*; the setæ are rather long in the species observed, and the fifth joint is slightly arcuated.

Clytemnestra, DANA, Proc. Amer. Acad. Sci., i. 153, 1849.

CLYTEMNESTRA SCUTELLATA.

Cephalothorax subacutè rostratus, segmento antico lato, posticè utrinque dilatato, tribus segmentis sequentibus subito angustioribus, margine posteriore valde arcuatis et lateribus posticè productis et subacutis. Abdomen 6-articulatum, segmentis subæquis, decrescentibus. Antennæ anticæ elongatæ, 8- (9-?)articulatæ; articulo quinto (sexto?) arcuato, sequente oblongo et apice cum appendice instructo (?), reliquis tribus oblongis; setis longis divaricatis, duabus apicalibus fere antennæ longitudine. Pedes antici pergrandes; articulo secundo subclavato, digito tenui arcuato fere articuli secundi vel precedentis longitudine.

Cephalothorax subacutely rostrate, anterior segment broad, and the posterior angles projecting laterally; the following three segments abruptly diminish in breadth, have the posterior margin much arcuate, and the sides produced backward and subacute. Abdomen six-jointed, segments subequal, decreasing successively. Anterior antennæ elongate, eight- (or nine)-jointed, the fifth (sixth?) arcuate, the following oblong, and bearing a short appendage at apex, the remaining three oblong; setæ of anterior antennæ long divaricate, two apical almost as long as the antenna. First pair of feet very large, second joint subclavate, with a slender arcuate finger nearly as long as preceding joint.

Plate 83, fig. 12 *a*, animal, enlarged; *b*, eyes; *c*, posterior antennæ; *d*, extremity of a maxilliped; *e*, cheliform legs; *f*, leg of the three natatory pairs.

Pacific, longitude 124° west, latitude 18° south, August 6, 1839, at 5 h. A. M. The description and figure are from the specimens of this locality. Afterwards, near Pitt's Island, Kingsmill Group, April 30, 1841, and in the China Sea, February 17, 1842, three hundred miles northeast of Singapore.

Length, one-twenty-fourth of an inch. Colourless. Anterior segment of body scarcely longer than broad. Eyes on a large subquadrate mass of deep red pigment. Abdomen more than half as long as cephalothorax; the segments with convex sides. Antennæ longer than

half the body, the arcuate joint concave behind, hardly as long as the following one; setæ divaricate, the long apical setæ articulated at base so as to admit of motion by muscles. Before the penult joint, the apical part of antenna may be flexed upon the preceding portion. Posterior antennæ long and slender; observed but three joints; the last terminates in four or five unequal moveable setæ. Extremity of maxillipeds bearing a few short setæ. Cheliform feet of very large size. The first joint as long as the second, more slender, and a little arcuate; the second six times as long as its greatest breadth, naked; finger made up of a very short joint and a long slender spine. Natories with the branches unequal, three-jointed; often thrown back as in the figure. Appendages to basal joint of abdomen four-jointed, and having setæ at apex extending nearly to extremity of abdomen. Caudal stylets but little longer than last segment of abdomen, not divaricate; two setæ, the second and third, are as long as the abdomen, and exterior to these are two very short ones.

GENUS SETELLA.

Corpus angustissimum, fere lineare, anticè attenuatum et subacutum et sub fronte appendices duas parvulas falciformes gerens. Antennæ anticæ flexiles, appendice brevi instructæ, setis brevibus; maris non subcheliformes. Pedes antici mediocres aut parvi; proximi sequentes lateraliter porrecti, apice breviter setigeri. Pedes abdominis quatuor elongati et elongatè setigeri, ad segmenta 1mum 2dumque affixi. Setæ caudales duæ longissimæ, reliquæ brevissimæ.

Body very narrow and nearly linear, anteriorly attenuate and subacute, and the beak bearing below two small falciform appendages. Anterior antennæ flexible, having a short appendage; setæ short; in *male* not subcheliform. Anterior feet of moderate size or small; next pair following extending laterally, short setigerous at apex. Four abdominal feet elongate, and bearing long setæ attached to the first and second segments of the abdomen. Two caudal setæ very long, the rest quite short spines.

The *Setellæ* are remarkable for their very slender bodies, and the extremely long caudal setæ—exceeding much the length of the body

in the species examined. They are barely discerned in the water without a glass. They differ from the preceding species also in the falciform appendages to the beak; and the male anterior antennæ have not a geniculating joint. The large alimentary cavity is usually filled with a bright red fluid, which makes the whole body appear red. The caudal setæ, as far as examined, are spinulous.

Females were often observed with the bag of eggs attached. In some specimens, the appendages or feet pertaining to the base of the abdomen differ very much from the same organs in others (see the two following species), and this difference is probably sexual, as all females, known to be such by their bags of eggs, were of a similar character in this respect.

These species are confined to the open ocean.

SETELLA TENUICORNIS.

Antennæ anticæ fere corporis longitudine; articulis duobus basalibus valde crassioribus, secundo oblongo, reliquis teretibus gracillimis, tertio longissimo, quarto cum appendice instructo. Rami pedis antici biremis subæqui, major 3-articulatus, articulis fere æquis. Pedes abdominis cum 5-6 setis elongatis subæquis instructi. Setæ caudales corpore fere duplo longiores.

Anterior antennæ nearly as long as body; two basal joints quite stout, the second oblong, others terete and very slender, the third longest, the fourth with an appendage. Branches of first pair of natatories subequal, the longer three-jointed, the joints nearly equal. Abdominal feet with five to six elongate subequal setæ. Caudal setæ nearly twice as long as body.

Plate 84, fig. 1 *a*, animal, enlarged; *a'*, beak, with appendages; *b*, base of anterior antennæ; *c*, posterior antennæ; *g*, first pair of feet, claw not shown; *i*, *k*, natatory feet of first and third pairs.

Atlantic, latitude 7°-9½° north, longitude 21°-24° west, October 13 to 20, 1838.

Length, one-fifteenth of an inch, exclusive of caudal setæ. Colour, pale bluish; in most specimens, the whole alimentary cavity is deep

red. Last three joints of cephalothorax two-fifths of the whole in length. Abdomen six-jointed; articulation between the second and third segments less distinct than the others; last joint rather the longest and rounded. Anterior antennæ seven- or eight-jointed; third joint with a few short setæ near the centre of front margin as well as at apex. The setæ of the appendages to base of abdomen extend all nearly to the last joint of abdomen. The caudal stylets are longer than half the body.

This species is rather stouter than the following, and is peculiar in having stout basal joints to the antennæ, which organs are otherwise very slender.

Figures 1 l, 1 m, represent the young of *Setellæ*. The first was caught on the same day with the *Setella* above described, and it is probably the same species. The second was met with a few days after (the 26th of October, in latitude 4° 15' north, longitude 19° 30' west), and may possibly be a still younger state of this animal, or else the young of another species. The former was one-thirtieth of an inch long (including caudal setæ) and had a faint orange tinge; the latter was one-twenty-fourth of an inch in length, and was nearly colourless.

SETELLA LONGICAUDA.

Maris (?):—*Antennæ anticæ ad basin non crassiores, 7 aut 8-articulatæ; articulo quarto paululum arcuato (posticè convexo) et cum appendice instructo, tertio fere duplo longiore quam quartus aut secundus. Ramus major pedis biremis antici 3-articulatus, articulo primo valde brevissimo. Pedum abdominis ramus exterior brevissimè setiger, interior duabus setis spinulosus instructus, apicem abdominis fere attingens. Setæ caudales corpore largè duplo longiores.*

Male (?):—Anterior antennæ not stouter at base, seven- or eight-jointed, fourth joint a little arcuate (convex behind) and bearing an appendage, the third nearly twice as long as fourth or second; longer branch of second pair of feet three-jointed, the first joint very short; outer branch of abdominal feet bearing very short setæ, the inner with two long spinulous setæ, which extend nearly to apex of abdomen. Caudal setæ full twice as long as body.

Plate 84, fig. 2 *a*, animal, enlarged; *a'*, appendage to beak.

Atlantic Ocean, latitude 5° north, longitude 22° west, October 22, 1838.

Length, one-twenty-fourth of an inch. Nearly colourless, except the deep red of the stomach and intestine. The caudal stylets are about as long as last three abdominal joints, and the setæ are scabrous.

This species closely resembles the preceding, and was at first supposed to be the male of it. This view is perhaps favoured by the difference in the abdominal appendages. But we deem it more probable that they are distinct, judging from the antennæ, the two basal joints in the *longicauda* being no stouter than the following; moreover, the third joint is much less than twice the second in length, and the first half the second; while in the *S. tenuicornis*, the third is more than twice the length of the second. Moreover, the caudal setæ are much the longest in the *longicauda*.

SETELLA GRACILIS.

Feminæ:—*Antennæ anticæ gracillimæ usque ad basin, rectæ, inter sese prope 130° divaricatæ; articulo primo obsolete, secundo quartum æquante et dimidio tertio longiore, quarto non arcuato. Digitus pedis antici dimidio articulo secundo longiore. Setæ caudales corpore fere duplo longiores.*

Female:—Anterior antennæ very slender even at base, straight, angle of mutual divergence 130°, first joint obsolete, second as long as the fourth and longer than half the third, fourth not arcuate; finger of first pair of feet longer than half the second joint; caudal setæ nearly twice as long as the body.

Plate 84, fig. 3 *a*, side view, enlarged; *b*, back view, showing the appearance swimming; *c*, appendage to beak; *d*, extremity of a maxilla; *e*, first pair of legs; *f*, abdominal appendages; *g*, spinous character of caudal setæ.

Pacific, near the Kermadec Islands, and north towards Tongatabu; abundant; April 14 to 20, 1840.

Length, one-twenty-fourth of an inch. Colour bluish, with the whole alimentary cavity deep red. Head very narrow, pointed in front, in upper view. Anterior antennæ two-thirds the length of the body, and extremely slender, much more so than in the following species; the third joint (or second, the first being obsolete) is the longest, and has two curved setæ on the outer margin near its middle; the appendage to the fourth joint, with the setæ which terminate it, lies nearly parallel with the terminal portion of the antenna, and is two-thirds as long as this portion; this terminal part is four-jointed, the second joint longest, and the last, which is longer than the preceding, has two curved hairs on the posterior margin near middle, and also one or two straight hairs at apex. The second pair of antennæ terminate in three moveable setæ, but little longer than the last joint. In the first pair of feet, the second joint has its basal portion on the inner margin furnished with a few short setæ.

The outer pair of appendages to abdomen consist each of an oblong joint, having a long curved seta at apex, spinulose externally, besides two or three short setæ or spines; the inner pair appeared to be three-jointed, and had one or two long straight setæ at apex, and two unequal and much shorter on the inner margin. The longer setæ extend to the last articulation of the abdomen. The external ovarian sac, which has a brownish colour, lies between these two pairs of organs.

These animals have a very flexible body, and move through the water with a steady, rapid motion.

SETELLA CRASSICORNIS.

Maris (?):—*Antennæ anticæ crassiores, rectæ, inter sese 130° divaricatæ; articulo primo obsolete, secundo tertioque brevibus, quarto appendiculato, hoc etiam sexto ultimoque tertium longitudine duplo superantibus. Digitus pedis antici dimidii articuli secundi longitudine setæ caudales prope sesqui corporis longitudine.*

Male (?):—Anterior antennæ stouter than in the other species; quite straight, angle of mutual divergence 130°, first joint obsolete, second

or third short, fourth, sixth, and last twice the third in length, finger of the first pair of feet about as long as half the second joint; caudal setæ about once and a half the length of the body.

Plate 84, fig. 4 *a*, animal, enlarged; *a'*, profile of head; *b*, anterior antennæ; *c*, extremity of second pair of antennæ; *d*, first pair of feet; *e*, abdomen, showing abdominal feet in profile.

China Sea, northeast of Singapore, latitude 4° 20' north, longitude 106° 30' east; February 17, 1842.

This species is peculiar in its comparatively stout antennæ; the first joint (*normally* first), if existing, is not seen in a back view, and hence the second joint appears to be the first. The appendage to the fourth joint (the third in appearance) and its setæ together are shorter than half the terminal portion of the antennæ; the fourth joint in this species is longer than the preceding, while generally in other species it is shorter. The width of the head across the eyes is about equal to the width of basal joint of antennæ. From the form of the abdominal feet we infer that the specimen was probably a male; the outer pair had only very short setæ, as in the *S. longicauda*; and the inner has but one long seta, and this extends back nearly to apex of abdomen, and is spinulose on its outer side. The articulation between the fifth and sixth abdominal segments is not very distinct.

SETELLA ACICULUS.

Feminæ:—*Antennæ crassiusculæ, fere rectè divaricatæ, ad basin paulum curvatæ; articulo primo perbrevis, secundo quartum longitudine æquante et longiore quam tertii dimidium. Pedis antici digitus dimidii articuli secundi longitudine. Setæ caudales sesqui corporis longitudine.*

Female:—Anterior antennæ rather stout, the two nearly in a straight line (angle of divergence 165°), having a slight curve at base: first joint very short, second 'as long as fourth and longer than half the third. Finger of anterior feet as long as half the second joint. Caudal setæ one and a half times the length of the body.

Plate 84, fig. 5 *a*, female, enlarged; *a'*, profile of head; *b*, anterior antennæ; *c*, posterior antennæ; *d*, first pair of feet; *e*, second pair of feet; *f*, bag of eggs; *g*, *g'*, profile of abdomen, showing appendages.

Eastern entrance of Straits of Sunda, March 5, 1842.

Body nearly colourless. The anterior antennæ not quite as stout as in the preceding species; the fifth and seventh joints nearly equal, and the eighth or last but little longer than the seventh. The first pair of legs a little larger than second pair of antennæ. The abdominal feet or appendages have in each pair an oblong base; to the apex of the outer branch there is a single long curved seta and two or three others quite short; the inner has two long setæ at apex (and one or two shorter on inner margin?). The caudal stylets are twice as long as the last segment of abdomen. The external ovarian sac had a dull green colour, and contained about twelve eggs.

FAMILY III. CORYCÆIDÆ.

THE Corycæidæ are characterized by having two large oblate lenticular cornea (which we call *conspicilla*), on the front of the animal, to concentrate the light that passes to the large prolate lens of the eye. These front lenses are well compared to a pair of spectacles, and in these minute animals nature anticipated man's invention. The organs of the mouth are quite small, and without jointed appendages, so that the only prominent organs of the cephalothorax are the two pairs of antennæ, a pair of prehensile legs, and four pairs of natatories.

The natatories are similar to those of the other Cyclopoidea. The fifth pair, corresponding to the genital feet of the Pontellæ, is often wanting.

The abdomen is either without appendages, excepting the terminal stylets, or the first segment bears a short pair, terminating in one or two setæ.

The external ovarian sacs are large, and either one or two in number, as in the Cyclopidæ.

The peculiar spectacle-eyes of this family were overlooked in the original examination of the genus *Sapphirina* by Thompson, and also in the descriptions of other species. The existence of lenticular corneæ is not peculiar to these species among Crustacea; but they have been observed only in compound eyes, in which case the lens and cornea are minute and not far distant. In the Corycæidæ they are often very remote, and of great size.

This family comprises two subfamilies; one of which, the MIRACINÆ, is related to the Harpacticinæ,—the structure of the body, frontal appendages, antennæ, single external ovarian sac, and other parts, being nearly as in *Setella*; the other, the Corycæinæ, having two bags of eggs, as in *Cyclops*, but diverging widely from that group, in the monodactyle posterior antennæ, the absence of mandibular and maxillary palpi, and approaching Harpacticus somewhat in the monodactyle anterior legs, and the simple superior antennæ. The following are the genera of these subfamilies and their characteristics:*

SUBFAM. 1. CORYCÆINÆ.—Antennæ anticæ non appendiculatæ. Antennæ posticæ plus minusve monodactylæ. Sacculi ovigeri duo.

G. 1. CORYCÆUS, *Dana*.†—Cephalothorax crassus, non depressus, antice rotundatus et conspicilla gerens, postice sæpius acutus. Abdomen multo angustius, pauci-articulatum, appendicibus basalibus carens. Antennæ posticæ monodactylæ pedibusque anticis majores. Pedes antici quoad sexus vix dissimiles, digito tenui confecti. Styli caudales styliformes.

G. 2. ANTARIA, *Dana*.‡—Cephalothorax fere ac in *Corycæo*, postice rotundatus. Abdomen ac in *Corycæo*. Antennæ posticæ parvæ, pedibus anticis non majores, digito apice breviter setigero, carpo posticè angulato. Pedes antici quoad sexus vix dissimiles, monodactyli, digito tenui subuncinato.

G. 3. COPILIA, *Dana*.§—Cephalothorax depressus, fronte latè quadrato et conspicilla ac angulos anticos gerente. Antennæ posticæ monodactylæ, digito elongato, subulato. Abdomen pauci-articulatum, appendicibus basalibus carens.

* The new species of Corycæidæ beyond are briefly described in the Proceedings of the Amer. Acad. Sci. Boston, ii. 1849.

† Proc. Acad. Nat. Sci. Philad., ii. 285, 1845; Amer. J. Sci. [2], i. 228, viii. 280, ix. 133; Proc. Amer. Acad. Sci., ii. 35, 1849.

‡ Amer. J. Sci. [2], i. 229; Proc. Amer. Acad. Sci. ii. 39. A species of this genus or of a *Corycæus*, is rudely figured by Dr. W. Baird, without a name, excepting a reference to the genus *Cyclops*, in Loudon's Magazine, iv. 501, 1831.

§ Proc. Amer. Acad. Sci., ii. 40.

G. 4. SAPPHIRINA, *Thompson*.*—Cephalothorax depressus, interdum crassus, fronte arcuato; conspicilla sive frontalia sive inferiora. Sexus quoad antennas posticas stylosque caudales similes, abdomen pedesque anticos dissimiles. *Maris*:—Abdomen thorace subito non angustius, 4–5-articulatum, appendicibus basalibus carens; pedes antici digito elongato instructi. *Feminæ*:—Abdomen thorace subito angustius, 5–6-articulatum, appendices breves basales gerens; pedes antici digito brevi. [*Mares* sæpe lætè opalini aut fulgidè metallini; *feminæ* sæpius incoloratæ et plus minusve pellucidæ, interdum opacæ et indigoticæ.]

SUBFAM. 2. MIRACINÆ.—Antennæ posticæ apice setigeræ et non monodactylæ. Sacculus ovigerus unicus.

G. 1. MIRACIA, *Dana*.†—Corpus subcylindricum, elongatum. Frons appendices duas falciformes gerens ac in *Setellâ*. Abdomen feminæ (quoque an maris?) 6-articulatum. Antennæ anticæ appendiculatæ. Pedes antici monodactyli, digito tenui; duo sequentes biramei, lateraliter paulo porrecti. Antennæ anticæ ac in *Setellâ*. Appendices quatuor abdominis basales elongatè setigeræ.

SUBFAMILY CORYCÆINÆ.

The organs of the mouth in this subfamily have been particularly examined by the author in species of the genera *Corycæus* and *Sapphirina*, and are described in the remarks upon those genera.

GENUS CORYCÆUS, *Dana*.

Cephalothorax crassus, non depressus, antice rotundatus et conspicilla grandia fronte gerens, postice sæpius acutus. Abdomen multo angustius, pauci-articulatum, appendicibus basalibus carens. Antennæ posticæ monodactylæ, pedibusque anticis majores. Pedes antici quoad sexus vix dissimiles, monodactyli, digito tenui confecti. Styli caudales styliiformes.

* Thompson, Zool. Researches, p. 46, pl. 8, f. 2; *Carcinium*, Erichson and Burmeister, in Meyen's Obs. Zool., in Itin. circum Terram, &c., in Nova acta Cæs. Leop. Car. Nat. Cur., xvi. p. 156. D. O. G. Costa has described a genus, which he calls *Edwardsia*, in his "Cenni Zoologici," etc. (1834), which appears to be near *Sapphirina*, if not identical with it. It has its brilliancy, a nine-jointed body, and several other characters of this genus.

† Proc. Amer. Acad. Sci., ii. 46, 1849.

Cephalothorax stout, not depressed, round before and bearing on the front large lenticular corneæ (conspicilla), behind usually acute. Abdomen much narrower than thorax, few-jointed, without basal appendages. Posterior antennæ monodactyle, larger than the anterior feet. Anterior feet, sexually hardly dissimilar, monodactyle, finger slender. Caudal stylets styloform.

The Corycæi have a stout and short cephalothorax, usually thicker than wide, and commonly acute at each angle behind. The abdomen is three- or four-jointed, and terminates in slender stylets. The posterior antennæ separate them from the Antariæ, the first pair of feet and not depressed body, &c., from the Sapphirinæ.

The *cephalothorax* is only four-jointed. The anterior segment is large and oblong; and below at the mouth there is a prominent angle. The front is rounded, and is occupied to a great extent by the large oblate lenticular corneæ or *conspicilla*. There is no appendage to the front, and no beak-like prolongation. The third segment, excepting on a single species of those observed, is prolonged and acute behind on either side. The last segment is smaller and much narrower, and has the angles either obtuse or acutely prolonged, according to the species.

Besides the division into segments here mentioned, there are indications of other segments sometimes to be observed within the large anterior segment. In fig. 5*a*, Pl. 85, six subdivisions may be distinguished, dividing this large segment into seven, the last six very short and nearly equal. If these correspond normally to as many segments, they represent—beginning with the posterior—1, the first pair of natatories; 2, the anterior feet or maxillipeds; 3, 4, the maxillæ, two pairs; 5, the mandibles; 6, the posterior antennæ; 7, the anterior antennæ. It would seem, however, from the position of the posterior antennæ that they should both be considered as belonging to the seventh in this enumeration, and possibly the last transverse pseudo-articulation is incorrectly so considered.

The lenses of the eyes are situated nearly over the mouth, and more remote from one another than the *conspicilla*. The latter are sometimes in contact, and as frequently somewhat separate; their diameter is often one-third and occasionally one-half the breadth of the cephalothorax. The vermiform masses of pigment extend backward from the prolate lenses, gradually converging and becoming

nearly in contact at their posterior extremities. Along the venter there is sometimes a keel-like projection, which is quite prominent between the natatory legs of the two sides, and into which the pigment projects, reaching in certain species nearly to the posterior extremity of the cephalothorax.

There is a clear open space between the lenses and the conspicilla (or cornea-lenses).

The minute eyes between the prolate lenses were seen, but were not clearly made out. In one species a very minute fibre, supposed to be nervous, was traced to the conspicilla; they have no large nerve like the true ophthalmic nerve.

The *anterior antennæ* are short, and consist of three to seven joints; they are not geniculately flexed as in the *Antariæ*. They are irregularly furnished with setæ, which are sometimes as long as the antenna, or a little longer. It is common to find the antepenult joint larger than the preceding or following.

The *posterior antennæ* have a two-jointed base and a two-jointed finger. The second joint is long and stout, with the posterior margin naked and nearly straight; it has the front margin naked, but has often an acute tooth at the inner apex. The sides are furnished with one or more stout setæ, which are long, and are either naked or sparsely spinulous. The naked setæ appear to be situated more anteriorly than the spinulous; and when one kind exists alone, as is frequently the case, it probably arises from the obsolescence of the other kind, and not from the naked setæ of one species being spinulous in another. This however requires confirmation. Most of the *Corycæi* have one naked seta, arising from near the base of the second joint, on the outer side, and one within; both extending often beyond the apex of this joint, either curving or straight.

The third joint is short, and forms the basal part of the finger; it bears one or more short setæ, which are sometimes stout and longer than the joint, but usually quite short. The fourth joint is a kind of claw when short, or a slender corneous finger when long. In the latter case, it is at times longer than the second joint of the antenna. In two or three species there was an appearance that was taken at the time for another articulation, like the first one of the claw (see fig. 8 *a*, Pl. 86). This occurs only where the finger was short, and it is important that the point should be corroborated, before it is accepted as a fact.

The *organs of the mouth* were not completely made out. The mandible has an acutely lobed summit. In one of the pairs of maxillæ, the last joint has the inner apex prolonged inward claw-like and corneous. Beneath this acute apical prolongation there are two or more slender processes, one having one margin and the apex short setose, and the other with very minute setæ at apex, and somewhat brush-like. In the other pair of maxillæ, there is a large oblong lamellar joint, fringed at summit, having a small rounded process or lobe on the inner side. (Figs. 12 *a* to *d*, Pl. 85.)

The *maxillipeds* are, properly, as they have been called in treating of the Calanidæ, the *anterior feet*. There are three joints; the second oblong, with one or two short setæ towards the apex; the third a slender claw or finger, which folds against the preceding.

There are four pairs of natatories, and rarely a fifth of similar character. These natatories, wherever particularly examined, consisted of three joints to each branch, and the shorter branch was not more than half the length of the other; in the fourth pair, the length is not over one-third the longer branch, and in some species it is much shorter. In the longer branch there are two flattened spines on the outer margin of the third joint, besides an apical, and one apical to the other joints. The last joint terminates in an ensiform seta, ciliated only on the inner side. (Figs. 4 *g*, 4 *h*, Pl. 85.)

The *abdomen* is one- to three-jointed. It is oblong, and usually about half as long as the cephalothorax. The basal half is rather broad and suboval; and within, two vessels may be often seen corresponding to the extremities of the two ovaries. The remaining part is quite slender. There are no appendages below to the basal portion of the abdomen, or only minute obsolescent appendages, or setæ.

In some species there were two oblong oval or falciform appendages to the upper part of the abdomen, near its hinder extremity, which appeared to be the remains of the ovaries after the exclusion of the eggs (fig. 6 *a*, Pl. 86). Yet occasionally these appendages were in a cluster. They were half as long as the abdomen, or even longer.

The *caudal stylets* are slender styliform, and are either quite short, or longer than the abdomen. They have three or four setæ, and the inner of the three is usually largest; they are never very long.

Two ovaries were distinct in some species. But external ovaries were not met with in any of the many specimens examined. These

ovaries in some cases appeared to form a single oblong mass in the cephalothorax. They were not convoluted or reticulate, as in the Sapphirinæ. The two oblong cavities within the abdomen connect distinctly with the ovaries (see fig. 5 *b*, Pl. 85).

The distinction of the sexes was not ascertained. The test so apparent in the Sapphirinæ is not applicable here. I have looked for a difference in the posterior antennæ, but have made out none. There are females with long fingers to these antennæ, and others with very short claws; there are females with naked setæ, and others with the setæ of these organs setulose; and whether there be a distinction in these organs, is a point yet undetermined. As with the Calani, whose external sexual distinctions were not made out, numberless specimens have been seen by the author.

The stomach is a large sac, occupying in some species the greater part of the cephalothorax. The œsophagus, where distinctly seen (fig. 5 *a*, Pl. 85), was elongate, and extended from the mouth to the lower side of the stomach, instead of its anterior extremity.

Some information with regard to the arrangement of the muscles will be gathered from figure 5 *a*, Plate 85.

The *nervous system* was particularly studied in a species of Sapphirina, and will be described in our remarks on that genus.

Corycæus, DANA, Proc. Acad. Nat. Sci. Philad., ii. 285, 1845; Amer. J. Sci. [2], i. 218, viii. 280, ix. 133; Proc. Amer. Acad. Sci., ii. 35, 1849.

1. ANTENNÆ POSTICÆ MACRODACTYLÆ, DIGITO NON BREVIORE QUAM CARPUS.

A. *Setæ caudales stylis valde breviores.* [*Cephalothorax posticè (ad segmentum tertium) acutus, segmento quarto minore.*]

CORYCÆUS GRACILIS.

Cephalothorax gracilis, ventre non carinato. Conspicilla fere contigua. Antennæ anticæ breviter setulosæ. Antennarum posticarum articulus 2dus digito brevior, setâ longâ, setulosâ. Abdomen uni-articulatum, apice subcylindrico fere triplo longius, basi angustum. Styli caudales abdomine breviores, setis brevissimis.

Cephalothorax slender, venter not carinate. Conspicilla large, very nearly in contact. Anterior antennæ short setulose. Finger of the posterior antennæ extremely slender and longer than the preceding joint, seta of the second joint long, setulose. Abdomen one-jointed, narrow at base, linear apex half shorter than the preceding elliptical part. Caudal stylets much shorter than the abdomen, setæ very short.

Plate 85, fig. 1 *a*, animal, enlarged, lateral view; *a'*, upper view, antennæ not finished; *b*, anterior antenna; *c*, posterior antenna; *d*, second or third pair of natatories.

Atlantic, latitude 1° 30' north, longitude 18° 20' west, October 31, 1838; also, latitude 2° 20' south, longitude 20° west, November 6, 1838.

Length, one-thirtieth of an inch. Colourless, except along the venter, which is blue, and a little blue in the abdomen.

This is a very slender species compared with other Corycæi, and is remarkable for the slight prominence of the ventral angle. In an upper view, the cephalothorax is much the broadest at the head and quite narrow behind; the two conspicilla occupy the whole front. The posterior angles are slender acute. The anterior antennæ have the second and fifth joints longest. The setæ are not more than half the length of the antenna.

The posterior antennæ may possibly have a naked seta also to the second joint; but only the setulose one was observed; this one is about as long as the second joint. The finger has a very fine extremity. The first joint of the finger was not accurately made out.

The four pairs of natatories have each three-jointed branches.

The minute eyes between the prolate lenses were observed.

The abdomen in a lateral view has a very abrupt rectangular narrowing on the under side, near middle. The caudal stylets are about half as long as the abdomen, and the setæ less than half the stylets.

CORYCÆUS DECURTATUS.

Cephalothorax ventre carinatus. Conspicilla fere contigua. Antennæ

antice breviter setulosæ. Antennarum posticarum articulus 2dus digito brevior, setâ nudâ elongatâ, etiam setâ alterâ setulosâ brevior. Abdomen basi crassum, apice subcylindrico fere quadruplo longius. Styli caudales viâ dimidii abdominis longitudine, setis brevissimis.

Cephalothorax with the venter carinate. Conspicilla large, very nearly in contact. Anterior antennæ short setulose. Finger of posterior antennæ longer than second joint, a long naked seta to second joint, another shorter setulose. Abdomen stout at base, linear apex one-third as long as the anterior subelliptical part. Caudal stylets half as long as the abdomen, setæ very short.

Plate 85, fig. 2 *a*, lateral view of animal, enlarged; *a'*, dorsal view, *ibid.*; *b*, anterior antennæ; *c*, posterior antennæ.

Pacific Ocean, off Duke of Clarence Island, latitude 9° south, longitude 171° 30' west, north of Samoa, January 27, 1841.

Length, one-thirtieth of an inch. Colourless.

Body rather slender; in dorsal view broadest in front and narrowing behind. As in the preceding, the conspicilla occupy the whole front, and together have the breadth of the animal. The eye-pigment is very much elongated, extending into penult segment of cephalothorax. The abdomen is scarcely narrower at base. The caudal setæ do not exceed one-third the stylets in length.

The anterior antennæ are short, and the setæ do not exceed half the length of the organ. The second joint of the posterior antennæ has one or two short spines on the surface and at apex, besides the long setæ; the naked seta is as long as the joint, the setulose one two-thirds as long.

The penult or hand joint of the anterior feet is half as long as second joint of posterior antennæ.

Hairs of natatory legs nearly obsolete, being merely a very short pectination of the margin. The abdomen in a lateral view, has the lower side straight to within one-third its length from the apex, where there is a very short spine and a sudden diminishing of thickness.

CORYCÆUS DEPLUMATUS.

Conspicilla remotiuscula. *Antennæ anticæ brevissimè setulosæ, 7-articulatæ. Antennarum posticarum articulus 2dus digito brevior, setâ setulosâ longâ, et aliâ nudâ. Abdomen uni-articulatum, tenue. Styli caudales vix dimidii abdominis longitudine; setis plus dimidio brevioribus.*

Conspicilla large, rather remote. Anterior antennæ very short setigerous, seven-jointed. Finger of posterior antennæ longer than second joint, one setulose seta and another naked, both long. Abdomen one-jointed, slender. Caudal stylets hardly half as long as abdomen, seta more than half shorter.

Plate 85, fig. 3 *a*, animal, natural size; *b*, one of the natatory legs.

Atlantic, latitude 9° 20' north, longitude 24° 15' west, October 13, 1838.

Length, one-thirtieth of an inch. Nearly colourless; bluish along the venter.

The *conspicilla* are more remote than in the two preceding species. The abdomen in a lateral view diminishes from near the middle by a gradual concave slope, and at the angle there is a pair of minute appendages.

Natatories five pairs, the last shortest and the penult longest. The branches are triarticulate, and they arise from a two-jointed base. Seta at apex of longer branch with distant pectination. On pressure a cylindrical mass of reddish matter was pressed out from the abdomen at the spot where its breadth diminishes and the minute appendages occur.

Plate 95, figs. 7 *a, b, c*, represent a young individual, which we suspect may pertain to this species, though it is very doubtful; it was found on the same day in the same bucket of water. It is rounded elliptical in form, prolonged behind, and having the posterior extremity margined with half a dozen minute spines a little remote. Eyes small, on a single red spot near the front margin. There are six pairs of

appendages, besides a fourth very short near the articulation of the thorax with the abdomen, 7 *a'*.

Anterior pair three-jointed and as long as half the cephalothorax; the second joint shortest, a few short spines at apex.

Next two pairs two-branched. Branches short, two-jointed, and having setæ at apex.

Colourless. Length, one-sixtieth of an inch. Movement very irregular and wriggling; not in regular leaps.

CORYCÆUS VARIUS.

Cephalothorax crassus. Conspicilla remotiuscula. Antennæ anticæ elongatè setulosæ. Antennarum posticarum articulus 2dus digito brevior, setâ longâ, nudâ. Abdomen 2-articulatum, segmento secundo cylindrico, breviorè quam primum. Styli caudales abdomine vix breviores, setis dimidio brevioribus.

Cephalothorax stout. Conspicilla rather remote, large. Anterior antennæ with long setæ. Finger of the posterior antennæ longer than the second joint, seta of the second joint long, naked. Abdomen two-jointed, first joint elliptical, with a short cylindrical apex, second cylindrical, shorter than the first. Caudal stylets hardly shorter than the abdomen, setæ half shorter.

Plate 85, fig. 4 *a*, animal, enlarged; *b*, same, dorsal view; *c*, side view of abdomen; *d*, anterior antenna; *e*, posterior antenna; *f*, natatory leg of first pair; *g*, *ibid.* of fourth pair; *h*, eggs, pressed from the body.

Atlantic, latitude 7° 25' north, longitude 22° west, October 17, 1838; latitude 1°–7° south, longitude 18°–21° west, November 5, 1838; latitude 7° south, longitude 20° west, May 11, 1842; latitude 1° south, longitude 30° west, May 16, 1842. Pacific, latitude 15° 30' south, longitude 138° 30' west, August 19, 1839; latitude 33° south, longitude 153° 30' east, November 29, 1839; near the Ladrões, December 31, 1841.

Length, one-twentieth of an inch. Colour of one specimen, blue; another colourless, except a tinge of blue along the venter, and a clear red in the terminal joint of the abdomen.

The setæ of the anterior antenna at apex are about as long as the organ, or even longer. The posterior antennæ have a long slender finger. The first joint of it bears one or two longish spines. The anterior feet have a long finger much incurved at apex. Posterior pair of natatories smallest. The branches are three-jointed, the shorter not quite half the longer.

The elliptical part of the abdomen is about half the whole length. The stylets are longer than twice the second joint. The inner setæ are half as long as the stylets; the next are nearly half shorter; the outer are minute and are situated on the side, a little distance from the apex of the stylet. The pigment of the eyes was deep red.

Eggs were pressed from the body, proving the individual to be a female. They were grayish or yellowish, and elliptical in form, as seen in the figure (4 *h*). In specimens collected in the Pacific, August 19, 1839, the internal ovaries were distinct. Each was an oblong cylindrical mass, lying in the cephalothorax, and extending from the posterior extremity upward and forward to near the middle of the anterior cephalothoracic segment. Leaving the cephalothorax with a small diameter, it constituted another smaller oblong mass in the elliptical part of the abdomen.

CORYCÆUS LONGISTYLIS.

Cephalothorax crassus. Conspicilla remotiuscula. Antennæ anticæ elongatè setulosæ. Antennarum posticarum articulus 2dus digito vix brevior, ad apicem internum dentiformis, nudus et acutus, setâ basali longâ, nudâ; digito setam nudam ad basin ferente. Abdomen uniaarticulatum, dimidio apicali cylindrico. Styli caudales tenues, abdomine valde longiores, setis perbrevibus.

Cephalothorax stout. Conspicilla large, somewhat distant. Anterior antennæ with the setæ rather long. Posterior antennæ having the second joint hardly shorter than the finger, dentiform and acute at the inner apex, its seta long and naked; finger also with a naked seta at base. Abdomen one-jointed, basal half elliptical, cylindrical apex but little shorter. Caudal stylets slender, much longer than the abdomen, setæ very short.

Plate 85, fig. 5 *a*, animal, enlarged, showing within the alimentary

cavity, the position of prominent muscles, and the ovaries, besides the eyes; *b*, same, dorsal view; *c*, posterior antennæ; *d*, one of the maxillæ and one anterior foot, drawing not completed.

China Sea, three hundred miles northeast of Singapore, latitude 5° north, longitude 107° east, February 17, 1842.

Length, one-tenth of an inch. Nearly colourless; brownish red about the mouth and along the venter.

The antepenult joint of the anterior antennæ is larger than the others, and the setæ are rather more than half the length of the antennæ. The setæ of the second joint of the posterior antennæ is as long as this joint. The next joint is less than one-third the following. The last segment of the cephalothorax has not the posterior angles at all prominent.

The abdomen in its elliptical part contained a pair of oblong sacs, as shown in the figure, which connected with a pair extending obliquely upward and forward in the cephalothorax, nearly to the middle of the back.

Within the cephalothorax along the back, there were appearances indicating traces of obsolete divisions, which if perfect would divide the large anterior segment into seven segments, corresponding (counting from the posterior part) to

- 1 pair of natatories.
- 1 pair of prehensile feet or maxillipeds.
- 2 pairs of maxillæ.
- 1 pair of mandibles.
- 1 pair of antennæ—the posterior.
- 1 pair of antennæ—the anterior.

The stomach is very large ovoid, and from the under side it connects with an oblong œsophagus, which diminishes a little to the mouth. The stomach occupies the greater part of the anterior segment, and becomes gradually smaller as it passes to the following segments.

The caudal setæ are about one-fourth as long as the stylets.

B. *Setæ caudales stylis non valde breviores, sæpe longiores.*

* Cephalothorax posticè obtusus.

CORYCÆUS OBTUSUS.

Conspicilla lata. Antennæ anticæ tenues, setis longiusculis. Antennarum posticarum articulus 2dus digito non brevior, setâ longâ nudâ. Abdomen 2-articulatum, sub basi apiculatum, segmento secundo dimidium primi longitudine paulo superante. Styli caudales dimidii abdominis longitudine, setis stylo parce longioribus.

Conspicilla large. Anterior antennæ slender, setæ rather long. Finger of posterior antennæ not longer than second joint, seta of second joint long, naked. Abdomen two-jointed, produced into a tooth below at base, second segment somewhat exceeding half the first in length. Caudal stylets half as long as the abdomen, setæ slightly longer than the stylets.

Plate 85, fig. 6, animal, enlarged, lateral view.

Pacific Ocean, near El Gran Cocal, latitude $5\frac{1}{2}^{\circ}$ south, longitude $175\frac{1}{2}^{\circ}$ east, March 25, 1841.

Length, one-thirtieth of an inch.

In a lateral view, the abdomen is very narrow at base, and then abruptly widens from below, and is prolonged into an acute curved tooth; it then narrows gradually. At the apex of the first segment below, there are two or more very short setæ. The stylets are quite slender. The longest of the setæ is about once and a half the stylets. The posterior antennæ are more than twice the size of the anterior legs.

† Cephalothorax posticè acutus.

CORYCÆUS CRASSIUSCULUS.

Cephalothorax crassiusculus, segmento quarto posticè subacuto. Conspicilla contigua. Antennarum posticarum articulus 2dus digito vix

brevior, setâ nudâ. Abdomen uni-articulatum, apice subcylindrico fere dimidio brevior quam pars basalis elliptica. Styli caudales dimidium abdominis longitudine superantes, setis paulo longioribus.

Cephalothorax rather stout, fourth segment posteriorly acute or subacute. Conspicilla in contact (or very nearly so). Finger of posterior antennæ longer than second joint, seta of second joint naked. Abdomen one-jointed, elliptical part a third longer than the cylindrical. Caudal stylets about two-thirds the length of the abdomen, setæ half longer than the stylets.

Plate 85, fig. 7 *a*, *b*, animal, enlarged, different views.

Sooloo Sea, west of the Island of Panay, January 27, 1842.

Length, one-twentieth of an inch. Nearly colourless, with deep red about the mouth and along the venter. Pigment of eyes red.

The cephalothorax in a dorsal view is about as broad behind as in front. The posterior angles are prolonged acute; and those of the small terminal segment lying between are acute and a little prolonged. This last character, the conspicilla in contact, and the characters of the abdomen, distinguish this species from the following.

In a lateral view the abdomen is gradually tapering, and the upper and under sides are nearly straight.

CORYCÆUS LATICEPS.

Cephalothorax crassus, segmento quarto breviter acuto. Conspicilla remotiuscula. Antennæ anticæ 7-articulatæ, setis dimidio brevioribus. Antennarum posticarum articulus 2dus digito paulo brevior, setâ longâ, nudâ. Abdomen 2-articulatum; segmento secundo cylindrico, dimidio brevior. Styli caudales dimidio abdominis breviores, setis parce longioribus.

Cephalothorax stout, fourth segment short acute behind. Conspicilla large, rather remote. Anterior antennæ seven-jointed, setæ half shorter than antenna. Finger of posterior antennæ longer than the second joint, seta of second joint long, naked. Abdomen two-

jointed, first segment broad elliptical, with a very short cylindrical apex, second segment cylindrical, about half shorter than the first. Caudal stylets less than half the abdomen in length, setæ slightly longer.

Plate 85, fig. 8 *a*, animal, enlarged; *b*, same in dorsal view; *c*, natatory leg.

Atlantic, latitude 4°–5° north, longitude 19°–22° west, October 22–26, 1828, abundant; latitude 1° south, longitude 18° 30' west, November 5, 1838; latitude 0° 15' south, longitude 31° west, May 17, 1842.

Length, one-twentieth of an inch. Colour, blue, with deeper blue along the venter; pigment of the eyes deep blue.

The basal joint of the anterior antennæ is the largest. The cylindrical part of the abdomen is very nearly as long as the elliptical portion, and the stylets are but little shorter. The fourth segment of the cephalothorax is acute behind, as in the preceding species, but the conspicilla are rather distant, the caudal stylets and setæ are shorter, and the elliptical part of the abdomen is shorter in proportion.

CORYCÆUS VITREUS.

Cephalothorax crassus, segmento quarto brevissimè acuto. Conspicilla remotiuscula. Antennæ anticæ elongatè setulosæ. Antennarum posteriorum articulus 2dus digito vix brevior, setâ nudâ, longâ. Abdomen 2-articulatum, apice cylindrico brevi. Styli caudales dimidii abdominis longitudine, setis stylos paulum superantibus.

Cephalothorax rather stout, fourth segment very short acute. Conspicilla large, rather distant. Anterior antennæ six- or seven-jointed, setæ long. Finger of posterior antennæ about as long as second joint, seta of second joint long, naked. Abdomen two-jointed, subovate, quite a short cylindrical apex. Caudal stylets about half as long as abdomen, setæ rather longer than the stylets.

Plate 85, fig. 9 *a*, animal, enlarged; *b*, same, dorsal view; *c*, anterior antennæ; *d*, anterior legs.

Pacific, latitude 18° south, longitude 124° 30' west, August 6, 1839,
5 A. M.

Length, one-fifteenth of an inch. Colourless, transparent.

The cephalothorax in the single specimen seen was a little broader in front than posteriorly. The cylindrical part of the abdomen is much less than half the preceding elliptical part, and is half as large in diameter. The long seta of the stylets a little exceeds the stylet in length. The slender finger of the anterior legs is about as long as the preceding joint. Some of the setæ of the anterior antennæ are as long as these organs. In a side view, the abdomen has both the upper and under sides alike and very slightly convex, the breadth diminishing rather abruptly where the cylindrical part begins.

CORYCÆUS AGILIS.

Cephalothorax crassiusculus, segmento quarto subrectangulato. Conspicilla remotiuscula. Antennæ anticæ breviter setulosæ. Antennarum posticarum articulus 2dus digito paulo brevior, setâ longâ, nudâ. Abdomen 2-articulatum, crassum, segmento secundo tenuiter subcylindrico, paulo brevior quam primum. Styli caudales tenuissimi, dimidio abdominis longiores, setâ paulo brevior.

Cephalothorax rather stout, fourth segment rectangular on either side. Conspicilla rather remote, large. Anterior antennæ quite small, setæ short. Finger of the posterior antennæ a little longer than the second joint, seta of second joint long, naked. Abdomen two-jointed, first segment oval, with a short cylindrical apex, second a little shorter than the first, and less than one-third the breadth, seta a little shorter.

Plate 85, fig. 10 *a*, *b*, animal, enlarged, different views.

Pacific, one to two hundred miles south of Tongatabu.

Length, one-thirtieth of an inch. Colour of venter, reddish; of abdominal legs, bluish; pigment, red.

The cylindrical part of the abdomen is quite as long as the pre-

ceding, and very slender. In a side view, the upper outline of the abdomen is nearly straight; the lower has a notch where the abdomen near middle diminishes in breadth; there are short setæ at this spot. The posterior antennæ have two naked setæ to second joint, according to my description; in the figure there is but one represented.

CORYCÆUS ORIENTALIS.

Cephalothorax crassus, segmento quarto rectangularato, subacuto. Conspicilla parva, remota. Antennæ anticæ breviter setulosæ. Antennarum posticarum articulus 2dus digito paulo longior, setâ longâ, nudâ, digito articulis duobus subæquis composito. Abdomen 2-articulatum, ad apicem vix productum, ad basin infra rectangularatum. Styli caudales breves, setis parce longioribus.

Cephalothorax stout, fourth segment rectangular, subacute. Conspicilla small, remote. Anterior antennæ with short setæ. Finger of the posterior antennæ scarcely shorter than the second joint, its two joints subequal; seta of second joint long, naked. Abdomen elliptical, apex scarcely prolonged, below at base rectangular in profile. Caudal stylets short, setæ but slightly longer.

Plate 85, fig. 11 *a*, animal, enlarged; *b*, dorsal view; *c*, posterior antenna.

Sooloo Sea, southwest of Panay, January 29, 1842; also, among the Sooloo Islands, February 2, 1842.

Length, one-twentieth of an inch. Nearly colourless, with red about the mouth and venter, and in the abdomen.

Cephalothorax in dorsal view elliptical. The conspicilla are remarkably small and distant. The abdomen is two-jointed, the second less than half the length of the first; the whole elliptical, apically a little prolonged, but not having a cylindrical apex. In profile the abdomen is broadest at base and tapers to apex, the lower side being however straight, and having a right angle at base. The stylets are less than half the length of the abdomen, and the setæ do not exceed half the abdomen.

2. ANTENNÆ POSTICÆ MICRODACTYLÆ; DIGITUS ARTICULO 2DO BREVIOR.

A. *Seta articuli antennarum posticarum 2di nuda.** *Styli caudales abdomine non breviores.*a. *Digitus antennarum posticarum articulo 2do paulo brevior.*

CORYCÆUS LAUTUS.

Cephalothorax ad segmentum quartum obtusus. Conspicilla remotiuscula. Antennæ anticæ longissimè setulosæ. Antennarum posticarum articulus 2dus digito paulo longior, setâ longâ, nudâ, digito subæquè 2-articulato, et ad basin setam nudam longam ferente. Abdomen 2-articulatum, segmentis fere æquis, 1mo paulo latiore. Styli caudales tenuissimi, abdomine valde longiores, setis perbrevibus.

Cephalothorax with fourth segment obtuse behind. Conspicilla rather remote. Anterior antennæ slender, setæ long. Finger of posterior antennæ a little longer than half the second joint, joints of finger subequal, near the articulation a short spine, and at base another spine nearly as long as the finger. Abdomen two-jointed, segments nearly equal, the first a little the stouter. Caudal stylets very slender, much longer than the abdomen, setæ very short.

Plate 85, fig. 12 *a, a'*, animal, enlarged; *b*, posterior antenna; *c*, two pairs of maxillæ; *d*, the maxillæ and the anterior feet (or maxillipeds), in position (nearly), figure not quite completed; *e*, extremity of one of the natatory legs that extend laterally.

Pacific, near the Kingsmills, April, 1841.

Colourless, except a little orange-red near the mouth, and in the posterior pair of natatories, which are extended laterally in the natural position of the animal. This species differs from the following under this subdivision, in having the last cephalothoracic segment obtuse, and in other characters. Several of the setæ of the anterior antennæ are as long as the organ. The caudal setæ are less than

one-third the length of the stylets; the stylets are very long, and were not divergent in the specimen seen.

b. Digitus antennarum posticarum articulo 2do valde brevior, uncinatus.

CORYCÆUS SPECIOSUS.

Cephalothorax ad segmentum quartum elongatè acutus. Conspicilla non contigua. Antennæ anticæ setis longissimis. Abdomen 2-articulatum, articulo primo crasso, secundo cylindrico et dimidio brevior. Styli caudales abdomine longiores, divaricati, setis brevibus. [Pedes biremes 4 posteriores utrinque protensi.]

Cephalothorax with the fourth segment acute behind. Conspicilla not in contact. Anterior antennæ seven-jointed, setæ very long. Abdomen two-jointed, first segment stout, the second half shorter, cylindrical. Caudal stylets longer than abdomen, divaricate, setæ short. [Four posterior natatory feet extended laterally.]

Plate 86, fig. 1 *a*, animal, enlarged; *b*, abdomen, in lateral view; *c*, one of the natatories of the second pair; *d*, same, third pair.

Atlantic, latitude 5°–7° north, longitude 21°–22° west, October 20 and 22, 1838.

Length, one-sixteenth of an inch. Specimen of October 22, colourless, except a bright red spot near middle of cephalothorax; that of October 20, having the four posterior natatories of a deep orange, and the antennæ with the stout part of the abdomen of the same colour.

This species is remarkable for the lateral extension of the two posterior pairs of natatories, which when coloured give a beautiful appearance to the little animal. The setæ of the anterior antennæ are somewhat longer than the organ. The finger of the posterior antennæ is a short claw. The abdomen is enlarged posterior to the middle of the first segment, and above, upon this enlarged part, there is some appearance of an aperture. The branches of the natatories are both three-jointed.

CORYCÆUS REMIGER.

Cephalothorax ad segmentum quartum elongatè acutus. Conspicilla remota, parvula. Antennæ anticæ 7-articulatæ, setis longissimis. Abdomen 3-articulatum, segmento ultimo subito angustiore, cylindrico. Styli caudales fermè abdominis longitudine, divaricati, setis stylo paulo brevioribus. [C. specioso quoad pedes biremes similis.]

Cephalothorax with fourth segment prolonged behind and acute. Conspicilla remote, small. Anterior antennæ seven-jointed, setæ very long. Four posterior natatory feet extended laterally. Abdomen three-jointed, the third segment abruptly smaller, cylindrical. Caudal stylets about as long as the abdomen, divaricate, setæ slightly shorter than the stylets. [Natatory feet as in the *C. speciosus*.]

Plate 86, fig. 2 *a*, animal, enlarged; *b*, posterior antenna.

Atlantic, latitude 11° south, longitude 29° west, November 10, 1838.

Length, one-fifteenth of an inch.

This species resembles the preceding, but differs in its abdomen and stylets. The fourth segment of the cephalothorax has the acute prolongations behind one-third those of the preceding joint, and the latter are more than half the length of the abdomen. The anterior antennæ have the second, fourth, and sixth joints longer than the others.

The second joint of the abdomen is broadest at apex, and in the specimen there were above at the posterior part two oval laminæ, of large size.

† Styli caudales abdomine breviores. [Cephalothorax posticè ad segmentum tertium elongatè acutus.]

CORYCÆUS LATUS.

Cephalothorax crassus, segmento quarto posticè elongatè acuto. Conspicilla parva, remota. Antennæ anticæ mediocriter setigeræ. Abdomen

crassum, posticè attenuatum, segmento ultimo subcylindrico. Styli caudales dimidio abdominis breviores, divaricati, setis parce longioribus.

Cephalothorax stout, fourth segment much prolonged behind and acute. Conspicilla small, remote. Anterior antennæ seven-jointed, setæ shorter than the antenna. Abdomen stout, attenuate behind, three-jointed, third segment nearly cylindrical. Caudal stylets shorter than half the abdomen, divaricate, setæ a little longer.

Plate 86, fig. 3 *a*, animal, enlarged; *a'*, anterior antenna; *b*, posterior antenna; *c*, first pair of feet; *d*, one of the natatories of second pair; *e*, abdomen, lateral view.

Atlantic, latitude 3° 45'–4° 20' north, longitude 19° 30'–18° 30' west, October 26, 27, 1838; latitude 6° 20' south, longitude 24° west, November 8, 1838.

Length, one-twenty-fourth of an inch. Colourless, or but slightly bluish.

The abdomen is fusiform in shape. The stylets are but little longer than the last segment. The second and fifth joints of the anterior antennæ are longer than the others. The finger of the posterior antennæ is about or nearly half the length of the second joint. The naked setæ are as long as this joint. The natatories of the four pairs have both branches three-jointed. The pigment of the large eyes extends backward into a prominent carinate ridge, on the under side of the cephalothorax, and this ridge has a nearly semicircular outline.

CORYCÆUS VENUSTUS.

Cephalothorax mediocris, segmento quarto breviter acuto. Conspicilla remotiuscula. Antennæ anticæ elongatè setigeræ. Antennarum posticarum articulus 2dus digito fere duplo longior, apice interno denticulato, setâ longâ, nudâ, digito subæque 2-articulato. Abdomen 2-articulatum, segmento primo paulo latiore et longiore. Styli caudales abdomine paulo breviores, divaricati, setis abdominis longitudine.

Cephalothorax moderately stout, fourth segment very short acute.

Conspicilla a little separate, large. Anterior antennæ very slender, setæ long. Finger of the posterior antennæ rather short and nearly equally two-jointed, second joint of antenna having a tooth at the inner apex, seta of this joint long, naked. Abdomen two-jointed, first segment broad, narrow at base, second smaller and shorter. Caudal stylets divaricate, a little shorter than the abdomen, setæ as long as the abdomen.

Plate 86, fig. 4 *a*, animal, enlarged, lateral view; *a'*, same, dorsal view; *b*, posterior antenna; *c*, mandible or inner maxilla; *d*, first pair of feet.

Pacific, Kingsmill Islands, twenty miles north of Charlotte Island, 4 A. M., April 22, 1841.

Length, one-sixteenth of an inch. Nearly colourless.

The posterior cephalothoracic segment has the angles very slightly prolonged and acute. The caudal stylets are two-thirds as long as the abdomen. The ventral angle of the cephalothorax is not very prominent. The anterior antennæ have some of the setæ longer than the organ.

The posterior antennæ have a stout two-jointed finger; the joints are nearly equal, and the first of the two is furnished with two or three short spines. The naked seta from the base of the second joint of the antenna was straight in the specimen examined, and longer than the joint.

Corycæus inquietus.—Plate 86, fig. 5 *a*, *b*, represents imperfectly a specimen taken in the Sooloo Sea. It was lost before the drawing was finished, having leaped from the glass containing it, the glass at the time being nearly dry. It has the posterior angles of the cephalothorax acute; also, the posterior angles of the fourth cephalothoracic segment acute; the conspicilla large and *in contact*; the posterior antennæ with a short claw and naked setæ; the posterior natatories (the preceding pair also?) laterally extended. None of the species of *Corycæus* seen by the author, combine contiguous conspicilla with the other characters mentioned.

B. *Seta articuli 2di antennarum posticarum setulosa.* [*Cephalothorax posticè elongatè acutus.*]

CORYCÆUS PELLUCIDUS.

Cephalothorax gracilis, ventre maximè carinato. Conspicilla fere contigua. Antennæ anticæ 7-articulatæ, setis fere brevibus. Antennarum posticarum articulus 2dus apicem internum acutus, digito brevi. Abdomen 1-articulatum, apice obliquè truncato. Styli caudales dimidio abdominis longiores, setis vix majoribus.

Cephalothorax slender, venter prominently carinate. Conspicilla nearly contiguous, large. Anterior antennæ seven-jointed, setæ rather short. Finger of the posterior antennæ short, second joint acute at the inner apex, and its setæ long and setulose. Abdomen one-jointed, posterior apex obliquely truncate and much excavate. Caudal stylets longer than half the abdomen, setæ scarcely longer than the stylets.

Plate 86, fig. 6 *a*, animal, enlarged; *b*, dorsal view of abdomen; *c*, profile of cephalothorax, showing carinate process below; *d*, posterior antennæ.

Atlantic, latitude 4°–7° north, longitude 19° 30'–21° 30' west, October 18, 20, 22, 24, 26; also, latitude 2° 20' south, longitude 20° west, November 6, 1838.

Length, one-twenty-fifth of an inch. Colourless and pellucid, with a little light blue in the cephalothorax and along the venter.

The cephalothorax in the specimen examined was peculiarly slender in a dorsal view, but this may not be a constant character. It was broadest anteriorly.

The abdomen in a lateral view has the upper and under sides parallel, through the basal two-thirds; after this the upper apex is truncated, and at this spot there are two oblong oval laminae attached. In an upper view, the outline of the abdomen is oblong elliptical. In one specimen there were several appendages to the abdomen above, instead of two, the usual number.

There are four pairs of natatories, and the fourth pair is very short. Both branches are three-jointed.

In latitude $17\frac{1}{2}^{\circ}$ north, longitude $20\frac{1}{2}^{\circ}$ west, October 2, 1838, a specimen was obtained having nearly the above characters. It was the first seen of the genus. The only points of difference which the drawings seem to indicate, are a much stouter cephalothorax in a dorsal view, and the anterior antennæ but five-jointed. Length, about one-thirtieth of an inch. Colourless, or slightly greenish. The abdomen has the same form as in the above, and two similar though smaller appendages.

CORYCÆUS CONCINNUS.

C. pellucido similis. Cephalothorax paulo crassior; abdomen gracilius; styli breviores, dimidium abdominis longitudine non superantes. Antennæ anticæ 3-articulatæ.

Similar to *C. pellucidus*. Cephalothorax a little stouter; abdomen more slender; caudal stylets shorter, not half as long as the abdomen. Anterior antennæ three-jointed.

Plate 86, fig. 7 *a*, lateral view, natural size; *a'*, dorsal view of cephalothorax, imperfect; *b*, posterior antenna.

Pacific Ocean, latitude $15^{\circ} 35'$ south, longitude $138^{\circ} 30'$ west, August 19, 1839; also, about two hundred and fifty miles south of Tongatabu.

Length, one-twenty-fourth of an inch. Colourless, with a blue tinge along the venter.

This species resembles the preceding; but has a more slender abdomen and shorter stylets in proportion. The upper and under sides of the abdomen in a profile view are parallel. There are appendages to the posterior part above as in the preceding. The anterior antennæ appeared to be quite short and to have only three joints. The apex of the second joint of the posterior antennæ is truncate and bears a minute spine, rendering it acute.

CORYCÆUS PRODUCTUS.

Antennæ anticæ 5-7-articulatæ, brevissimè setulosæ. Antennarum posteriorum articulus 2dus ad apicem acutus et digitus brevis forsan 3-articulatus. Abdomen elongatum, versus basin crassius ad apicem oblique non truncatum. Styli caudales fere dimidio breviores, setis stylo paulo longioribus.

Anterior antennæ five- to seven-jointed, setæ short. Second joint of posterior antennæ acute at apex, finger short, probably three-jointed. Abdomen long, half as long as cephalothorax, stoutest near base, not obliquely truncate at apex. Caudal stylets nearly one-half shorter, setæ a little longer than the stylets.

Plate 86, fig. 8 *a*, animal, enlarged; *b*, natatory of third or fourth pair.

Atlantic, latitude 8° 35' north, longitude 23° 40' west, October 15, 1838.

Length, one-thirtieth of an inch. Colourless, or a light tinge of blue, with brown along the venter.

In a lateral view, the abdomen abruptly enlarges below, very near the basal articulation; from this part the under side is straight, while the upper has a slight slope and curve, the abdomen gradually diminishing in height. The conspicilla are large, but it is not stated in my notes whether they are in contact or not.

The posterior natatories the smallest; the branches three-jointed.

The claw or finger of the posterior antennæ appeared to have two short basal joints; but it is possible that the existence of one or two short spines may have led to a mistake with regard to one of the articulations.

CORYCÆUS LONGICAUDIS.

Cephalothorax mediocris, segmento quarto elongatè acuto. Conspicilla fere contigua. Antennæ anticæ 7-articulatæ, setis longiusculis, antennâ

brevioribus. Antennarum posticarum articulus 2dus ad apicem internum acutus, et digitus parvulus, 3-articulatus (?). Abdomen mediocre, subellipticum. Styli caudales abdomine longiores, setis dimidio brevioribus.

Cephalothorax moderately slender, fourth segment prolonged behind and acute. Conspicilla large, nearly in contact. Anterior antennæ seven-jointed, setæ rather long, but shorter than the antenna. Second joint of posterior antennæ acute at inner apex, finger small, three-jointed (?). Abdomen rather longer than one-third the cephalothorax, subelliptical. Caudal stylets longer than the abdomen, setæ about half as long as the stylets.

Plate 86, fig. 9 *a*, animal, enlarged; *a'*, dorsal view; *b*, anterior antenna; *c*, posterior antenna.

Atlantic, latitude 5° north, longitude 20° west, October 24; and also, latitude 0° and 2° 20' south, longitude 17° and 20° west, November 1 and 6, 1838.

Length, one-eighteenth of an inch. Colourless.

The length of the stylets exceeds that of the abdomen, and this species is thus at once distinguished from the preceding. The anterior antennæ have the first and fifth joints longest, and the whole length is about one-third that of the cephalothorax. The finger of the posterior antennæ is about half the preceding joint in length. Claw of first pair of feet very short. Natatories four pairs.

The short exterior seta of the caudal stylets is situated some distance from the apex. The abdomen in an upper view is oblong elliptical; in a lateral view, the upper side is a little convex, the under side very slightly convex, or nearly straight.

GENUS ANTARIA, Dana.

Cephalothorax fere ac in Corycæo, postice rotundatus. Abdomen ac in Corycæo. Antennæ posticæ parvæ, apice breviter setigeræ, pedibus anticis non majores, articulo secundo posticè angulato. Pedes anticæ monodactyli, quoad sexus vix dissimiles, digito tenui.

Cephalothorax nearly as in *Corycæus*, rounded behind. Abdomen as

in *Corycæus*. Posterior antennæ small, short setigerous at apex, not larger than the anterior feet, second joint having an angle on the posterior margin. Anterior feet monodactyle, not differing between the sexes, finger slender.

The *Antariæ* differ from the species of the preceding genus in having the anterior feet not smaller than the posterior antennæ, and sometimes very much larger. Moreover, the posterior antennæ terminate in a short slender joint, having a few setæ and perhaps a claw at apex; and the preceding joint has an obtuse angle on the posterior side, with a very minute seta at its apex. Besides, the cephalothorax as far as observed is obtuse behind, and the conspicilla are remote.

The anterior antennæ have two very short joints at base, and three longer subequal joints, the last of which is usually triarticulate. These organs are bent at an obtuse angle after the third and fourth joints. The setæ are nearly as in the *Corycæi*, sometimes nearly as long as the antenna.

The external ovarian sacs are subdorsal in position, being attached to the second abdominal joint on its upper and outer side.

The ventral line in the profile of the *Antariæ* is slightly convex, or forms a low angle at the mouth.

The first pair of feet have each a slender finger, which folds down upon the inner side of the preceding joint or hand, as in *Corycæus*.

Antaria, DANA, Amer. Jour. Sci. [2], i., 229; Proc. Amer. Acad. Sci., ii. 39.

ANTARIA CRASSIMANA.

Pedes antici pervalidi, antennis posticis valde majores, articulo secundo abdomen longitudine fere æquante. Abdomen 3-articulatum, segmentis primo tertioque perbreuibus. Styli caudales abdomine triplo et setæ duplo breviores.

Anterior feet very stout, much longer than the posterior antennæ, second joint about as long and stout as the abdomen, claw but little shorter. Abdomen three-jointed, second segment long elliptical, first and third very short. Caudal stylets about one-third the length of the abdomen, setæ a little longer, the two exterior nearly as long as the stylet.

Plate 86, fig. 10 *a*, lateral view of animal, enlarged; *a'*, back view, conspicilla omitted; *b*, posterior antennæ; *c*, anterior feet.

Atlantic, latitude $0^{\circ} 30' - 1^{\circ}$ north, longitude 18° west, November 3, 1838, 4 A. M.

Length, one-thirtieth of an inch. Nearly colourless; extremity of abdomen and of the anterior antennæ, vermilion, passing backward into orange and yellow.

The cephalothorax in a vertical view is ovate or suboval, being slightly larger anteriorly and truncate behind. The abdomen has the apical joint and the basal each not one-fourth the second. The anterior antennæ have five joints, the two basal quite short, the three terminal subequal, and the last obsoletely triarticulate; setæ at apex about half the length of the antenna.

ANTARIA GRACILIS.

Pedes antici mediocres, antennis posticis paululo majores. Abdomen sensim attenuatum. Styli caudales abdomine quadruplo breviores, setis dimidio abdominis longioribus.

Anterior feet rather small, very slightly larger than the posterior antennæ, claw small. Abdomen gradually tapering. Caudal stylets one-fourth as long as the abdomen, setæ longer than half the abdomen.

Plate 86, fig. 11 *a*, lateral view of animal, enlarged; *b*, back view of the first, with the external ovarian sacs; *c*, anterior antennæ; *d*, posterior antennæ; fig. 12, another variety.

Atlantic, latitude $5^{\circ} - 7^{\circ}$ north, longitude $21^{\circ} - 22^{\circ}$ west, October 18, 20, 22, 23, 1838, and latitude $2^{\circ} 20'$ south, longitude 20° west, November 6, 1838.

Length, one-twentieth of an inch. Colourless; also, often bluish, and reddish.

Cephalothorax in a vertical view is oval. The second abdominal

segment is subcylindrical, a little the largest near the base. The caudal setæ are sometimes as long as the abdomen. This is the case in one of the figures, the bluish one, a female, while in the reddish one they are somewhat shorter. The anterior antennæ have five joints, with the last distinctly triarticulate. Some of the setæ are nearly as long as the abdomen. There are four pairs of natatories, which are nearly equal, the anterior shortest.

In some specimens there were two bags of eggs attached to the abdomen. They were oval, and lay a little over the abdomen, attached to its upper and outer side near the base of the second joint. Their colour was a pale shade of bluish purple, like that of the animal. The abdomen of the same individual was yellowish.

ANTARIA OBTUSA.

Pedes antici parvuli, antennis posticis paululo majores. Abdomen sensim attenuatum, apice obsoletè 3-articulatum. Styli caudales dimidio abdominis paulo breviores, setis longiores.

Anterior feet small, slightly larger than the posterior antennæ, claw about as long as preceding joint. Abdomen gradually smaller towards apex, long ovate, with three obsolete articulations near apex. Caudal stylets a little shorter than half the abdomen, setæ longer, external setæ very short.

Plate 86, fig. 13 *a*, animal, enlarged; *b*, lateral view of body; *c*, posterior antennæ; *d d'*, anterior feet, the claw in the former open.

Sooloo Sea, southwest of Panay, January 29, 1842.

Length, one-twentieth of an inch. Colour, red, in blotches; other parts nearly colourless.

The abdomen is five- or six-jointed, counting the imperfect articulations near apex. The whole except the first or basal joint, constitutes in appearance a single oblong segment. The longest caudal seta is half as long as the abdomen and stylets together, the one inside of this is a third shorter, and the one next outside of it is one-fourth less; the two external are very short, but little exceeding the diameter of the

stylet. The setæ of the anterior antennæ are rather shorter than these organs. The first joint of the abdomen is partly included between the rounded projections of the cephalothorax either side.

Another specimen, taken in the Balabac Passage, had the stylets somewhat shorter in proportion, and possibly was a different species. It had two bags of eggs attached. Figure 13 *e*, represents the abdomen and one of the ovarian sacs. The caudal stylets are mutilated.

Very similar specimens, of a red colour, probably of the same species, were found twelve miles north of New Zealand. Longest hairs of stylets twice as long as stylet.

GENUS COPILIA, Dana.

Corpus depressum, fronte quadratum, conspicilla ad angulos anticos gerens. Antennæ posticæ monodactylæ, digito elongato, subulato. Abdomen pauci-articulatum, appendicibus basalibus carens.

Body depressed, quadrate in front and having the conspicilla very distant, being situated on the angles. Posterior antennæ monodactyle, the finger long subulate. Abdomen few-jointed, without appendages at base.

The species here included differ from the Corycæi in having the body depressed, with the front broad truncate, and the conspicilla occupying the distant angles. In other respects they resemble more the Corycæi than the Sapphirinæ. The anterior antennæ of the two species seen have five joints. The posterior are four-jointed, the first and second long, the second with a prominence and spines on the margin near the basal extremity, which may in grasping be opposed to the long moveable finger. The third joint is short. The finger appears to have free motion at the articulation with the third joint, instead of acting in concert with this joint, the common mode in the Corycæi.

Copilia, DANA, Proc. Amer. Acad. Sci., ii. 40, where the following new species are described.

COPILIA MIRABILIS.

Cephalothorax fronte latus et parce excavatus, posticè paulo latior, segmentis posticis latere obtusis, ultimo ad apicem dorsalem spinigero. Antennæ posticæ ad articulum primum setulosæ, digito longo. Abdomen tenue, cephalothoracis dimidio brevius, obsoletè 5-articulatum. Styli abdomine longiores, tenuissimi.

Cephalothorax broad in front and sparingly excavate between the conspicilla, broader posteriorly; following segments laterally obtuse, the last with a minute spine at the dorsal apex. Abdomen slender, hardly half as long as cephalothorax, obsoletely five-jointed. Stylets longer than abdomen, very slender.

Plate 86, fig. 14 *a*, animal, enlarged; *b*, under view of same, enlarged, showing the antennæ, mouth, conspicilla, &c.

Pacific, near the Kingsmill Islands.

Colourless. Length, one-sixteenth of an inch.

This singular species, as shown in figure 14 *b*, has the lenticular corneæ or conspicilla (*a*) of the eyes very distant from the lens (*b*). The form of the conspicilla on the anterior side is nearly a segment of a sphere; but behind it is low subconical. The pigment is bent at an angle and is very long, the two slender masses nearly meeting along the centre. Fig. 14 *b*, also shows the nerve (*c*) passing to the anterior antennæ, and the muscles (*d, e, f,*) moving the organs of the mouth; also *g*, moving the anterior leg or maxillipeds, which organs are like those of the preceding genus. The outer maxillæ appear to be quite different in form; they have a broad terminal joint, two-lobed, and ciliate or hairy at apex. The stomach is broad ovate, and hardly extends beyond the anterior segment. The first segment of the cephalothorax slightly enlarges from the front backward, and more rapidly towards its posterior part.

The three posterior cephalothoracic segments gradually decrease in width, but not much in length; the last is hardly half shorter than

its width. The abdomen has two setæ, situated somewhat dorsally at the first articulation, and below there are a few minute teeth at the following articulations. These articulations are indistinct, the organ appearing to be one-jointed. The stylets were divergent; their setæ were mutilated.

COPILIA QUADRATA.

Cephalothorax anticè bene quadratus, fronte parce excavatus, segmentis latere obtusis, postico brevissimo. Abdomen 4-articulatum, tenue, segmentis secundo tertioque non longioribus quam primum, quarto dimidium abdominis longitudine superante et lateribus parce excavato. Styli caudales abdomine longiores, tenuissimi.

Cephalothorax anteriorly regularly quadrate, the front a little excavate, segments laterally obtuse, the last very short. Abdomen four-jointed, slender, the first segment as long as second and third, the fourth longer than half the abdomen and with concave sides. Stylets longer than abdomen, very slender.

Plate 86, fig. 15 *a*, animal, enlarged; *b*, posterior antenna; *c*, under view of mouth organs and first pair of legs; *d*, natatory leg.

Pacific, latitude 15° 20' south, longitude 148° 20' west, obtained a single individual, September 10, 1839; also, May, 1841, near longitude 165° east, between latitude 10° and 12° north.

This species has the sides of the anterior half of the first cephalothoracic segment quite parallel, and consequently the head looks more quadrate than in the preceding species. The third and fourth segments are very short compared with their width. The caudal stylets were divergent; their setæ were mutilated. The posterior antennæ have the first and second joints nearly equal in length, the fourth as long as second and third. The termination of the fourth is acute, or like a short spine at the extremity. The first joint appeared to be naked (no setæ are mentioned in my notes, or represented in the figure).

The eyes and pigment are as in the preceding species.

There were two large oval glandular masses in the anterior part of the cephalothorax, situated as indicated in the figure.

The figure of the posterior antennæ (fig. *b*) was drawn from the specimen obtained near longitude 165°, in 1841, while the other figures are from that of 1839.

GENUS SAPPHIRINA, *Thompson.*

Corpus plus minusve depressum, fronte arcuato. Conspicilla in frontem vel superficiem capitis inferiorem insita. Sexus quoad antennas posticas stylosque caudales similes, abdomen pedesque anticos dissimiles. Maris:—Abdomen thorace subito non angustius, 4–5-articulatum, appendicibus basalibus carens; pedes antici digito elongato instructi. Feminae:—Abdomen thorace subito angustius, 5–6-articulatum, appendices breves basales gerens; pedes antici digito brevi. [Mares sæpe lætè opalini aut fulgidè metallini; feminae sæpius incoloratæ et plus minusve pellucidæ, interdum opacæ et indigoticæ.]

Body more or less depressed, front arcuate. Conspicilla either on the front margin or under surface of the head. Sexes alike in the posterior antennæ and caudal stylets, but differing in the abdomen and anterior feet. *Male*:—Abdomen not abruptly narrower than thorax, four or five-jointed, without basal appendages; anterior feet with a long finger. *Female*:—Abdomen abruptly narrower than thorax, five- or six-jointed, having basal appendages; anterior feet with a short finger. [Males often beautifully opaline or brilliant with metallic tints; females usually colourless and more or less pellucid, or else opaque and indigo-blue in colour.]

The *body* in the Sapphirinæ varies from a long narrow form, three or four times as long as broad, to an ovate shape. The cephalothorax is much longer than the abdomen, and consists of either four or five segments; *four* is the usual number, and when *five*, the first or added articulation is often faint. The anterior segment is quite large; the others are short and transverse. When there are five segments each of the last four bears a pair of natatories. These segments vary in different species in their relative dimensions, and in the lateral margins and angles.

The *abdomen* in males is continuous in outline with the cephalothorax, and the whole body has an unbroken ovate, or oblong elliptical form. The number of joints is five, and the last is often concealed beneath the preceding.

In females, the abdomen is about half as wide at base as the posterior part of the thorax. The number of segments is five or six. The first is smaller or shorter than the following, and bears on either side a small cylindrical appendage, which is one- or two-jointed, and has a couple of setæ at apex. The second segment is commonly narrower than the third, and the sides are not often acute. The following two or three segments are generally lunate in form. The terminal segment is narrower than the preceding, and nearly truncate behind. It is often included almost wholly within the concavity of the preceding segment, or the cusps of this lunate segment.

The *caudal stylets* are lamellar and never as long as the abdomen. They are generally nearly ovate, with a rounded apex, but are sometimes quite narrow and falciform, and occasionally are truncate at apex. They have normally five setæ; one quite short, or reduced to merely an acute point at the inner apex, or on the inner side; two longer at apex; one at the outer part of the extremity, and one on the outer side, often distant from the apex. The inner is sometimes altogether wanting, and is not even represented by an angle in the lamella; and in this case there are but four setæ. The setæ are never longer than the lamellæ. Along a longitudinal line within the caudal stylets, there is a duct, which opens outward at the apex; and often loose shreds were seen projecting from the apex of the stylets at the extremity of each duct. The nature of the duct was not ascertained.

The *eyes* are of two kinds. One pair has an extremely large prolate lens, and a lenticular cornea of still larger size, as already explained. The pigment is an oblong cylindrical mass, of a very deep red, or blue colour, but lighter at the anterior extremity. This extremity is usually oblique, and faces forward and outward.

The eyes of the other pair (if eyes they are) are placed between the inner lenses just described. The two constitute a minute oval spot, only distinguishable under a lens of considerable power. This spot has a deep colour at the forward and hinder extremity, and appears to be divided longitudinally. No very distinct idea of the nature of

these eyes was obtained with a magnifying power of two hundred diameters; yet sufficient to suggest that there were two lenses placed side by side. See figs. 2 *a*, and 3 *b*, Pl. 88.

The *anterior antennæ* are short, five- to seven-jointed, with scattered setæ seldom as long as the antenna. They project either side of the head.

The *posterior antennæ* are slender prehensile, with a claw-shape joint at apex, and not a tuft of setæ. They are four-jointed, exclusive of the claw, which is properly a fifth joint. The organ is flexed at the second articulation, and the third and fourth joints are mostly in a single line; these two joints therefore constitute a kind of finger, and are so designated for convenience in the following descriptions. The second and fourth joints are the longest. The finger sometimes is slightly longer than the second joint, and occasionally is less than half as long. The claw is short, seldom when longest exceeding half the finger in length. There is usually a very short seta on the inner side of the second joint, near middle; one or two at the apex of the third joint, and often others at the apex of the fourth joint.

The *mouth* (see figs. 4 *d-l*, Plate 88), consists of a pair of *mandibles*, without palpi; a *first pair* of short *maxillæ*, having a few spines at apex; a *second pair* of *maxillæ*, rather slender and corneous, somewhat furcate at apex, with one or two slender setose processes on the under side, projecting when in position beneath and beyond the apex of the maxilla, and another similar but shorter seta on the inner side. The maxillipeds or the *first pair of feet* have a stout two- or three-jointed base, and terminate in a corneous joint. In females, this corneous joint is short and acute. In males, it is quite long, slender, and bends around. Moreover, in male individuals, the large penult joint of the base has a tuft of short setæ on the inner side. It is evidently used in grasping the female in coition.

The *natatories* are eight in number, or four pairs. They are lamellar, and the last pair is the smallest.

The *nervous system*, in the species examined, contains a single, large oblong ganglion, which embraces the œsophagus anteriorly (see fig. 2 *a*, *g*, Pl. 88). The pigment of the large eyes is often directly over the anterior part of the ganglion; the nerves passing to the eyes, or those of the first pair, were distinguished. One pair of nerves, from the anterior margin of the ganglion, branches in the front portion of the head; a third pair, of large size, was seen going to the anterior antennæ; a

fourth pair, smaller, to the second pair of antennæ. The ganglion subdivides behind the œsophagus, and after continuing a short distance and widening, gives off four nervous cords from each side, one to each pair of natatories, the outer to the first pair; from the inner of the four a branch passes from the inner side to the abdomen. The nerves going to the mouth organs were not distinguished.

The particles in the circulating fluid were not observed, even with a magnifying power of two hundred diameters.

The stomach is a large cavity, of very different shapes in different species, and sometimes occupies a large part of the cephalothorax. It connects with the mouth by a slender œsophagus; it graduates into an intestinal canal, without a separating sphincter.

The genital system of the male consists of two ovoid or pyriform seminal glands, united at the hinder apex, and placed nearly over the mouth; from these glands a duct passes backward to the first abdominal segment, where it terminates in a small oval gland or mass, which appears to have a corneous exterior (fig. 2 *a*, and *f*, Plate 88), with the interior transparent, except a slightly obscured vermiform centre. The efferent duct was not distinctly seen.

In females, the ovaries are in the form of a branching or reticulated vessel, occupying either half of the cephalothorax, and extending often quite to the front margin. Besides the two main subdivisions, there are in some cases, at least, two smaller intermediate branches, lying nearer the medial line of the animal, and extending less far forward. The eggs are often brightly coloured.

The Sapphirinæ were met with both in the torrid and temperate zones, and in some regions were very abundant. Nothing can exceed the beauty of some species, and especially the males. On account of their extreme brilliancy and rich reflected tints they may be seen at great depths on a sunny day, and as each becomes visible only when the position is right for the observer's eye, the water seems to flash with moving gems; they even rival the richest opal and sapphire, and the most brilliant combination of metallic hues. They swim with a graceful motion, often turning over and over, changing their tints, and disappearing to reappear again, through their varying motions. Blue is a common colour; but with this shade, fire-red, carmine, and bright yellow are often commingled. Some females have a nearly black colour, giving smalt blue reflections; while others are faintly

tinted, or are quite colourless. The species were not observed to be phosphorescent.

The genus Sapphirina was established by Thompson,* after a species collected near the Cape of Good Hope. His description is, however, imperfect; only the male was seen, and the peculiar character of the eyes is not mentioned. Templeton has described a species (*S. fulgens*, from the same region), with little additional information respecting the general characters of the Sapphirinæ.† This species is mentioned by Milne Edwards to have been found by M. Raynaud in the Atlantic. Tilesius had described a species previously under the name of *Oniscus fulgens*.‡ It is impossible to identify these species without fuller descriptions or better figures.

In Meyen's Zoological Observations on a voyage of circumnavigation,§ there is a species of Crustacea figured (pl. xxvii.), which appears to be a male Sapphirina. The figure is drawn much enlarged, and combines observations of minute accuracy with others of doubtful character. The species may belong to a different genus; yet, the obvious errors are so great, that we suspect the species will prove on further examination to be a true Sapphirina. The conspicilla on the front (having the same position as in our species) are described as concavities or dimples (*Grübchen*); the minute ovoid spot between the lenses within, which are certainly wholly internal, and probably a pair of eyes, is called the mouth (*Mund*); the ovoidal glands at the lower extremity of the genital system, are considered the *phosphorescing organs* (*Leuchtorgane*); and the nervous ganglion, as made out in the figures, is probably the pair of male genital glands. A series of spreading setæ radiate from where the mouth is situated; and these differ so widely from any organs in the Sapphirinæ, that we might suppose the animal of a different family, were it not for the evident errors pointed out; and moreover, as these organs are wholly abnormal in character, we suspect that they are merely the setæ of the anterior antennæ, seen in an upper view, the organs themselves being concealed under the margin of the cephalic segment.

* Zoological Researches, p. 46, pl. 8, fig. 2.

† Trans. of the Entomol. Soc. of London, i. 194, pl. 21, fig. 8.

‡ Neue ann. Watterausch, i. 10, pl. 213, fig. 24.

§ F. J. F. MEYENII, Obs. Zoolog. in Itin. Circum Terram institutas, accedunt Guil. Erichsonii et H. Burmeisteri Descriptiones et Icones Insectorum, A. Meyenio in ista Expeditione Collectorum; from the 16th volume of the Nova acta Cæs. Leop. Car. Nat. Cr., page 156, pl. xxvii.

1. *Conspicilla contigua*.

SAPPHIRINA IRIS.

Antennæ posticæ abbreviatæ, digito dimidii articuli 2di longitudine. Lamellæ caudales tenuiter divaricatæ; setis tribus, duabus apicalibus dimidio styli longioribus, alterâ externâ. Feminæ:—Corpus gracilimum valde elongatum (latitudine maximâ plus quintuplo longius). Conspicilla fronte insita. Abdomen 6-articulatum, segmento primo sequentibus vix angustiore. Maris:—Corpus lineari-ellipticum, anticè rotundatum. Conspicilla inferiora, fronte remotiuscula.

Posterior antennæ short, finger half as long as second joint. Caudal lamellæ slender, divaricate, setæ three in number, two apical longer than half the stylet, the other external. *Female*:—Body slender, more than five times as long as broad. Conspicilla of moderate size, situated on the front. Abdomen six-jointed, segments subequal, first hardly narrower than the following. *Male*:—Body lineari-elliptical, rounded in front, last segment mostly concealed beneath the preceding; anterior scarcely oblong, posterior angles of the segments obtuse. Conspicilla inferior, a little removed from the front, in contact.

Plate 87, fig. 1 *a*, *female*, enlarged; *a'*, one of the anterior antennæ; *b*, posterior antenna; *c*, anterior feet or maxillipeds. Fig. 2 *a*, *male*, enlarged; *a'*, anterior antennæ; *b*, posterior antennæ; *c*, anterior feet; *d*, seminal glands and ducts.

South Pacific, latitude 41° south, longitude 76° 24' west. Found in the cavity of a Salpa.

Length, one-third of an inch. Transparent, with every muscle visible. A brilliant play of colours, purple, carmine, fire-red, yellow, &c.

The female is much more slender than the male. In the latter, the length is nearly three times the greatest breadth; in the former, more than five times. The caudal stylets are quite similar in the two, in each the length being nearly four times the breadth, and their diver-

gent position is the same. The posterior antennæ are also alike. The anterior feet, or maxillipeds, differ; in the *male*, the second joint has a prominence on the inner side covered with very short setæ, and the last joint is very long and slightly curved; in the *female*, the second joint is without the prominence, and the terminal joint is a spine not longer than the second joint.

The abdomen of the female is nearly half narrower than the cephalothorax, and more than half as long. First segment of abdomen not shorter than the following; bearing short appendages on either side. Second segment having the posterior angles a little prominent and obtuse; the three following acute at posterior apex.

In the female, the ovary forms an open reticulation on either lateral half of the cephalothorax, extending into the head nearly to the front margin. In the *male* (see figure 2*a*), the seminal glands are ovate oblong, united at apex, and lie over the stomach. The ducts extend backward, and terminate in the anterior abdominal segment.

I was unable with a lens magnifying two hundred and fifty diameters to detect anything with reference to the circulation.

SAPPHIRINA ANGUSTA.

Digitus antennarum posticarum articulo 2do valde (non duplo) brevior. Lamellæ caudales elongatæ, subovatæ, apice interno prominulo, subacuto; setis quatuor, duabus apicalibus dimidio lamellæ brevioribus, aliis duabus externis brevioribus. Feminæ:—Corpus valde elongatum (latitudine maximâ fere quadruplo longius). Conspicilla fronte insita. Abdomen 6-articulatum, segmento primo angustiore, tertio, quarto, quintoque lunatis et latere acutis, primo secundoque fere æquis.

Finger of posterior antennæ much longer than second joint. Caudal lamellæ elongate, more than twice as long as broad, subovate, prominent and subacute at inner apex; setæ four, two apical not half as long as lamella, other two external, shorter. *Female:—*Body much elongate, more than twice the breadth in length. Conspicilla very large, in contact, placed on the front. Abdomen six-jointed, segments subequal, the first a little shorter and narrower, the first two obtuse laterally, the following three lunate and acute behind.

Plate 87, fig. 3 *a*, animal, much enlarged, showing external and internal ovaries, with the eggs bright blue; *b*, posterior antenna.

South Pacific, latitude 43° south, longitude 78° 45' west, April 3, 1839; also (the specimen figured), on the Lagulhas Bank, latitude 35° 50' south, longitude 23° east, April 11, 1842.

Length, one-eighth of an inch. Transparent, except the eggs, which are rich blue; there are slight opalescent colours in certain lights, and the surface in one specimen was sparsely punctate with black dots. The conspicilla are very large, so as to occupy the front margin; and the anterior antennæ project laterally some distance behind the conspicilla. The anterior articulation of the cephalothorax is less distinct (as usual) than the following. The appendages to the first segment of the abdomen are oblong cylindrical, and terminate in two unequal divergent setæ. The eggs of the external ovaries were large, and the bags did not extend quite as far as the extremity of the abdomen; twenty or twenty-four eggs in each. The ovaries within extend quite to the front of the animal. They are in four lines; the two inner are not half the length of the cephalothorax, and containing eggs of smaller size than the others; the two outer spread laterally, or ramify in each of the segments, and also either side of the mouth; after reaching the front, they return back for a short distance along the margin of the animal.

The duct in the caudal lamellæ was distinct, and some shreds were observed externally at the extremity of each.

SAPPHIRINA ELONGATA.

Digitus antennarum posticarum tenuis, dimidio brevior quam articulus 2dus. Lamellæ caudales latæ, breviter ovatæ, apice interno vix prominulo, setis quatuor, totis dimidio lamellæ brevioribus. Feminæ:—Corpus angustè elongatum, valde convexum. Conspicilla fronte insita. Abdomen 5-articulatum, segmento primo parvulo, secundo majore, sed valde minore quam sequens, sublunato.

Finger of posterior antennæ half shorter than second joint. Caudal lamellæ broad, short ovate, breadth more than half the length, inner apex hardly prominent, setæ four, all shorter than half the

lamellæ. *Female*:—Body very narrow and nearly cylindrical. Cephalothorax more than three times as long as broad, posterior angles obtuse or subacute, anterior segment very long. Conspicilla very large, situated on the front. Abdomen five-jointed, first segment very short and much the narrowest, second larger, but much smaller than the following, sublunate.

Plate 87, fig. 4 *a*, animal, enlarged; *b*, posterior antenna.

Pacific, latitude 15° north, longitude 179° east, December, 1841.

Length, one-tenth of an inch. Not coloured.

This species is near the preceding; yet the body is more convex or more cylindrical, and the abdomen is but five-jointed, with the first segment much shorter and narrower than the second, instead of having the two nearly equal, and the second is as much smaller than the third. Moreover, the caudal lamellæ are proportionally much broader, the length being one and a half times the breadth. The caudal setæ are not half as long as the lamellæ. The cephalothorax has four distinct segments, and the first of the four is more than twice as long as broad.

SAPPHIRINA METALLINA.

Lamellæ caudales fere rectangulatæ, apice subtruncatæ, setis quatuor apicalibus subæquis, parè brevioribus quam lamellæ. Maris:—*Corpus valde depressum, angustato-ellipticum, 9-articulatum, segmento ultimo tecto, primo oblongo, quarto dimidio breviorè quam quintum. Conspicilla fronte insita.*

Caudal lamellæ oblong, subrectangular; four terminal setæ, which are scarcely shorter than the lamellæ. *Male*:—Body much depressed, narrow elliptical, nine-jointed, last segment concealed below, first a little oblong, fourth half shorter than fifth; segments of thorax and abdomen lunate, and acute laterally or subacute. Conspicilla of moderate size, situated on the front.

Plate 87, fig. 5 *a*, animal, enlarged; *b*, under view of anterior part; *c*, caudal lamella.

Pacific, near Gilbert's Island, Kingsmill Group, 1° 26' north, longitude 173° 10' east, April 19, 1841, 6 h. A. M.

Length, one-tenth of an inch. Colours, bright metallic, varying between bright blue and fire-red through yellow, changing with the position of the animal. By transmitted light, blue, carmine, and purple, in blotches or patches.

The body is rounded alike at the two extremities. The setæ of the anterior antennæ are some of them longer than the organ. The last thoracic segment is much shorter but not narrower than the antepenult or following segment. The last segment of the body is concealed beneath the preceding, and the latter is so excavate behind that the caudal lamellæ project but little beyond it. The setæ of the lamellæ are all terminal or nearly so, the extremity being truncate, and so also the outer angle.

SAPPHIRINA CORUSCANS.

Digitus antennarum posticarum paulo brevior quam articulus 2dus, tenuis. Lamellæ caudales subovatae, ad apicem rotundatae, apice interno setam brevem gerente, setis aliis quatuor, totis brevibus (lamellâ fere quadruplo brevioribus). Maris:—Corpus depressum, elongato-ovatum, posticè angustatum, segmento primo (fere duplici) parce oblongo, aliis segmentis fere consimilibus. Conspicilla fronte insita, prominentia.

Finger of posterior antennæ a little shorter than second joint, slender. Caudal lamellæ ovate, rounded at apex, twice as long as broad, inner apex bearing a short seta, the other setæ four, all very short (about one-fourth as long as lamellæ). *Male*:—Body depressed, long ovate, narrowed behind, first segment (appearing faintly double) slightly oblong. Conspicilla large and prominent, situated on the front.

Plate 87, fig. 6 *a*, animal, natural size; *b*, posterior antenna.

Pacific, latitude 18° 10' south, longitude 125° 30' west, August 8, 1839.

Length, one-sixteenth of an inch. Colours by reflected light, richly variegated and changeable, with an extremely brilliant lustre, like tinsel.

The body gradually tapers from the second segment backward. The first segment is about as long as broad. The conspícilla on the front are very large. The third and fourth joints of the posterior antennæ are together about three-fifths the second, and very slender.

SAPPHIRINA INÆQUALIS.

Digitus antennarum posticarum articulo 2do non brevior, tenuis, unguiculo brevi. Lamellæ caudales oblongæ, subovatæ, apice interno prominulo, subacuto, setis quatuor, dimidio lamellæ non longioribus. Femina:—Corpus elongatè ovatum, segmentis cephalothoracis tribus posticis dissimilibus, segmento ultimo brevior et latere acuto, penultimo obtuso. Conspícilla fronte insita. Abdomen 6-articulatum, segmento primo fere obsoleto aut tecto, secundo utrinque posticè acuto.

Finger of posterior antennæ not shorter than the second joint, slender, claw short. Caudal lamellæ oblong, subovate, twice as long as broad, inner apex a little prominent, subacute, setæ four, not more than half as long as lamella. *Female*:—Body long ovate, cephalothorax with the last three segments dissimilar, antepenult segment having the posterior angles obtuse, penult laterally subtruncate, obtuse, last lunate, acute. Conspícilla small, situated on the front. Abdomen six-jointed, first segment nearly concealed, second having the posterior angles acute.

Plate 87, fig. 7 *a*, animal, enlarged; *b*, posterior antennæ.

Pacific, latitude 43° south, longitude 78° 45' west, April 3, 1839.

Length, one-twelfth of an inch. Colour, a little reddish. Anterior segment of the cephalothorax has an imperfect articulation across, and the anterior part is nearly as long as broad, and shaped like the letter

D. The last segment is fully as broad as the preceding, but shorter and sublunate. Inner apex of caudal lamellæ slightly prominent. Pigment of eyes deep blue.

SAPPHIRINA OVATA.

Digitus antennarum posticarum fermè longitudine articuli 2di, articulis duobus digiti subæquis. Lamellæ caudales graciles, lanceolatae, parce divaricatae; setis 4-5, unâ internâ, unâ aut duabus apicalibus, et aliis duabus externis, totis dimidio lamellæ valde brevioribus. Feminae:—Corpus valde depressum. Cephalothorax ovatus, segmento antico paulo oblongo, segmentis duobus posticis latere rotundatis, ultimo brevioris. Conspicilla fronte insita. Abdomen elongato-ellipticum, 5-articulatum, segmento primo non angustiore.

Finger of posterior antennæ not shorter than the second joint, the two joints of the finger nearly equal. Caudal lamellæ slender lanceolate, nearly as long as the abdomen, sparingly divaricate, setæ four to five, less than half as long as lamellæ, one of them internal, one or two apical, two external. *Female*:—Body nearly flat; cephalothorax ovate, length not twice the breadth, first segment a little oblong, last two segments laterally rounded, last shorter. Conspicilla of moderate size, on the front. Abdomen long elliptic, five-jointed, the first (second?) segment longer and not narrower than the second, second, third, and fourth sublunate and acute.

Plate 87, fig. 8 *a*, animal, enlarged; *b*, posterior antenna.

Balabac Passage, north of Borneo, East Indies, February 8, 1842.

Length, one-twelfth of an inch. Colour, reddish.

The first of the four segments of the cephalothorax is longer than broad. It has a faint articulation across, leaving an anterior segment nearly as long as broad. The first (normally first) segment of the abdomen was probably concealed by the last segment of the thorax. The segments are but slightly prominent on either side. Setæ of the anterior antennæ not longer than half the antenna.

SAPPHIRINA SPLENDENS.

Digitus antennarum posticarum tenuis, articulo 2do vix brevior. Lamellæ caudales ovato-rotundatæ, apice interno acuto; setis quatuor, duabus apicalibus dimidio lamellæ vix brevioribus, aliis externis. Maris:—Corpus valde depressum, ovatum, segmento primo (vix duplice) transverso, aliis longitudine subæquis, latere obtusis. Conspicilla fronte insita.

Finger of posterior antennæ slender, very nearly as long as second joint. Caudal lamellæ rotund-ovate, quite short, length once and a half the breadth, inner apex acute, setæ four, two apical half as long as the lamellæ, the others external. *Male*:—Body ovate, flat, eight-jointed, segments laterally obtuse, anterior like the letter D, shorter than broad, and having an obsolete articulation across, the others subequal, laterally obtuse. Conspicilla of moderate size, situated on the front.

Plate 87, fig. 9 *a*, animal, enlarged; *b*, posterior antenna (sketch not finished); *c*, caudal lamellæ.

Pacific, thirty miles west of Assumption, one of the Ladrões, latitude 19° 30' north, longitude 144° 30' east, December 31, 1841.

Length, one-fifteenth of an inch. Presents bright metallic reflections. This species is peculiar in its very short caudal lamellæ, of nearly ovate form; in its articulations having the posterior lateral angles obtusely rounded, and in its conspicilla in contact on the front. The lamellæ are much shorter than in the following species with contiguous conspicilla.

SAPPHIRINA OVALIS.

Digitus antennarum posticarum crassus, articulo 2do fere longior, articulis digiti valde inæquis. Lamellæ caudales ovatæ, setis quinque, unâ internâ, duabus apicalibus, et aliis externis, totis paulo brevioribus

quam lamellæ. *Feminæ*:—*Corpus valde convexum.* *Cephalothorax ellipticus, 5-articulatus, segmento antico non oblongo, postico parvo.* *Conspicilla fronte insita.* *Abdomen 5-articulatum, segmento primo minore, latere truncato, tertio quartoque lunatis, 2do sublunato.*

Finger of posterior antennæ rather stout, as long as second joint or slightly longer, the two joints of finger very unequal. Caudal lamellæ ovate, nearly twice as long as broad, setæ five, one internal, two apical, the others external, all shorter than the lamellæ. *Female*:—Body much convex. Cephalothorax elliptical, five-jointed, first segment not oblong, posterior segments laterally obtuse, the last abruptly narrower than the preceding. Conspicilla situated on the front, of moderate size. Abdomen five-jointed, first segment short, laterally truncate, third and fourth lunate, acute, second sublunate.

Plate 87, fig. 10 *a*, animal, enlarged; *b*, posterior antenna.

South Pacific Ocean, one hundred and fifty miles south of Tongatabu.

Colour, deep azure blue reflections from a black ground. The anterior segment of the cephalothorax is about as long as broad. The last segment is half shorter and nearly half narrower than the preceding. The first abdominal segment bears as usual lateral appendages.

This species resembles the following; but the caudal lamellæ are shorter and their setæ much longer; moreover, the finger of the posterior antennæ is not shorter than the preceding joint; and the claw of these organs is much less than half the finger in length.

SAPPHIRINA DETONSA.

Digitus antennarum posticarum tenuis, articulo 2do paulo brevior, unguiculo dimidii digiti longitudine. *Lamellæ caudales approximate, subovate, latitudine plus duplo longiores, setis brevissimis (obsolescentibus).* *Feminæ*:—*Corpus valde convexum.* *Cephalothorax ellipticus, 5-articulatus, segmento primo non oblongo, aliis latere obtusis.* *Con-*

spicilla fronte insita. Abdomen 5-articulatum, segmento primo fere obsoleto aut tecto, secundo latere obtuso, tertio quartoque lunatis.

Finger of posterior antennæ slender, finger three-fourths the second joint, claw half the finger in length. Caudal lamellæ approximate, subovate, oblong, length exceeding twice the breadth, setæ very short (obsolescent). *Female*:—Body much convex. Cephalothorax oval, five-jointed, anterior segment scarcely shorter than the breadth, posterior segments laterally obtuse, diminishing in breadth to the last. Conspicilla of moderate size, situated on the front. Abdomen five-jointed, breadth sparingly less than the length, first segment very short, second laterally obtuse, third and fourth lunate, acute.

Plate 87, fig. 11 *a*, animal, enlarged; *b*, under view of anterior segment, showing how far the upper shell is reflexed; *c*, posterior antenna.

Pacific Ocean, in the Paumotu Archipelago, near Honden Island, latitude 15° south, longitude 138° 45' west, August 19, 1839.

Length, about one-sixteenth of an inch. Translucent. Colour, brownish by transmitted light, and bright blue by reflected light.

The last four segments of the cephalothorax rather rapidly and regularly diminish in breadth, so that the last of the four is about half as broad as the first. The first of the abdominal segments bears a pair of short appendages. The second is much larger, but it is narrower than the third and a little longer; it is not acute laterally. The caudal lamellæ are as long as the last three abdominal segments. The setæ are not over a fourth the length of a lamella. The abdomen is very short for its breadth.

SAPPHIRINA INDIGOTICA.

Digitus antennarum posticarum tenuis, fere articuli 2di longitudine, et unguiculo fere dimidii digiti. Lamellæ caudales subovatae, apice interno vix prominulo, setis quatuor, duabus apicalibus, aliis externis, totis dimidio lamellæ vix brevioribus. Feminae:—*Corpus valde con-*

rexum. Cephalothorax ellipticus, 5-articulatus. Conspicilla fronte insita. Abdomen 6-articulatum, segmento primo parvulo, tertio quarto quintoque lunatis.

Finger of posterior antennæ slender, nearly as long as second joint, claw about half as long as finger. Caudal lamellæ subovate, inner apex hardly prominent, setæ four, two apical, the others external, all a little exceeding half the lamellæ in length. *Female*:—Body very convex. Cephalothorax oval, five-jointed, first articulation obsolete, posterior segment obtuse on either side. Conspicilla of moderate size, situated on the front. Abdomen oblong, six-jointed, first segment small, third, fourth, fifth lunate.

Plate 87, fig. 12 *a*, animal, enlarged; *b*, posterior antenna.

North Pacific Ocean, latitude 28° north, longitude 177° east, May 20, 1841.

Length, about one-sixteenth of an inch. Opaque. Colour, deep blue, with rich ultramarine reflections.

The first segment of the cephalothorax, which is separated from the second by an obsolete articulation, is not quite as long as broad. The first abdominal segment is very short, and bears appendages. Caudal lamellæ subovate, as usual.

SAPPHIRINA ORIENTALIS.

Digitus antennarum posticarum tenuis, fermè articuli 2di longitudine, unguiculo minus dimidio digiti. Lamellæ caudales breviter ovatae, prope apicem internum dente acuto armatae, setis quatuor, duabus apicalibus, aliis externis, totis brevibus, vix dimidii lamellæ longitudine. Maris:—*Corpus valde depressum, subovatum, 10-articulatum, segmento antico latiore et paulo transverso, aliis sensim angustioribus. Conspicilla fronte insita. Feminæ (?)*:—*Corpus convexum. Cephalothorax ellipticus, 5-articulatus, segmento antico non transverso, postico ad latera truncato, angulis posticis acutis. Conspicilla fronte insita. Abdomen 6-articulatum, segmento primo minore, lateribus truncatis, secundo lateribus rotundatis, tribus sequentibus lunatis.*

Finger of posterior antennæ rather slender, very nearly as long as the second joint, the claw hardly half the length of the finger. Caudal lamellæ distinctly shorter than twice their length, ovate, having a tooth on inner side near apex, setæ four, scarcely half as long as the lamellæ, two apical the others external. *Male*:—Body flat, subovate, ten-jointed, first segment the broadest and somewhat transverse, last nine segments gradually decrease in breadth, the tenth is concealed beneath the ninth. Conspicilla on the front. *Female*:—Body convex. Cephalothorax oval, five-jointed, first segment hardly longer than the breadth, posterior having the sides nearly rectangular, and at middle behind a little prominent. Conspicilla of moderate size, in contact, on the front. Abdomen six-jointed, oblong, first segment quite small, sides truncate, second with sides rounded, third, fourth and fifth lunate, acute.

Plate 87, fig. 13 *a*, female, enlarged; *b*, part of posterior antenna; *c*, caudal lamella. Fig. 14 *a*, male, enlarged; *a'*, posterior antenna; *b*, anterior antenna; *c*, under view of anterior part of animal.

East Indies, Sooloo Sea, southwest of the island of Panay, January 29, 1842.

Length, one-tenth of an inch. Colour of female, deep blue black. Colour of male, bright opal tints; imperfectly transparent.

It is not certain that the male and female here described are of the same species. The only evidence of this consists in their having been collected on the same day, and their having similar anterior and posterior antennæ, conspicilla, and caudal lamellæ.

The body of the male is broadest at the first articulation, and from thence the sides are straight convergent. The length is twice the greatest width, or nearly so. The segments are laterally obtuse, excepting the two or three last, which are acute or nearly so. The length of the caudal lamellæ is one and two-thirds the breadth, which is a little shorter in proportion than in the female.

2. *Conspicilla non conjuncta.*

SAPPHIRINA OVATO-LANCEOLATA.

Digitus antennarum posticarum dimidio articuli 2di paulo longior, articulis duobus digiti valde inæquis. Lamellæ caudales latitudine duplo longiores, non divaricatæ, setis quinque, totis brevibus, unâ brevissimâ ad apicem internum insitâ. Maris:—Corpus ovato-lanceolatum, 10-articulatum, segmento antico vix oblongo, tribus penultimis lunatis et ad latera subacutis aut obtusis. Conspicilla subremota, inferiora et fronte remota. Feminæ:—Corpus ovato-lanceolatum, abdomine (articulo primo brevissimo excluso) vix angustiore. Cephalothorax 4-articulatus, segmento antico fere duplici, aliis inter sese similibus, latere obtusis. Conspicilla remotiuscula, fronte insita. Abdominis segmenta secundum tertium quartumque latè sublunata et latere subacuta.

Finger of posterior antennæ much shorter (nearly half) than second joint, the two joints of the finger nearly equal. Caudal lamellæ twice as long as broad, not divaricate, furnished with five setæ, all short, one at inner apex very short. *Male*:—Body ovato-lanceolate, ten-jointed, first segment hardly oblong, three before the last lunate, and sides subacute or obtuse. Conspicilla subremote, situated on the inferior surface remote from the front margin. *Female*:—Body ovato-lanceolate, a little convex. Cephalothorax four-jointed, twice as long as broad, obtuse behind, rounded in front, first segment nearly divided by an articulation, hardly oblong, others similar to one another. Conspicilla a little separate, of moderate size, situated on the front. Abdomen five-jointed, first segment very short and narrow, second broadest and large, second, third, and fourth lunate, fourth much shorter than the fifth.

Plate 87, fig. 15 *a*, female, enlarged; *b*, posterior antenna; *c*, anterior foot or maxilliped. Fig. 16 *a*, male of same, enlarged; *b*, under view of head.

Atlantic, off the harbour of Rio Janeiro, abundant, November, 1838; also, November 19, 1838, in latitude 23° south, longitude 41° west.

Length of female observed, one-sixteenth of an inch; of males, one-seventh of an inch. Females, nearly colourless, not diaphanous. Males, very brilliant with opaline reflections of various rich colours, but mostly blue, and appearing like resplendent blue gems deep in the water, flashing on the eye as they change their positions.

The *female* has five joints to the cephalothorax, the first articulation not very distinct; the first segment is about as long as broad. The second abdominal segment is the broadest. The caudal lamellæ have five setæ, one at the inner apex quite short, the two apical rather less than half the lamella in length; the outer situated quite near the base of the lamellæ. The conspícilla are either on the front, or mostly on the lower surface of the head; they are much nearer to one another than in the male, but are not in contact. Length of the anterior antennæ equalling about half the breadth of the cephalothorax; setæ more than half the length of the antennæ.

The *male* has nearly the same breadth anteriorly as the female. The last or tenth segment is much narrower than the penult, and is situated in the convexity of the penult, not projecting beyond it; the articulation is not very distinct. Anterior antennæ five-jointed. The posterior antennæ and caudal lamellæ are as in the female. Stomach small, somewhat triangular in form, the anterior angles being prolonged forward.

SAPPHIRINA GEMMA.

Digitus antennarum posticarum articulo 2do parce brevior, tenuis, articulis duobus digiti valde inæquis, unguiculo brevi. Lamellæ caudales subellipticæ, latitudine duplo longiores, ad apicem internum minutè apiculato, setis quatuor, brevibus, duabus apicalibus, aliis externis. Feminae:—Corpus gracillimum, elongatum. Cephalothorax 5-articulatus articulatione primâ fere obsoletâ, segmento antico parce oblongo, posticis inter sese similibus, sensim minoribus. Conspícilla remotiuscula, inferiora, prope frontem insita. Abdomen valde angustius, 6-articulatum, segmentis primo secundoque subæquis, sequentibus vix lunatis. Maris:—Corpus oblongo-subellipticum 10-articulatum, segmento antico paulo transverso, posticis latere non acutis. Conspícilla remotiuscula, inferiora et fronte remota.

Finger of posterior antennæ slender, nearly as long as second joint,

its two joints very unequal, claw quite short. Caudal lamellæ sub-oval, twice as long as broad, at inner apex a minute point, setæ four, short, not half as long as lamellæ, two apical, the others external. *Female*:—Body very slender, long, length more than three times greatest breadth. Cephalothorax five-jointed, first articulation nearly obsolete, segments not having the posterior angles acute, sides truncate, first anterior segment a little oblong, the others gradually smaller. Conspicilla small, a short distance from the front. Abdomen narrow, six-jointed, first and second segments subequal, the following hardly lunate. *Male*:—Body ten-jointed, linear-elliptical, length about two and a half times the breadth; first segment not oblong, the three posterior not acute laterally, the last nearly concealed. Conspicilla rather distant, remote from the front.

Plate 88, fig. 1 *a*, female, enlarged; *a'*, anterior antenna; *b*, *b'*, posterior antenna, different views; *c*, anterior feet (or maxillipeds); *d*, *e*, maxillæ; *f*, maxillæ in place. Fig. 2 *a*, male, enlarged, showing nervous system (reddish), digestive system (greenish), genital system (bluish), &c. (*a*, inner prolate lenses of eyes; *b*, *b'*, nervous system; *c*, *c'*, genital system; *d*, œsophagus; *f*, conspicilla); *a'*, prolate lenses and pigment, with eyes intermediate; *b*, anterior antenna; *c*, posterior antenna; *d*, first pair of feet; *e*, same, in place; *f*, lower extremity of genital system (same with *c'* in 2 *a*); *g*, nervous ganglion, with its branches.

Lagulhas Bank, south of Cape of Good Hope, April 11 and 12, 1842. Probably the same, twelve miles northeast of New Zealand.

Length, one-eighth of an inch. Female, colourless; bags of eggs, dull bluish. Male, with very brilliant blue reflections, dazzling in the sun's rays, with various other bright colours as the animal changes its position. The water was spangled with them for several hours while on the Lagulhas Bank. By transmitted light, deep yellow, rose, carmine, and fire-red tints. The female has the cephalothorax two and a half times as long as broad. Joints obtuse and similar. Eggs of external ovarian sacs small and very numerous.

The male is lamellar. The last segment is placed partly under the preceding and is half narrower. The inner angle of the caudal

lamellæ is not prominent, and has a very minute acute point. The hairs of the anterior antennæ are not as long as the organ.

This species may possibly be the *Sapphirina indicator*.

SAPPHIRINA BELLA.

Digitus antennarum posticarum tenuis, fermè articuli 2di longitudine, articulis digiti fere æquis, unguiculo parvulo. Lamellæ caudales divaricatæ, angustæ, lanceolatæ, setis quatuor, duabus apicalibus, aliis externis, totis perbrevibus. Maris:—Corpus ovatum, 9-articulatum, segmento ultimo tecto, antico parce oblongo, ad latera totis obtusis. Conspicilla parvula, remotiuscula, inferiora, prope frontem insita.

Finger of posterior antennæ slender, about as long as second joint, two joints of finger nearly equal, claw quite short. Caudal lamellæ slender, divaricate, narrow lanceolate, three times as long as broad, setæ four, two apical, the others external, all very short. *Male:—*Body long ovate, about twice as long as broad, lamellar, nine-jointed, last segment concealed, first sparingly oblong. Conspicilla quite small, separate, a little distant from the front.

Plate 88, fig. 3 *a*, animal, enlarged; *b*, prolate lenses, with the intermediate eyes; *c*, posterior antennæ; *d*, caudal lamella and part of segment of abdomen, to which it is attached.

Pacific, near Hall's Island, Kingsmill Group, April 13, 1841, at 4 A. M.

Length, one-fifteenth of an inch. Transparent. Purple and carmine in blotches, changing a little with the position of the animal.

The outline of the body is even, and *all* the segments are laterally obtuse and rounded. The first segment is like the letter D in outline. The setæ of the caudal stylets are much shorter than half the stylet. The tips of the anterior antennæ were barely seen in an upper view, as they project but slightly.

SAPPHIRINA OPALINA.

Digitus antennarum posticarum tenuis, articulo 2do fere longior, ungui-

culo brevi. Lamellæ caudales suborbiculatæ, apice interno producto, acuto, setis dimidio lamellæ vix longioribus. Maris:—Corpus ovatum, 10-articulatum, articulatione primâ fere obsoletâ, segmento postico tecto, quatuor penultimis latere ad angulos posticos acutis. Conspicilla remotiuscula, fronte insita.

Finger of posterior antennæ slender, not shorter than second joint, claw short. Caudal lamellæ suborbicular, breadth but little less than length, inner apex most prominent, acute, setæ hardly longer than half the lamellæ. *Male*:—Body ovate, length nearly twice the breadth, flat, ten-jointed, the tenth concealed, first semicircular, posterior four laterally acute, first articulation nearly obsolete. Conspicilla on the front, a little remote.

Plate 88, fig. 4 *a*, male, enlarged; *b*, third pair of natatories; *c*, fourth pair of natatories; *d*, anterior part, showing the relative position and forms of the antennæ (*a*¹, *a*²) and (*b*), the mouth organs and first pair of legs in natural position; *e*, mouth organs, with one of the legs removed; *f*, same, both legs removed; *g*, same, one of outer maxillæ removed; *h*, same, both of outer and one of inner maxillæ, removed; *i*, one of inner maxillæ and mandible; *k*, *l*, outer maxilla, in different positions.

Atlantic, latitude 1°–0° north, longitude 17°–18° west, November 1 and 2, 1838, specimen figured in figs. 4 *a*, *b*, *c*; latitude 4° 30' south, longitude 25° west, specimens affording figures *d* to *l*, on May 13, 1842.

Length, one-eighth of an inch. Colours brilliantly opaline, tints varying with the position of the animal; bluish, reddish, purple, yellow, and milk-white are the most common.

Setæ of the anterior antennæ about as long as the joints. The finger of the posterior antennæ has the first joint about half as long as the second. Claw of posterior antennæ not half as long as preceding joint. The inner margin of the stylets is very nearly straight.

Swims with a very graceful waving motion, turning over and over.

SAPPHIRINA VERSICOLOR.

Digitus antennarum posticarum tenuis, articulo 2do vix longior, ungui-

culo longiusculo (dimidium digiti longitudine fere æquante). Lamellæ caudales latæ, latitudine breviores, apice interno producto et acuto, setis quatuor, brevissimis. Maris:—Corpus ovatum, 10-articulatum, segmento antico transverso, semicirculari, aliis longitudine subæquis, quatuor penultimis ad latera minutè acutis. Conspicilla remotiuscula, fronte insita.

Finger of posterior antennæ slender, hardly longer than second joint, claw rather long, half as long as finger. Caudal lamellæ broad, shorter than breadth, inner apex produced and acute, setæ four, very short. *Male*:—Body ovate, scarcely twice as long as broad, ten-jointed, last segment concealed, first segment semicircular transverse, the sides from thence straight, the segments subequal in length, with the posterior angles rounded; the abdominal segments also rounded, but having at the middle either side a minute acute prominence. Conspicilla on the front, a little remote.

Plate 88, fig. 5 *a*, animal, enlarged; *b*, posterior antenna; *c*, internal lenses and intermediate eyes, in relative position.

Off Rio Janeiro, latitude 24° south, longitude 43° west, January 9, 1839.

Length, one-tenth of an inch. Colours, like the preceding.

Resembles the preceding, but has the sides posterior to the first segment an even straight line, not curved, and the acute point on the abdominal segments is situated near the middle of the sides, which are rounded behind. The caudal lamellæ are shorter in proportion; the claw of the posterior antennæ longer, being more than half the length of the preceding joint.

SAPPHIRINA TENELLA.

Digitus antennarum posticarum tenuis, articulo 2do longior, unguiculo parvulo. Lamellæ caudales latitudine duplo longiores, setis dimidio lamellæ valde brevioribus, unâ ad apicem internum fere obsoletâ. Fæminæ:—Cephalothorax ovatus, 5-articulatus, articulatione primâ fere obsoletâ, segmento antico non transverso, posticis inter sese similibus, an-

gulo postico subacuto. Abdomen angustum, 6-articulatum, segmento primo brevissimo, secundo latere obtuso, tribus sequentibus lunatis. Conspicilla remotiuscula, fronte insita. Maris:—Corpus elongate ovatum, 10-articulatum, posticè segmentis sensim minoribus, segmento antico semicirculari, lateribus obtusis. Conspicilla remotiuscula fronte insita. Maris corpus diaphanum pulchrè versicolor; feminæ subdiaphanum, incoloratum.

Finger of posterior antennæ slender, longer than second joint, claw small. Caudal lamellæ twice as long as broad, setæ much shorter than half the lamellæ, one at inner apex nearly obsolete. *Female:*—Cephalothorax ovate, five-jointed, first articulation nearly obsolete, anterior segment not transverse, the posterior similar to one another, posterior angle subacute. Abdomen narrow, six-jointed, first segment very short, second laterally obtuse, the three following lunate. Conspicilla rather remote, situated on the front. *Male:*—Body long ovate, ten-jointed, segments posteriorly gradually smaller, anterior segment semicircular, sides obtuse. Conspicilla rather remote, situated on the front.

Plate 88, fig. 6 *a*, male, enlarged; *a'*, view, showing outline of stomach; *b*, posterior antennæ; *c*, leg of first pair. Fig. 7 *a*, female, enlarged; *a'*, anterior antennæ; *b*, posterior antennæ; *c*, leg of first pair.

Atlantic, latitude 20° to 23° south, longitude 38° 45' to 41°; five individuals taken, November 17 and 19, 1838; also latitude 24° south, longitude 43°, just south of Rio Janeiro, January 9, 1839; also latitude 4½° south, longitude 25° west, May 13, 1842.

Length of female, one-twelfth of an inch; of male, one-fifteenth of an inch. Male, nearly transparent; colours, bright and of light tints, variable. Female, nearly colourless, and less transparent than the male. Eggs of external sacs dull-greenish; in other specimens eggs of internal ovaries pale blue or wine-yellow.

The antennæ have the second joint largest; the third hardly half the second. Claw of posterior antennæ quite short. The stomach in the male occupied the larger part of the cephalothorax, and had five deep lobes in each side, which were attached by muscles. The ovaries

of the female were convoluted on either side of the medial line of the cephalothorax.

Figures 8, *a, b*, plate 88, represent a velvety blue-black specimen of a female, which is near the above in general form. The abdomen differs in having the first and second segments equal in length nearly, the first much the narrower; the following three lunate segments much shorter in proportion to the length; the caudal lamellæ shorter than twice the length. The cephalothorax is much convex, and ovate in outline, or nearly oval. The posterior antennæ have the second joint one and one-half times the first; the finger about as long as the second; the claw short.

This species is near the *S. fulgens* of Edwards (Crust., iii. 415).

SAPPHIRINA OBESA.

Lamellæ caudales latè subellipticæ, latitudine non duplo longiores, setis brevissimis, fere obsoletis, unâ ad apicem internum vix dispiciendâ.
Feminæ:—Cephalothorax latè subovatus, convexus, 5-articulatus, segmento antico transverso, ultimis duobus duplo brevioribus quam tertium, quarto ad angulos rotundato, quinto ad angulos subacuto. Conspicilla remotiuscula, fronte insita. Abdomen 5-articulatum, segmento primo brevissimo, tribus sequentibus lunatis.

Caudal lamellæ broad suboval, not twice as long as broad, setæ very short, nearly obsolete, one at inner apex scarcely distinguishable.
*Female:—*Cephalothorax broad subovate, convex, five-jointed, rounded in front, segments laterally obtuse, first shorter than broad, last two half as long as third, fourth with the angles rounded, fifth having the angles acute. Conspicilla situated on the front, a little separate. Abdomen five-jointed, first segment very short, having appendages, next three lunate, acute, last longest.

Plate 88, fig. 9, animal, enlarged.

Pacific, off Hopper Island, Kingsmill Group, latitude 0° 30' north, longitude 174° east, April 15, 1841.

Length, one-sixteenth of an inch. Colour, brownish, without

iridescence. The cephalothorax is broadest at posterior part of first segment, where there is an imperfect angle in the outline. The penult segment is rounded on either side behind, and the last is nearly truncate; these last two are of nearly equal length, and each is about half shorter than either of the two preceding.

SAPPHIRINA OBTUSA.

Lamellæ caudales elongatæ, non divaricatæ, setis dimidio lamellæ valde brevioribus. Feminæ:—Cephalothorax convexus, 4-articulatus, ad frontem subtruncatus, segmento antico oblongo, lateribus fere parallelis angulis posticis rotundatis, segmentis aliis dissimilibus, secundo latere truncato, tertio rotundato, quarto (vel ultimo) ad medium lateris angulato. Conspicilla fronte insita, parce remotiuscula. Abdomen angustum, 5-articulatum, segmento primo parvulo, tribus sequentibus sublunatis, lateribus obtusis.

Caudal lamellæ oblong, not divaricate, setæ quite short, much shorter than half the lamellæ. *Female:—*Cephalothorax convex, elongate, about twice as long as broad, four-jointed, subtruncate in front, segments laterally rounded, anterior oblong, not narrow behind, obtuse, second truncate either side, third rounded, fourth or last angulate on either side at middle, and rounded at the posterior angles. Conspicilla situated on the front, nearly in contact. Abdomen narrow, five-jointed, first segment quite narrow and small, three following sublunate, sides elongate, obtuse.

Plate 88, fig. 10, animal, enlarged.

Pacific, latitude 43° south, longitude 78° 45' west, April 3, 1839.

Length, one-fifteenth of an inch. Colour, reddish, with some yellow. The legs are often seen, in an upper view, projecting below and either side of the basal portion of the abdomen.

SUBFAMILY MIRACINÆ.

GENUS MIRACIA.

Corpus subcylindricum. Frons duas appendices parvulas falciformes subtus gerens. Antennæ anticæ flexiles, appendiculatæ. Pedes antici mediocres, monodactyli, digito tenui. Pedes duo proximi biremes, lateraliter paulo porrecti. Appendices quatuor abdominis basales elongatè setigeræ. Setæ caudales elongatæ.

Body subcylindrical. Front with two small falciform appendages. Anterior antennæ flexible, appendiculate. Anterior feet of moderate size, monodactyle, finger thin. Next pair of feet two-branched, laterally extended. Four appendages of abdomen near base long setigerous. Caudal setæ elongate.

The Miraciæ have the general structure of the Setellæ, being similar to them in their abdomen, antennæ, abdominal and thoracic feet, though the body is stouter anteriorly, and not pointed in front. They differ from them in the large conspicilla, which occupy the front of the head. As the parts were opaque, excepting these oblate cornea, an intermediate pair of eyes could not be distinguished. In the specimens of one species (female, and we think also male), the anterior segment of the body was much stouter than the following. In another species, the specimen seen had the body uniformly even in size, though gradually tapering posteriorly.

The Miraciæ occur in the tropical part of both the Atlantic and Pacific Oceans. They move less by leaps than is common with the Cyclopoidea, having usually a continuous motion. The body is very flexible, and goes wriggling along, but with great rapidity.

MIRACIA EFFERATA.

Corpus 10-articulatum, segmento antico valde latiore, aliis sensim attenuatis. Conspicilla fronte insita, maxima, valde prominentia, contigua. Antennæ anticæ mediocres, 7-articulatæ, articulis tertio quinto septimoque brevibus. Styli caudales oblongi, setis duplo longioribus.

Body ten-jointed, anterior segment much the stoutest, the others gradually diminishing. Conspicilla situated on the front, very large and prominent, in contact. Anterior antennæ of moderate size, seven-jointed, third, fifth, and seventh joints short. Caudal stylets oblong, setæ full twice longer than stylet.

Plate 88, fig. 11, female, enlarged.

Atlantic, latitude 7° – 4° north, longitude 21° $30'$ – 20° west, October 18 to 25, 1838; also, 4° $30'$ south, longitude 25° west, May 13, 1842.

Length, one-sixteenth of an inch. Colour, deep blue, with some yellow along the ventral portion, and the intestine often deep red. The conspicilla stand out nearly like transparent glassy hemispheres on the front. The antennæ are stouter than in the following species; the fifth joint a little arcuate; the fourth joint the longest. Eggs of the ovarian sac were generally rich ultramarine blue; in one specimen, bright red. Caudal stylets about as long as two preceding segments of abdomen, and the setæ about two-thirds the length of the abdomen.

MIRACIA GRACILIS.

Corpus gracile, sensim posticè attenuatum, 10-articulatum, segmento antico non latiore. Conspicilla maxima, paulo prominentia, fronte insita. Antennæ anticæ tenuissimæ, articulis secundo quarto duobusque ultimis brevibus. Styli caudales oblongi, setis quadruplo longioribus, fere corporis longitudine.

Body slender, gradually diminishing, ten-jointed, the first segment not stouter than the following. Conspicilla situated on the front, very large, but little prominent. Anterior antennæ very slender, second, fourth and last two joints short. Caudal stylets oblong, setæ four times as long as stylets, or nearly as long as the body.

Plate 88, fig. 12 *a*, animal, enlarged; *b*, appendage to beak; *c*, another variety.

South Pacific, latitude 32° $24'$ south, longitude 177° east, northeast

of New Zealand, April 9, 1840; also, April 14, off Sunday Island, in the same region.

Length, one-sixteenth of an inch. Colour of head, very deep blue (nearly black); of the rest of the body, bright grass-green in one specimen, excepting yellowish along the venter; in another, bluish, with the intestine deep red; stylets, sienna-yellow. One blue specimen had an egg attached, showing it to be a female. The two anterior antennæ extend obliquely forward, making an acute angle with one another. These organs are very slender, and have a few short hairs at apex of first and second joints, and a long setiform appendage at apex of third joint, which is the longest joint of the organ. This joint evidently corresponds normally to the *fourth* in the preceding species, and is the third, because the normal first was obsolete. The last two joints are subequal. Two very short hairs from under margin of last joint near apex. The characters here specified are entirely those of the *Setellæ*.

The first pair of legs is very slender, and has three very short moveable setæ at apex, which are not longer than the third (or last) joint. First pair of natatories much smaller than the following three, and, as in the preceding species, one branch is two-jointed, while the other is three-jointed. Two caudal setæ are very long and scabrous; the others are minute.

TRIBE II. DAPHNIOIDEA.

THE Daphnioidea are distinguished by having a large carapax covering the whole body exclusive of the head, and not closing completely below, and by the posterior antennæ being exsert; also, by having four to six pairs of foliaceous or subnatatory appendages, corresponding to the natatory legs of the Cyclopoidea, although of different form. The abdomen is usually incurved, and is acutely furcate at extremity. The superior antennæ consist of but one or two joints,

except in the group *Bosminidæ*, in which they are multiarticulate; often they are quite obsolete. The inferior antennæ, on the contrary, are prominent organs, ending in two or three few-jointed branches. The foliaceous legs are partly branchial in character, and have in most genera a small appendage, especially adapted for this function.

There is usually a pair of minute appendages, or, at least, a pair of setæ, near the base of the abdomen, having a dorsal position.

Although approaching the *Cyproidea* in general habit, the presence of the pairs of subnatories serves to distinguish them, the corresponding organ in the *Cyproidea* being obsolete. This character is of more importance than the existence of a separate head in the *Daphnioidea*, although the latter is the more obvious character.

We do not undertake to draw out an account of the structure of the animals in this tribe, as our own observations have been comparatively few; and these will be given with the descriptions of the species.*

The known species of *Daphnioidea* belong to four families, distinguished by the number of pairs of legs and the antennæ. These are the *PENILIDÆ*, with six pairs of legs and obsolescent anterior antennæ; the *DAPHNIDÆ*, with five pairs of legs and obsolescent anterior antennæ; the *BOSMINIDÆ*, with five pairs of legs and multiarticulate anterior antennæ; the *POLYPHEMIDÆ*, with four pairs of legs.

These groups appear to be based on important characteristics. The presence, as in the *Bosminidæ*, of multiarticulate superior antennæ, in a tribe which through nearly all its species has these antennæ obsolescent, is a characteristic of considerable importance.

The *Polyphemidæ* constitute a trenchant group, remote from the other *Daphnioidea*. They carry in front a large head, full of eyes; the legs are subterete, rather than foliaceous, and are destitute of the branchial appendage, and moreover they are not wholly covered by the shell; the body behind inclines downward, and leaves a very large cavity for the young or ova.

The *Daphnidæ* and *Penilidæ* are more nearly related, as they are mostly similar in the characters of the legs, and in most points of structure. Yet they differ in the number of legs, and these legs are rather narrower in the *Penilidæ* than in the *Daphnidæ*. The poste-

* A general review of the subject, with many original observations, is contained in Baird's *British Entomostraca*. The extended and thorough investigations of E. Schödler, on the *Acanthocercus rigidus* (*Archiv f. Nat.*, 1846, 301-374 pp.), have thrown great light upon the structure of this species, as well as the *Daphnioidea* generally.

rior antennæ also diverge from the *Daphnia* character, the branches having uniformly three joints each, in the *Daphnidæ*, and one or both of the branches with less than this number in the *Penilidæ*.

M. E. Schödler, in his paper on the *Acanthocercus rigidus*, suggests the subdivision of the *Daphnioidea* based on the number of legs, as a natural grouping of the genera.

The *Lyncei* are separated from the *Daphnidæ* as a distinct family by Dr. Baird: yet the species are identical in all proper family characteristics,—in the general form of body, in the number of organs, their structure, and all points, except such as may be a basis for subordinate divisions. The only characters mentioned by Dr. Baird in the characteristic of the family “*Lynceidæ*” not included in that of the “*Daphniadæ*,” are, the existence of a black spot in front near the eye; the convolution of the intestine; and a distinct articulation at the base of the abdomen. But the “black spot” according to Schödler, exists in most (if not all) of the *Daphnidæ*: he has shown its connexion with an opening in the basal portion of the anterior antennæ, and concludes that it is connected with the organ of hearing, being probably the *otolites*. The convolution of the intestine is of little importance as a basis for a family division. The genus *Acanthocercus*, for example, is closely similar to Baird’s *Macrothrix*, so closely that it is referred to *Macrothrix* by Baird; and yet it has a convoluted intestine, like the *Lyncei*. If this be right, the same genus may include species of both kinds of intestine.

The families of the tribe *Daphnioidea*, and the genera as yet known, may be distinguished as follows:—

FAM. I. PENILIDÆ.*

Pedes foliacei numero duodecim, angustiores. Antennæ anticæ obsolescentes.

G. 1. *SIDA*, *Straus*.†—*Antennarum posticarum ramus longior 3-articulatus, alter 2-articulatus. Caput grande, infra non acute productum. Antennæ 1mæ juxta capitis basin insitæ.*

* Dana, Proc. Amer. Acad. Sci., ii. 47, 1849; family *Daphniadæ*, subfamily *Sidina*, Dr. W. Baird, Brit. Entomost., 106; *Sididæ*, Gray, Cat. Brit. Crust. Brit. Mus., 93, 1850.

† *Sida*, *Straus*, Mém. sur les *Daphnia* in Mém. du Mus. d’Hist. Nat., v., 38.

- G. 2. *DAPHNELLA*, *Baird*.*—Antennarum posticarum rami ambo 2-articulati, ramo brevior inter dum prope basin articulationem etiam imperfectam habente. Caput oblongum, infra non productum, antennis anticis medio gerens.
- G. 3. *PENILIA*, *Dana*.†—Antennarum posticarum rami ambo 2-articulati. Caput breve, infra acute elongato-productum, antennis anticis obsolescentes versus apicem gerens. [Species marinæ.]
- ? G. 4. *LATONA*, *Strauss*.‡—Antennæ posticæ ramis tribus 1-articulatis confectæ.

FAM. II. DAPHNIDÆ. §

Pedes foliacei numero decem, latiores. Antennæ anticæ 1-2-articulatæ.

1. *Tubum cibarium medio non convolutum. Caput majusculum.*

- G. 1. *DAPHNIA*, *Müller*.—Corpus plus minusve oblongum. Antennæ anticæ minutæ, fere celatæ. Testa cellulis linearibus reticulata.
- G. 2. *CERIODAPHNIA*, *Dana*.—Corpus fere globosum, capite brevi. Antennæ anticæ minutæ (raro elongatæ?) Testa cellulis hexagonis et pentagonis subtilissimè areolata.
- G. 3. *MOINA*, *Baird*.||—Caput infra globosum. Antennæ anticæ longiusculæ, apud capitis latus inferius pendentes.
- G. 4. *MACROTHRIX*, *Baird*.¶—Caput infra subacutum vel obtusiusculum, antennis anticis longiusculas pendentes ad rostri extremitatem gerens. Seta articuli I uni rami longa, alias superans.

2. *Tubum cibarium medio convolutum.*

a. Caput majusculum, ac in Daphniis.

- G. 5. *ACANTHOCERCUS*, *Schödler*.**—*Macrothrici* similis.

* Baird, Brit. Entomost., 109.

† Proc. Amer. Acad. Sci., ii. 47.

‡ The genus *Latona* is placed in this division by Schödler, on account of a general resemblance to *Sida*, with a query as to its correctness.

§ Dana, Proc. Amer. Acad. Sci., ii. 1849; *Daphnita*, Gray, Cat. Brit. Crust. Brit. Mus., 88. *Daphniadæ* (in part), of W. Baird, Brit. Entomost., 62.

|| W. Baird, Brit. Entomost., 100; *Pasithea*, Koch, Deutschl. Crust. The name *Pasithea* is rejected by Baird, because of its being previously used twice in Zoology.

¶ W. Baird, Trans. Berw. Nat. Club, ii. 149, 1845, Ann. Mag. N. H., xi. 87, 1843, xvii. 412, 1846, Brit. Entomost., 103.

** E. Schödler, Archiv f. Naturgeschichte, 1846, p. 301. It is probable that this genus should be united to *Macrothrix*.

b. Caput breve.

- G. 6. *EURYCERCUS*, *Baird*.*—Caput quoad rostrum paulo productum et infra incurvatum. Antennæ anticæ rostro vix breviores. Abdomen perlatum.
- G. 7. *LYNCEUS*, *Müller*.†—Caput quoad rostrum valde productum et infra incurvatum, lateraliter visum tenuiter acutum (apice raro inflexum). Antennæ anticæ minutæ, prope rostri basin insitæ et rostro plus dimidio breviores. Abdomen latitudine mediocri.
- G. 8. *ALONA*, *Baird*.‡—Caput quoad rostrum minus productum et paulo divaricatum. Antennæ anticæ rostri apicem fere attingentes. Abdomen latitudine mediocri.

FAM. III. BOSMINIDÆ.

Pedes foliacei numero decem. Antennæ anticæ elongatæ et multarticulatæ.

- G. 1. *BOSMINA*, *Baird*.§—Caput infra rostriforme, ad rostri apicem antennis anticis gerens. Antennæ posticæ sat breves.

FAM. IV. POLYPHEMIDÆ.||

Caput grande, oculis repletum. Pedes numero octo, fere teretes. Antennæ anticæ obsolescentes.

- G. 1. *POLYPHEMUS*, *Müller*.—Corpus apud thoracem posticum deflexum posteaquæ quoad abdomen reflexum et tenue, extremitate setis duabus longis armatâ. Caput discretum. Ramus antennarum posticarum unus 4 alter 3-articulatus.

* This genus as adopted includes *Chydorus*, *Peracantha*, and *Pleuroxus* of Baird (*Brit. Entomost.*), which scarcely differ except in the form of the shell.

† Baird, *Brit. Entomost.*, 123.

‡ *Trans. Berw. Club*, ii., *Ann. and Mag. Nat. Hist.*, ii., *Brit. Entomost.*, 131. We include with *Alona*, the genera *Acroperus* and *Camptocercus* of Baird. The last is distinguished by having a very narrow elongated abdomen which is also flexible. In the genus *Alona*, as adopted, the beak diverges from the body, and the inferior side makes a large angle (between 60° and 90°), with the shell below or adjoining; while in *Lynceus* the beak curves parallel with the shell, and makes a very small angle with it; other and better grounds for generic divisions may hereafter be detected.

§ *Trans. Berw. Nat. Club*, 1845, *Ann. Mag. N. H.*, xi. 412, *Brit. Entomost.*, 105.

|| Baird, *Trans. Berw. Nat. Club.*, ii. 149, 1845., *Brit. Entomost.*, 111.

- G. 2. *EVADNE*, *Loven*.*—Corpus postice deflexum, abdomine non reflexo, capite vix discreto. Testa postice subacuta. Rami antennarum posticarum 3-articulati.
- G. 3. *PLEOPIS*, *Dana*.—Corpus postice non deflexum, fere rectum; abdomen crassum extremitate furcatum, setis nullis. Testa postice rotundata. Rami antennarum posticarum 3-articulati.

FAMILY PENILIDÆ.

GENUS DAPHNELLA, *Baird*.

THE legs in this genus are much narrower than in the Daphnidæ. They have two branches, and differ not very much from the natatory legs of other Entomostraca. The first pair has both branches narrow and two-jointed; the longer as well as the basal part is ciliated below. The fourth pair has the shorter branch considerably the broadest and lamellar, and it is furnished with a few distant setæ, approximating to the form in *Penilia*. The abdomen is but little inflexed. The dorsal setæ are situated on a common prominence, and are rather long.

The head is not shorter than its breadth, either in a lateral or vertical view, and is arcuate or slightly angled below; it bears the superior antennæ from its lower side remote from the base of the head. One of the branches of the posterior antennæ (the shorter, when they differ in length) has the second joint short, as in *Penilia*, and the first joint of the same branch very near base has an appearance of another articulation;† the other branch has the first joint shorter than the second, unlike *Penilia*. It is an interesting fact, that the fresh waters of the Feejee Islands should afford species of this genus as well as those of Great Britain.

* Zoologisk Bidrag, 1; Edwards, *Crust.*, iii. 390; Goodsir, *Edinb. Jour.*, xxxiii. 366; Baird, *Brit. Entomost.*, 114.

† The branch which is three-jointed in *Sida* is the other one, not that in which the terminal joint is short.

DAPHNELLA ANGUSTA.

Corpus lateraliter aut superne visum angustum, non tumidum, dorso rectum. Caput discretum, vix oblongum, parce angustius. Antennæ 1mæ perbreves; 2dæ corpore breviores, ramis subæquis, rami unius articulo 2do duplo longiore quam 1mus, alterius articulo 2do brevior quam dimidium 1mi. Setæ abdominis dorsales dimidio corporis breviores.

Body narrow, whether seen from above or in profile, a little higher posteriorly, not tumid, back straight. Head separated by a constriction, hardly oblong, a little less than the body in height. Anterior antennæ quite short; posterior pair shorter than the body, the branches subequal, the second joint of one branch twice as long as the first joint, and second of the other branch half the first joint of same. Dorsal setæ of abdomen not half as long as the body.

Plate 89, fig. 1 *a*, dorsal view, enlarged; *b*, side view; *c*, anterior antennæ; *d*, first pair of legs; *e*, fourth pair, magnified three-fourths more than the figure of the animal; *f*, dorsal abdominal appendage.

Fresh-water pools, Vanua Lebu, Feejee Islands.

In a dorsal view, the head is short oval, and the eye is at the front extremity; the body behind is narrow oval or ovate, with the posterior extremity truncate or slightly excavate. The minute anterior antennæ are seen in an upper view, either side of the head. In profile, the eye is at the extremity of the front. Only the tips of the caudal extremity project beyond the shell. The short spines at the extremity of the abdomen are nearly straight, not a sixth of the length of the animal.

GENUS PENILIA, Dana.

Caput fere discretum, infra elongate rostratum et acutum. Antennæ posticæ grandes, birameæ, ramis duobus 2-articulatis. Abdomen non inflexum, 2 stylis corneis elongatis confectum et extus non spinulosum.

Head nearly separate, below long rostrate and acute. Posterior antennæ large, two-branched, the two branches two-jointed. Abdomen not inflexed, ending in two long corneous stylets and exteriorly not spinulous.

This genus includes two marine species, very similar in character, one obtained by the author at Rio Janeiro, and the other in the East Indies. The shell is very large, having great vertical breadth, and is open widely below; the lower margin is sinuous and elegantly denticulate, and terminates behind either side in an acute point. The posterior margin is also sinuous, and over the middle of the back, as seen from above, is arcuately excavate; the lower part of this margin is denticulate. The head is but imperfectly separated by a suture from the part behind; it has a long vertical front, and ends below in an acute point or beak. The anterior antennæ are very small, and are situated towards the extremity of the beak on its inner or posterior side. The posterior antennæ are quite large. The branches are nearly equal in length, and the second joint is very short, the first being long. The eye is small. The thoracic legs are narrow and of peculiar form (fig. 3, *e*, Pl. 89), unlike the other Daphnioidea described. There are two branches: one, the longer, nearly terete, three-jointed, furnished on the lower side, like the base of the organ, with a fringe of longish hairs; the other, having an orbicular extremity, which is set around with five to seven long setæ, each having an articulation not far from its base.

The abdomen is two-jointed; the first of the segments is about as broad as long, and has at the dorsal apex a pair of small appendages, each furnished with a long seta. The rest of the abdomen, exclusive of the terminal stylets, is oblong, subterete, gradually diminishing in breadth, and without spinules below.

The egg cavity is rather large, the back of the animal being considerably convex; the largest number of embryos observed was six.

PENILIA AVIROSTRIS.

Testa posticè ad medium profundè excavata. Setæ appendicum abdominis dorsalium stylis caudalibus multo breviores, basin stylorum fermè attingentes.

Shell posteriorly over middle of back deeply excavate. Setæ of dorsal abdominal appendages not as long as caudal stylets, barely reaching to base of stylets.

Plate 89, fig. 2 *a*, side view of animal, enlarged; *b*, dorsal view.

Harbour of Rio Janeiro, December 24, 1838; abundant.

Length, one-twentieth of an inch.

In dorsal view, head obtuse, very low triangular, sides of body arcuate, posterior angles of shell prolonged, acute, nearly as remote as greatest breadth of animal; centre of posterior margin deeply rotund-excavate. In side view, back very much inflated, and within this part there were six immature young. The head is lengthened downward, appears acute, and terminates in a short acute appendage (rudimentary anterior antennæ). The lower margin of the shell is rounded anteriorly, then nearly straight but undulate, and both this and the lower half of the posterior margin is set with minute teeth. The antennæ have a long subcylindrical base, and two smaller and somewhat shorter branches; the branches are subequal, consist of a long slender joint and a very short apical, and bear a few setæ at apex, hardly as long as the branch.

The abdomen extends beyond the carapax; it has a subcylindrical form, and terminates in two curved setæ, longer than the abdomen. From near the base of dorsal part of abdomen, there is a pair of minute appendages, slender in form, bearing one or two slender setæ; the tips of the setæ extend nearly to apex of abdomen, or not beyond it.

Penilia avirostris, DANA, Proc. Amer. Acad. Sci., ii. 47, 1849.

PENILIA ORIENTALIS.

Testa postice ad medium parce excavata. Setæ appendicum abdominis dorsalium longissimæ, apicem stylorum caudalium superantes.

Shell shallow excavate posteriorly over middle of back. Setæ of dorsal abdominal appendages very long, reaching even beyond apex of caudal stylets.

Plate 89, fig. 3 *a*, dorsal view, enlarged; *b*, side view; *c*, ventral view; *d*, antenna; *e*, one of the natatory legs.

East Indies, at the eastern entrance of the Straits of Sunda. Collected, March 5, 1842.

This species is near the preceding, and at first appeared to be identical with it. But the dorsal abdominal setæ are more than twice the length in that species, while the stylets at the extremity of the abdomen are shorter in proportion, being a little shorter than the abdomen. These stylets have an appearance of a suture near base, and there are two very short setæ on the outer side at this suture or pseudo-articulation. The front in an upper view is straight truncate, or scarcely triangular. The anterior margin of the shell below the head is much longer, and rounds with a much broader curve into the inferior margin. It forms an acute angle with the posterior side of the rostrum, while in our drawing of the *P. avirostris* there is a short neck below, separating the two. The concavity at the middle of the posterior margin of the shell is quite shallow, and the acute posterior angles of the shell are less prolonged as seen in a dorsal view.

The setæ of the antennæ are a little longer than the branch; the second joint of the branches is about one-third as long as the first. The *mouth* consists of a pair of stout *mandibles*, situated transversely, with broad dentate extremities. No palpus was detected. Posterior to the mandibles, there is a pair of slender maxillæ, having at apex a few short spines.

The dorsal cavity contained three large embryos.

Penilia orientalis, DANA, Proc. Amer. Acad. Sci., Boston, ii. 47.

GENUS DAPHNIA, Müller.

We separate from this genus the species having the shell reticulate, with hexagonal or pentagonal cells.

DAPHNIA AUSTRALIENSIS.

Valde tumida, paulo oblonga, capite per constrictionem vix discreto, pone

medium altior, posticè subtriangulata, obtusa, margine supero-postico subtilissimè denticulato. Caput breve, infra truncatum et non rostratè productum, supernè visum triangulatum, obtusum. Rami antennarum posticarum subæqui, setis sat longis. Testa reticulata, areolis angustissimè linearibus, obliquis, prope marginem valde latioribus.

Very tumid, a little oblong, head hardly separated by a constriction, body higher posterior to middle, behind subtriangular, obtuse, on posterior part of back minutely denticulate. Head short, beak horizontally truncate; seen from above, triangular, obtuse. Posterior antennæ having the branches longer than base, subequal, setæ rather long. Shell reticulated, the cells long linear and parallel, running obliquely, much larger at the margin.

Plate 89, fig. 4 *a*, side view of female, enlarged; *b*, profile of male; *c*, vertical view of head; *d*, abdomen in part, with stomach and intestine; *e*, enlarged view, showing areolation of shell.

From fresh-water pools, near Sydney, New South Wales.

Greatest height of male, half the whole length; of female, three-fourths the length. In the latter, the body behind is obtuse triangular; in the former, the dorsal side of the angle rounds into the back; on both there are minute spines along this supero-posterior portion of the shell. The beak is truncate below, and the truncation, though horizontal, is excavate at middle. The eye, as seen in a vertical view is placed at a very short distance from the front margin. The abdomen terminates in a pair of slightly curving spines, and also six other pairs of spines of decreasing size, none of which are more than half as long as the terminal. The setæ of the antennæ are minutely plumose.

Daphnia australiensis, DANA, Proc. Amer. Acad. Sci., ii. 48.

DAPHNIA MACRURA.

Gracilis, elongata, testâ postice aculeato-productâ, aculeo tenui, paulo breviorè quam corpus. Caput grande, corpore non humilius, supra non discretum, infra nec rostratum; fronte latere viso rotundato, supernè

viso bene acuto. Testa apud margines dorsales infero-posticosque et spinam caudalem subtilissimè denticulata. Rami antennarum posticarum æqui.

Slender elongate, produced behind into a long spine, which is but little shorter than the body; head large, not separate, below not produced into a beak, equalling the body in height; front in side view rounded, in upper view acute. Dorsal and infero-posterior margin minutely denticulate. Branches of the inferior antennæ equal.

Plate 89, fig. 5 *a*, side view, enlarged; *b*, upper view of head, in outline.

From fresh-water pools, near Sydney, New South Wales.

The slender body, long aculeate prolongation of the shell behind, and the large non-rostrate head, acute in a dorsal view, are strong characteristics. The dorsal line, from the head to the tip of the caudal elongation, has an uninterrupted gentle concave curvature, and the same bends around the front of the head. The head in profile is convex subtriangular, and the outline is continuous with the outline of the venter, excepting a slight emargination. The height of the body is nearly the same before and behind, and is scarcely greater at middle than elsewhere.

Daphnia macrura, DANA, Proc. Amer. Acad. Sci., ii. 48.

GENUS CERIODAPHNIA, Dana.

Corpus fere globosum, capite brevi, instar rostri infra vix productum. Antennæ anticæ minutæ (raro elongatæ?). Testa cellulis hexagonis vel pentagonis areolata.

Body nearly globose, head quite short and not produced into a beak below. Anterior antennæ minute (rarely elongate?). Shell areolate, with hexagonal or pentagonal cells.

This genus includes the *Daphnia rotundata* and allied species.

CERIODAPHNIA TEXTILIS.

Subglobosa, paulo oblonga, pone medium paulo latior, posticè breviter subtriangulata, obtusa. Caput breve, infra brevissimè acutum, supernè visum breviter subtriangulatum, obtusum. Rami antennarum valde inæqui, setis paucibus et brevibus.

Subglobose, a little oblong, broader posterior to middle, behind low triangular, obtuse. Head short, very short acute below, form as seen from above short subtriangular, obtuse. Posterior antennæ with branches very unequal, setæ few and short.

Plate 89, fig. 6 *a*, side view of animal, enlarged; *b*, dorsal view.

Fresh-water pools at Sandal-wood Bay, Vanua Lebu, Feejee Islands.

The length is about one-fourth greater than the breadth in both a side and vertical view. The outline of the back in a *side view* is a flattened curve; the head is large, but very short, with the front convex but flattened, and the small acute beak below, is situated very near the body. The body behind is rather low triangular, with the apex small truncate, or a little concave; there is here an opening through which, when the animal is at rest, the divergent setæ of the dorsal abdominal appendages are exerted. The longer branch of the posterior antennæ is as long as the basal portion, and one and a half times the length of the shorter branch.

The shell is very neatly reticulate with hexagonal cells. There is a distinct depression between the head and the back.

Daphnia textilis, DANA, Proc. Amer. Acad. Sci., ii. 47.

GENUS LYNCEUS, *Müller*.

LYNCEUS LATIFRONS.

Valde tumidus: latere visus, rotundatus, capite non discreto, brevissimo

rostrato, rostro gracili, acuto, ad corpus strictè appresso; supernè visus, antice latissimè truncatus, fronte parce angustiore quam corpus, posticè breviter triangulatus et obtusus.

Very tumid: in side view rotund, head not separate, very short, beaked, beak slender and close to body, acute; in upper view animal very broad truncate anteriorly, the front therefore nearly as broad as body, behind low triangular and obtuse.

Plate 89, fig. 7 *a*, side view of animal, enlarged, the heart at *h*; *b*, upper view.

Fresh-water pools, on Vanua Lebu, Feejee Islands.

The form of this species corresponds with that of the *Chydorus* of Baird; a subgenus which may be sustained, but should rest on better characters than those published. The front margin (as seen in an upper view) is more than three-fourths the greatest breadth of the body. The slender pointed beak is very close to the body, and no distinct head was made out. The eye is just above the beak. In profile, the length exceeds very slightly the height, and the curve behind is nearly a regular semicircle. The abdomen is broad and has a truncate apex; there are two minute setæ near dorsal base at an abrupt narrowing of this part of the animal; and at apex there are two spines about as long as breadth of abdomen, besides others which are much shorter.

Lynceus latifrons, DANA, Proc. Amer. Acad. Sci., ii. 48.

FAMILY POLYPHEMIDÆ.

GENUS PLEOPIS, Dana.

Corpus quoad thoracem abdominemve non deflexum, rectiusculum. Abdomen crassum, extremitate furcatum, setis apicalibus nullis. Testa postice rotundata. Antennarum posticarum rami 3-articulati.

Thorax not deflexed, nearly straight and in same line with abdomen. Abdomen stout furcate at extremity, with no setæ at apex. Branches of posterior antennæ three-jointed. Shell rounded behind.

The abrupt downward bend of the thorax of Polyphemus and Evadne is one of their most striking characteristics, and in Polyphemus the abdomen is quite slender, and takes again the longitudinal position. But in Pleopis, the whole is nearly straight and stout. The head is very large and occupied with eyes, as in other Polyphemidæ; and there is a suture separating it from the following part. The legs of the second pair were terete; four joints were observed, an oblong basal, and the following part, but slightly longer, consisting of a long joint and two minute apical, and bearing a few longish setæ. The legs of the fourth pair were much shorter and rather stouter. The three joints of the terminal portion of the leg were nearly equal in length; their setæ were about as long as in the second pair. The shell is very tumid behind and subglobose, instead of being pointed as in Evadne.

The name of the genus, from *πλεος*, *full*, and *ωψ*, *eye*, alludes to the large head filled with eyes.

PLEOPIS BREVICAUDIS.

Caput oblongum, conoideum, corpore postico parce brevius, antice latius et subglobosum. Antennæ oblongæ, basi crasso, ramis duobus subæquis, 3-articulatis, parce setigeris. Pedes crassi. Abdomen breve et crassum, apice parce exsertum, furcatum, acutum.

Head oblong conoid, largest and globular anteriorly, but slightly shorter than body. Antennæ oblong, base stout; branches two, subequal, three-jointed, sparingly setigerous. Abdomen short and stout, tip but slightly exsert, furcate and acute.

Plate 89, fig. 8 *a*, lateral view of animal, enlarged; *b*, second pair of feet; *c*, fourth pair of feet.

In the Atlantic, latitude 41° south, longitude 62° west, near Rio Negro. Collected, January 25, 1839.

Length, one-thirtieth of an inch.

The antennæ have a long basal portion, with the branches a little shorter than this base. The body is much narrower at the junction of the head and thorax than elsewhere. The eyes are enclosed within a cornea beneath the shell, which admits of some motion, mostly rotary. The heart is an oval organ, situated near the dorsum, in the anterior portion of the thorax. The large cavity over the body within the shell was empty.

Polyphemus brevicaudis, DANA, Proc. Amer. Acad. Sci., ii. 49.

TRIBE III. CYPROIDEA.

THE Cyproidea differ from all other Crustacea, excepting the Lernæoids and Rotatoria, in the absence of the pairs of appendages belonging to all the normal cephalothoracic segments posterior to the eighth, that is, to the six posterior of these segments. The last two of these six pairs are obsolete in all the Lophyropoda; and in the Cyclopoidea and Daphnioidea, the first four of them are natatory or foliaceous, together with also another pair, next anterior in most species. The pairs of appendages present in the Cyproidea, posterior to the mandibles—in number *four* pairs—are divided variously between the mouth and legs. The modes observed are as follows:—

1. One pair of maxillæ and three pairs of legs, as in *Cythere*.
2. Two pairs of maxillæ and two pairs of legs, as in *Cypris*, *Conchœcia*, and *Halocypris*.
3. Three pairs of maxillæ and one pair of legs, as in *Cypridina*. The outer pair of maxillæ may be called maxillipeds, yet they are more like maxillæ in form.

The posterior legs may be true feet, as in *Cythere*, *Conchœcia*, and *Halocypris*, or slender organs fitted for action in the ovarian cavity, as in *Cypris* and *Cypridina*.

On Plate 90, we have arranged the several appendages of the diffe-

rent genera in parallel lines, for comparison. Figures 1 *a*, 2 *a*, 3 *a*, 4 *a*, 5 *a*, represent the anterior antennæ; *b*, the posterior antennæ; *c*, the mandibles; *d*, the first pair of maxillæ; *e*, *f*, *g*, the three following pairs of members. Figures 1 *a*, *b*, *c*, *d*, *e*, *f*, *g*, are of a *Cypris*; 2, of a *Cythere*; 3, of a *Cypridina*; 4, of a *Conchoecia*; 5, of a *Halocypris*.

The *anterior antennæ* are subterete organs, varying in number of joints from *three* to *seven*, and are furnished with more or less setæ, especially at apex. In *Conchoecia* and *Halocypris*, in which the number of joints is but three, one of the setæ at apex is quite long, and incrassated towards its extremity.

The *posterior antennæ* are of two types. In the fresh-water and sea-shore species (*Cypris* and *Cythere*), they are rather slender, simple subpediform organs, consisting usually of five joints, with setæ at the extremity and also a tuft, in the genus *Cypris*, at the apex of the third joint; and in *Cythere*, two or three finger-like spines at apex, and a very long slender two-jointed spinous process proceeding from the apex of the second joint (fig. 2 *b*, Pl. 90). In the marine or oceanic species, the organs are two-branched, and the basal joint is very stout, being thick and subtriangular, sometimes as broad as long; it is filled with muscles, for moving the rest of the organ, which is especially fitted for natatory purposes. The terminal portion consists of an oblong cylindrical joint, and a multiarticulate extremity of five to seven short joints, furnished with long plumose setæ. There is also a second branch from below the apex of the large basal joint; this branch is short and two-jointed.

The five joints in the second type are represented normally as follows. The large basal joint corresponds to the second, or to the first two of the normal joints, as it bears the accessory branch, which is an appendage normally to the *second* joint of an antenna or leg. The next joint corresponds to the third in *Cypris*; the last five or seven, forming the multiarticulate extremity, to the fourth and fifth in the first type. The setæ at the extremity of these organs in *Cypris* pertain to the fourth and fifth joints; and in *Conchoecia* to the representatives of these joints. We have numbered the joints in correspondence with these views, to aid the comparison with one another, and also with the organs of the Cyclopoidea on Plate 70.

The mandibles are also of two types. The one characterizing the fresh-water and sea-coast species (*Cypris* and *Cythere*) has a denticulate apex, and bears a palpus on one side remote from the extremity, in the usual way, the palpus (the proper termination of the mandi-

bular leg) appearing like an appendage to the mandible. The other type, characterizing the oceanic species, has the mandibular leg like an ordinary leg in form, the first or mandibular joint bearing the next at or near its apex, and the second joint (first of the so-called palpus of other species) often aiding by a denticulate process in the mandibular function. The structure in *Limulus* is here represented, and the true relation of the part called the palpus is well shown. In both types the terminal portion of the leg is prominent, and acts like a leg, though largest and stoutest in the second type. In the first type, the first joint of the palpus (second of the organ) bears an accessory branch, which is wanting in the second type.

The number of joints in the organ, counting the mandible as the first, is *five* in both types, as will be seen on Plate 90.

The *first pair of appendages* following the mandibles, is in all the Cyproidea a pair of maxillæ. They consist of two to four joints, and have in the fresh-water species a plate above the base ciliated with long plumose setæ. This plate is kept in constant vibration, evidently to produce a current of water over the body, for the purpose of aeration. The body of the organ fig. 1 *d*, 2 *d*, Plate 90, terminates in four or five linear lobes ending in a brush of setæ, the outer of which lobes is two-jointed and articulated at base. These two joints are properly therefore the two terminal joints of the maxilla; and the preceding part appears also sometimes to consist of two joints, the second of the two bearing the lobe next to the jointed one. The ciliated plate was not observed distinctly in the marine species, and probably does not exist, although a similar one is found attached to the following pair.

The *second pair* varies much in character. In the marine species it is furnished with a large plate at base, edged with long plumose hairs; which plate is wanting in *Cypris* and *Cythere*; and besides this plate and the setigerous maxillary joint to which it belongs, there is also at times a slender three-jointed appendage ending in one or two long setæ. In *Cypris*, on the contrary, the organ has a maxillary process interiorly, and a lateral or posterior one-jointed branch, with few short setæ at apex. In *Cythere*, these organs are represented by a pair of slender five-jointed legs, ending in a long slender claw, similar to the two following pairs.

The *third pair* is a proper leg in each of the genera, excepting *Cypridina*. In *Cypris* and *Cythere* it is long and slender; in *Conchoecia* and *Halocypris* it is shorter, and has a few setæ at apex; in

Cypridina it is a broad maxilla, setigerous at its inner margin, and having a single broad lateral joint edged with a few setæ.

The *fourth pair* is a slender five-jointed ovarian leg, in Cypris; a pediform leg, like those of the preceding pair, in Cythere; a flexible linear or vermiform ovarian leg, in Cypridina; and a short two- or three-jointed leg, ending in some shortish setæ, in Conchœcia and Halocypris.

Besides these appendages, Conchœcia and Halocypris have a moveable spicula, either dart-like in form or cylindrical, situated between the anterior antennæ, and arising apparently from the same base as these organs. It may be projected out of the shell.

The *eyes* in the Cyproidea are either two simple eyes on a single spot of pigment, or two distinct compound eyes. The latter is the case only in the genus Cypridina.

From this partial review of the organs in the Cyproidea, it is apparent that there are two types of species, distinguished more especially by the second antennæ and mandibles, though also distinct in other organs. One includes Cypris and Cythere, which belong to fresh waters or sea-shores; the second, the other genera, which are confined apparently to the purer ocean waters. These groups or families we distinguish as the CYPRIDÆ and HALOCYPRIDÆ. Each of these families includes two known subfamilies; the first, *Cyprinæ* and *Cytherinæ*; the second, *Cypridininæ* and *Halocyprinæ*. These subdivisions and the included genera may be characterized as follows:—

FAM. I. CYPRIDÆ.

Antennæ 2dæ subteretes, 3–5-articulatæ. Mandibulæ apice productæ et denticulatæ et lateraliter palpigeræ, palpo ab mandibulæ apice remoto. Oculi pigmento unico minuto conjuncti, lenticulis duobus sphericis. Pedes duo vel plures tenuiter pediformes.

SUBFAM. I. CYPRINÆ.*—Pedes numero quatuor; anteriores tenues pediformes, posteriores debiles. Abdomen elongatum stylis duobus confectum.

G. I. CYPRIS, *Müller*. — Antennæ 2dæ ad articuli 3tiii apicem bene setigeræ. Species natatoriæ.

* *Cypridæ*, Baird, Brit. Entomost., 139.

G. 2. CANDONA, *Baird*.* — Antennæ 2dæ ad articuli 3tii apicem vix setigeræ. Species gressoriæ.

SUBFAM. 2. CYTHERINÆ.† — Pedes numero sex, toti tenues, con-
similes, pediformes.

G. 1. CYTHERE, *Müller*.‡ — Testa tenuis, lævis. Cauda brevis.

G. 2. CYTHEREIS, *T. R. Jones*.§ — Testa rugulis vel tuberculis ornata. [Animal ignotum. An hujus sedis.]

FAM. II. HALOCYPRIDÆ.

Antennæ 2dæ basi crassissimo, articulo 2do cylindrico, apiceque 5–7-articulato elongate setigero, instructæ. Pedes mandibulares bene pediformes, articulo 1mo (mandibulâ verâ) juxta ejus apicem articulum 2dum (1mum palpi) gerente, instar pedis veri, processu articuli 1mi mandibulari sæpe cum alio processu articuli 2di pro mandibulæ usu conjuncto. Oculi sive in pigmento unico mediano conjuncti, sive pigmentis duobus et remotis.

SUBFAM. 1. CYPRIDININÆ.|| — Frons sæpe rostratus. Maxillæ numero sex et pedes duo tantum.

G. 1. CYPRIDINA, *Edwards*. — Pedes duo flexiles, vermiformes, articulis distinctis nullis. Oculi duo remoti, compositi.

SUBFAM. 2. HALOCYPRINÆ. — Maxillæ numero quatuor, et pedes quatuor; maxillæ 2dæ palpo pediformi instructæ. Pedes mandibulares crassæ, apice paulo setigeræ. Spiculum inter antennis 1mas exsertile. Testa clausa antice incisa.

G. 1. CONCHÆCIA, *Dana*.¶ — Oblonga. Pedes mandibulares articulis tribus ultimis inflexi, articulo 2do multum oblongo.

G. 2. HALOCYPRIS, *Dana*. — Curta. Pedes mandibulares non inflexi, articulo 2do parce oblongo.

* *Trans. Berw. Nat. Club.*, ii. 152, 1845; *Ann. Mag. Nat. Hist.*, 1846, xvii. 415; *Brit. Entomost.*, 159.

† *Cytheridæ*, *Baird*, *Brit. Entomost.*, 162.

‡ *Cytherina*, *Lamk.*, *Römer*, etc.; *Cypridina*, *Bosquet*, *Entomost. de la Craie de Maestricht*; *Bairdia*, *M'Coy*.

§ *T. R. Jones*, *Entomost. of Cretaceous Formation*, 1849; *Cytherina*, *Römer*, *Jahrb. &c.*, f. *Min.*, 1838.

|| *Cypridinadæ*, *Baird*, *Brit. Entomost.*, 176.

¶ *Dana*, *Proc. Amer. Acad. Sci.*, ii. 51, 1849. *Asterope?* *Philippi*, *Archiv f.*

FAMILY CYPRIDÆ.

THE two subfamilies of Cypridæ, *Cyprinæ* and *Cytherinæ*, are mentioned on page 1280. Although agreeing in the general character of the antennæ, the maxillæ, and the mandibles, and thus distinguished from the Halocypridæ, they have many important points of distinction. Part of these have already been mentioned. The characters of the genus *Cythere* will be gathered from figures 9 *a* to 9 *l*, Plate 89, and those of *Cypris*, from Plate 90.

In *Cythere*, the superior antennæ are only five-jointed, and they are furnished with a few naked setæ. In the species examined by the author, they were used somewhat like feet. The second pair are more decidedly pediform, and instead of having hair-like setæ at apex, there are two stout finger-like spines, lying side by side, besides another shorter below. The organ has four distinct joints, besides the terminal spine; and as the outer of these spines appears to have an obsolete joint near its base, it probably corresponds to two normal joints, like the finger in *Corycæus*. In this way the full number of joints, *six*, is made out. The spiniform lateral appendage proceeds from the apex of the second joint, and therefore corresponds normally to the second branch; it is as long as the rest of the organ, and has a joint towards its extremity. Very near the apex it is abruptly narrowed, as shown in figure 9 *a*. The mandible is closely alike in *Cypris* and *Cythere*. The palpus in each is four-jointed, and bears a branch from the first of these joints, this being normally the second joint of the organ, as the mandible is properly the first joint.

Naturg., vi. 186, 1840. "Testa bivalvis corpus abscondens antice subtusque incisa. Antennæ duæ simplices, apice penicillatæ. Oculi duo. Pedes 4, compressi subfoliacei. Fila peculiaria ad retinenda ova. Cauda compressa uncinis pluribus terminata." This description, in the eyes, the antennæ, legs, and caudal extremity, agrees with the species of *Cypridina*, as observed by the writer; and where it differs from the description of Edwards, as in the caudal extremity, that description appears to be incorrect. The species was obtained by Philippi, at Naples, and is named *A. elliptica*.

The maxillæ are also very similar in the two genera. The number of plumes ciliating the moveable plate was fourteen in the species of *Cythere*, studied by the author, the same as found by Dr. Baird.*

In the following pairs of legs the two groups diverge from one another. Yet still the type in *Cythere* is indicated in *Cypris*; for the legs of *Cythere* are similar in general structure to the first pair in *Cypris*. The form is slender, and they end in a long spiniform claw. But in *Cypris*, the pair corresponding to the first pair in *Cythere* is a very short maxilliped, having a maxilliform process anteriorly, and a short single-jointed process behind. The last pair in *Cypris*, instead of being a proper leg, like the preceding pair, as in *Cythere*, is reflexed so as to pass up into the egg-cavity.

The three pairs of legs in *Cythere* are quite similar, and increase in size from the first to the last, as shown in fig. 9 *a*. They are supported at base by a framework of corneous processes lying on the skin of the side of the body, as shown in figure 9 *k*, one process being articulated with the base of each leg, and another process on the venter forming the support on that side.

The abdomen affords the most striking distinction between the groups. In the *Cyprinæ* it has a furcate styliform extremity, each branch having a few setæ at and towards apex on the upper side (fig. 7 *c*, Plate 90). In the *Cytherinæ*, it bears two large fleshy lobes, which lie side by side, and have on the margin a single stout spine, or small setigerous joint. Figures 9 *a, e, f, g, h, i*, Plate 89, represent this structure in the *Cythere Americana*, D. In figure 9 *a*, the female abdomen is seen in place, and in fig. 9 *e*, the male abdomen. The specimens were put in boiling water, in order that the shell might be easily removed for the study of the animal within; the process was perfectly successful, and in one case, the abdomen was found thrown out of the shell, as shown in figure 9 *f*. These figures represent a side view, and exhibit only the lateral surface of one of the lobes; *c*, in these figures, is the proper caudal extremity of the animal, the lobes being below and anterior to this; *s*, is the spine on the margin of the lobe, and *a*, the anterior angle. In the course of the dissections, the abdomen was made to lie open, as in fig. 9 *g*; here the two lobes are simply opened—the letters *s, a*, showing the corresponding parts, and their relation to the abdomen in place (fig. 9 *e*). In another case, one lobe was pushed

* Brit.-Entomost., p. 166.

partly off from the other, and appeared as seen in figure 9 *h*. These figures represent also the corneous processes, which lie in the surface of these fleshy lobes; those of figure 9 *g* are on the inner surface of the lobes. Figure 9 *i*, represents another view obtained, in which the caudal extremity (*c*) was observed pushed above the rest, as if a distinct piece, for a greater length than simply the small appendage. This appendage was a little pubescent at extremity and was not distinctly jointed. In the female form, figure 9 *a*, the caudal appendage was two-jointed (fig. 9 *a* and 9 *l*), and instead of the stout spine on the margin of the lobes, there is a small joint bearing two naked setæ (*s*, fig. 9 *a*).

In some instances, after putting the females in hot water, they came out with simply the extremity of the abdomen exerted, the caudal appendage and the joint on the margin below (*s*), with the part intervening, being outside the shell.

The shell in the Cytherinæ is much thicker than in Cypris, and is marked with granules or lines. In the species referred to for the above illustrations, the surface under a high magnifier has the appearance represented in figure 9 *c*. There is a translucent margin around, which is narrow in the part of the shell below the mouth organs. The rest is too opaque to permit a view of any organs or parts beneath. Through the translucent margin there are at intervals minute ducts, which terminate each in a short hair on the margin, as seen in figs. 9 *b*, 9 *c*. The hinge in Cythere consists of a large number of minute truncate teeth ranging along the dorsal margin (fig. 9 *a*).

SUBFAMILY CYPRINÆ.

GENUS CYPRIS, *Müller*.

The separation of the Candona of Baird from Cypris is based on the habits of the species—their crawling over aquatic plants—and the absence of a tuft of long setæ from the apex of the third joint. Our *C. albida*, beyond, was observed to have the habits of a Candona, and may possibly be of that genus.

CYPRIS SPECIOSA.

Oblonga, subovata, anticè angustior, subtus fere recta, vix excavata, alioque bene arcuata, latior et plus duplo longior quam alta; ad marginem anticum pubescens, posticum breviter ciliata. Flava et lætè viridis, areis flavis paucis imperfectis viridi circumdatis.

Oblong, subovate, narrower anteriorly, below straight or scarcely excavate, the margin in other parts regularly arcuate, broader than high, and length more than twice the height; pubescent on the anterior margin, short and sparsely ciliate behind. Colour yellow and green, consisting of a few large irregular areas, more or less perfectly surrounded by broad bands of bright green, and margin also green.

Plate 90, fig. 6, animal, enlarged.

Pool of standing fresh water, near Rio Janeiro, Brazil. Collected in December, 1838.

The antennæ were usually extended out as far as one-third the length of the shell, or rather more. The last joint of the first pair of legs is long. The colours are so arranged that there is an irregularly polygonal area of yellow near the centre of the side, and six or seven other imperfect areas around; the latter above and below are short and broad, elsewhere long. The green colour is a bright grass-green.

Cypris speciosa, DANA, Proc. Acad. Nat. Sci., ii. 49.

CYPRIS CHILENSIS.

Latere visa, subovata, pone medium parce altior, subtus paululo arcuata, dorso vix gibbosa, triplo longior quam lata, duplo longior quam alta, marginibus antico infero posticoque pubescentibus. Antennæ anticæ 7-articulatæ, setis dimidio corporis vix longioribus.

Subovate (in a side view), a little the highest behind the middle,

below slightly arcuate, and on the back scarcely at all gibbous, length three times the breadth and twice the height, front, back and lower margins pubescent. Eye placed near the margin. Anterior antennæ seven-jointed, setæ as long as half the body, or a little longer.

Plate 90, fig. 7 *a*, side view, enlarged; *b*, upper view of shell; *c*, side view of animal, shell removed. Also, figure 1 *b*, second pair of antennæ; *c*, mandibular foot; *e*, maxilla of second pair; *f*, first pair of legs.

From small fresh-water pools, to the southwestward of Valparaiso. Collected in May, 1839.

Length, one-sixteenth of an inch. Form, in a vertical view, narrow ovate, with the extremities obtuse. Colour, brownish yellow. Swims freely.

The figures referred to exhibit the characters of the several organs. The *anterior antennæ* are seven-jointed. The basal joint is largest; the third longer than the second; the following four gradually diminishing and bearing the long setæ. These antennæ may be curved backward by the animal along the back of the shell. The *posterior antennæ* are large and stout, five-jointed, the joints oblong and subequal, excepting the apical, which is very short and small. The third joint is rather longer than the fourth, nearly twice as long as the second. The organ terminates in several stout hairs, which are rather longer than the penult joint. The apex of the third joint is also furnished with several long and stout hairs.

The *mandibular feet* consist of the mandible, proceeding from a stout base, and a four-jointed extremity, commonly called the palpus. The mandible is a narrow corneous process, curving inward and dentated at apex. The second and fourth of the following joints are short, and the last two are furnished with short setæ.

The *first pair of maxillæ* are lobed below and furnished with a number of short and stout setæ. Attached to the base, projecting above, along the side of the animal, there is a broad lamellar appendage, somewhat oblong triangular in form, but with curving sides, which is coarsely pectinated on its posterior convex side, and furnished with long and stout setæ.

The *second pair of maxillæ* consist of a short base, supporting two broadly divergent extremities; one slender, directed forward, terminating in a few short setæ; the other stouter, though of about the same length, directed backward, and with a single spine at apex. There are three short setæ on the posterior margin of the base.

The *first pair of feet* are five-jointed excluding the long arcuate spiniform joint in which they terminate. The third joint is much smaller than the second, and about equals the fourth and fifth; the fifth is the shortest; the terminal is one-third longer than the three preceding together.

The *second pair of feet* is as long as the preceding, and consists of five joints. The fourth is much the largest; the fifth is nearly half shorter, and appeared to have at apex two very short claws.

The abdomen terminates in two long slender stylets; each has a stout naked seta at apex, which is a little shorter than the stylet, and also two shorter setæ from the margin near apex, and also another short additional one at apex.

Cypris chilensis, DANA, Proc. Amer. Acad. Sci., ii. 50.

CYPRIS PUBESCENS.

Brevis; latere visa *latissimè fabiformis, subtus recta, extremitatibus latè et æque rotundatis, dorso bene arcuato*; supernè visa *latè ovata, fronte subacuta*; *ad totam superficiem pubescens. Antennæ anticæ 7-articulatæ, setis vix longioribus quam 5 articuli ultimi simul sumti. Antennæ posticæ crassiusculæ, articulo ultimo fere dimidii penultimi longitudine, setam longam ad apicem gerente, penultimo ad apicem elongatè setigero. Pallidè olivacea.*

Short; in a side view, very broad fabiform, straight below, and extremities broadly and equally rounded, back irregularly arcuate; in an upper view broad ovate and subacute in front; whole surface pubescent. Anterior antennæ seven-jointed, the setæ about as long as last five joints. Posterior antennæ rather stout, the last joint nearly half as long as the preceding and bearing a long seta at apex; apex of preceding joint long setigerous. Colour, pale olive-green.

Plate 90, fig. 8 *a*, side view, enlarged; *b*, upper view; *c*, anterior antenna; *d*, posterior antenna; *e*, first pair of legs.

From fresh-water pools near Sydney, New South Wales. Collected in March, 1840.

The length of the shell is about one-fourth greater than the height, and the breadth and height are nearly equal. The eye is situated about two-fifths the length from the front. The last four joints of the anterior antennæ gradually diminish in size, and each is but slightly longer than broad.

Cypris pubescens, DANA, Proc. Amer. Acad. Sci., ii. 50.

CANDONA (?) VITIENSIS.

Elongatè subfabiformis; latere visa plus duplo longior quam alta, subtus recta, dorsum arcuata, ante medium paulo altior, extremitate anticâ latius rotundatâ; supernè visa subelliptica, ante medium vix latior, anticè subacuta, posticè rotundata, latitudine duplo longior quam lata; totâ superficie pubescens. Antennæ anticæ 7-articulatæ, articulis quinque ultimis inter sese longitudine fere æquis, setis antennâ brevioribus. Antennæ posticæ crassæ, articulo ultimo dimidio breviorè quam precedens, setis brevibus, setâ longâ penultimâ unicâ quoque alterâ antepenultimâ simili.

Oblong subfabiform; in side view, length more than twice the height, below straight, back arcuate, a little highest just anterior to middle, front most broadly rounded; in upper view suboval, slightly broadest across the eye, front subacute, rounded behind, breadth about half the length; whole surface pubescent. Eye situated close to the margin. Anterior antennæ seven-jointed, the last five joints nearly equal, a short spine at apex of antepenult, penult and last with setæ, the setæ about two-thirds as long as the antenna. Posterior antennæ stout, the last joint about half the preceding and bearing short setæ; a long seta to apex of the penult and antepenult joints.

Plate 90, fig. 9 *a*, side view, enlarged; *b*, vertical view; *c*, anterior antenna; *d*, posterior antenna.

From fresh-water pools near Nailoa Bay, on Vanua Lebu, of the Feejèe Group, abundant; also, at Sandal-wood Bay. Collected in July, 1840.

Length, one-fortieth of an inch.

The two lenses of the eyes were distinctly seen; they were spherical and on the same spot of pigment. The apex of the third joint of the posterior antennæ, instead of having a cluster of setæ, is furnished with only a single long seta. We therefore, yet with some hesitation, place the species under Candona.

Cypris vitiensis, DANA, Proc. Amer. Acad. Sci., ii. 50, 1849.

CANDONA? ALBIDA.

Latere visa, breviter subelliptica, extremitatibus fere æqua, latè rotundata, subtus recta, supra obsolete gibbosa; triplo longior quam lata non duplo longior quam alta, margine pubescente. Oculus margine superno remotus. Albido-margaritacea, posticè et supernè paulo brunnea.

Short subelliptic (in profile view), extremities very nearly equal, broadly rounded, margin below straight, very slightly gibbous above, length full three times the breadth, much less than twice the height, margin pubescent. Eye distant from the upper margin. Colour, pearl-white, behind and along the back, a little dark brown.

Plate 90, fig. 10, animal, enlarged.

In small fresh-water pools, to the southwestward of Valparaiso. Collected in May, 1839.

Length, one-twenty-fourth of an inch. This species was seldom seen swimming in the water. It usually was crawling along the stones of the bottom or sides of the pool. Its white colour, by reflected

light, is peculiar. It is more opaque than the following species. The height is about two-thirds the length.

Cypris albida, DANA, Proc. Amer. Acad. Sci., ii. 49.

FAMILY HALOCYPRIDÆ.

SUBFAMILY CYPRIDININÆ.

GENUS CYPRIDINA, *Edwards*.

THIS genus differs from *Cypris* in the beaked front, and in the fact that the feet corresponding to the first pair in *Cypris* is here foliaceous, or properly a pair of maxillæ. The ovarian feet are longer and much more flexible, bending like a worm; and they are furnished with setæ about the extremity, the terminal of which are reversed. Besides, the mandibular feet are elongate and fitted for prehension at the extremity; the posterior antennæ end in a pencil of plumose setæ from several short joints, and are subnatatory, while the anterior antennæ are furnished at apex with a few unequal straight setæ, that may be diverged or brought together.

The mandible is a small process on the basal joint of the mandibular feet, and it appeared to have but little strength or firmness. Other characters of the genus will be gathered from the descriptions and figures of the following species.

This genus was established under the name *Cypridina* by Milne Edwards, and imperfectly described by him in a note to l'Hist. des Anim. sans Vertèbres de Lamarck, 2d edit., t. 5, p. 178, and Hist. des Crustacès, par M. Milne Edwards, iii. 409. It appears to include the *Asterope* of Philippi (Archiv für Naturgeschichte, vol. vi. 1840, p. 186, taf. iii.), which is described as differing only in the caudal extremity. Since all our species agree with Philippi's specimens, we infer that there must be an error in Edwards's description. Some new species have recently been added to the genus by Mr. W. Baird, in

the Annals and Magazine of Natural History, 2d Ser., i. 21, and vii. 430; see also, Brit. Entomost., p. 176.

CYPRIDINA LUTEOLA.

Compresso-ovoidea; latere visa, latè elliptica, anticè breviter rostrata, rostro ultra marginem testæ infero-anticum non saliente, marginibus aliis arcuatis, postico non gibboso; supernè visa, angusto-ovata, anticè acuta, posticè rotundata. Digitus pedis mandibularis ad basin crassus, sensim attenuatus. Antennæ anticæ ad apicem 4-5-setigeræ, setis antennâ non longioribus.

Compressed ovoid; in lateral view nearly oval, broad, front short rostrate, but not projecting beyond anterior margin of shell. The margin elsewhere arcuate throughout, the posterior side not at all gibbous; in an upper view, narrow ovate, acute in front, rounded behind. Finger of mandibular foot quite stout at base and tapering to apex. Setæ at apex of the anterior antennæ not longer than the organ, four or five in number.

Plate 91, fig. 1 *a*, side view of animal, enlarged; *a'*, natural size; *b*, vertical view; *c*, side view of animal, with the shell removed, enlarged (*d*, eye; *e*, anterior antenna; *f*, second pair of antennæ, the extremity thrown back upon the basal portion; *g*, mandibular feet; *h*, buccal mass, showing profile of processes; *i*, first pair of maxillæ; *k*, second pair of maxillæ; *l*, third pair of maxillæ; *m*, ovarian feet; *n*, caudal extremity); *d*, eye; *d'*, lens of the eye; *e*, anterior antenna; *f*, part of plume of posterior antennæ; *g*, part of mandibular foot, with mandibular process at *g'*; *h*, buccal mass and organs, under view (*g*, mandibular feet; *i*, first pair of maxillæ; *k*, second pair of maxillæ; *l*, third pair of maxillæ; *r*, *t*, processes on the anterior part of the buccal mass, seen on figure 1 *c*, forming upper and under prominences of *h*; *s*, fleshy process, the intermediate prominence on *ch*); *i*, first pair of maxillæ, same with *ci* and *hi*; *i'*, same, reversed; *k*, second pair of maxillæ, same with *ck* and *hk*; *l*, third pair of maxillæ, same with *cl* and *hl*; *m*, extremity of ovarian feet; *n*, larger of caudal spines.

Sooloo Sea, harbour of Soung; taken at 8 p. m., February, 1842.

Length, one-twelfth of an inch. Colour, yellowish.

The shell in a side view appears very slightly flattened behind, and the outline of the beak does not project beyond the general outline of the front. This beak is short and quite narrow in profile. The length of the shell is not one and a half times its breadth.

The *eyes* consist of spherical lenses upon a mass of dark pigment. A distinct cornea was seen, extending over the whole, and having a simple undivided surface; and also within the cornea one of the humours, as shown in fig. 1 *d*. One of the lenses was seen to have an equatorial line, which had the appearance shown in figure *d'*, as if minute oval and rounded pieces had been chipped out. It extended over the outer side of the lens, as seen in the right lens on figure *d*.

The appendages consist, as represented in figure *c*, of two pairs of antennæ, one of mandibular feet, three of maxillæ, one ovarian pair of legs, besides the caudal extremity.

The *first pair of antennæ* (*ce* and *e*) has seven joints, the last two minute, and the third and fifth shorter than the others. These organs are geniculated between the first and second joints, which are nearly equal in length; in *ce*, there is only an end view of the basal joint. There are one or two short setæ at the apex of the second and fourth joints; at apex of fifth, two plumose setæ nearly as long as last four joints of organ; at apex of sixth and seventh, four longer naked setæ, which spread widely at the will of the animal; they are hardly as long as the last six joints of the organ.

The *second pair of antennæ* (*cf*) has a very large subtriangular base. The longer branch (the only one observed) consists of an oblong cylindrical joint, and seven short joints, the latter together about equalling the preceding one. Each of the short joints is furnished with a long plumose seta, longer than the branch. These setæ are delicately articulate, as shown in fig. *f*.

The *mandibular feet* (*cg*, *g*, *hg*) are geniculate at the second articulation. The first joint bears on one side a thin and flexible short-ciliate process, which is the true mandibular process, although so weak and small. The second joint is stout and oblong, and bears a few naked setæ, besides a longer which is setulose in tufts. The third is short. The fourth (or finger) is long, and tapering from a stout base; it is furnished on its sides with several setæ, some half as long as the joint. The claw at the extremity is small.

The *buccal mass* (*ch*, *h*) in a ventral view has large obtuse promi-

ment processes (*ht*) at either anterior angle, and another (*hr*) centrally in front; also two just posterior to the front central process on the under surface (*hs*) which are soft fleshy.

The *first pair of maxillæ* (*i, ci, hi*) are stout oblong appendages, having a short thick base, with an oblong one-jointed extremity. The base appears to have two articulations across its upper extremity, and the inner side; there are three lobes on this side which bear clusters of stout setæ. The extremity of the maxilla is obtuse, and there is a tuft of stout setulose setæ at apex, besides three on the outer margin below.

The *second pair of maxillæ* (*k, ck, hk*) are thick and stout organs, with a broad truncate summit, and a very small joint at one apex, which bears two small one-jointed processes. The extremity and edge are tufted with stout setulose setæ, and the lower side bears a very broad and oblong lamina, which is elegantly fringed with long plumose setæ. A side view is shown in figures *k* and *ck*, and a ventral view in *hk*.

The *third pair of maxillæ* (*l*) in a ventral view is seen between the preceding pair, as shown in figure *h*, at *l*. In figure *c*, a side view, it is seen to project below the second pair of maxillæ. The organ consists of an oblong subrectangular base, and a broad joint proceeding from its side. There are several setulose setæ at the apex of the base, and others at the apex of the second joint. Both joints have the apex very broad, and that of the base is somewhat lobed. The setæ are setulose, those of the base tufted setulose.

The *feet*, or next pair of appendages, are very long and slender vermiform. About the extremity there are several setæ, which are articulated through their apical half, and furnished at the articulations with minute and very short reversed setules. The apical of these setæ are longest and reversed. At the apex of the organ there is a minute spirally incurved spine.

The *abdomen* (*cn*) is two-jointed; the basal segment very short. The extremity is very oblique, and furnished with two sets of corneous setæ, eight or ten in each.

CYPRIDINA PUNCTATA.

Compresso-ovoidea, punctata; latere visa, latè elliptica, posticè gibbosa, infra supraque œquè arcuata, anticè breviter rostrata, fronte promi-

nulâ, ultra testam infero-anticam saliente, rostro acuminato; supernè visa angusto-elliptica, extremitatibus rotundatis. Spinulæ caudales decem.

Compressed ovoid, punctate; in side view broad oval, upper and under margins strongly and equally arcuate, behind gibbous, anteriorly short rostrate, the front a little prominent beyond the front margin of shell below, the beak narrow, acuminate; in upper view narrow oval, extremities rounded. Caudal spinules ten in number.

Plate 91, fig. 2 *a*, lateral view of animal, enlarged; *b*, upper view.

Sooloo Sea, harbour of Soung, along with the preceding.

Colour, faint yellowish. The shell has a punctate appearance arising from the surface being uneven and having clear spots scattered over it. The dorsal and under sides, in a side view, are very strongly and evenly arcuate. Behind there is a rounded gibbosity, abrupt on its upper side. The front is more prominent in this species than the shell below the beak.

The length, in a side view, is less than one and a half times the breadth; in a vertical view, it is more than twice the breadth.

CYPRIDINA OLIVACEA.

Subovoidea; latere visa, oblongo-subelliptica, dorso parè arcuata, posticè truncata et sparsim ciliata, anticè rostrata, rostro ad apicem rectangularato, fronte ultra testam infero-anticam paulo saliente; supernè visa, elongatè ovata, anticè obtusa, posticè subtruncata. Antennæ anticæ setis corpore longioribus ad apicem instructæ. Spinulæ caudales octo.

Subvoid; in side view, oblong elliptic, the back but little arcuate, the posterior margin truncate and sparsely ciliate, front rostrate, the beak rectangular at apex, projecting a little beyond front margin of shell below; in upper view, long ovate, obtuse in front, subtruncate behind. Anterior antennæ having two long setæ at apex, longer than the body. Caudal spinules eight, four in each series.

Plate 91, fig. 3 *a*, side view of animal, enlarged; *a'*, same, natural size; *b*, upper view.

Sooloo Sea, in the harbour of Soung, with the preceding.

Length, one-tenth of an inch. Colour, clouded with deep bluish green.

The hinder margin is straight with rounded angles, and the beak, instead of being slender acute, is rectangular at apex in profile. The outline of the back is much less arcuate than that of the venter. The very long setæ of the anterior antennæ are characteristic.

The length of the body in a side view is nearly twice the breadth; and in a vertical view, a little more than twice the breadth.

CYPRIDINA GIBBOSA.

Latere visa, angusto-subovata, infra supraque arcuata, posticè valde gibbosa, anticè breviter rostrata, rostro acuto, fronte ultra testam infero-anticam paulo saliens. Antennæ anticæ tribus setis longis aliisque brevioribus apice instructæ, setis antennâ paulo brevioribus. Spinulæ caudales sexdecim.

In side view, narrow, irregular ovate, arcuate above and below, lower half of posterior part large gibbose, anterior extremity short rostrate, beak small and acute, the front above somewhat prominent or more in advance than the part of the shell below the beak. Anterior antennæ with three long setæ at apex and others shorter, the setæ not quite as long as the antenna. Caudal spines sixteen (eight on each side).

Plate 91, fig. 4 *a*, side view of animal, enlarged; *b*, anterior antenna; *c*, posterior antenna; *d*, mandibular feet; *e*, abdomen.

In the Pacific, latitude 15° 20' south, longitude 148° west. Collected, September 10, 1839.

Length, one-twentieth of an inch. Nearly colourless, but *brightly phosphorescent*. Contents of the stomach, reddish.

The length in a side view is very nearly twice the height. The gibbosity behind is much larger and more prominent than in the *punctata*. The eyes have a quivering motion. The eggs occupied all the space over and posterior to the abdomen, behind the eyes.

CYPRIDINA FORMOSA.

Compresso-ovoidea; latere visa, breviter elliptica, infra supraque valde arcuata, fronte rostrato, rostro subacuto, ultra marginem testæ infero-anticam vix saliente, margine postico interrupto, non gibboso; supernè visa, angusto-elliptica, extremitatibus obtusis. Antennæ anticæ elongatè setigeræ, setis antennâ parce longioribus. Pedes mandibulares articulis 3tio 4toque tenuibus. Spinulæ caudales decem.

Compressed-ovoid; in side view short oval, above and below strongly arcuate, behind with an interruption in the margin but not gibbous, in front rostrate, beak acute, front scarcely prominent beyond the margin of the shell below; in upper view, narrow oval, obtuse at the extremities. Anterior antennæ long setigerous, setæ a little longer than the antenna. Mandibular foot with the third and fourth joints slender. Caudal spines about ten.

Plate 91, fig. 5 *a*, lateral view of animal, enlarged; *a'*, natural size; *b*, dorsal view; *c*, lateral view, with valve of shell removed, showing members; *d*, first pair of antennæ; *e*, second pair of antennæ; *f*, mandibular foot, with mandibular process at *d'*; *g*, ciliated plate from second pair of maxillæ; *h*, third pair of maxillæ.

Collected off Upolu, one of the Samoan Islands, 9 P. M., February 26, 1841.

Length, one-tenth of an inch. Colour, purplish, with scattered dots of deep purple.

The front over the beak scarcely projects beyond the outline of the shell below the beak. The interruption in the margin behind is very narrow, and abrupt upward. The length in a side view hardly one-fourth greater than height; greatest height just posterior to middle. In vertical view, length about three times greatest breadth. The

eyes contain each twenty to twenty-five facets. The flagellum of the second pair of antennæ consists of seven short joints. The mandibular process is a thin horny prominence, ciliated or pubescent at the margin. The third pair of maxillæ consists of two joints, the second is transverse subovate and margined with hairs. The ovarian feet are nearly as in the *luteola*. They are very flexible and worm-like in their twisting motions. Found, by dissection, an ovary containing eggs; but there were no external eggs beneath the shell.

This is a beautiful species.

SUBFAMILY HALOCYPRINÆ.

The two genera in this subfamily have, in most points, a similar structure.

They differ widely from the preceding in the antennæ and mandibles, and the posterior feet. Moreover the eyes are not compound: these organs were not very distinctly made out, but in one species were believed to be distinguished as two simple eyes near the medial line, just posterior to the base of the tentacles. The fleshy exsertile spiculum between the anterior antennæ is also peculiar to the genus. Moreover, the shell has an opening in front, through which the antennæ may be exserted without opening the valves of the shell.

The *anterior antennæ* in the species seen consist of three joints, the third of which is shortest, and bears at apex several long setæ, one or more of which are curved.

The exsertile spiculum is in one genus dart-like at the extremity, and in the other obtuse acicular. It proceeds from between the bases of the antennæ, and is exserted at the will of the animal.

The *second pair of antennæ* resemble those of the Cypridinæ. They have a very large basal joint, muscular within, bearing at the extremity two branches: one short and one- or two-jointed, the other consisting of an oblong basal joint and five (or seven?) very short joints furnished with long plumose setæ.

The *mandibular feet* are five-jointed; the first and second are rather long, and at right angles with one another; the other three are much shorter, with several setæ at apex, which are unilaterally setulose; these last are abruptly inflexed in one of the genera (*Conchoëcia*), while the organ is nearly straight in the other (*Halocypris*). At the

apex of the first joint, and often also at the adjoining base of the second, there is a corneous prominence with a broad denticulate apex, which is mandibular.

The first pair of maxillæ consist of a stout base, much prolonged laterally and terminating in several spines; this part bears from the basal portion a three-jointed extremity in the genus *Halocypris*, if not also in *Conchœcia*; the second joint of which is broad and stout, and both this and the third are furnished with several setæ.

The *second pair of maxillæ* (or *the maxillipeds*), as observed in a species of *Halocypris*, have a basal joint, like the first pair both in form and in its spinigerous extremity. To the basal part of this base, there is attached a small lamina, which is edged with long setæ, and also a slender oblong three-jointed extremity, which bears at apex one or two very long bent or curved setæ. This appendage extends backward like the following pairs of legs, instead of forward and inward like the corresponding part of the first pair of maxillæ.

The two pairs of feet are slender, the anterior much the longer; one or both have a lamina at base edged with setæ, and also several setæ at apex.

The caudal extremity is very much like this part in the *Cypridinae*.

GENUS CONCHŒCIA, *Dana*.

Testa oblonga. Pedes mandibulares articulis tribus ultimis inflexi, 2do multum oblongo.

Oblong in form. Mandibular feet having the last three joints inflexed, the second straight and much elongate.

The species referred to this genus have a short projecting beak, and an oblong body, subrectangular in outline, though rounded at the lower anterior angle. The opening in the shell in front, through which the antennæ and spiculum are protruded, is quite large. The anterior antennæ are long and slender, and consist of three joints; the first half the whole organ in length, the last short. The setæ are straight, except towards apex, where they are curved. One is quite stout and denticulate on the inner side; two are very slender, and one of the two a little shorter; a third is flexed from its base directly backward parallel with the base of the antenna.

CONCHÆCIA AGILIS.

Supernè visa, *elongatè ovata, anticè rotundata, posticè fere acuta*; latere visa, *oblonga, subrectangulata, antice paulo altior, fronte instar rostri producta, postice recte truncata, et angulo superno acutè rectangulato. Spiculum saggitto-capitatum. Pes mandibularis articulo 2do valde oblongo, recto, articulis sequentibus sensim attenuatis.*

In an upper view, long ovate, rounded in front, acute behind; in a side view oblong rectangular, a little higher anteriorly, front prolonged forward beak-like, straight truncate behind, with the upper angle sharp rectangular. Spiculum sagitto-capitate. Mandibular feet five-jointed, second joint straight and oblong, the following gradually more slender.

Plate 91, fig. 6 *a*, under view of animal, enlarged; *b*, side view; *c*, ventral view, the shell open; *d*, the anterior antennæ, with *d'* the spiculum between them; *e*, mandibular feet.

In the Atlantic, latitude 4° north to 0°, longitude 20° 10' to 17° 30' west; latitude 0° to 6° south, longitude 17° 30' to 24° west; collected, October 25, 26, 27, 29, and November 2, 3, 5, 8, 1838. Abundant.

Length, one-twentieth of an inch. Colour, a little greenish.

The anterior antennæ when fully exerted, have the tips of the setæ extending forward to a distance greater than one-third the whole length of the body; but the apical joint scarcely projects beyond the shell. The bases of these organs are situated together on a fleshy mass, about one-third the length of the animal from the front margin. The terminal setæ are four in number, as described in our remarks on the genus.

The spiculum is very slender, but has an enlarged sagittate extremity, with a subacute apex. Along the centre a longitudinal line was distinguished, which appeared to indicate that it was tubular. It resembles in position, and possibly in function, an analogous organ in the *Argulus*.*

* See Memoir on the *Argulus Catostomi*, by the author in conjunction with E. C. Herrick, American Journal of Science and Arts, xxxi. 297, 1837.

The second pair of antennæ have the five short terminal joints together a little shorter than the preceding one; and whole length of the five and the one preceding not one-fifth the length of the animal. The large basal joint is longer than half the shell. The setæ at apex are about two-fifths the length of the animal.

These two pairs of antennæ and the spiculum, are usually protruded through the front opening, as in fig. 6*a*, and the posterior antennæ are the organs employed in the exceedingly rapid motions of the animal.

The mandibular feet are five-jointed, and the three terminal joints are usually bent inward and backward, so that the organs lie like the exterior maxillipeds of a Decapodous Crustacean. The second joint is little more than half as long as base of second pair of antennæ. The first joint is placed transversely, and the adjoining parts of the two on the inner side are prominent and corneous (brownish, or brownish-red), so as to act together like a single mandible.

First pair of maxillæ lie obliquely just behind the base of the mandibular feet, and have short setæ at apex. The whole of this organ was not distinctly seen.

A second pair of maxillæ (or maxillipeds), has a large lamellar plate ciliated with setæ, attached to the base, and also a slender appendage three-jointed, having a long seta at apex, which projects backward.

CONCHÆCIA ROSTRATA.

Agili similis; pedes mandibulares sensim non attenuati, articulis duobus apicalibus fere æquis, vix oblongis, setis longis; pedes penultimi duplo longiores quam ultimi, et elongatè setigeri.

Near *C. agilis*; mandibular feet not becoming smaller to apex, the last two joints nearly equal in diameter, scarcely oblong, setæ long; penult feet twice as long as the next following, having three long setæ at apex.

Plate 91, fig. 7 *a*, posterior antennæ; *b*, mandibular feet; *c*, maxilla of first pair; *d*, second pair of maxillæ; *e*, first pair of legs; *f*, second pair of legs.

In the Pacific, north of the Equator, near Hall's Island, one of the Kingsmill Group.

This species closely resembles the preceding, and may be the same. Yet the form of the mandibular feet and also of the posterior legs, differs so much from the drawings of the Atlantic species, that I have made them separate. The form of the shell is the same, and so also the form of the spiculum and the anterior antennæ. The setæ of the mandibular feet were unilaterally setulose, and this is probably a common character. The relation of the organs *d*, *e*, *f*, in the drawing, was fully ascertained, the last-mentioned being the posterior. A third pair of feet still posterior to these was not observed. *d* represents a part of the second pair of maxillæ.

GENUS HALOCYPRIS, Dana.

Corpus curtum. Pedes mandibulares fere recti et non inflexi, articulo 2do parce oblongo.

Form short. Mandibular feet not inflexed and folded upon itself, but straight nearly, second joint sparingly oblong.

The second joint of the mandibular feet, instead of being straight, is much bent, its basal part being parallel for a short distance with the preceding joint, and the apical half nearly at right angles with it. The third joint is not longer than the second; and this and the following part remain straight. The contrast between the form in this genus and *Conchoecia* will be observed in the figures to be great and important. The spiculum in this genus as far as observed is terete, instead of sagitto-capitate. Moreover, the anterior antennæ are shorter, the setæ somewhat bent, and the incrassate one was not denticulated towards the extremity.

HALOCYPRIS INFLATA.

Supernè visa, brevissimè ovata, fronte rotundata, posticè subacuta; latere visa, subrotundata, dorso fere recta, literæ D formâ similis, angulis

rotundatis, fronte obsolete prominulo. Antennæ anticæ 3-articulatæ, setis longis, unâ subclavatâ, nudâ. Antennæ posticæ 7-articulatæ, articulo secundo plus duplo longiore quam 5 ultimi simul sumti. Pedes mandibulares 5-articulati, articulo secundo brevi, non longiore quam tertius, basi elongate producto, primo ad apicem pariter producto, his processibus duobus denticulatis instar mandibulæ.

In upper view, very short ovate, rounded in front, subacute behind; in side view, subrotund; nearly straight along the back, like the letter D in shape, with the angles rounded, the front not at all or very slightly prominent. Spiculum cylindrical. Anterior antennæ three-jointed, setæ long, one subclavate and naked. Posterior antennæ seven-jointed, second joint more than twice longer than five last together. Mandibular feet five-jointed, second joint short, not longer than third, base laterally very much prolonged, and apex of first joint alike prolonged, the two processes together acting as a mandible.

Plate 91, fig. 8 *a*, dorsal view of animal, enlarged; *b*, side view; *c*, ventral view, shell wide open (*d*, anterior antennæ, with the spiculum between; *e*, posterior antennæ; *f*, mandibular feet; *g*, maxilla of first pair; *h*, second pair or maxillipeds; *i*, *k*, feet of two pairs; *m*, muscle for closing shell); *d*, anterior antenna, with spiculum; *e*, posterior antenna; *f*, mandibular feet; *g*, *h*, maxillæ of two pairs; *i*, *k*, legs of two pairs.

In the Atlantic, latitude 1° south, longitude 18° west, November 5, 1838; also, latitude 11° south, longitude 12° west, May, 1842, at which time the dissections were made.

Length, one fifteenth of an inch. Nearly colourless, or a slight shade of dirty yellow, with a tinge of green. Less diaphanous than the *Conchæcia agilis*. Swims with rapidity.

This species resembles the following, but has not the front projecting, or but obsoletely so, and in an upper view the front is rounded.

The spiculum has an obtuse apex. The anterior antennæ have one seta much longer than the four others, and curved, and it is incrassate towards apex. The organ tapers a little, and is stouter than in the *Conchæcia agilis*. The second joint of the posterior antennæ is longer

in proportion to the following five, than in the *brevirostris*. The mandibular feet are nearly straight instead of being inflexed. The first pair of maxillæ have four joints, the basal laterally elongate and setigerous, the third very broad, the fourth small, with setæ. The second pair have a similar base to the first pair; besides, they have a rounded lamina at base, ciliated with long setæ, and also a slender three-jointed appendage (a termination), the first joint of which is long, and the others short, the apical much the shortest, and it terminates in two long but unequal bent setæ.

The two pairs of feet posterior to these organs are unequal in length; the anterior one-half longest, five-jointed, at base ciliated with long setæ, which act maxilla-like; the joints following the base oblong, and mostly naked, excepting the last, which is very short and bears a few setæ not a fourth as long as the leg. The posterior pair of feet have a few setæ at apex still shorter, and some also at base.

HALOCYPRIS BREVIROSTRIS.

Supernè visa *brevissimè elliptica, antice posticeque subacuta*; latere visa, *lateræ D formâ similis, dorso fere recta, postice rotundata, fronte prominula et truncata. Antennæ anticæ setis inæquis, longiore curvatâ, prope apicem incrassatâ. Spiculum capite cylindricum. Antennæ posticæ 7-articulatæ, articulo secundo non duplo longiore quam sequentes simul sumti.*

In upper view, very short oval, extremities subacute; in side view, like the letter D in shape, nearly straight along the back, rounded behind, front a little prominent and truncate, setæ of anterior antennæ unequal, the longer curved and incrassate towards apex. Spiculum with a long nearly cylindrical head. Posterior antennæ seven-jointed, second joint not twice longer than the following five together.

Plate 91, fig. 9 *a*, dorsal view of animal, enlarged; *b*, side view; *c*, part of second pair of antennæ.

In the Atlantic, latitude 23° south, longitude 41° 10' west. Caught one individual, November 19, 1838.

Length, one-sixteenth of an inch. Body within the shell, white. The shell is marked with minute parallel ridges, seen only with a high lens.

The setæ of the second pair of antennæ were a little bluish, and nearly half as long as the shell. In profile, the upper part of the front margin, for about one-fourth of the height, projects a little beyond the outline below.

Anterior to the mouth there appeared to be a pair of simple eyes, the two rather distant.

LEGION II. PHYLLOPODA.

THE larger subdivisions or tribes in this section are mentioned and described on a preceding page. As no specimens were collected by us, we mention merely the known genera and their characteristics.

TRIBUS I. ARTEMIOIDEA.

FAM. I. ARTEMIADÆ.*

Cephalothorax multiannulatus usque ad caput, testâ nusquam tectus.
Pedes numerosi, foliacei.

* *Branchipoda*, Leach; *Branchipiens*, Edw.; *Branchipidæ*, Burmeister, on Trilobites; *Branchipusidæ*, Baird, Trans. Berw. Nat. Club, 1845; *Branchipodidæ*, Baird, Brit. Entomost., 38. As the generic name *Branchipus* is not retained, it cannot properly be used for deriving the name of the family. The name *Branchipus*, moreover, is not more applicable to the species than it is to those of *Limnadia* or *Apus*, and there is not therefore any special reason for using it. We therefore derive the names of the tribe and family from another word. We take *Artemia* rather than *Chirocephalus* as the origin of these names, partly because it is shorter, but primarily because the peculiar head apparatus of *Chirocephalus*, to which the name alludes, is not a necessary distinction of the tribe or family, although characterizing the subfamily so-called. In the rejection of this generic name, we follow Dr. Baird (Brit. Entomost., 40), who shows that Schæffer's *Branchipus* was probably of another genus.

SUBFAM. 1. CHIROCEPHALINÆ.—Corpus gracile. Abdomen longum et multiarticulatum. Antennæ 2dæ breves sed percrassæ, *maris* prehensiles.

G. 1. CHIROCEPHALUS, *Prevost*.^{*}—Abdomen 9-articulatum, appendicibus duabus oblongis confectum. Antennæ 1mæ tenues; 2dæ *maris* varie appendiculatæ. Pedes foliacei viginti duo.

G. 2. ARTEMIA, *Leach*.[†]—Abdomen 6-articulatum, extremitate breviter bilobatæ. Pedes foliacei viginti duo. Antennæ 2dæ *maris* non appendiculatæ.

SUBFAM. 2. EULIMENINÆ.—Abdomen fere obsoletum. Antennæ quatuor fere filiformes.

G. 1. EULIMENE, *Latr.*—Pedes foliacei viginti duo.

FAM. II. NEBALIADÆ.†

Cephalothorax testâ fere bivalvi bene tectus. Abdomen non inflexum, pauci-annulatum. Pedes plures posteriores biremes, ac in *Cyclopoideis*, reliqui anteriores foliacei, branchiales.

G. NEBALIA, *Leach*.—Antennæ quatuor. Pedes sexdecim anteriores foliacei instar branchiarum, octo posteriores biremes. Abdomen lamellis duabus confectum.

TRIBUS II. APODOIDEA.

FAM. I. APODIDÆ.§

Oculi duo compositi. Appendices duæ caudales longæ, rigidè setiformes.

G. 1. APUS, *Schœffer*.—Pedes duo antici teretes, ramosi, ramis multiarticulatis, reliqui foliacei branchiales, quoad pares numero sexaginta. Antennæ duæ breves, simplices.

* *Prevost*, Jour. de Phys., lvii. 37, 1803; *Ino*, Schrank, Faun. Boic., iii. 249, 1803; *Branchipus*? *Schœffer*, Elementa Entom.

† *Leach*, Diet. Sc. Nat., xiv.; *Artemisus*, Lamk., Hist. An. s. Vert. [2nd Edit.], v. 199; *Artemis*, Thompson, Zool. Res., 104.

‡ *Apusiens* (in part), Edwards, Crust., iii. 353; *Nebaliadæ*, Baird, Brit. Ent., 31.

§ Baird, Brit. Ent. 18; *Apusiens* (in part) Edwards, Crust. iii. 353.

TRIBUS III. LIMNADIOIDEA.

FAM. I. LIMNADIDÆ.*

- G. 1. LIMNADIA, *Ad. Brongniart*.—Caput vix rostriforme, dorso tuberculum pyriforme gerens. Pedes toti foliacei. Abdomen extremitate appendicibus acuminatis quatuor armatum.
- G. 2. CYZICUS, *Audouin*.†—Caput instar rostri productum, dorso non tuberculiferum. Pedum pares numero fermè 21, foliacei. Abdomen fere ac in *Limnadiâ*.
- G. 3. LIMNETIS, *Loven*.‡—Antennæ internæ 2-articulatæ. Cauda brevis, truncata, appendicibus facie inferiore destituta. Pedum pares 12.

We add a few words on the above groups. The Artemioidea are closely related to the Mysidea; and if we look at this relation, we shall appreciate the propriety of uniting together in one group all the genera which we have so assembled. This relation is apparent in the general form of the body, the extended abdomen, and the caudal appendages. These appendages are simply two lamellæ, and the abdomen has the normal form, although abnormal in its number of articulations, while in *Limnadia*, *Apus*, and the allied, the abdomen is of a very different character. The carapax of *Nebalia* is much like the same in the Mysidæ and *Erichthidæ*, while the divided cephalothorax of *Chirocephalus* without a carapax, is but a step removed from other Mysidea. The Cyclopoidea, which of all Entomostraca are nearest to the Mysidea, have no free carapax, but instead an annulated cephalothorax analogous to that of *Artemia* and *Chirocephalus*, although with fewer segments.

Again, the relation of both *Nebalia* and *Chirocephalus* to the Mysidea is seen in the presence of pedunculated eyes, which is a remnant of the *Podophthalmia* structure in this lower order of Crustacea.

* *Apusiens* (in part), of Edwards, *Crust.*, iii. 353.

† Audouin, *Ann. de la Soc. Entomologique*, vi. 1837, and *Bulletin*, Feb., 1837; *Estheria*, Rùppel, *Mus. Senkenbergianum*, ii. 119, 1837; *Isaura*, Joly, *Ann. des Sci. Nat.* [2], xvii. 293, 1842.

‡ Königl. Vet. Akad. *Handl.*, for the year 1845, Stockholm, 1847, 427. *Hedessa* of Liévin (see *Branchiop. der Danziger Gegend. Ein Beitrag. zur Fauna der Provinz Preussen*, 4to with eleven plates, Danzig, 1848, and *Arch. f. Nat.* 1849, 327), is very near *Limnetis*.

This is a peculiarity found in no other Entomostraca. It appears, therefore, that *Nebalia* is properly associated with *Chirocephalus* in a common tribe, and the two represent separate families in that tribe. Of the other Phyllopods, *Limnadia* is built on the *Cypris* type in its abdomen and other parts, and is far remote from *Nebalia*; and *Apus* on the *Limulus* type in many points of its structure, although different in its mouth. These, therefore, cannot with propriety be associated with *Nebalia* in a common group.

Dr. Baird, in his *British Entomostraca*, makes the higher subdivisions of the Phyllopoda, *family* divisions. The distinctions among them, as we have shown, are as great, at least, as those of the *Cypris*, *Daphnia*, and *Cyclops* groups in the *Lophyropoda*.

The homologies of the *Limnadiæ* may be elucidated by a comparison of the structure with that of *Cypris*. In *Limnadia*, and also *Limnetis*, an allied genus, the eighth and ninth pairs of legs have a slender appendage, which extends upward into the ovarian cavity over the back of the animal beneath the shell. In *Cypris* and *Cypridina*, the posterior pair of legs is adapted to the same function, and in the latter genus the organ is flexible, as in *Limnadia*.

Now, in both *Cypris* and *Limnadia*, there are a pair of mandibles and one of maxillæ, which of course correspond in the two genera. In *Cypris*, there are then three pairs of organs following, the last of which has the ovarian use alluded to. In *Limnadia*, pairs of foliaceous legs follow the maxillæ, the eighth and ninth of which have the ovarian appendage. If now each pair of legs in *Cypris* corresponds to *three* pairs in *Limnadia*, as suggested on page 41, the ovarian legs will have normally the same relation in both. The corresponding parts will be as follows:—

	I.	II.	III.	IV.	V.
<i>Cypris</i> ,	mand.	max.	max.	1 pair feet.	ovarian feet.
<i>Limnadia</i> ,	mand.	max.	3 pairs feet.	3 pairs feet.	3 pairs (2 ovarian).

It is altogether probable that this is the true relation of the parts. In this case, in *Limnadiæ* having eighteen or twenty-one pairs of feet, there will be three or four additional normal pairs of feet represented, beyond the *Cypris* number of appendages, making the number found in the *Cyclopidæ*; and when, as in *Limnetis*, there are but twelve pairs, three of which are posterior to the ovarian pairs, there is but a single pair represented additional to the *Cypris* number.

SUBORDER II.

C O R M O S T O M A T A.

THERE are two widely different types of structure among the suctorial Crustacea.

In one type, characterizing by far the larger part of the species, the general arrangement of the organs is identical with that in the Cyclopoidea, the only essential variation from that group being found in the mouth. There are species like the subcylindrical Cyclops, and others depressed, like the Sapphirinæ. The succession of parts, the natatory thoracic legs both as to form and number, and the particular structure of the abdomen, are represented exactly among the species; and a change in the mouth to the ordinary sessile form would bring the species strictly within the limits of the Cyclops section of Lophyropods. Only the lower divisions, in which the members are partly obsolete, would stand apart; and thus separated would still form a closely related group.

The second type—exemplified in Nymphon and Pycnogonum,—presents an Arachnoid form, and most nearly approaches in general outline the genus Cyamus among the Isopods. The abdomen is obsolete; the body short and annulate throughout without a carapax; the legs long and spreading, spider-like, and the only appendages to the thorax.

The species of the first type constitute the section PÆCILOPODA, those of the second, the section ARACHNOPODA.

The most important and fundamental point of distinction between the Pœcilopoda and the preceding group, next to the trunk form of the mouth, consists in the fact that throughout the characteristic species of Pœcilopods, the second maxillæ (or the maxillipeds) of the

Cyclopoidea are properly a pair of legs. The mouth has thus one pair less of appendages, including only a pair of mandibles and a pair of maxillæ; even the maxillæ are sometimes obsolete, and where present are often true maxillipeds.

I. PÆCILOPODA.

THE Pœcilopoda are intimately related to the Cyclopoidea. They diverge more and more widely from that group as the species descend in rank, and the lowest of them bear but a faint trace of the typical form or structure.

In *one* section, that most closely Cyclopoid, the eight natatory legs have the ordinary form, and the body is usually subcylindrical or subterete, without a proper carapax; moreover, the female carries the embryos externally in sacs or bags, as in Cyclops or Corycæus. These are the ERGASILOIDEA.

In a *second* section, the eight natatory legs are equally present, though often changed in part to apron-like appendages, the body is depressed and has commonly a large peltate carapax, and the female carries the embryos externally in two long tubes, containing the ova in a single series,—a mode of structure not found in the Cyclopoidea. Rarely, as in Argulus, there are no external tubes, the ova becoming free directly from the oviduct; but the structure of such species is still essentially the same, as in the Caligi. These are the CALIGOIDEA.

The variations in form among the natatory legs in the Caligoidea are very great, and these modifications, as we pass to lower forms, end in the obsolescence of these legs; and while the posterior part of the body thus loses its members, the anterior part often fails in the first pair of antennæ. Such are the LERNÆOIDEA. The body may be thick and short, or long and worm-like. The appendages are at times all obsolete, excepting one or two short jointless processes attached to the head or anterior part of the body. The eggs in the Lernæoidea are carried externally, sometimes in bags or sacs, as in the Ergasi-loidea, and sometimes in slender tubes, as in the Caligoidea.

The Pœcilopoda thus form a continuous line downward from the higher Cyclopoidea. The line comes more especially through the Corycæidæ, and for the reason that these are the Cyclopoidea species in which the posterior antennæ are prehensile. There are a few of the sucking Ergasiloidea, in which these antennæ are without a prehensile character. But in *Ergasilus*, the form is quite like that of *Corycæus* and *Sapphirina*; and in nearly all the lower groups, the prehensile structure is well developed, although under varied forms. These organs are clinging organs throughout the greater part of this section of suctorial Crustacea, and the principal organs of this character in a large number of species.

The three tribes of Pœcilopoda are hence characterized as follows:

- I. ERGASILOIDEA.*—Cephalothorax annulatus, carapace non tectus. Truncus buccalis non mobilis, brevis, mandibulis interdum obsoletis (?). Pedes 8 postici bene natatorii ac in *Cyclopoideis*. Ova externa in sacculos gesta. Corpus sæpius non depressum.
- II. CALIGOIDEA.†—Cephalothorax sive annulatus sive carapace tectus. Truncus buccalis mobilis, mandibulis armatus. Pedes 8 postici plus minusve natatorii, sæpe partim in laminis coaliti. Ova externa in tubos duos longos uniseriatim gesta, tubis raro obsoletis. Corpus sæpius valde depressum et peltatum.
- III. LERNÆOIDEA.‡—Cephalothorax vix annulatus. Corpus sive breve et obesum sive elongatè vermiforme. Pedes natatorii obsoleti. Ova externa sive in sacculos aggregata sive tubos uniseriata.

* *Ergasiliens*, Edw., Crust., iii. 476.

† Includes the "*Peltocephales*" of Edwards, and his "*Dichelestiens*."

‡ *Lernæides*, Edw., Crust., iii. 488; *Lernæoda* and *Penellina* united of Burmeister, Acta Ac. Cæs. Leop., xvii. 270; *Lernæadæ*, Baird, Brit. Entomost., 307.

TRIBE I. ERGASILOIDEA.

THE Ergasiloidea may contain different families corresponding to the families among the Cyclopoidea. At present we recognise only three. One, MONSTRILLIDÆ, representing very closely the Setellæ and Antaridæ in the general form of the body, the abdomen and its appendages, although different in having no posterior antennæ. A second, ERGASILIDÆ, having the form of the Corycæidæ, together with their prehensile posterior antennæ. A third, the NICOTHOIDÆ, most nearly related to the Harpactici. The large lateral appendages in Nicothoe are independent of its type of structure, and can hardly be more than a *subfamily* characteristic, separating them from other species that are destitute of these appendages.

The characteristics of these families and of the genera they comprise, are as follows:—

FAM. I. MONSTRILLIDÆ.

Corpus elongatum fere cylindricum. Abdomen 5-6-articulatum, segmentis 1mo et 2do appendicibus setosis munitis ac in *Setellâ*. Maxillæ, antennæ posticæ et pedes antici obsoleti, pedes octo maxime biremes.

G. MONSTRILLA, *Dana*.

FAM. II. ERGASILIDÆ.

Corpus breviusculum, cephalothorace crasso, abdomine stylis caudalibus minutis setigeris confecto. Antennæ posticæ subprehensiles ac in *Corycæo*, pedes octo postici bene biremes.

G. ERGASILUS, *Nordmann*.

FAM. III. NICOTHOIDÆ.

Ergasilidis affinis. Antennæ posticæ perbreves vel rudimentariæ.
[Corpus lobis tumidis prodigiosis lateraliter productum.]

G. NICOTHOE, *Aud. et Edw.*

The genus *Bomolocus*, Nordmann, is of doubtful place. The general form is like that of *Ergasilus*, but only two antennæ are mentioned, and these are peculiar in having a spinous basal portion for attachment and a pauci-articulate flagellum.

The homologies of the Ergasiloidæ will be inferred at once from a comparison of the animals with the series of parts in the Cyclopoidea (Cyclops or Corycæus).* The four pairs of natatories are in both groups appendages to the *eighth*, *ninth*, *tenth*, and *eleventh* normal segments. In Nicothoe, the three pairs of appendages preceding, are homologues of the maxillæ, maxillipeds, and first pair of legs (fifth, sixth, and seventh normal segments); while the buccal trunk includes or corresponds to the mandibles and lips (fourth normal segment). In *Ergasilus*, there are two pairs of antennæ, as in *Corycæus*, which completes the animal anteriorly, these corresponding to the second and third normal rings of other Crustacea. The second pair of antennæ are considered maxillipeds by Milne Edwards.

Van Beneden, in a recent paper on Nicothoe,† in which the embryology is quite fully illustrated, observes, that the species appears from its course of development to belong to a different type from *Ergasilus*. This genus and *Caligus* he refers to the same type with *Cyclops*, and considers Nicothoe as pertaining to another category.

* The appendages in *Corycæus* and the allied genus *Sapphirina* are given in order on Plate 92, figures 1 *a*, *b*, *c*, etc., pertaining to *Sapphirina*, and 1 *a'*, *b'*, etc., to *Corycæus*.

† Mem. Acad. Roy., Belg., vol. xxiv.

FAMILY MONSTRILLIDÆ.

GENUS MONSTRILLA, Dana.

Cephalothorax fere cylindricus, 4-articulatus. Abdomen 5-6-articulatum. Antennæ duæ. Oculi duo simplices; quoque oculus inferior sicut Pontellis. Truncus buccalis parvulus subconicus, maxillis pedibusve non munitus. Pedes octo, natatorii. Abdominis segmenta Imum 2dumque appendices gerentia ac in Setellis.

Cephalothorax nearly cylindrical, four-jointed. Abdomen five- to six-jointed. Two simple eyes; also an inferior eye, as in the *Pontellæ*. Antennæ two. Buccal trunk quite small, cylindrical, and not moveable at base. Maxillæ and anterior feet obsolete; four pairs of natatory feet. A pair of abdominal appendages to each first and second segments, besides caudal stylets.

MONSTRILLA VIRIDIS.

Gracilis, posticè attenuata. Oculi superiores remoti. Antennæ 5-articulatæ, setis antennâ brevioribus. Abdomen 5-articulatum, segmento secundo brevioribus. Styli caudales oblongi, parvi, divaricati, setis 5 subæquis, diffusis.

Slender, attenuate posteriorly. Eyes remote. Antennæ five-jointed, setæ shorter than the antennæ. Abdomen five-jointed, the second segment shorter than first or third. Caudal stylets small, oblong, divaricate, setæ five, subequal, spreading.

Plate 94, fig. 1 *a*, animal, enlarged; *b*, profile view; *c*, buccal prominence, more enlarged; *d*, abdomen in profile, with last thoracic segment and natatory feet.

Sooloo Sea, Harbour of Soung; taken at 8 P. M., on the 3d of February, 1842.

Length, one-fifth of an inch. Colour, grass-green.

This specimen was taken for an imperfect individual, when first seen, on account of the absence of all the anterior organs between the mouth and the four pairs of natatory feet, as well as that of the posterior antennæ. But beyond these particulars it has no appearance of being an abortion. It cannot be young, for its size exceeds that of most of the Calanidæ. It has the head of a Pontella, and the abdomen of a Setella or Miracia. The buccal trunk is situated near the centre of the cephalothorax below; it is oblong conical and truncated at apex, as seen under a high magnifying power; and it contains a cylindrical sucker which opens at the apex. No mandibles were made out, and no appendages of any kind about the sucker. The shell of the venter anterior to the natatory legs is unbroken and smooth, excepting the buccal prominence.

The first segment of the cephalothorax is long and nearly linear. The antennæ are rather short, and are directed straight forward. The appendages to first segment of abdomen are small and short, those of the second long and vergiform, extending beyond the apex of the abdomen. The stylets and setæ are precisely as in the Pontellæ.

TRIBE II. CALIGOIDEA.

THE Caligoidea, although closely related, like the Ergasilidæ, to the Cyclopoidea, are more remote from that tribe in general form, and pass through wider variations of structure. These species are naturally grouped in three sections. One, the ARGULIDÆ, differs from the other two in having no external oviferous appendages, the ova passing out free direct from the oviduct: they are characterized also by having no anterior antennæ; the posterior antennæ two-branched, the first pair of legs tubular and suctorial; the second pair unguiculate and not prehensile.

In the two remaining sections there are oviferous appendages, and these are alike in being simple tubes, with the ova in a single series; they have a pair of short anterior antennæ; moreover, the posterior

antennæ are simple, and more or less hooked or prehensile; the first pair of legs are slender pediform organs; the second pair are stout and prehensile. The species in one of these two sections, the CALIGIDÆ, have a broad peltate body, the anterior segment or shield covering a large part of the whole; and the second antennæ are very short and stoutly hooked, and concealed beneath the body. In the other section, the DICHELESTIDÆ, the body is narrow; the anterior segment is comparatively short; and the second antennæ are elongated, and project beyond the head.

The Dichelestidæ are related to the Ergasilidæ in some of their characters; and yet are more closely similar to the Caligidæ. The structure of the maxillæ, buccal trunk, and first pair of legs (or maxillipeds), is much like the same in the Caligidæ; the natatory legs have little of the perfection of those of Ergasilus, they approximating in the form of the four anterior, and in the abnormal character of the four posterior, to the structure in the Caligus type.

These characters, together with the tubular form of the oviferous appendages, fix their relations to the Caligidæ.

The Caligidæ exhibit a relation to the Corycæidæ, and especially to the flat Sapphirinæ, in their hooked second antennæ, and the general character of the legs, including the prehensile form of the second pair (the second pair of legs corresponding normally to the first pair in that family). This affinity is also strikingly seen in the fact that some species have the *spectacle-eyes* of the Sapphirinæ and Corycæi, as detected by the author.

The Argulidæ are similar to the Caligidæ in their posterior antennæ; but they are more remote from the Corycæidæ than either the Caligidæ or Dichelestidæ, since the anterior antennæ are wanting; the legs which correspond to the first pair in the Corycæidæ are not prehensile; the females carry no external bags or tubes of eggs. The division Peltoccephala of Edwards, which includes the Argulidæ and Caligidæ and excludes the Dichelestidæ, is not therefore retained in our system. The mere form of the body, as shown in the Corycæidæ, is a character of inferior value.

The three families mentioned may be characterized as follows:—

Fam. I. ARGULIDÆ. — Corpus late depressum, peltatum. Antennæ 1mæ obsoletæ. Pedes 1mi tubulati, 2di unguiculati. Ova in tubis vel sacculis externis non gesta.

Fam. II. CALIGIDÆ.—Corpus late depressum, peltatum, segmento antico pergrandi. Antennæ 1mæ breves; sæpius 2-articulatæ, raro 3-articulatæ, 2dæ corpore tectæ. Pedes 1mi graciles, 2di prehensiles vel ancorales. Ova externa in tubis gesta.

Fam. III. DICHELESTIDÆ.—Corpus angustum, segmento antico parvo. Antennæ 1mæ breves, 5–10-articulatæ; 2dæ fere frontales ultra caput exsertæ. Pedes 1mi graciles, 2di prehensiles. Ova externa in tubis gesta.

We follow these general remarks on the relations of the Caligoidea and their subdivisions, by some details with reference to their structure and their homologies.

Segments of the body.—In the Corycæidæ, among the Cyclopoidea, the cephalothorax consists of one large anterior segment, and three posterior; and rarely there is another articulation, though less distinct, across the posterior part of the first of these segments. Each of the three posterior segments bears a pair of natatories, that is, the second, third, and fourth pairs of these organs; and when another segment is present in the body, it bears the first pair of natatories. This same structure is exhibited among the Caligoidea. In the species of Pandarus and Specilligus, Plate 95, there are four cephalothoracic segments distinct, the last two of the body alone being abdominal. One of the four is a large anterior segment, and the other three are posterior segments, pertaining to as many pairs of natatories. In Nogagus (Plate 94, fig. 9), the first of the three posterior is not distinct; and in the species of Caligus (fig. 1 *a'*, and 1 *h*, Plate 93), only the last is separate, the others being coalesced with the anterior segment. Caligus, however, presents the semi-articulation alluded to, just anterior to the first pair of natatories. The same is probably present in Specilligus, although not shown in the figure, and if so, this species has the full number found in any Sapphirina. Moreover, all the four posterior pairs of legs are true natatories in Specilligus, while in Caligus the third pair is an apron-like appendage, and the fourth is slender subpediform.

In Argulus, we find the four segments distinct (fig. 2 *a*, Plate 94), and also traces of the preceding or medial articulation.

The bizarre forms of some Caligoidea arise from the enlargement or

alate expansion of the shell of the second or third posterior cephalothoracic segments. In the Pandari (see Plate 95), some of the forms assumed by these segments are shown. The first of these three segments is prolonged backward on either side, and this prolongation, while it is of ordinary character in the *P. brevicaudis*, has peculiar shapes in the *P. satyrus* and *P. concinnus*; the other two segments are two-lobed behind, and the lobes have different forms. In *Lepidopus* (Plate 95, fig. 5 *a*), only the last two or three segments are seen, and the lobes are very large. In *Dinematura* (Plate 95, fig. 4 *a*) there are also but two; and while one is small and transverse, the second is very large, and divided nearly longitudinally into two halves.

The anterior segment, when the semi-articulation exists just anterior to the first pair of natatories (see fig. 1 *a'* and *h* of *Caligus*, Plate 93, and also fig. 2, Plate 94, of *Argulus*), is not entirely crossed by this articulation; but towards the middle of either half it bends backward and runs to the posterior margin; at the same time, a similar pseudo-articulation, or line admitting of flexure (E, fig. 1 *h*, Plate 93), extends forward towards the anterior antennæ, though seldom reaching more than half the way. These lines make a kind of a letter H on the back of the animal, as shown in the figures. The object of these semi-articulations is to enable the animal to draw the margin of the shell down to the surface upon which it may lie, for the purpose of close adhesion.

A long osseous process lies in the shell of the alar pieces, and enlarges a little at its termination (E, fig. 1 *h*, Plate 93), against the anterior branch of the longitudinal semi-articulation; its object is to afford a firm articulating surface for the purposes of the flexure which here takes place.

Besides the transverse semi-articulation in *Caligus*, near the middle of the cephalic segment, there is another a little less distinct near the anterior margin; it separates a frontal segment which bears laterally the anterior antennæ, and is normally the first antennary segment of the body. At the middle there are often two small papillæ. Like the longitudinal, it favours the attachment of the animal by this margin. For this movement there are strong muscles, and also towards either side (at *c*, fig. 1 *h*, Plate 93), an osseous articulating surface, forming the termination of a process lying longitudinally in

the segment behind. We state beyond a reason for considering this segment the basal portion of the anterior antennæ.

The margin of the large anterior portion in the Caligidæ is aided in attaching itself in two ways, which may occur either separately or together. These are, 1, minute spinules ranging along a line parallel with the lateral outline, often in colourless species near the inner limits of the narrow transparent margin of the body (fig. 1 *h*, *r*, Plate 93); 2, sucker-like disks fitted expressly to affix the body to the surface on which it may rest. There are often two of these sucker-disks on the anterior margin, and they have been mistaken for eyes; one is represented enlarged, in the figure just referred to. They vary from a circular to an elliptical form; and are thin fleshy disks, attached by their central portions. Posterior to the first pair of antennæ in the Caligidæ and opposite the second pair, there is often a *second* disk, either side; and sometimes a *third* exists near the latero-posterior margin.

Besides these means of affixing itself, independently of the regular appendages, there is in the young forms of some species, a slender organ, proceeding from the middle of the front, which ends in a small disk. In some species the stem is quite slender. The genus *Chalimus* is based on the presence of this organ. But Kröyer has shown that this organ is not a proper basis for a genus,* and the same view is more recently sustained by Dr. Fr. Müller.† In 1838, the author, in an account of the *Caligus Americanus*,‡ described the same appendage as occurring sometimes in this species. Plate 93, figures 1 *u*, *v*, *w*, represent its appearance in different states. 1 *u* represents an upper view of the front of the animal, just before a change of skin; *c*, *d*, is the front of the *Caligus*; *e*, *f*, the front of the inner new-formed shell; *m*, *n*, *o*, the appendage. In 1 *v*, the appendage *n*, *m*, *o*, is seen in profile, the corresponding parts being lettered alike in 1 *u*, and 1 *v*. In 1 *w*, the same appendage is represented, with the outer shell of the animal removed, and the organ drawn forward. In one instance, the author observed an animal having the appendage situated as in 1 *w*, except that it consisted of three of these appendages placed end to end; and probably it was formed at three successive moultings. In external appearance, this organ much resembled a muscle, as it was striated like them, though very coarsely.

* Tids., ii. 1837.

† Archiv für Naturgeschichte, 1852, 91.

‡ Amer. J. Sci., vol. xxxiv, p. 225.

The *abdomen* has from one to three segments; the number is usually two. In *Argulus* (fig. 2 *a*, *b*, Plate 94), only one segment is distinct; this one is deeply two-lobed behind, and at the bottom of the sinus separating the lobes there are two minute appendages, which are rudiments of a pair of caudal stylets. In *Caligus*, the abdomen has a large basal segment, following which there are one or two much narrower segments. The basal segment in females with eggs is larger than in males, and of different form; and at its posterior angles it bears the oviferous tubes. It hence follows that this basal segment is the homologue of the second, or first and second abdominal segments, in the Cyclopoidea; for the second is normally the egg-bearing segment throughout that tribe. In males, the posterior angles are often projecting, and are sometimes furnished with two or three very short setæ; the same setæ may occur in females.

In *Dinematura*, *Cecrops*, and *Lepidopus*, the abdomen has but two segments, and though very large, the second segment is quite small, and is situated beneath the preceding, near its extremity. The caudal stylets in *Caligus* and allied genera are much like those in the Cyclopoidea, and have the same number and arrangement of setæ. In *Lepidopus*, they appeared to be wanting, being represented by very small lobes on the hinder margin of the last abdominal segment.

Appendages of the body.—The figures on Plate 92, represent in parallel columns the different forms of these organs among the principal sections of the Caligoidea, together with the same in *Sapphirina* and *Corycæus* for comparison.*

The *anterior antennæ* in the Caligidæ are short, and consist usually of but two joints (L, in fig. 1 *a*, and 1 *r*, Plate 93). The first joint has a number of short setæ along the anterior margin, which are setulose, and each receives a branch of the antennary nerve. These setæ shrink up on drying, and thus differ from the setæ of the body. The second joint has only a few naked setæ; there is a single seta at the middle of the posterior side; also a lower and an upper apical set, the former of which are a little the longer and more acute. The frontal segment of the cephalothorax in *Caligus* and the allied genera is probably the basal portion of these antennæ, and if counted as such, the organs would be three-jointed. In *Læmargus*, this frontal segment is

* Of the figures of this plate, 1 *a*, *b*, etc., represent organs of *Sapphirina*; 1 *a'*, *b'*, etc., *ibid.* of *Corycæus*; 2, of *Argulus*; 3, of *Caligus* (3 *k'* of *Calistes*); 4, of *Pandarus*; 5, of *Lepidopus*; 6, of *Dichelëstion*; 7, of *Chondracanthus*.

wanting, and the antennæ are actually three-jointed, the basal joint in this case not extending along the front of the head.

In the Dichelestidæ, as in the Ergasiloidæ, these antennæ are terete, and four- or five- to seven-jointed.

The *posterior antennæ* are short organs, consisting of two or three joints, the last either bent into a hook at the extremity, or furnished with short claws, or else curved and set with teeth along the margins; these different means adapting it for attaching the animal in its parasitic life. There is often a stout spine at base, directed backward; and also exterior to the base, or connected with it, another curved or hooked spine. This last spine may perhaps correspond to a second branch of these organs; for in *Argulus*, there is a terete second branch, of three or four joints, occupying nearly the same position, being just posterior to the stout hooked portion. This hooked joint has on its posterior side a slender two- or three-jointed appendage; but this appendage appears to be properly the termination of the organ, rather than a separate branch, for the branch always proceeds from the normal second joint, while the hooked portion is normally the third or fourth joint.

These antennæ are sometimes very different in the two sexes. In *Caligi*, the males end in a short joint furnished with two small claws (3 *b*, Plate 92), while in females, this terminal joint is wanting, and the preceding is slenderly prolonged to a bent point (3 *b'*).

The trunk-formed *mouth* is either short ovate, with a rounded extremity behind; or it is long and slender, and gradually tapers to a narrow point.

When of the ovoid form, as in *Caligus* (figs. 1 *a* and *p*, Plate 93), the trunk is a hollow organ, bounded above and below by distinct membranes, which represent the upper and under lips. It has a lunate opening between the approximate lips (*a a* and *b*, fig. 1 *p*).

The lateral and lower margin of the buccal trunk is formed by a slender bone (*c, b, c*, fig. 1 *p*), which forms a projection at *c*, where it suddenly curves around inward, and runs backward a short distance nearly parallel with the margin (*c, 1 p'*). These bones form the sides to the *lower* membrane of the cavity of the mouth. At the anterior extremity of the buccal mass within, they are connected with several small bones, which run to the medial line of the mouth (*m, l, and n*, fig. *p'*, and *r, s, t*, fig. *p''*, an under view); these bones lie either on or in the lower membrane of the mouth. No portion of the

upper membrane of the buccal mass is connected with the bones of the lateral margin, except a small subtriangular piece either side, near the anterior angle (*d, a, e*, fig. *p*), between which pieces there is a semicircular opening; the edges of this opening are furnished with ciliæ, and constitute the lower margin of the lunar opening, or the *lower lip*. This lower lip is divided at its centre (*b*, fig. 1*p*), and the edges thus formed are curved inward, so that in a vertical view several ciliæ are projected together, and have the appearance of one branching cilia.

The whole membrane forming the upper portion of the buccal mass may be called the *upper lip*. It is represented separate in fig. *p*³. It is united with the lower portions, at its anterior extremity (*q, q*, figs. *p* and *p*³). It may be viewed as consisting of two parts, a moveable and an immoveable. The *moveable* portion, which is very much the smallest, is an elliptical, nearly circular membrane, inserted in a semicircular concavity (*a a*) in the anterior margin of the *immoveable* portion. Its front edge is coarsely subcrenated and furnished with ciliæ. The large immoveable portion of the upper lip is bounded by a bony edge on all sides except between *p* and *p*. At *f* (figs. *p* and *p*³), there is a curved process, elongated outward, serving for the attachment of a muscle.

Through the opening between the lips (fig. *p*), we may observe the two slender bones *l* (fig. *p*¹), and just before these, there are visible, through the membranes, two dentated organs, which, when the membranes above are removed, appear as represented in fig. *p*². These organs are the *mandibles*. They are long slender organs, with a falciform termination, curved inward, and dentated on the interior edge; the number of teeth is about twelve. The outer margin of the dentated portion is provided with a narrow, corneous, transparent edge. These mandibles extend backward, and pass out of the buccal mass just anterior to the lateral projection, *c* (figs. *p* and *p*¹), and behind the process, *f*. Here they are connected with a bony tendon, to which the large muscles are attached which move the mandible. The mandibles have no appendages, and are very slightly connected at their base with the membranes of the buccal mass. When the buccal mass is separated from the body by force applied below, the mandibles invariably remain attached to their muscles.

The remaining corneous organs at the extremity of the mouth have been already described as connected with the lower membrane; the

two pairs *m*, *l*, on the surface of this membrane, and the remaining, in its texture. The pair *l*, have just been referred to as seen through the opening between the lips. These bones approximate at their apices; at the other extremity they curve backward and terminate under the junction of the two lips (fig. *p*¹, and *a a*, fig. *p*); the bones, *m*, which are situated under the mandibles, are very finely pectinated on their outer margin; they terminate at the same place with the preceding pair.

The remaining bones form a kind of framework for the lower membrane. Three slender bones, *r*, *s*, *t* (fig. *p*⁵), occupy the extremity of this membrane, and the bones, *o*, its inner portion. The bones, *o*, extend backward and enlarge at the posterior part of the buccal mass (*g*, fig. *p*⁵), where they serve for the attachment of the muscles elevating the buccal mass. They appear to form by their union at their anterior extremity (figs. *p*⁵ and *p*¹) a short, oblong process (*k*), which is situated between the apices of the pectinated bones, *m*. The piece *n* (figs. *p*¹ and *p*⁵) passes directly outward from this process, and is gradually lost in the membrane.

We have often observed through the upper membranes of the buccal mass, and just in advance of the bony arch *a*, *a*, fig. *p*, an obscure curved line, nearly concentric with the anterior margin of the buccal mass, which is frequently in motion. From the peculiarities of its action, we suppose that there is here an internal opening to the œsophagus. At this place, there are several folds seen below (fig. *p*⁵), which may be the seat of the sense of taste. Above, we observe (fig. *p*) four fleshy oblong organs extending from a point deeply situated near the base of the œsophagus, obliquely upwards to the upper part of the buccal mass. At their lower extremity, they are connected by a slender ligament with the bone, *g*. These organs appear to close the œsophagus. They often open and close in consequence of the similar action of the processes, *g*, with which they are connected.

The articulation of the buccal trunk with the surrounding parts is formed by means of a bony process situated in it below *f*, and another slender process (*h*, figs. *p* and *p*⁵) extending backward and outward in the adjacent teguments. A curved bony process (*i*, fig. *p*¹) connects the projection *c* (figs. *p*⁵, *p*¹) with the process below *f*, uniting the two portions of the buccal mass.

In *Argulus*, the form of the trunk is nearly as in *Caligus*. The

extremity of the mandibles stand nearly at right angles with the preceding part, and to give the organ in this part better support, there is, just above the insertion of the corneous extremity, a short lateral bony process.

In mouths of the more slender variety, the opening is terminal, and the mandibles are straight, or nearly so.

The mouth and its organs correspond normally to the upper and under lips and the mandibles of other Crustacea.

The *maxillæ* are of two types. In species of Caligidæ with the obtuse or ovate trunk, as in *Caligus*, the maxillæ are a little distant from the mouth either side, and have the form of a very large and stout spine lying on its side, and pointed backward with one or two points; and there is usually a minute second joint on its under surface, bearing two or three spinules (fig. 1 *a*, and *d*, Plate 93). In species with a slender pointed trunk, the maxilla is a small lamellar organ, directly embracing the sides of the trunk towards its base. Three joints may sometimes be distinguished, the first nearly of the size of the whole organ, a second quite small, and the third a minute terminal point.

Legs.—The first pair of feet consists, in most species, of three oblong slender joints, with sometimes a short basal. The second joint is much more slender than the preceding, and not shorter; and its lower apex is prolonged to a very slender point; and where this prolongation begins, the third joint arises; this resembles the apical process of the preceding joint alongside of it, and both together form a kind of bidigitate termination to the legs: each has generally a very minutely pectinated edge.

In *Argulus*, the legs of the first pair are very large tubular, and have a broad rayed margin for attachment, the rays of which, when highly magnified, are moniliform (Plate 92, fig. 2 *e*). In *Nicothoe*, the leg approaches the form in *Caligus*; but the first joint is stouter, and the second or last is long and somewhat hooked.

The second pair of legs is stout in all the species, and generally it is well fitted for prehension, especially in males. In male Caligidæ it has often the form of a thick didactyle hand (fig. 3 *f*, Plate 92); but in some females it is not half as stout, and is monodactyle (3 *f'*), the moveable finger being longer, but not closing against a process on the preceding joint, none existing for this purpose. The fingers are sometimes in a transverse position with reference to one another, but at

times also they are placed one alongside of the other. In the genus *Lepidopus*, the finger is wanting, and the preceding joint has a large flat surface below, which is set with scales, each scale having a minute point at apex (Plate 92, fig. 5*f*). In *Argulus* alone, the leg though stout is elongate, and not prehensile, and has a more ordinary pediform character, ending in a small claw.

Preceding the third pair of feet, or first natatory pair, there is often a furcate corneous process on the venter, pointing backward.

The *third pair of feet*, or *first pair of natatories*, is the smallest of the natatory feet in the *Caligidæ*, though hardly less than the following in the *Argulidæ*. It is either simple or two-branched, and is furnished with a few setæ. In *Argulus*, the two branches are long and plumose, and there is a third branch which is two-jointed, and lies reflexed alongside of the basal portion of the leg.

In the *Dichelestidæ*, the eight natatories are nearly similar, having two branches furnished with setæ, as in *Ergasilus* and *Corycæus*.

The *second pair of natatories* in *Argulus* is like the first. In *Caligus* it is much larger and stouter, and always two-branched. The branches are two- or three-jointed, and furnished with setæ, which are quite long and plumose in some genera, and the setæ of the inner branch in such species extend inward over the venter when at rest. The terminal seta of the outer branch, as in the *Cyclopoids*, is ensiform, and only ciliated on the lower edge.

The *third pair of natatories* in *Argulus* resembles the second, except that the reflexed branch is wanting. In a few *Caligidæ*, also, it is near the second pair in structure; but in most of them it is expanded into a very broad, lamellar form, having the two branches very short and attached to the margin. The legs of the two sides, when thus modified, are often united together by a free lamellar sternum, so as to form a large apron-like appendage, which unites with the margin of the shell around in giving a close attachment of the body to any supporting surface. The cavity beneath the body is thus completely closed in, and water may be retained within, and thus sustain the animal, although out of water. To give strength to the articulation of this moveable apron, a pair of slender corneous processes extend backward from the sternum of the preceding pair (see fig. 1*g*, Plate 93) to the sternum of the apron, which has a corneous anterior margin.

The *fourth pair of natatories* is more variable. In *Argulus* and

some Caligidæ it is simply two-branched and natatory in character. In other Caligidæ it is a broad plate, with two small one-jointed marginal appendages much like the third pair; and in others—the true Caligi—there is but a single branch, and the leg is rather slender, and ends in a long spiniform finger with also one or two shorter spines below, being wholly without plumose setæ, and having no natatory character. The finger is minutely pectinated along its inner margin.

Eyes.—The *eyes* are either simple or compound, being simple in the Caligidæ and compound in the Argulidæ. In Caligus, the two simple eyes are placed on the same spot of pigment and have spherical lenses, resembling the superior eyes of the Cyclopoidea. The shell above the eyes is flat. Below it, over the eyes, there is a cornea, thin and transparent, about twice the diameter of the lens.

Besides the ordinary simple eyes in the Caligidæ, there is sometimes a pair of simple eyes with large prolate lenses and oblate concipilla or broad convex corneas, like those of the Corycæidæ, as in our genus Specilligus. The presence of this kind of eyes is not attended by any marked peculiarities in the structure of the species, analogous to that separating the Corycæidæ from the other Cyclopoidea, and consequently the character is not to be received as a family distinction, though a proper basis for a subfamily division.

Muscular System in Caligus.—The muscles moving the several members, may, in general, be distinctly seen and traced to their insertions, through the pellucid covering of the body. All the muscles appear transversely striated, and by means of this important character, they are distinguished from the nerves. These striations are most distinctly seen in the flat, simple muscles; those composed of several bundles of fibres, which is the case with many of the large muscles on the back, exhibit it, but less perfectly. These striations vary much in their fineness. In general, they are from $\frac{1}{800}$ to $\frac{1}{500}$ of an inch apart. In some muscles, among which we may mention those elevating the buccal mass, we found them as coarse as $\frac{1}{500}$ of an inch.

On account of the peculiar forms and motions of some of the organs in this animal, it contains several muscles of unusual character.

a. Muscles of the Segments of the Body.—The frontal segment is

flexed by two short slender muscles on each side (R, R'), situated just exterior to the process which forms the articulation of this segment (figs. 1 *a* and *h*, Pl. 93), and directed backward and outward. They unite in a common short tendon. They act in depressing this segment, and assist in attaching its cup and anterior margin. This margin is provided with a narrow ridge, which is striated or wrinkled transversely, like the cup, and is apparently intended to produce a closer attachment of this margin.

For the motions at the medial articulation of the cephalothorax there are three pairs of muscles, situated in the anterior segment, two attached near the median line, and one pair laterally. A pair of short muscles (I, I, fig. *h*), run nearly parallel with the median line; they produce the slight flexion admitted at this articulation. Another pair of muscles, long and large (S), are situated on each side of the preceding; they pass obliquely outward. In addition to aiding in flexion, they produce a lateral sliding motion, often observed between these segments. A third pair (K) also assist in flexion. The large muscles (K') situated in the posterior segment, appear also to pertain to this joint; but we are not fully assured that this is really their insertion.

The extensor muscles of the posterior thoracic segment, and of the abdomen, arise adjacent to the median line, near the centre of the anterior thoracic segment. Three pairs of muscles are attached at this point. The outer (L) pass obliquely outward, and are inserted near the apex of the posterior thoracic segment. The two pairs (M, N) appear to continue through the thorax, to the last joint of the abdomen. Another pair of muscles (O) commence in the thoracic joint, near the median line; they pass obliquely outward to a point in the first abdominal segment, just below its centre, where they are inserted into the teguments. Another pair of slender muscles (P) arise near the insertion of the last, and pass to the following segment.

The flexor muscles of these segments, situated along the venter, are remarkable for having but two anterior attachments, although, counting the several insertions in the posterior segments, there appear to be six distinct muscles. Two broad muscles arise on each side of the medial line, opposite the prehensile legs. As they pass between the sternums of the natatory legs, they divide into three portions, as represented in fig. 1 *f*, the large muscle here continuing on, much dimi-

nished in volume, and exterior to this continuation, two muscles being attached, each by a tendon, to the diminishing portion of the main muscle. Though apparently distinct, these three muscles continue connected, and pass on beyond the sternum of the second pair of natatories, where there is a second subdivision of the muscle. We observe an oblique constriction of the whole (fig. 1*f'*), below which, the three muscles are continued of nearly their former size, and a fourth is added, exterior to the three. Thus divided, the muscle continues into the abdomen, where the four parts are separately inserted: the exterior pair diverge, and are attached near the base of the abdomen; the interior are inserted below the centre of the abdomen, directly under the insertions of the extensor muscles of the back; the two remaining pairs are continued into the terminal abdominal segment, the outer passing beyond the centre of this joint. Another pair of small muscles are inserted in the base of this joint, which arise near the attachment of the interior pair of abdominal muscles.

The other set of muscles, consisting of two pair, arise a short distance below the sternum of the posterior natatory, exterior to the muscles just described. One pair, the outer, is inserted in the base of the posterior thoracic segment, and the inner, laterally below the centre of the abdomen.

The lateral motion of these segments is produced by the simultaneous action of the flexor and extensor of the same side. The insertion of the more powerful of the abdominal muscles below the centre of this segment, in preference to an attachment near its base, enables the animal to give this segment great flexion. When the animal has been attached to the glass out of the water, we have often separated the anterior portion of the body from the glass, till it formed an angle of 75° or 80° with the abdominal portion, and generally the animal has succeeded through the action of these muscles in restoring its head again to the glass.

The muscle (O) on the back (fig. 1*h*) may possibly be attached to the muscle (N), and not to the thoracic segment. We have not succeeded, in our dissections, in exposing these muscles, in order to determine this point.

(1.) *Muscles of the Organs of the Anterior Cephalothoracic Segment.*
—In the following account, we shall in general describe only the

muscles moving the basal joints of each of the legs. More minute particulars may be obtained by reference to the figures on Plate 93.

The muscles moving the cup have not been satisfactorily determined. A slightly elevated line passes from each side with a curve into the membrane of this organ, which may be muscular; if so, they act in flattening the cup preparatory to its attachment.

The anterior antennæ have two extensors and one flexor. The two extensors are inserted in a tendon occupying the anterior margin of the base. They extend half way to the eyes; one (a, fig. *h* and fig. *a*), above the flexor of the anterior cephalic segment, is attached to the upper shell; the other (a', fig. *a*), much the smallest, passing under the same muscle, is attached below. The flexor (b, figs. *h* and *a*) is inserted near the outer part of the base, by means of a short tendon, and is attached near the base of the preceding muscles. These organs have but little motion, and are seldom observed in action.

The elevators of the *buccal mass* are four short narrow muscles, inserted in the bony processes, *g* (figs. *p* or *p*⁵), and attached to the teguments below, under the anterior extremity of the mouth; the insertion of one is exactly posterior, and of the other, a little lateral, as is represented in fig. 1 *p*⁵. By means of these muscles the buccal mass may be elevated to a right angle with the surrounding parts. On dying, the mouth is often left in this elevated position. A muscular band passes across the back part of the buccal mass, and after attaching itself to the curved process, *f* (fig. *p*), on each side, continues on, and is inserted in the shell. At *c* (fig. *h*), near the eyes, we observe the attachment of a pair of muscles, which are in action when the buccal mass moves; we have not detected their insertion, but suppose, from their position, that they act in depressing it.

The internal parts of the mouth which receive distinct muscles are as follows:—the upper lip, the mandibles, and the inner parts of the mouth. The upper lip is provided with two pairs of retractors, which are attached near the centre of the exterior membrane of the mouth. The interior pair are very slender; they are inserted in a minute process near the extremity of the lip (fig. *p*³), and move merely the extremity, giving it the position in fig. *p*⁴. The exterior pair are four times the width of the interior; they are inserted near the middle of the lip, and retract this organ nearly to the bony arch.

The mandibles are provided with muscles of extraordinary length

and power. There are two pairs connected with the same slender bony tendon, the one with its extremity, and the other with its posterior side. The former (*d*, figs. *a* and *h*) pass outward and a little downward, and on approaching the apex of the basal joint of the third pair of maxillipeds, curve suddenly backward; they are finally inserted in the margin of the shell opposite the articulation of the head and thorax, after having run over a space equal to one-half the whole length of the cephalothoracic segment. The other pair extend obliquely backward and outward under the base of the maxillæ. Although these organs are provided with such remarkable muscles, they are very confined in their motions. They occasionally have a vibratory motion when the animal is nearly exhausted, and this is the only action we have observed. Their position and the form of the adjacent parts satisfy us that their extremities cannot be projected out of the mouth; and probably they can scarcely reach the opening between the lips.

On account of the thickness of the enveloping membranes, and the difficulty of dissecting the internal parts of the buccal mass, we have not discovered the muscles moving these parts. We can only specify one pair of slender muscles, which are inserted in the lateral portions of the process, *g* (fig. *p*⁵). It is the retractor of these processes, and through them opens the folds which close the œsophagus, by means of a tendon inserted in the lower extremity of these folds.

The basal joint of the *posterior antennæ* has but little motion. There are two short muscles, elevating or depressing the extremities of this joint, which we may consider a flexor and an extensor. The flexor, which is inserted near the interior extremity, is directed backward and a little outward to its attachment to the lower shell, exterior to the base of the following pair of feet. The extensor is inserted at the posterior margin of the joint, and extends obliquely inward, approaching the attachment of the flexor. In the female these muscles have nearly the same position as in the male (fig. *b*); the flexor is inserted near the spines on this joint. The united action of these muscles draws the anterior margin of this joint from the shell. To oppose this motion there is a large muscle inserted near this margin and extending one side below the eyes (*e*, fig. *h*), where it is attached to the back shell.

The extensor of the second joint of this pair of organs is a long broad muscle, attached to the shell above the large curved spine (*f*,

fig. *h*). There is a small flexor of this joint, attached to the posterior apex of the basal joint.

The *maxillæ* are provided with but few small muscles, requiring no remarks.

The *feet of the first pair* are remarkable for having as various motions as could be afforded by a ball and socket joint. This arises from their insertion on a fleshy prominence. To produce these various motions, each leg is provided with five muscles radiating from the base, some of which are of very peculiar form. Four of these muscles are inserted into the base of the first joint, and one along its posterior margin. The latter appears to be attached to the back near the median line, a short distance behind the eyes (g, fig. *h*). Of the remaining muscles, two pass forward and outward (h, i, fig. *a* and fig. *h*), one directly outward, and the fourth (k, fig. *h*) backward and outward. The most anterior (h) is a slender muscle, attached just exterior to the base of the first pair of maxillipeds. The second (i, fig. *a* and fig. *h*) is composed of two parts inserted into the same tendon. These parts continue together through half their length, then separate, and soon after each divides into two nearly equal portions, which diverge under the large curved spine, and pass to their attachment at the margin of the shell.

The base of the second pair of feet has a narrow prolongation, which affords attachment to two muscles; one passes posteriorly, and is attached near the articulation of the head and thorax (m, fig. *h*), another extends outward in front, beneath the extremity of the adjacent spine. Two other short muscles are inserted at the base of the prolongation, and are also attached near the spine; one on the back, and the other below. The last of the muscles moving this pair of legs extends outward, and is attached to the epimeral articulation (l, fig. *h*).

The terminal claw is provided with flexor muscles of great strength. A large conical muscle attached along the whole posterior margin, is inserted in a bony tendon extending from the inner portion of the base of the claw. Another large muscle arises from the basal portion of the joint, and is inserted into the preceding muscle a short distance from its insertion. There is the same arrangement in the female (fig. *c*). A small extensor is inserted in the outer part of the base of the claw, and attached to the outer posterior margin of the first joint.

(2.) *Muscles moving the Natatory Appendages.*—The two legs of each pair of natatories have been described as simultaneous in their action, which consists in their rotation with the included sternum, on their anterior margin.

The principal elevator of the first pair of natatories is a large digastric muscle. This muscle occupies the space between the basal joint of these legs and the preceding pair. It is composed of four muscles which unite in a common tendon; this tendon passes under a curved osseous process, by which it is confined in its place, and is then united to another bundle of muscular fibres inserted in the lower surface of the leg. The depression of these legs is produced by a long muscle, which is inserted in the joint near its base; it is directed forward and outward, passing under the digastric muscle beyond the articulation between the head and thorax, and is attached to the epimeral articulation (n, fig. *h*). This pair of legs, though thus provided with muscles of considerable strength, are seldom used by the animal in effecting its motions.

The second pair of natatory legs are especially adapted to form powerful propelling organs; the flabelliform arrangement of their pinnulæ, the attachment of these pinnulæ to two distinct articulated branches, added to the flattened form of the joints, give the oars a broad expanded surface for action on the water in swimming. They are farther fitted for this object by the provision of a large number of powerful muscles, which occupy nearly the whole of the thoracic segment.

Inserted in the anterior part of these legs, there are three large muscles attached to the back shell, two of which (o, p, fig. *h*) arise on the median line—a third (q) at the median articulation of the cephalothorax. Four powerful muscles are inserted in its posterior margin; the three outer (u, t, s) pass backward, and are inserted in the posterior and medial part of the segment above. The fourth (r) is attached to the back shell over the anterior part of the base of the leg, near the medial line of the body; it first passes inward and backward, then curves outward around the base of the muscle adjoining (s), and finally extends upward to the posterior margin of the leg. The circular form of this muscle is so very extraordinary, that we at first doubted its muscular nature. We have however assured ourselves of this fact by frequent dissections. Two other short muscles, with converging fibres (w, v), arise laterally from a broad base in the epimeral

articulation, and serve to retract the leg to the shell. These muscles probably co-operate with the posterior in the depression of the leg.

If these oar-like legs struck the water with the same broad expanded surface, in their backward motion, as in their forward propelling action, the animal would advance but slowly, if at all, as the latter would be counteracted by the former. There is a provision against such a defect, in the muscles moving the several joints of these legs, by the action of which, the terminal portions receive a partial revolution, and cut the water, when drawn backward, by their thin anterior edge. Their special adaptation for this purpose is apparent, even in the pinnula terminating the leg, which instead of being ciliated on both edges, is furnished anteriorly with a thin membranous expansion.

These legs appear to be the only organs for walking as well as swimming.

The principal extensors of the third pair of natatories, or the *apron*, are four in number; two (y, z) arise on the back near the medial line, and pass laterally to the outer insertion of the apron. One of the remaining two (x) arises just above the posterior sinus, and the other from the inner margin of this sinus; both are attached on the back, and inserted near the articulation of the sternum. The flexor muscles arise below, just outside the apron, and occupy the greater part of its interior. A single muscle is attached near the articulation of the sternum, and passes into the basal portion.

This apron, appended to the cephalothoracic segment, forms the anterior portion of the body into a large, broad cup, which is perfectly closed, with the exception of a small opening at each of the posterior sinuses. These are provided with a folded membrane, furnished with muscles capable of drawing it over and completely shutting the opening. The membranous margin of the animal near the antennæ, has also a fold by which a small leak, if it be such, is closed. Considering these several provisions, it is probable, that the whole of this anterior portion of the animal is especially adapted to enable it to attach itself firmly during the rapid motions of the fish, and that the small marginal cups in front are relied on, only while the fish is stationary, or but slowly moving.

The remaining pair of legs are moved by short slender muscles, and seem to possess little power. They usually hang loose and motionless

while the animal is swimming, and when attached to the body of the fish, are commonly extended by the side of the abdomen.

The Nervous System.—The nervous system in *Caligus* contains but two ganglions, and these by their close approximation appear to compose but one. They are situated directly behind the eyes, one above the oesophagus, and the other below it, and are so intimately connected on each side of this portion of the alimentary canal, that it is impossible to separate them (fig. 1 s). Indeed, it would scarcely convey an incorrect idea of the *form*, to describe it as a single mass, with a longitudinal cavity through the centre, for the passage of the oesophagus. The size of the united ganglions is rather greater than that of the buccal mass. The nerves arising from these ganglions are flat, fibrous cords, enclosed within a membranous envelope or neurolemma. This neurolemma is often one-fourth wider than the bundle of nervous fibres contained within, and these fibres appear to pass through without any attachment. The neurolemma is sometimes slightly folded, which gives a crenated appearance to the margin of the nerve.

The proper cephalic ganglion has a broad ovate or subcordate form. It gives off three pairs of nerves.

The first pair (a, fig. s) leave the central part of the anterior margin and pass directly to the eyes. As the eyes are adjacent to the ganglion, these nerves are very short.

The second pair (b, fig. s) arise from the same margin laterally, and extend upward towards the cups (fig. q), passing just within the articulating process of the cephalic segments. Each gives out large branches, which are distributed to the surrounding muscles and teguments. The anterior extremity which goes to the cup is scarcely one-third the size of the base.

A small tubular vessel (fig. 1 q) extends from the middle of the front along the median line, and appears to terminate in a bulb, about half way to the ganglion. This vessel has been the subject of much investigation, without removing all the doubts respecting its nature. When separated from the body, it appears to be a large neurolemma, containing two small bundles of nervous fibres, and this is our final conclusion, though adopted with some hesitation. It appears probable, from the result of some of our dissections, that this bulb receives a nerve from each side, which either arises directly from the cephalic ganglion, or is a branch of the nerve last described.

The remaining pair of nerves (*c*) arise from the anterior angles of the ganglion, and pass to the antennæ; they are one-half larger than any other in the body. Near their origin, they give off exteriorly a slender branch, which continues nearly parallel with the main nerve, and passes to the muscles of the antennæ. Without farther branching, they extend in nearly a straight line to the base of the antennæ, where they subdivide into four large branches, which are distributed to the fleshy papillæ (fig. *r*). Two nerves from the posterior branch run along the muscles, and are continued into the terminal joints, one to each of the two terminating sets of setæ. The antennæ are so abundantly furnished with nerves, that they must be the seat of an important sense. The sense of touch is the only one for which their peculiar form and their delicate papillæ appear adapted.

The thoracic ganglion, which is composed of all the thoracic and abdominal ganglions united, has a cordate form, and is somewhat larger than the cephalic. This ganglion gives off seven pairs of nerves in front and laterally, and two pairs behind, besides a central nerve or cord.

The first two pairs originate at the centre of the anterior margin (*d*, *e*, fig. *s*). The inner is quite slender, and appears to enter the mouth each side of the œsophagus. The second has twice the diameter of the first; it curves more outward, and is supposed to go to the mandibles and their muscles. These nerves pass under the buccal mass, and cannot be traced while it is in its natural position. They invariably appear broken off when the buccal mass is removed; and sometimes after detaching it, a nerve equal in size to the first, has been seen entering the mouth near the œsophagus, as above stated. These facts have been deemed sufficient to authorize the above opinion respecting the destination of these nerves.

The third pair (*f*, fig. *s*) arise from the anterior angle of the ganglion. They give out a branch exteriorly to the muscles of the first pair of legs, and afterwards continue to these organs, and pass into the terminal joints after giving a branch to the basal.

The fourth pair (*g*) arise just posterior to the last, and are distributed to the outer teguments. They afford a branch near their origin, which probably passes to the rudimentary legs: soon after they divide into two parts; one branch passes outward and a little

forward towards the curved spine, and subdivides into four branches before reaching it, which are distributed to the neighbouring teguments; the other branch extends backward to the epimeral articulation, just below the articulating processes, where it passes to the epimeral segment; it then branches, and is distributed to the various parts of the inferior portion of this segment.

The fifth pair (h) arise from the lateral margin of the ganglion, some distance behind the preceding. They give off a slender branch near their origin, and pass along with the branch to the first pair of feet.

The sixth pair (i) arise near the preceding, and are large nerves. They divide immediately, and then subdivide into several branches, which are distributed to the second pair of feet, and their muscles.

The seventh pair (k) originate near the last, soon divide into two branches, which pass to the muscles of the same legs. They are slender nerves.

The remaining nerves pertain to the natatory legs, and the abdominal portions of the body.

The outer pair (l) belong to the anterior natatories. They continue parallel with the central cord till they reach the furcate process on the venter; they then curve outward, exterior to the ventral muscles, and give off three branches in succession from the outer side to the muscles of the first natatory. Before entering the basal joints of these legs, they divide into three portions, which enter together; the inner branch is quite slender, and passes to the posterior moveable seta, and the jointed appendage; the middle is distributed to the muscles of the basal joint; the outer branch gives a slender nerve to the apex of the basal joint, and then passes to the two following joints, dividing as it enters them. We refer for minuter details to figure 1 *q*.

This pair of nerves give off a slender branch near their origin (r, fig. *s*), which passes to the attachments of the stomach.

The next pair of nerves (m) are distributed to the second pair of natatories. They diverge from the central cord—to which they are adjacent—below the furcate process, and soon give off a branch interiorly, which passes down the venter, and appears to be distributed to the ventral muscles. As they approach the second pair of natatories, they give off another branch from the same side, which also passes

backward, and is supposed to furnish nerves to the posterior muscles of these legs. On entering these natatories, the nerve divides into two branches, the upper of which soon gives off a third; the inner nerve, as in the preceding legs, goes to the posterior seta and the articulated appendage; the middle furnishes the basal joint, and sends a branch into the terminal; the outer affords a small nerve to the seta at the apex of the basal joint, and then passes into the extremity of the leg.

This pair of nerves give off a branch exteriorly near their origin (*s*, fig. *s*) which curves outward under the furcate process (*s*, fig. 1 *q*), *beneath* the ventral muscles, sends a nerve to these muscles, and is then distributed to the anterior muscles of the second pair of natatories, and to the adjoining teguments. Its branches may be seen at *s'*, *s''*, fig. *q*.

The central cord furnishes the nerves to the remaining members. It appears to be composed of two parts near its origin, but there is no division till it has passed beyond the sternum of the second pair of natatories. Previous to this division, a short distance below the sternum, this cord gives off from each side a large nerve which goes to the apron. These nerves are seldom exactly opposite in their origin; as is also the case with the nerves, *r*, *r*, and *s*, *r*, fig. *s*.

The nerves to the apron, just before entering it, give off a branch exteriorly, which is distributed to the outer portions of the apron, or more properly, its terminal joints. Soon after entering the apron the main nerve again divides, and one branch is distributed to the basal part, and the other to the muscles of the following portion of the apron.

The central cord, after giving off the nerves to the apron, soon divides. Thus divided, it gives off a pair of nerves to the remaining thoracic legs, and on entering the abdomen, furnishes a pair of nerves which branch in this segment. It thence continues to the last segment, and distributes fibres to the terminal portions of the body.

The nervous system in *Caligus* agrees with that of *Sapphirina* in the existence of but a single compound ganglion for the whole body, there being no separate ganglia for the posterior thoracic or abdominal segments and their members. But the two differ strikingly in form, as shown in the figures (2 *g*, Plate 88, and 1 *s*, Plate 93). In *Sapphirina*, the large ganglion is furcate behind, and the two stout prolongations, after passing a short distance, give off, each four nerves,

one either side, to each of the natatory legs, the inner passing also to the abdomen; while in *Caligus*, the ganglion is not furcated, but instead, narrows and terminates in two pairs of nerves for the two anterior pairs of natatories, and a central nerve, which affords branches for the third pair (or apron), and then furcating, gives a branch to the fourth pair, and extends into the abdomen.

In *Argulus*, there is a single ganglion behind the mouth, as in *Caligus*; but there are faint traces of a division into rings, each giving out a pair of nerves. They indicate the actual composite character of the ganglion in *Caligus*, although there is no appearance of such a subdivision.

Organs of Digestion.—The alimentary canal in *Caligus* (fig. 1 *k*) is composed of three distinct parts, corresponding to the oesophagus, the stomach, and the intestine.

The oesophagus constitutes one-sixth the whole length of the alimentary canal, and in large individuals is about one-sixteenth of an inch long. It extends in the form of a long slender tube, of uniform diameter, to the stomach, and passes a short distance into its cavity. Its insertion in the buccal mass may be seen in fig. *p*⁵, which is an under view of this organ. The anterior opening is closed by two fleshy folds, which have already been described when speaking of the organs and muscles of the buccal mass. At its commencement, there is an oblong enlargement (fig. *l*), longitudinally striated, which may be considered a pharynx. The communication with the stomach is closed, but whether by a sphincter or valve is undetermined. The peristaltic motion frequently seen in the stomach and intestine, never extends into the oesophagus.

This portion of the alimentary canal is readily separated into two membranes. The inner, the mucous coat, is thin and transparent, and very smooth. The outer is much thicker and scarcely semi-transparent; its muscular fibres were not distinguished. When highly magnified, its exterior surface appears very uneven. If the mouth is detached from the body with care, the oesophagus often continues attached to it, and presents the appearance exhibited in fig. *p*⁵. The inner coat is usually entire to its termination in the stomach, while the outer, which is continuous with the exterior membrane of the sto-

mach, is invariably torn off, not far from the base of the oesophagus, as in the figure.

The stomach has a broad cordate form, and is a little shorter than the oesophagus, and when expanded is somewhat wider than long; vertically it is quite narrow. The anterior extremity lies between the prehensile legs, and posteriorly it extends under the furcate process on the venter. The lateral margin is very deeply crenated, owing to the peculiar arrangement of its muscles. The teguments of the stomach are composed of the same coats as the oesophagus, and they present the same general character. The inner appears uniformly smooth and even. The outer contains several muscular bands, which connect the opposite crenations: in their contraction the crenations are rendered more prominent. These muscles are connected by other slender muscles, irregularly arranged, which contract the stomach longitudinally. The lateral portions of the stomach are connected on each side with the shell adjoining, by ligamentous attachments, as is represented in fig. *l*. There is no valve between the stomach and the intestine, and when the peristaltic motion is reversed, as often happens, the fluids frequently return into the stomach.

The intestine, at its commencement, is between three and four times the diameter of the oesophagus, and about one-fifth the diameter of the stomach. It is slightly enlarged below the second pair of natories, where there are two pairs of glands, contracts again as it passes below the apron, and thence continues of uniform size to the rectum. Its structure is very similar to that of the stomach, both in its inner and outer coat. The arrangement of its muscles in regular bands is represented in fig. *m*; during their action the canal is crenated, as in the figure. The intestine is attached by distinct ligaments at several places; near the glands, *d*, and the glands, *e* and *f*, we have distinctly seen these attachments.

The rectum occupies the terminal half of the last abdominal segment, and is about one-half the diameter of the intestine. Its communication with the intestine is closed, in the natural state of the parts. This rectum, if it may be so called, appears to have a longitudinal opening below, extending its whole length, and its walls are usually in close contact. The external opening or anus is situated at its extremity.

This portion of the alimentary canal is opened laterally by seven pairs of slender muscles. The first pair, at the extremity, pass directly

outward, along the margin of the joint; the second are inserted near the extremity, and pass upward and a little outward. The following three pairs are attached near the middle, and pass outward and a little upward; the remaining two pairs are inserted near the opening to the intestine, and have the same direction as the last. The muscles have often been seen in action, in expelling the fæces; the two sides move either simultaneously or alternately, according to the necessity of the case, in the act of expulsion.

The intestinal fluids are usually light yellow; occasionally they present a deep wine-yellow colour, especially below the sternum of the second pair of natatories. Solid vermiform masses, of a brown colour, are often seen floating in the fluids.

Along the alimentary canal there are several small glands, which have a granulous structure, and are in general but slightly coloured. Their particular functions are mostly conjectural.

The central projection between *g*, *g*, fig. *p*, is the termination of a gland of considerable size, which is situated beneath the posterior extremity of the buccal mass, and is usually detached with it, on dissection. It is represented in fig. 1 *n*, where its size corresponds to the mouth in fig. 1 *k*. When separated from the mouth, a duct may be seen on each side, entering the mouth near the oesophagus. Anterior to the mouth, another collection of glands is observed (fig. 1 *o*, see also fig. *a*), which also communicate with the mouth by ducts. These are probably salivary glands.

The oesophagus, especially near its base, is furnished with a large number of exceedingly minute, transparent globules, supported on short pedicels (fig. *l*). These appear to be glands, and their pedicels ducts.

Below the stomach, in the thorax, there are four pairs of glands. One pair, of nearly spherical form, are situated at the lower extremity of the stomach (*c*, fig. *k*). The second pair, larger, of an oblong form (*d*), occur just below the sternum of the first pair of natatories, and are connected with the intestine by a duct under the following sternum. The third and fourth pairs (*e*, *f*) are situated on the enlargement of the intestine, below the sternum of the second pair of natatories. The functions of a liver are probably performed by some or all of these glands.

Two other pairs of small glands are situated in the abdomen, which we presume to be connected with the intestine; we have not, however,

distinguished their ducts, neither have we by dissections obtained more than one of them separate from the body. They are possibly urinary glands.

The Caligi have heretofore been supposed to live by sucking the blood of the fish on which they are found. It is however apparent, from the structure of the mouth, that they are wholly unfitted for this mode of life. There is no organ which can perform the functions of a sucker. Moreover, we have never detected any blood in the stomach of these animals, although we have often examined them, immediately on taking them from the fish. On the contrary, the fluids always have a light colour.

We have not fully satisfied ourselves of the nature of its food, but presume that it lives on the mucus which covers the body of the fish. The mucus is one of the natural secretions of the fish, and is always abundant. The organs of the mouth are well formed for the collection of it, and the free motion in the whole buccal mass seems peculiarly fitted for this purpose.

Several specimens of the Caligus, when confined on their backs in but a small portion of water, just sufficient to cover them, have been observed to elevate the buccal mass, and take in globules of air, which passed down the oesophagus into the stomach, and thence through the intestine. Occasionally, the globules of air have been so numerous and taken in such rapid succession, as to fill the stomach, and very much inflate it. In their passage through the oesophagus they usually stop for a short time at the entrance to the stomach, indicating the existence of a valve or sphincter at this place.

Circulation—The blood of the Caligus, as in most other Articulata, is a limpid fluid, containing suspended in it numerous minute colourless particles. These particles are very various in their form and size; the smallest scarcely equal $\frac{1}{3000}$ of an inch. We have observed one particle the length of which was about $\frac{1}{700}$ of an inch, and its breadth $\frac{1}{4}$ its length; another had nearly the same length, and a breadth equal to $\frac{1}{2}$ its length. These particles can accommodate themselves to the size of the passage through which the blood is flowing, becoming narrow and elongated if the passage is narrow, and again resuming their former proportions when they have reached a free open space. In this respect the species are very unlike the Sapphirinæ, Calani,

and related species, in which we were unable to detect any blood-corpuses.

The circulation in the *Caligus* is wholly lacunal; it appears to consist of broad irregular streams, passing through the spaces left among the internal organs, and in no part have we discovered distinct vessels. These streams have in general definite directions, yet are seldom uniform, continuous currents. They mostly advance by successive vibrations, depending on the palpitating action of the body. A single centre of circulation, or a *heart*, this animal can scarcely be said to possess. There are two points in the medial line where there is a valvular action, and each has its claims to be considered as performing the functions of this organ, though neither is entitled to that name. One of these systems of valves, the more perfect of the two, is situated in the posterior thoracic segment (fig. 1 *g*, *g'*). There are at this place three distinct valves; two laterally on the back, situated in the dorsal currents which are flowing *towards* the tail, and one centrally below, giving passage to the ventral current flowing *from* the tail. The dorsal and ventral valves open alternately. Their action may be seen in the figures above referred to; *g*, represents the dorsal valves as shut, and the ventral open, and *g'*, the dorsal relaxed or open, and the ventral shut. The action of these valves is very regular, and the currents which pass them are more uniform than those in other parts of the body. The number of palpitations has been found to vary from thirty to forty per minute.

The blood coming down the back* from the head, and also in two lateral currents from the point of intersection of the head, thorax and epimeral segments (fig. *h*), passes the dorsal valves. It continues posteriorly; part, into the terminal joint of the body, and then up the venter, entering the ventral current at the extremity of the intestine; another portion, into the same ventral current near the centre of the abdomen, and at other varying points. The ventral current passes through the ventral valve under the anterior margin of the apron, and continues up the body, washing, at the same time, freely over the intestine and stomach, to the thoracic ganglion, where it divides, and passes each side of this organ. Each of these branches goes off laterally; one portion (which we may call A) enters the adjoining prehensile legs, and returns down the body, uniting with an-

* The course is marked by arrows, on figs. 1 *a* and *h*.

other current, which we shall soon mention; a second (B) passes a little forward and outward, gives off blood to the first pair of feet, continues outward, accompanies the muscles of the mandible, and runs down the body near its margin; a third (C) goes forward outside of the base of the second pair of antennæ, continues to the anterior antennæ, to which it gives a portion of its blood, turns inward, passing into the frontal cephalic segment, and along its articulation to the medial line. At this place the currents, meeting from the two sides, flow down the medial line to the mouth.

The *second* instance of valvular action occurs in this last medial current, between the second joints of the second pair of antennæ (fig. 1 *a*). There is a single valve, composed of a membrane, playing backward and forward, and thus preventing the return of the blood that has passed it. Between this valve and the mouth there appears to be a large cavity for the reception of the blood, from which it is propelled by a palpitating motion, or powerful muscular action, in the buccal mass and surrounding parts. It acts in the following manner: the current enters through the valve while the posterior part of the mouth is elevated; the valve then closes, and immediately the buccal mass is brought down, and forces it out in a current on each side. This very extraordinary action is carried on uniformly, and is absolutely necessary for the flowing of the blood. Indeed, the blood flows *in* by the out-currents, until the action of the buccal mass throws it out. We presume that the depression of this organ is produced by the muscular band which has been described as passing across the posterior part of the mouth, to an attachment in the shell on each side (fig. 1 *p*). If the mouth be cut off, the blood flows out in a large free current, and the animal soon dies from exhaustion.

A current passes from this cavity each side of the mouth, and others on the back. One portion of the side-current unites with the current C, before described, of which it forms the greater part, and thus soon returns to the buccal cavity. Another portion flows outward, following the muscle of the mandible, and unites with B; this current, thus much enlarged, passes near the margin to the posterior extremity of the cephalothoracic segment, returns up by the epimeral articulation, crosses the same just above the junction of the head and thorax, and then turns suddenly backward; a part flows on the back, forming the lateral current on the back before referred to; the remaining portion below flows to the base of each of the natatory legs and

the apron, and enters them, and at the same time and place, passes in part on the back; the current from the apron flows laterally down the abdomen.

Another portion of the side-current leaves the buccal cavity just alongside of the mouth, unites with A, and flows to the base of the first pair of natatories. The union of these currents is somewhat peculiar: the blood vibrates upward on the venter, to a spot near the base of the prehensile legs, where a portion remains, although the main current vibrates back on the venter; at this moment, the current comes from the buccal cavity and carries the whole below.

The irregularity in the circulation in this animal is even greater than will be inferred from the above description. These currents are merely main directions; the blood flows into them or from them, through all their extent. The current coming laterally down to the base of the second pair of natatories, besides going into the natatory and on the back, is carried up the venter at each of the upward vibrations of the ventral current. The current from the apron also passes into the same current, in addition to its backward course. When it is considered that the currents of blood occupy merely the spaces left by the muscles and other internal organs, it will be readily seen that similar irregularities must occur in various parts of the body. These directions are occasionally subject to singular deviations. One of the two currents which run from each side in front and unite on the medial line, has been observed to cross the medial line into the other current, and thus continue flowing for some time with considerable force; soon after, each flowed by vibrations towards the centre, but with alternate motion. This was observed immediately on taking the *Caligus* from the water, when it was apparently very lively. As, however, the cod from which they were taken, had been for several days confined in the harbour near the market, all the specimens examined may have lost part of the activity usual in the open sea. At times, the blood in some parts merely vibrates back and forward, without advancing in either direction; and occasionally the blood flows in a direction exactly the contrary to its usual course.

We have not fully satisfied ourselves of the mode of respiration in the *Caligus*. The natatory pinnulæ—to which we must add those of the tail, as they are identical in their structure—have been supposed to supply the place of branchiæ. When the animal is attached to any object, these legs keep up a very regular action, which appears to

correspond to the palpitations in the body.* We have not, however, observed the blood to flow into their setæ, and the currents passing into the legs are among the least regular. We are disposed to believe that these pinnulæ are not the special organs for this function, but that aeration takes place over the whole surface of the body. It is stated by Straus, that on separating the branchiæ of a lobster, the body absorbed nearly one-half the oxygen usual before the removal of these organs. The thin envelope of the Caligus, and the extent of its external surface, must render its body a far more perfect substitute for branchiæ than the solid covering of the lobster. The vibrating action of the natatory legs serves to keep up a constant current of water, and thus affords continually a new portion to undergo the respiratory action of the body. It might be remarked that these legs, on account of their breadth, could not act so as to produce this current of water, when the whole margin around is attached. Probably the animal is not thus attached except when it is rendered necessary by the swift motion of the fish; under which circumstances there is a sufficient current, without the action of these legs. We may presume that the special object of these marginal cups is to enable the animal to attach itself, and still keep the principal part of its body free, so that these natatory legs, when the fish is motionless, may have space to act, and sustain a continued current.

Organs of Reproduction.—On each side of the stomach in Caligus there is a large pyriform organ (fig. *q*), of a glandular appearance internally, and provided with a distinct duct, which extends through the whole length of the thorax into the abdomen, where it is continuous, in the male, with organs known to be seminal, and in the female, with the egg-bearing vessels. These organs, thus shown to be connected with the organs of generation, correspond with the spermatogenic glands in the male and the ovaries in the female.

In the male, they are rather larger than the buccal mass (fig. *1 t*), and are situated just anterior to the stomach, in part beneath the base of the prehensile legs and the spine of the preceding pair. Their small posterior extremity is produced into a short ligament, by which it adheres above the stomach; the anterior portions are so enveloped in their cellular or membranous attachments, that they are separated

* This action is not so rapid and branchial-like as in the Argulus, but takes place at intervals of about one and a half seconds.

with great difficulty. In general appearance, each of these glands resembles a pyriform membranous sac, with an internal granulose structure. The duct, which is attached on the outer margin, is a slender vessel, of a thin, membranous nature. It continues of a uniform size through the thorax to the central parts of the abdomen, where it gradually enlarges and undergoes a few convolutions.

A short distance below the convoluted portion, in the abdomen, there is a small oval gland, with well-defined limits, contained within a distinct sac. It is composed of several concentric parts, of which three are very apparent; there are two less distinct. Its interior is a transparent globule; the outer coats are less transparent, and the one adjacent to the interior, the least so. The central part of this gland is connected with a small subcorneous tube, which gradually enlarges and passes into the anterior extremity of the above convolutions. On one occasion, when we had separated this gland and its duct from the abdomen, a fluid, containing particles similar in appearance to those in the blood, rapidly poured out. The convoluted vessel appears therefore to receive the secretions of two seminal glands, and probably corresponds to the vas deferens. Though much time has been employed in searching for the exit of the vas deferens, we are yet uncertain on this point. It is presumed, from the appearance of the parts, that it terminates either on the outer surface of the lappet at the extremity of the abdomen, or beneath this organ.

The ovaries in the female have the same situation and attachments as the spermatic gland in the male (fig. *q*). They are however much larger, and extend above the stomach nearly to its centre. They may be distinctly seen through the back shell. They appear to contain a long convoluted vessel, which gradually diminishes in size, from its anterior to its posterior extremity. The duct arising from its margin extends without any variation in its size, till it reaches the posterior segment of the thorax, where it gradually enlarges, and continues to increase as it enters the abdomen. In the gravid female, it passes through the abdomen, with a few convolutions, and extends out at the vulva, in the form of a long, whitish, nearly cylindrical membranous tube. This external portion of the oviduct is often a little longer than the animal.

The vessel in the ovary does not appear to contain divisions indicating the presence of eggs; but the oviduct usually contains eggs

through its whole extent. Where exerted, it is very distinctly divided by membranous partitions into narrow compartments, each containing an egg, though not quite filled with it. The eggs in the anterior slender portion of the oviduct are oblong and uniformly transparent. As they increase in size, they present a clouded appearance, and become divided into two parts, the inner of which appears clouded and composed of albuminous globules (fig. *q*).

In the advanced eggs at the extremity of the ovary, we observed, in one instance, that there were two distinct eyes at their outer extremity; they were approximate, but not situated on the same black ground.

In addition to the ovaries above described, there is a pair of organs in the abdomen, connected with the system of generation. They are straight, flat-cylindrical organs, usually as broad as the external oviduct, and lie along the central portions of the abdomen. At the lower extremity, they are connected with the oviduct a short distance above the vulva, and at the upper, they terminate in a cul-de-sac. They contain a single series of transparent flattened globules (fig. *q*), occupying, like beads, their central line, and in width about one-half the width of the ovary. These false ovaries, when torn or cut, do not emit an albuminous fluid, like the true oviducts, but appear to have a gelatinous consistence. They are as much developed in the young as in the old females.

The eggs in females of the same size present very different degrees of development. We have seen full-grown individuals with no eggs in the abdomen, and consequently, instead of the swollen appearance usual in the adult female, their abdomens could scarcely be distinguished from those of the male sex. Occasionally, very young individuals have had external ovaries; the smallest observed was scarcely one-sixth of an inch long. May we not infer from this, that a single coition is sufficient to impregnate the individuals of at least *one* succeeding generation?

A few instances have come under our notice, of a very extraordinary irregularity in these organs. The extremity of the *false ovary* has been seen hanging externally in the place of the regular external ovaries, and neither eggs, nor the internal oviduct, were discoverable in the interior on that side. Moreover, the corresponding ovary near the stomach was discovered with difficulty, and appeared like a folded empty sac. At the same time the ovary and the ovarian tube on the

other side presented their usual appearance. This singular derangement was observed in a full-grown female, which was perfect in all its other organs.

An additional peculiarity, as yet inexplicable, has been observed in some females. The lappets at the extremity of the abdomen, each side of the tail, have been already described as very short in the female. On their lower surface there is an irregular osseous process, from which a slender corneous organ, which we suppose to be a duct, runs forward and a little inward, gradually diminishing, and terminates with a few irregular curves (fig. *g*). The peculiarity we refer to, is an appendage to this lappet, arising from the termination of the internal duct (fig. *l t*). It is a long corneous duct, wholly external, terminating in an oval sac of similar texture, and usually filled with a whitish fluid. These appendages have been observed, in a few instances, hanging each side of the terminal joint of the body (fig. *t*). In one instance the ducts were crossed over the adjacent articulation, and each attached by its sac to the lappet of the opposite extremity. These are the only facts that have been discovered respecting these singular organs. They were found attached to very few individuals, and in these the eggs were scarcely developed.*

The figures on Plate 92, representing the relations of the parts in the various Caligoidea, hardly require particular remark. There is much confusion in different works, with regard to the limits of the thorax and abdomen, and the appendages pertaining to them. The comparisons that have been made appear to settle the doubts on this point. We have added Dichelestion, *6 a* to *k*, from the Plates in Edwards's Cuvier (Plate 79). We suspect that the appendages of Nicotioe, lettered *e*, in *1 a*, of Plate 79, in Cuvier, will prove to be the second antennæ, on farther examination, although called maxillæ by Edwards, since they resemble these organs in Dichelestion; moreover, unless so related, the second antennæ are here obsolete.

The Lernæoids have a closely parallel character, as will be seen from the appendages of a Lernentoma (figs. *7 a*, *b*, etc.), on the same Plate. The prehensile legs behind evidently correspond to the similar organs in Ergasilus and Corycæus—the first pair of feet in Corycæus, or the second pair, as we name them, in the Caligidæ. They

* The *Caligus Americanus* afforded the preceding details, and the representation on page 93. In the investigations the author was aided by Dr. C. Pickering.

are named the second pair in this section, because both pairs are actually feet, and not maxillæ or maxillipeds; and because the transfer of appendages from the mouth to the foot-series, marks a very important step in the gradation of the species, distinguishing the Caligoidea from the Cyclopoidea.

In the lowest Lernæoids, the only appendages present appear to be homologues of the second antennæ.

The following is a synopsis of the subfamilies and genera of Caligoidea. The family Argulidæ contains, as far as known, but a single genus. The Caligidæ embrace three types of structure: *one*, CALIGINÆ, with the trunk-mouth ovoid and obtuse, and the maxillæ distant from it, with a stout spiniform base, and the rest of the organ obsolete or nearly so; a *second*, PANDARINÆ, having the trunk slender and tapering, with the maxillæ small lamellar and appressed to the sides of the trunk, and the external oviferous tubes straight; a *third* (the Cecropinæ), like the second in its mouth and maxillæ, but having the oviferous tubes convoluted beneath the body.

FAM. I. ARGULIDÆ.

G. ARGULUS, *Müller*.

FAM. II. CALIGIDÆ.

SUBFAM. 1. CALIGINÆ.—Truncus buccalis ovoideus, paulo oblongus, aperturâ oris inferiore. Maxillæ ab ore remotæ, brevissimæ, crassæ. Tubi ovigeri externi recti. Antennæ anticæ 2-articulatæ.

G. 1. CALIGUS, *Müller*.—Cephalothorax segmento postico unico transverso et non alato instructus. Pedes natatorii 1mi simplicissimi; 2di biramei; 3tii latè laminati et coaliti; 4ti simplicissimi subteretes et elongati et non natatorii, setâ digitiformi longâ 2-3 aliis brevioribus confecti. Frons discis duobus suctatoriis infra instructus.

G. 2. LEPEOPHTHEIRUS, *Nordmann*.—*Caligo* cephalothorace pedibusque similis. Frons discis suctatoriis non instructus.

G. 3. CALIGERIA, *Dana*.—*Lepeophtheiro* similis. Segmentum cephalothoracis 2dum utrinque alatum. Pedes duo postici biramei, setis brevibus, non natatoriis.

G. 4. CALISTES, *Dana*.—*Lepeophtheiro* cephalothorace discisque nullis frontis similis. Pedes duo postici biramei, subnatatorii, setis plumosis instructi. Segmentum cephalothoracis posticum non alatum.

G. 5. TREBIUS, *Kr.*—Cephalothorax 3-articulatus, segmentis duobus posticis transversis, non alatis. Pedes 8 postici biremes, setis pennatis toti armati. Frons discis suclatoriiis non instructus.

[G. 6. CHALIMUS, *Burmeister.*—*Lepeophtheiro* similis. Pedes postici simplicissimi, breviusculi, setis paucis brevibus muniti. An *Lepeophtheiro* haud convenit? Appendix tenuis frontis mediani ancoralis juniori sæpius pertinet et character generis non validus videtur.*]

SUBFAM. 2. PANDARINÆ. †—Truncus buccalis tenuis fere acuminatus. Maxillæ lamellares, ad truncum appressæ. Tubi ovigeri externi recti.

G. 1. NOGAGUS, *Leach.*—Cephalothorax 4-articulatus, segmentis duobus posticis transversis, non alatis. Pedes 8 postici toti biremes, setis pennatis bene armati. Pedes 2di percassi, digitis brevibus et truncatis. Styli caudales lamellati, sat breves, setis plumosis.

G. 2. PANDARUS, *Leach.*—Cephalothorax 4-articulatus, segmentis 3 posticis latere vel postice alatis. Pedes 8 postici biramei, setis perbrevis instructi, duo posteriores latè lamellati. Styli caudales laterales, elongatè styliformes. Pedes 2di subchelati, digitis brevibus truncatis.

G. 3. PHYLLOPHORA, *Edw.*—Cephalothorax 4-articulatus, segmentis 3 posticis totis late alatis. Pedes natatorii toti foliacei. Styli caudales non styliformes. Pedes 2di subchelati.

G. 4. DINEMATURA, *Latr.*—Cephalothorax 3-articulatus, segmento 2do transverso, non alato, 3tio postice quoad testam valde expanso et profunde bilobato, formâ paulo elytrideo. Abdomen 2-articulatum, segmento antico magno, postico parvo sub antico celato. Styli caudales lamellati, terminales. Pedes 2di subchelati, digito mobili acuto. Pedes natatorii 4 antici biremes, 3tii bene foliacei.

G. 5. EURYPHORUS, *Nordmann.*—Cephalothorax 2-articulatus, segmento postico parvo, breviter alato. Abdomen 2-articulatum, segmentis permagnis, 1mo postice paulo alato, 2do postice profunde bilobato et medio sinus anguste prolongato, extremitate lamellis caudalibus duabus parvulis.

G. 6. LEPIDOPUS, *Dana.*—Corpus antice non latius. Cephalothorax 3-articulatus, segmentis duobus posticis posticè late alatis. Abdomen 2-articulatum, segmento postico parvo, sub antico celato. Antennæ posticæ articulo tenui falciformi marginibus bene denticuligero confectæ. Pedes 2di crassi, manu non instructi superficie inferiore latâ et acutè squamatâ. Pedes natatorii 4 ultimi late lamellati.

SUBFAM. 3. CECROPINÆ.—*Pandarinis* affinis. Corpus antice non latius. Tubi ovigeri sub corpore convoluti. Antennæ anticæ in-

* The posterior feet are much shorter than in *Caligus* or *Lepeophtheirus*, and have not the long finger-like spine at the extremity. Yet it should be observed that the *Caligi* graduate into the same form nearly; and as *Kröyer* suggests, it is probably only a form of *Caligus*.

† *Edwards*, in his *Crust.*, iii. p. 461, has the division *Pandariens*, but it does not correspond to our *Pandarinæ*.

terdum 3-articulati. Cephalothorax segmento frontali partim vel omnino destitutus.

G. 1. CECROPS, *Leach*.—Antennæ anticæ 2-articulatæ. Pedes natatorii 2di 3tii 4tique foliacei, basi late expanso, ramis brevibus.

G. 2. LÆMARGUS, *Kr.*—Antennæ anticæ 3-articulatæ. Cephalothorax segmento frontali carens, segmentis 2do 3tioque breviter transversis, sequente postice late expanso et bilobato.

SUBFAM. 4. SPECILLIGINÆ.—*Pandarinis* affinis. Oculi duo simplices e lenticulis magnis prolatis corneisque grandibus (conspicillis) oblatis testâ insitis instructi (ac in Corycæidis).

G. SPECILLIGUS, *Dana*.*—*Nogago* segmentis cephalothoracis pedibusque affinis.

FAM. III. DICHELESTIDÆ.†

SUBFAM. 1. DICHELESTINÆ.—Corpus angustum, pluri-articulatum, non foliis ornatum.

G. 1. DICHELESTIUM, *Hermann*.—Corpus angustum, pluri-articulatum, segmentis non alatis. Antennæ 2dæ oblongæ, crassiusculæ, bidigitatæ. Pedes 2di prehensiles digito acuminato. Pedes natatorii 4 antici perparvi, 2-ramei; 3tii lobis lamellatis mediocribus; 4ti obsoleti.

G. 2. NEMESIS, *Roux*.—Corpus angustum, fere lineare, pluri-articulatum, segmentis subæquis, non alatis. Pedes 2di, monodactyli; natatorii 1mi simplicissimi, fere nudi, 2di, 3tii, 4tique breves biremes nudiusculi.

SUBFAM. 2. ANTHOSOMATINÆ.—Corpus angustum, foliosum et parce articulatum.

G. 1. ANTHOSOMA, *Leach*.—Cephalothorax 2-articulatus, segmento 1mo oblongo, 2do postice elongate alato et bilobato. Antennæ 2dæ oblongo, apice uncinato. Pedes 2di subheliformes, digito acuto. Pedes natatorii foliis latissimis instructi, corporis latera postice tegentibus.

* From Kröyer's description and figure of a specimen, which he refers with a query to *Læmargus muricatus*, as a young individual of this species, it is apparent that the animal has the conspicilla of this family, and it may belong to our genus *Specilligus*. It is similar to it in the joints of the body, and the caudal stylets. Our *Specilligus* was a fourth of an inch long, and cannot be a young individual of a genus so remote as *Cecrops* or *Læmargus*.

† *Dichelestiens*, Edwards, *Crust.*, iii. 481.

Lamproglena of Nordmann is arranged with the *Dichelestidæ* by Edwards. The body is elongate and few-jointed, as in *Dichelestium*, but the joints are fewer and less distinct; the eight natatories are very small or obsolescent; the second antennæ are represented by a pair of hooks, looking like horns to the head. Moreover, the external ovigerous appendages are probably not simple tubes, but sacs.

FAMILY I. ARGULIDÆ.

GENUS ARGULUS, *Juvine*.

IN the greater part of the Caligidæ, the body clings to the surface upon which it may rest by the margin, even where there are no sucatorial disks for this purpose; and the enlargement of the third pair of natatories into a broad united plate serves to adapt the animal to this mode of life. Within the cavity beneath the shell the organs may have motion; and only the fourth or posterior pair of natatories is outside of the cavity, for use when the body is attached.

In the Arguli, on the contrary, the first pair of feet is a large pair of clinging sucker feet, and the animal attached by them may have the margin free, with the natatory legs in motion to keep up constant currents over the body. The four pairs of natatories are very similar to one another, and the two anterior pairs are the largest.

The maxillæ are either wholly obsolete, or they are represented by the sheath and its exsertile spiculum, that projects forward from the anterior part of the mouth. This we suspect to be the true relation of this spiculum, an organ not found in other Caligoidea.

The divisions of the shell or carapax in this genus are well shown in figure 2 a, Pl. 94. The same sutures exist as have been described with regard to Caligus, though under some different modifications. The natatory legs in Argulus are arranged by their bases along the sides of the thorax; while in the Caligidæ, they are attached to its under surface.

ARGULUS PUGETTENSIS.

Carapax oblongus, ellipticus, pedes omnes tegens. Abdomen oblongum carapace dimidio angustius, postice profunde usque ad medium bilobatum, lobis postice subacutis. Ramus anticus antennæ articulo 2do (ultimo) apice uncinato, antice posticeque spinam gerente, 1mo postice spinâ armato et posterius spinâ aliâ, exteriusque spinâ aliâ ramum posticum antennæ gerente. Pedes 2di percrassi, articulo basali denti-

gero longiore quam sequens, dentibus tribus fere conicis. Pedes 8 postici crassi, ramis basi vix longioribus.

Carapax oblong elliptical, covering all the feet. Abdomen oblong, nearly half as wide as carapax, behind very deeply two-lobed, the lobes reaching to middle of the abdomen and subacute behind. Anterior branch of antennæ with the second joint uncinatè at apex, and bearing a spine both on the anterior and posterior side; also, a spine at base, another behind base, and still another more exteriorly, from which the posterior branch of the antennæ proceeds. Feet of second pair very stout, third, fourth, and fifth joints hardly oblong, the dentigerous basal joint longer than the next following, and the three teeth behind subconical. Eight posterior feet stout; the branches hardly longer than the base.

Plate 94, fig. 2 *a*, dorsal view of animal, enlarged; *b*, ventral view.

Puget's Sound.

Length, two-thirds of an inch. The base of the second pair of feet has a tooth on the inner side of base, in addition to the three which form the posterior margin of the basal portion.

FAMILY II. CALIGIDÆ.

SUBFAMILY CALIGINÆ.

GENUS CALIGUS, *Müller.*

IN characterizing species of *Caligus*, it is important to note that the sexes differ widely:—

1. In the form of the posterior antennæ, these organs being simply uncinatè at apex in females, and two-clawed in males.
2. In the form and size of the second pair of legs, the hand being very stout and usually didactyle in males, and much less stout and monodactyle in females.

3. In the shape of the abdomen, the female often having the broadest or the longest abdomen.

The sexes are similar in the other organs, and very nearly so in the position and size of the stylets of the abdomen.

In Milne Edwards's *Histoire Naturelle des Crustacés*, the anterior abdominal segment is considered a part of the thorax; and in comparing our descriptions, it should be noted that we consider it as properly corresponding to the second (or first and second) segments of the abdomen, the second being the one in the Cyclopoidea and this group of Entomostraca from which the external ovaries proceed.

CALIGUS THYMNI.

Carapax oblongus. Abdomen 3-articulatum, segmento primo lato, sequentibus duplo latiore, ano valde prominente. Styli caudales parvuli, ad angulos abdominis posticos insiti, anum vix superantes. Antennæ posticæ spinâ extus basin non munitæ. Furcula simplex, brachiis divergentibus, subacutis. Feminæ:—Abdominis segmentum primum oblongum, lateribus rectis et posticè parce divergentibus, angulis posticis prominentibus; segmentis duobus sequentibus simul sumtis elongatis, et fere longioribus. Maris:—Abdominis segmentum primum subquadratum, angulis posticis vix prominentibus, segmentis sequentibus simul sumtis brevioribus.

Carapax oblong. Abdomen three-jointed, first segment broad, twice broader than the following, the anus quite prominent. Caudal stylets small, filling out the posterior angles and hardly projecting beyond the anus. Posterior antennæ without a spine exterior to base. Furcula simple, prongs divergent, pointed. Female:—Anterior abdominal segment oblong, sides divergent, posterior angles prominent, following part longest. Male:—Anterior abdominal segment nearly quadrate, posterior angles scarcely prominent, the following part shortest.

Plate 94, fig. 3 *a*, ventral view of male, enlarged; *b*, posterior antennæ of female; *c*, abdomen of female.

From the external surface of the body of a Bonito (*Thynnus pelamys*); collected in the Atlantic, September 27, 1838, latitude 27° north, longitude 19° 30' west.

Length, three-eighths of an inch; breadth, two-fifteenths of an inch.

The length of the carapax is once and a half its breadth. It has no emargination in front. The caudal setæ are parallel, and densely plumose; the setæ in the male are longer than the last two abdominal segments. On the front margin of the carapax, there is a minute seta, about one-half the distance from the sucker disks to the centre of the margin. The sucker disks are elliptical. Terminal setæ of the anterior antennæ as long as the joint. The posterior antennæ of the male are uncinatæ at apex, and have a parallel spine on the inner margin, near its centre. In the female, there is no spine posteriorly on the base, and none exterior to it. The maxillæ are stout and broad, nearly as in *C. americanus*.* The first pair of feet have the basal portion about one-fourth shorter than the following part. The second pair very stout; hand narrowing outward or subconical in shape; finger not half as long as hand; no thumb. First pair of natatories with three longish pinnules to apical joint. Posterior thoracic legs long and slender; the second portion three-jointed. Eyes appearing deep red on a black ground. External ovarian tubes not shorter than the body in the specimens seen.

CALIGUS PRODUCTUS.

Feminæ:—*Carapax ovatus; segmento secundo angusto. Abdomen 3-articulatum, segmento primo ad basin perangusto, oblongo, subelliptico, angulis posticis elongatè crasseque productis, duobus sequentibus prælongis linearibus, ano non prominulo. Styli caudales parce oblongi, terminales. Antennæ posticæ ad basin posticè acutæ et extus basin spinâ munitæ. Furcula simplex, brachiis parce divergentibus, tenuibus, acutis.*

Female:—*Carapax ovate, second segment narrow. Abdomen three-*

* See Plate 93, for figures of the *C. americanus*; also the *Amer. Jour. Sci.*, xxxiv. 225, 1838.

jointed, first segment very narrow at base, oblong, subelliptical, posterior angles long and stoutly produced, the following part long and narrow linear; anus not prominent. Caudal stylets sparingly oblong, terminal. Posterior antennæ acute on posterior side of base, and armed with a spine exterior to base. Furcula simple, prongs slightly divergent, slender, acute.

Plate 94, fig. 4, ventral view of female, enlarged.

Found with the preceding, within the gill-covers of the Bonito, on the operculum. Only two females seen.

Length, one-fourth of an inch. Very transparent, excepting the external ovarian tubes, which were of a light dirt-brown colour.

Length of carapax, about one-fifth greater than width. Front emarginate at centre, and having minute processes or papillæ like the *C. americanus*. Sucker disks perfectly circular. Second segment of body not more than one-fifth or one-sixth the width of the carapax, and united to the preceding and following segments by a narrow neck.

The terminal portion of the abdomen is nearly linear, or slightly larger posteriorly, and about as long as preceding portion. The lamellar stylets are broadest towards apex, and the two are nearly in contact.

Anterior antennæ have the terminal setæ less than half the length of the apical joint.

Posterior antennæ with the last spiniform joint slender, scarcely larger at base, and having as usual a stout recurved extremity. Basal joint with a spine directed backward, and exterior to base, a curved corneous process.

Maxillæ, a long and slender aculeate spine, supporting a rudimentary jointed appendage, as in other species.

Second pair of feet, with the base or hand very stout, subconical, and without an immoveable finger; moveable finger a slender claw, more than half the length of hand.

First pair of natatories without plumose pinnules. Last pair of legs long and slender, the second portion two-jointed, and having a terminal toothed seta.

External ovarian tubes rather longer than the body in the specimens examined.

CALIGUS GRACILIS.

Feminæ:—*Carapax oblongus, fere ellipticus, discis suctatoriis rotundatis. Segmentum secundum transversum, brevissimum. Abdomen 2-articulatum, segmento antico fere quadrato, postico angustiore, parce oblongo, posticè truncato. Styli caudales terminales, paulo oblongi. Furcula ventralis simplex, brachiis divergentibus, truncatis. Antennæ posticæ spinâ oblongâ extus basin munitæ.*

Female:—Carapax oblong, nearly elliptical, sucker disks of front round. Second segment transverse, very short. Abdomen two-jointed, the anterior segment broadest, nearly square, the posterior slightly oblong, truncate behind. Caudal stylets terminal, a little oblong. Ventral furcula simple, prongs divergent, truncate. Posterior antennæ having an oblong stout spine exterior to base.

Plate 94, fig. 5 *a*, dorsal view of animal, enlarged; *b*, posterior antennæ; *c*, maxilla; *d*, second pair of legs.

Rio Janeiro, from the body of a Serranus.

Length, one-sixth of an inch. Colourless. Sucker disks a little yellowish and very distinct.

The first abdominal segment is nearly half as broad as the carapax. The posterior is truncate behind, without the anus prominent, and having the stylets projecting their length beyond the anus. Three plumose setæ about as long as the posterior segment, and one or two shorter.

The posterior antennæ very slender towards apex. The corneous spine exterior to its base long and slender, and but slightly curved. On the posterior side of the base there is a very short spine. The maxillæ have the spine long and slender. The second pair of feet (f. 5 *d*) have the finger about half as long as the preceding part.

The external ovarian tube in the specimen examined was shorter than the body.

LEPEOPHTHEIRUS BAGRI.

Carapax subrotundatus, discis suctatoriis non munitus, segmento secundo fere oblongo. Abdomen 3-articulatum, segmento primo valde latiore, segmentis duobus posticis simul sumtis oblongis, ano prominente. Styli caudales parvuli, ad angulos abdominis posticos insiti, anum vix superantes. Antennæ posticæ spinâ extus basin non munitæ. Furcula simplex, brachiis divergentibus, subacutis. Feminae:—Abdominis segmentum primum valde oblongum, posticè truncatum, anticè angustius, lateribus parallelis. Maris:—Segmentum abdominis primum latum, paulo oblongum, subhexagonum. Pedes paris secundi crassissimi, digito mobili acuto setâque internâ armato, margine manûs interno fere recto, digito immobili nullo.

Carapax nearly round, second segment very narrow and slightly oblong. Abdomen three-jointed, the first segment much the broadest, the following two (the last longest) of equal breadth, together oblong, anus prominent. Caudal stylets small, filling out the angles, and hardly projecting beyond the anus. Posterior antennæ without the corneous spine exterior to base. Furcula simple, prongs divergent, hardly acute. *Female*:—Anterior segment of abdomen much elongate, truncate behind, smaller anteriorly. *Male*:—Same segment broad, a little oblong, subhexagonal. Feet of second pair very stout, finger acute, and having a seta on the inner side; inner side of hand nearly straight, without an immoveable finger.

Plate 94, fig. 6 *a*, dorsal view of female, enlarged; *b*, posterior antennæ of female; *c*, maxillæ, *ibid.*; *d*, first pair of feet, *ibid.*; *e*, second pair of feet, *ibid.*; *f*, posterior antennæ of *male*; *g*, second pair of feet, *ibid.*; *h*, male abdomen.

Rio Janeiro; taken from the exterior of the body of a species of *Bagrus*, and also from within the gill-covers. Collected in November, 1838.

Length, about one-fourth of an inch. Colourless.

The cephalothorax is rather longer than broad, and slightly broadest posteriorly. The first abdominal segment is about half the breadth of the carapax. In the female, it has parallel sides along the posterior half, but narrows anteriorly; it is sometimes a little longer than the carapax. The following portion of the abdomen is longer than broad, and rectangular in form, the stylets completing the posterior angles of the rectangle. These stylets are furnished with three plumose setæ, as long as this smaller part of the abdomen. The external ovarian tubes were about as long as the body, and contained each about one hundred eggs. The male abdomen was imperfectly hexagonal, a little oblong, the greatest breadth being near centre. The caudal stylets scarcely project beyond the anus.

Posterior antennæ in female without a corneous spine exterior to base; in male, having two short hooks at apex. Spine of maxillæ a little curved, acute, about as long as buccal trunk. Second pair of feet in female rather slender, with the finger about half the preceding part in length and diameter, and having a small claw at apex. Same in male very large, with the finger slender, subulate, with a stout seta on the inside of the finger; hand nearly half its length in breadth, inner side nearly straight, without an immoveable finger.

This species is near the *C. pectoralis*, but has the second cephalothoracic segment longer, the female abdomen much longer, and the second pair of feet in the male stouter, with a seta on the inside of the finger; and the ventral furcula has the prongs divergent.

GENUS CALISTES, Dana.

Caligo similis. Cephalothorax 2-articulatus, discis suctoriis nullis; segmento postico non alato. Pedes postici biramei, subnatorii, setis plumosis instructi.

Near *Caligus*. Cephalothorax two-jointed, without disks for attachment, posterior segment not alate. Posterior feet two-branched, subnatory, being furnished with plumose setæ.

Like the Caligi, the Calistes have the maxillæ a little remote from the buccal trunk, and aculeate backward; there is but one joint to the thorax posterior to the carapax, and the third pair of natatories

is a large apron. In each of these particulars, the species differ from the Trebii, although resembling them in having the posterior feet two-branched and subnatatory. The species examined had no sucker disks beneath the front. The furcula anterior to the first pair of natatories was similar to the same in the Caligi. The maxillæ are furcato-aculeate behind, as in Trebius, and not simply aculeate, as in the Caligi described. The posterior feet were more ventral in attachment than usual in the Caligi.

CALISTES TRIGONIS.

Feminæ:—*Cephalothorax subrotundatus*; *segmentum secundum parvum, lateribus rotundatis. Abdomen 3-articulatum, segmento primo lato subquadrato angulis rotundatis, duobus sequentibus fere æquis et simul sumtis non brevioribus quam primum, linearibus, ano vix prominente. Styli caudales styliformes, oblongi. Antennæ posticæ spinâ corneâ longâ extus basin munitæ. Furcula simplex, brachiis parallelis. Pedes postici natatorii, ramis 3-articulatis, parce subæquis, setis longis.*

Cephalothorax subrotund; second segment small, with the sides rounded. Abdomen three-jointed, anterior segment very broad, subquadrate, angles rounded, the following two together about same length, narrow linear, two segments nearly equal; anus scarcely prominent. Caudal stylets styliform, oblong. Posterior antennæ having a long corneous spine exterior to base. Furcula simple, with the prongs parallel. Posterior feet natatory, branches subequal, three-jointed, setæ long.

Plate 94, fig. 7*a*, ventral view of animal, enlarged; *b*, posterior antenna, with the exterior spine, *b'*; *c*, aculeate part of maxillæ, showing furcation; *d*, first pair of feet; *e*, second pair of feet.

Taken from the body of a Trigon, at Rio Janeiro, December, 1838.

Length, one-fourth of an inch. Colourless, or nearly so.

The cephalothorax has a slight emargination in front. The first abdominal segment is about half as broad as carapax. The last segment has a constriction near apex, which appears to indicate an obso-

lete articulation. The apical angles are cut off in a very slightly oblique direction. The stylets are narrow oblong, and the setæ but little longer than the stylets.

The posterior antennæ are slender, and the recurved part is nearly half the length of the joint. The large spine exterior to its base is nearly straight and slender. The maxillæ have the inner prong longest; the outer has a short spine on the outer margin.

The first pair of natatories has a small appendage to first joint near inner apex. The apron is smaller than in the true Caligi, and has larger appendages. The fourth pair resembles the second. The external ovarian tubes of specimen examined, were about as long as whole abdomen. The first abdominal segment is broad concave behind, with the posterior angles widely rounded.

GENUS CALIGERIA, Dana.

Caligo similis. Cephalothorax 2-articulatus, discis suctoriis carens, segmento postico bi-alato. Pedes postici biramei, setis brevibus, non plumosis.

Near *Caligus*. Cephalothorax two-jointed, without disks for attachment, posterior segment bi-alate. Posterior feet two-branched, setæ short and not plumose.

This genus is also near *Caligus*, but differs in its two-branched posterior feet, and alate posterior thoracic segment. In this last character it shows a transition to the *Pandarus*. It has the maxillæ, furcula, and stout obtuse buccal trunk of *Caligus*. There were no sucker disks in the species seen. The eyes were united on a single spot of pigment. The caudal setæ were peculiar in being short and stout, and not plumose.

CALIGERIA BELLA.

Feminæ:—*Cephalothorax rotundatus*, discis suctatoriis nullis. Segmentum secundum transversum, ad angulos posticos alatum, alis latis, approximatis, margine toto arcuato. Abdomen 3-articulatum, seg-

mento primo lato, subelliptico, angulis posticis rotundatis, segmentis sequentibus dimidio angustioribus, non oblongis, subæquis, tertio posticè truncato; lamellis caudalibus latis, paulo oblongis, contiguis, setis lamellâ brevioribus, fere æquis. Furcula simplex, tenuis, basi angustissimo, brachiis divergentibus. Pedes postici tenues, ramis valde inæquis, ramo breviorè 2-articulato, altero 3-articulato.

Female:—Cephalothorax nearly round; second segment transverse, posterior angles alate, wings broad, approximate, the margin around arcuate. Abdomen three-jointed, anterior segment broad, subelliptical, posterior angles rounded, following segments half narrower, not oblong, subequal, the last truncate behind; caudal lamellæ broad, oblong, contiguous, setæ shorter than the lamellæ, nearly equal. Furcula simple, slender, narrow at base, prongs divergent. Posterior feet rather slender, branches very unequal, the shorter two-jointed, the other three-jointed.

Plate 94, fig. 8 *a*, dorsal view of animal, enlarged; *b*, posterior antennæ; *c*, maxillæ, adjoining buccal trunk; *d*, first pair of feet; *e*, second pair of feet; *f*, furcula (the preceding, from *b* to *f*, have the same relative position as in the animal); *g*, posterior feet; *h*, under view of abdomen, showing appendages to abdomen.

From the gills of an Albicore, in the Atlantic, May 7, 1842, latitude 11° south, longitude 14° west.

The carapax is emarginate in front. The second pair of feet have the finger nearly as long as the hand. The furcula is very narrow at base. The alate appendages to second segment of the body are rather larger in surface than the segment. They are placed obliquely, being in contact at the centre of the posterior side of the segment. The caudal lamellæ are as long as the last abdominal segment, and resemble much those of the Sapphirinæ. There are four setæ on the terminal margin shorter than the lamellæ, three of which are in contact towards the inner angle, and the fourth is a little separate, and situated at the outer angle.

The singular appendages to the first abdominal segment, represented in figure 8 *h*, resemble what we have elsewhere described (page 1347).

SUBFAMILY II. PANDARINÆ.

Pandarus and some other genera are made into a distinct family ("Tribu des Pandariens") by Milne Edwards, on the ground of their having alate dorsal extensions of the shell of the second or second and third segments of the body. This character cannot be of family importance, as is evident from its nature; and besides, it takes place without any striking difference of function or habit. The peculiarity of the maxillæ is more important. Moreover, it is connected with a very slender buccal trunk, in which the mandibles are straight or nearly so, and have exit at the apex. On this striking characteristic, we separate some non-alate species from the Caliginæ, and unite them to the group of the Pandari. The Caligeriæ have the alate peculiarity to some extent, yet the trunk and maxillæ are like those of the Caligi.

GENUS NOGAGUS.

Cephalothorax 4-articulatus, fronte arcuatus. Segmento secundo lateribus postice producto, sequentibus vix alatis. Oculi simplices remotiusculi (An quoque oculus minutissimus intermedius?). Pedes prehensiles quatuor duobus posticis crassè cheliformibus, digitis brevibus truncatis (An maris tantum?). Pedes natatorii octo, grandes. Abdomen stylis brevibus sublamellatis setigerisque confectum.

Cephalothorax four-jointed, arcuate in front; the second segment with the sides prolonged behind, the last two not alate. Eyes simple, a little remote (also, a very minute intermediate eye?). Prehensile feet four, the two posterior stout cheliform, the fingers short and truncate (perhaps in the *male* only). Natatories eight, large. Abdomen terminating in a pair of lamellar setigerous stylets.

The Nogagi have four cephalothoracic segments, instead of *three*, like Trebius. The individuals examined have the posterior antennæ with a simple slender recurved apex, like the female Caligi, and this excited the suspicion that they were females. But the legs of the second pair were very stout and cheliform, having a large hand, and

an obtuse finger plying against a short obtuse immoveable finger. The first pair of legs is similar to the same in the Caligi. The first pair of natatories is rather large, and the following three pairs quite large and broad, the fourth not less so than the preceding. The setæ are long and plumose. The mandibles are slender and straight toward the apex, and when in action protrude from the very extremity of the buccal trunk. The second cephalothoracic segment is somewhat alate on either side; the third and fourth not at all so. The eyes are a little remote, and have between them a minute spot, much resembling what is found in the Sapphirinæ, which we have suspected to be another eye.

NOGAGUS VALIDUS.

Carapax paulo oblongus, ellipticus, segmento secundo ad latera posticè producto, segmentis duobus sequentibus transversis. Pedes secundi paris crassissimè cheliformes, digito immobili brevi, truncato, digito mobili obtuso. Abdomen 2-articulatum, segmento antico subquadrato, angulis posticis prominulis; segmento postico brevi, transverso, angulis posticis truncatis. Styli caudales latè lamellati, paulo oblongo, setis tribus plumosis.

Carapax a little oblong, oval, second segment with the sides prolonged backward, third and fourth transverse, subequal, half as wide as carapax. Feet of second pair very stout cheliform, immoveable finger short, truncate, moveable finger obtuse. Abdomen two-jointed, anterior segment subquadrate, posterior angles a little prominent, second segment short transverse, the angles obliquely truncate. Caudal stylets rather large, lamellar, a little oblong, setæ three, plumose.

Plate 94, fig. 9 *a*, dorsal view of animal, enlarged; *b* to *g*, organs, in their relative positions; *b*, anterior antennæ; *c*, posterior antennæ; *d*, buccal trunk, with the maxillæ; *e*, first pair of feet; *f*, second pair of feet; *g*, first pair of natatories; *h*, third and fourth pairs of natatories.

From a shark, in the Pacific, northeast of New Zealand; taken April 15, 1840.

The articulation of the carapax with the next segment is not very distinct. This second segment has a prolongation on either side, which extends either side of the third segment, nearly as far as the following articulation, and the posterior angles are rounded. The third and fourth segments are as broad as the abdomen, and laterally obtuse. The abdomen has the first segment large, about as broad as long, truncate behind, with quite a small prominence either side of base of last segment, and also an emargination exterior to this prominence, and a few setæ on the angle. The last segment is half the breadth of the preceding, and twice as broad as long. The lamellar stylets project nearly their length beyond the anus, and the three setæ are subequal, the inner shortest.

The front of the carapax moves to some extent with the anterior antennæ.

The posterior antennæ are quite similar to those of female Caligi. No spine exterior to base was observed.

The first pair of feet have the furcation on the third joint half the length of the second and third joints together.

The first pair of natatories are rather large, with long plumose setæ to each branch. The base consists of a very short first joint, and a large second joint, the latter with a prolonged obtuse apex.

GENUS PANDARUS.

Corpus antice latius. Cephalothorax 4-articulatus, segmento antico (vel carapace) grandi, sequentibus transversis, secundo lateribus retrorsum alate producto, tertio quartoque testâ posticè expansis et bilobatis. Abdomen 2-3-articulatum, segmento secundo posticè rotundato et latere stylis caudalibus munito, postico celato. Oculi duo remotiusculi. Pedes natatorii octo. Pedes prehensiles paris secundi crassè cheliformes. Styli caudales styliiformes, acuti, fere nudi.

Body anteriorly broadest. Cephalothorax four-jointed, anterior segment (or carapax) large, the following transverse, second with the sides alately produced backward, third and fourth with the shell expanded behind and bilobate. Abdomen two- to three-jointed, second segment posteriorly rounded, and having on the sides the caudal stylets, last segment concealed below the second. Eyes two,

somewhat remote. Natatory feet eight. Prehensile feet of second pair stout cheliform. Caudal stylets styliform, acute, nearly naked.

The Pandari are at first sight distinguished by the rounded caudal extremity, bearing usually on each side a slender pointed stylet, which has two or three minute spinules or setæ on its inner margin. In a few species the stylets are concealed below. They are also strongly marked by their posterior thoracic segments, the first posterior to the carapax being alately prolonged backward on either side, and the next two having the posterior margin of the shell expanded backward and bilobate.

The frontal margin is very narrow near the medial line. The carapax is large, arcuate in front, more or less concave behind, and the posterior margin for some distance is often dentate. The winged prolongation of the second segment is elliptical or subrectangular. The posterior lobes of the following segments are separated either by an acute or a rounded concavity. The first abdominal segment is large, and as usual bears the long external ovarian tubes. The posterior is entirely ventral, and is so situated that its stylets usually project backward (a little divergent) either side of the preceding segment.

The anterior antennæ are two-jointed; they have very short setæ on the outer margin of first joint, and others at apex of second joint in two small clusters. These organs as usual pertain to the frontal segment of the carapax. The posterior antennæ are three-jointed, and the last in the species examined is slender, and terminates in a recurved point. Near the outer margin of the carapax, there are two sucker disks on each side, one just posterior to the antennæ, the other near the posterior part of the cephalothorax. A third is sometimes (always?) found growing from the outer part of the base of the posterior antennæ. The buccal trunk is quite slender, and has small lamellar maxillæ hugging it on either side. The first pair of feet are the same as in *Caligus*. The second pair of feet are large and stout cheliform, as in *Nogagus*. The first pair of natatories is small, the next larger, the two following very broad and lamellar. Their setæ are very short, never long plumose, often looking like small spines.

The species have frequently a deep brownish-black colour, excepting a clear spot over the eyes, and some light tints in certain other parts.

PANDARUS CONCINNUS.

Carapax paulo oblongus, ellipticus, posticè truncatus et dentatus, angulis posticis paululo elongatis, obtusis. Segmentum secundum brevissimum, alis divaricatis, subrectangulatis, angulis posticis subacutis. Segmenta duo sequentia transversa, subæqua, lobis rotundatis acutè sejunctis. Abdomen 3-articulatum, segmento antico lato, postice profundè excavato, lateribus arcuatis, angulis posticis acutis, bene divaricatis. Styli caudales apertè laterales.

Carapax a little oblong, elliptical, truncate behind and toothed, with the posterior angles a little prolonged and obtuse. Second segment very short, wings divaricate, subrectangular, the posterior angle subacute. Next two segments subequal, the lobes rounded, and separated by an acute excavation. Abdomen three-articulate, anterior segment broad, very deeply excavate behind, sides arcuate, posterior angles prominently divaricate, acute. Stylets not covered.

Plate 95, fig. 1 *a*, dorsal view of animal, enlarged; *b*, anterior antennæ; *c*, caudal stylet.

From the body of a shark, taken south of Tongatabu.

Frontal margin of the carapax entire. Number of teeth on the posterior margin ten to twelve. The wing of the second segment has the outer angle rounded, the inner a right angle, and it is about twice as long as broad. The third segment is a little shorter than the fourth. The first abdominal segment is about as long as broad, and somewhat harp-shape, being broader towards base and having the posterior angles curving outward. The next segment is full half the breadth of the preceding, and more than half its length. The stylets have the outer margin entire, and on the inner three short spines, the one nearest apex longest and most slender, or seta-like. The posterior antennæ are slender and have an incurved apex. The second pair of prehensile feet very stout cheliform, with the finger obtuse and emarginate at apex. Sucker disks, three pairs, two to sides of shell, and one on base of posterior antennæ. Eyes approximate, but not in

contact; a single spherical lens each. Body translucent or subtransparent.

PANDARUS SATYRUS.

Carapax *vix* oblongus, *posticè sensim latior*, *angulis posticis parce prominentibus*, *marginè postico integro*, *antico obsoletè denticulato*. *Segmentum secundum brevissimum*, *alis divaricatis*, *oblongo-ellipticis*. *Segmenta cephalothoracis sequentia transversa*, *primo minore*, *lobis rotundatis acutè sejunctis*. *Abdomen 3-articulatum*, *articulo antico grandi*, *posticè angusto-excavato*, *lateribus fere rectis*, *parce deinde subito angustioribus et angulis posticis internis acutis*; *segmento secundo dimidio vix angustiore*, *oblongo*, *obovato*. *Styli caudales aperte laterales*.

Carapax scarcely oblong, gradually widens posteriorly, posterior angles sparingly prominent; posterior margin entire, anterior obsoletely denticulate. Second segment very short, wings divaricate, oblong elliptical. Following segments transverse, the first considerably smaller, the lobes rounded and separated by an acute excavation. Abdomen three-jointed, anterior segment large, narrow excavate behind, sides nearly straight, somewhat convergent, and posteriorly abruptly converging, the inner posterior angles acute, and but little remote. Second segment hardly half narrower, oblong obovate. Caudal stylets not covered.

Plate 95, fig. 2 *a*, dorsal view, enlarged; *b*, ventral view; *c*, view of extremity, with commencement of external ovarian tube.

Found with the preceding.

Length, five lines. Body, opaque. Colour, sometimes nearly black, excepting a pale yellowish-red spot over the eyes; pale brownish yellow, with a tinge of red, forming a margin to the frontal segment of carapax, and the wings of second segment of body, and colouring the posterior angles of carapax, basal half of first abdominal segment, and stylets. Other specimens opaque, dirty white, or yellowish white, with few traces of a brownish-black colour.

The first abdominal segment is much broader than half the breadth

of carapax. The acute points on its posterior side are situated directly over the bases of the stylets. Suction disks as in the preceding. The posterior pair of disks is attached to the same segment with a pair of natatories, and not to the carapax; and this is probably the case also in the *concinuus*.

The anterior antennæ have very short setæ on anterior margin of first joint, and also at apex of second, as in figure.

The first pair of prehensile feet has the basal portion shorter than the following. The second pair is very stout, and consists of a very thick and broad base, much broader than long, which diminishes to a narrow neck, and then enlarges somewhat, and bears an obtuse immoveable finger and a short emarginate moveable finger.

The anterior natatories have the basal joint shorter than broad; the shorter branch is two-jointed, the other three-jointed. The second pair has a two-jointed base, the second large and oblong, and attached to the venter by the greater part of its anterior side. The two branches each two-jointed. The third and fourth pairs broad lamellar, the third with the branches two-jointed, the fourth with each an undivided plate.

The last segment of the abdomen is situated under the articulation of the preceding with the first, and is small, quadrate in form, bearing the stylets from its posterior angles. They have a minute spine on the inner margin towards apex, and another smaller towards the base. At the outer basal angle there is a minute prominence.

This species is near the *P. Cranchii*, but differs in the form of the first abdominal segment, the acute points behind, the stylets, and the large cheliform legs. The latter have not the narrow constriction towards apex in these legs.

PANDARUS BREVICAUDIS.

Carapax vix oblongus, subellipticus, posticè valde excavatus, angulis posticis elongatè productis, obtusis, segmentis 2do 3tio 4to transversis, 2do alato, alis non divaricatis, 3tio 4toque subæquis, abdomine non latioribus, margine postico arcuato excavato. Segmentum abdominis anticum subquadratum, postice angustius, angulis posticis obliquè truncatis et setâ minutâ extus instructis, postice subtruncatum et angustum; segmentum secundum parvulum, transversum, stylis triplo longioribus.

Carapax slightly oblong, suboval, posteriorly much excavate, the angles long produced and obtuse. Following segments transverse; the second with the wings not divergent, obtuse behind; the third and fourth of the breadth of the abdomen, and posterior margin of each broad, rounded excavate at middle. First segment of abdomen subquadrate, narrowing posterior to middle, the posterior angles truncate, and exteriorly having a minute seta, behind subtruncate and narrow; second abdominal segment very small, transverse, the stylets either side three times longer than the segment.

Plate 95, fig. 3 *a*, dorsal view of animal, enlarged; *b* to *g*, organs in their relative positions; *b*, anterior antennæ; *c*, posterior antenna, with suction disk on its base; *d*, buccal trunk and maxilla; *e*, first pair of legs; *f*, second pair of legs; *g*, first pair of natatories; *h*, last two pairs of natatories.

From a shark, taken in the Pacific, northeast of New Zealand, April 15, 1840.

Length, one-fourth of an inch.

The carapax has the posterior angles much prolonged. The winged prolongation of the following segment extends parallel with the body, beyond the posterior part of the segment. The concavity in the posterior margin of the third segment is much broader and shallower than in the fourth. The second segment is rather longer than the third, which is unusual. The posterior margin of first abdominal segment is not concave, and not longer than half the greatest breadth of the joint.

The eyes are quite near but not in contact, and between them there were two minute coloured spots. The basal part of first pair of feet is about as long as the following portion. The second pair of feet is very large and stout cheliform. Basal joint of first pair of natatories subquadrate.

GENUS DINEMATURA.

Corpus antice parce latius. Cephalothorax 3-articulatus, segmento secundo parvo, tertio testâ dorsali retrorsus valde expanso et profundè

bilobato. Abdomen 2-articulatum segmento primo bilobato, postico celato. Styli caudales lamellati, terminales.

Body anteriorly but slightly broader than behind. Cephalothorax three-jointed, second segment small, third with the dorsal shell very much expanded backward and profoundly bilobate. Abdomen two-jointed, but little narrower than the carapax. Anterior segment bilobate, the posterior concealed. Caudal stylets lamellar, terminal.

The great breadth of the abdomen, its deep bilobate character, and the absence of any second or third abdominal segment in an upper view, as well as the two elytra-like prolongations of the shell of the third segment of the body, constitute the more striking peculiarities of the *Dinematuræ*.

The frontal segment of the carapax is as in *Caligus*; the anterior and posterior antennæ are also similar to those in that genus. The mouth is a slender trunk, with the maxillæ close appressed to it, as in other *Pandarinaæ*. The first pair of feet is like those of the *Caligi*. The second pair is cheliform, with a slender pointed finger and a stout prominence acting as an immoveable finger. The first and second pairs of natatories are like those of *Caligus*. The third forms a large plate, with small appendages to the margin corresponding to the two branches. The fourth is smaller, and the appendages are much broader and oblong, being thin lamellar, and edged with a few very short setæ.

The internal ovaries are convoluted in the large abdominal segment, as usual, and the external are like those of other *Caligidæ*.

DINEMATURA BRACCATA.

Carapax fere rotundatus, abdomine latior, discis suctoriis pone antennas munitus; posticè quadrilobatus, lobis duobus internis angustis, curvatis, subacutis. Segmentum secundum transversum, latere subacutum. Segmenti alæ tertii vix oblongæ, dimidii abdominis longitudine, posticè parce latiores, angulis rotundatis, margine postico fere recto obliquè transverso. Segmentum abdominis primum profundè bilobatum, secundum quadratum. Styli caudales grandes, subovati, abdominis extremitatem paulo superantes, setis paucis brevissimis.

Carapax nearly round, broader than the abdomen, furnished posterior

to the antennæ with a sucker disk, behind four-lobed, the two inner lobes narrow, curved and subacute. Second segment transverse, laterally subacute. Wings of third segment slightly longer than broad, about half as long as the abdomen, a little the broadest behind, angles rounded, posterior margin hardly sinuous, oblique transverse. First segment of abdomen profoundly two-lobed, second quadrate. Caudal stylets large, subovate, extending a little beyond the extremity of the abdomen, setæ very short.

Plate 95, fig. 4 *a*, dorsal view of animal, enlarged; *b*, ventral view; *m*, third pair of natatories; *n*, laminæ of fourth pair; *o*, last abdominal segment; *p*, caudal stylets.

From the body of a shark, taken south of Tongatabu, Pacific Ocean.

Length, half an inch. Body greenish in part, or subtransparent.

The front is obsoletely emarginate. The carapax is scarcely as long as broad, and the inner lobes behind are curved under the outer lobes. The wings of the third segment are nearly trapezoidal in form, and very slightly longer than broad; and in the specimen seen, they were not quite in contact on the medial line. The second and third segments belong to the third and fourth pairs of natatories.

The abdomen (as seen below) is rather longer than the carapax. The caudal lamellæ have a rounded apex, and bear five minute setæ, two near middle of posterior margin, one a little more exteriorly, and two on the outer margin, near its middle.

The posterior antennæ have a slender, recurved, pointed apex, as usual in the Caligi. The first pair of legs has the basal portion nearly as long as the following, and the furcation very short. The second pair is large, and has an acute moveable finger plying against a broad and low, flat-topped prominence, answering to an immoveable finger.

The first pair of natatories have two short branches, furnished with very short setæ. The setæ of the second pair are also short.

This species is near *D. affinis* (Hist. Nat. des Crust., par M. Milne Edwards, iii. 465, Plate 38, figs. 15-18), but the inner lobes to posterior part of carapax are subacute; the caudal lamellæ extend beyond the extremity of the abdomen; the abdomen is considerably narrower than the carapax; the form also of the second segment of the body is different.

GENUS LEPIDOPUS, Dana.

Corpus anticè non latius. Cephalothorax 3-articulatus, segmentis 2dis 3tiisque posticè largè bi-alatis. Abdomen 2-articulatum, segmento postico parvulo, celato, antico maximo et posticè bilobato. Antennæ posticæ articulo tenui falciformi confectæ, marginibus bene denticulatæ. Pedes paris secundi superficie latâ terminali prehensili squamatâ instructi. Pedes natatorii quatuor ultimi similes, latè lamellati, 1mi simplicissimi, setis totis perbreuibus.

Body not broadest anteriorly. Cephalothorax three-jointed, second and third segments posteriorly large bi-alate. Abdomen two-jointed, the last segment quite small and concealed below, the other very large and bilobate behind. Posterior antennæ ending in a slender falciform joint, having the margins neatly denticulate. Prehensile feet of second pair having the last joint broad and flat below, and covered with scales for adhesion. Last four natatory feet similar, broad lamellar, first pair quite simple, setæ all very short.

This genus is near *Læmargus*, but differs in having the second segment two-winged like the third, and the large prehensile legs end in a broad disk, for attachment and locomotion. The posterior antennæ in the only species seen terminates in a long curved joint, which is set with two rows of minute teeth. The first and second pairs of natatories are nearly as in *Pandarus*, except that the first is without a second branch. The third and fourth have the basal joint enlarged and flattened into a nearly circular lamina, with the two branches mere one-jointed appendages to the posterior edge.

The first pair of feet are furcate at apex, as in other *Caligidæ*; this furcation arising, as usual, from the prolongation of the second joint, and the addition, where this prolongation begins, of another slender joint of similar character.

The buccal trunk is long and slender, and the mandibles have a straight extremity, with the inner margin serrulate. The maxillæ are close appressed to it near its base.

The last segment of the body is concealed below, and terminates in two small processes, corresponding to stylets. The frontal segment of the carapax is separated by a suture, and is longer than usual.

LEPIDOPUS ARMATUS.

Corpus oblongum, posticè sensim latius. Carapax subquadratus, posticè paulo latior, margine postico vix arcuato. Segmenta duo sequentia subæqua, profunde bilobata, alis grandibus, fere rotundatis. Abdomen oblongum, carapace valde longius, posticè non angustius, paulo bilobatum, lobis rotundatis. Antennæ posticæ ad apicem elongatè falciformes et denticulis biseriatis armatæ, articulo penultimo subquadrato. Pedes paris secundi crassi, articulo penultimo ad apicem spinigero, ultimo crassissimo, superficie terminali oblongâ, squamatâ, squamulis spinulâ armatis.

Body oblong, gradually broader posteriorly. Carapax subquadrate, a little the broadest behind, posterior margin scarcely at all arcuate; two following segments nearly equal and very deeply bilobate, wings large, subrotund. Abdomen oblong, much longer than carapax, not narrower behind, lobes rounded. Anterior antennæ terminating in a long slender joint, curved like a sickle and set with two rows of teeth, preceding joint subquadrate. Large prehensile feet having a stout spine at apex of penult joint, the last joint very stout, its lower surface oblong and covered with scales.

Plate 95, fig. 5 *a*, dorsal view, enlarged; *a'*, ventral view; *b*, buccal trunk, with maxilla either side; *c*, extremity of the same; *d*, separate view of maxilla; *e*, posterior antennæ; *f*, first pair of feet; *g*, second or large pair of prehensile feet; *h*, first pair of natatories; *i*, second pair of natatories; *k*, one of two posterior pairs of natatories.

From a fish of the genus *Mustelus* (family of Sharks), in the market at Rio Janeiro; only two specimens were obtained.

Length, one-third of an inch. Colour, brownish.

The body consists of five segments, of which the last is quite small, and is concealed beneath the penult. The frontal segment of the carapax is larger than usual, and hardly shorter at middle. The anterior antennæ arise from it on either side, and are quite small and two-jointed, as usual. The second joint is about as long as the first, and more slender.

The first pair of feet has the terminal part about as long as the basal, and the furcation occupies one-third of its length.

The second pair has for adhesion a very broad and flat surface covered with scales, each scale terminating in a minute spine. The animal was with difficulty detached from the fish, on account of its attachment by these legs. The first pair of natatories was not observed to have a branch. It consists of three joints. The second rather slender, and a little longer than the first; the third much shorter, and a little broader than the second, and terminating in a few short setæ. The second pair has a very short basal joint, the second very stout and oblong, and this bears two two-jointed branches, subequal in size, and furnished with very short setæ. The third and fourth pairs, have the basal portion thin and very large circular, with two small appendages, corresponding to branches, on the posterior margin, each with very short setæ.

Below, either side of last abdominal segment, there is a large subtriangular appendage, nearly fleshy in character; and also, just anterior to same segment, there is a pair of small oblong prominences.

The last abdominal segment is less than one-fifth the full breadth of the abdomen.

SUBFAMILY SPECILLIGINÆ.

GENUS SPECILLIGUS.

Cephalothorax, abdomen, antennæ, pedesque ac in Nogago. Cephalothorax pone antennas 1mas disco suctorio infra armatus.

Near *Nogagus* in the joints of the cephalothorax and abdomen, and in the feet and antennæ. The cephalothorax having below, behind the first antennæ, a disk for attachment.

The essential point of difference between this genus and *Nogagus*, is the existence of two large transparent lenticular corneæ (conspicilla), exactly like those of the *Sapphirinæ*. These conspicilla are attached to the exterior shell, but with some difficulty may be separated. On pressure they proved to be brittle, though rather hard. The lenses of the eyes are situated below, near the conspicilla, though

a little nearer the medial line. Between the two there is a minute coloured spot.

The species below was found with the *Nogagus validus*, and was at first supposed to be the female to that species.

We judge from the description of *Nogagus gracilis* that it may belong to this genus. Kröyer describes and figures a specimen, which he refers to as young of *Læmargus muricatus*, with a query.* It is apparent that the animal has conspilla, besides other characters of our genus *Specilligus*, being similar in the joints of the body, the caudal stylets, etc.

SPECILLIGUS CURTICAUDIS.

Feminæ?—*Carapax oblongo-ellipticus, anticè arcuatus. Segmentum secundum ad latera posticè productum; tertium quarto latius et dimidio carapacis parce latius. Pedes secundi paris crassissimè cheliformes, digito immobili brevi truncato, digito mobili obtuso. Abdomen 2-articulatum, segmento antico paulo oblongo, angulis posticis truncatis et setam minutam gerentibus, segmento postico brevi, ano prominente; stylis parvulis, triangulatis, ad angulos insitis, anum non superantibus, setis tribus, plumosis.*

Carapax oblong-oval, arcuate in front, second segment with the sides prolonged backward, third broader than fourth, and a little broader than half the carapax. Anterior antennæ setigerous at apex, the setæ rather long and plumose. Feet of second pair very stout cheliform, the thumb short and truncate, the finger obtuse. Abdomen two-jointed, anterior segment a little oblong, posterior angles truncate, and bearing a minute seta; posterior segment short, anus prominent, stylets triangular, situated on the angles, not extending beyond the anus, setæ three, plumose.

Plate 95, fig. 6 *a*, dorsal view, enlarged; *b*, eyes; *c*, under view (showing *a*, frontal margin; *b*, anterior antennæ; *c*, sucker disk; *d*, posterior antennæ; *e*, buccal trunk and maxilla; *f*, first pair of feet; *g*, second pair of feet; *h*, first pair of natatories); *d*, *e*, hand of second

* Tidsskr., i. 1837, Pl. 5, f. D. *a*.

pair of feet in profile; *f*, penult natatories; *g*, posterior or fourth pair of natatories; *h*, mandible and extremity of buccal trunk.

From the body of a shark, northeast of New Zealand, April 15, 1840, where it occurred along with *Nogagus*.

The sucker disks are large and oblong. The second segment of the body is prolonged on each side as far backward as the carapax. The fourth segment is considerably narrower than third, and a little narrower than the abdomen. The first segment of the abdomen is truncate behind, but with the posterior angles cut off, and a minute seta at the outer apex. The second segment has the posterior angles very deeply removed, and their places occupied with the stylets.

The plumose setæ at apex of anterior antennæ are as long as the second joint. The buccal trunk is a long slender beak, with the mandibles exsertile at apex. The mandibles are long and straight, curving a little towards the place of their insertion, and having a minutely denticulate inner margin at apex.

The posterior antennæ are similar to those of female *Caligi*, having a recurved pointed apex.

The first pair of legs have the furcation extending half way to apex of basal joint.

The second pair is very stout, like that in the species of *Nogagus* described. The stout blunt finger folds against the oblique outer surface, and extends to a blunt immoveable finger, the apex of which is corneous.

The last six natatories are very broad, and have long plumose setæ on the biarticulate branches. The basal joint of the first pair has a projecting apex, and is longer than broad.

The pigment of the two eyes was deep blue; the colour of the minute spot between, bright red.

LERNÆOIDEA.

THE relation of many of the Lernæoids to the Corycæi is very striking, and a figure is added on Plate 92 for comparison. It represents the *Lernentoma cornuta*, from Nordmann's Mikr. Beit. It is a male; the females of this and allied species are very diverse in forms, and alone would seldom suggest this relation, or but imperfectly so. Ergasilus is the connecting link between such species and the Corycæidæ, and in both these groups, the oviferous appendages are sacs instead of simple tubes. Other Lernæoids are rather related to the Caligidæ; and traces of this in the first pair of legs may be observed, as in Lernanthropus. Still, owing to the transitions of form among the groups, it is difficult to base an arrangement of the species on these relations. This department of Crustacea has not been specially studied by the author, and no attempt is therefore made to revise the genera. The following classification of the genera is here presented. Edwards adopts three grand divisions; the first (Chondracanthiens), including species having distinct ancoral appendages or feet to the cephalothorax; the second (Lernéopodiens), those whose females, at least, have a pair of appendages united at summit, and sometimes from base, terminating in a disk for adhesion; the third (Lernéoceriens), embracing species without ancoral appendages, and only one or two pairs of unjointed processes attached to the anterior part of the body. The last are the *Penellida* of Burmeister, and the first two groups his *Lernæoda*.

These groups may be divided into subfamilies, as follows:—

FAM. I. CHONDRACANTHIDÆ.

Appendices cephalothoracis numero quatuor vel plures, unguibus plus minusve ancorales.

SUBFAM. I. SELINÆ.—Antennæ anticæ et pedes thoracis postici graciles.

G. SELIUS, Kr.

SUBFAM. 2. CHONDRACANTHINÆ.—Antennæ anticæ graciles vel perbreves. Pedes thoracis postici breviter et crassè ancorales.

G. CHONDRACANTHUS, *De la Roche*; LERNANTHROPUS, *Blainville*; LERNENTOMA, *Blainville*; CYCNUS, *Edw.*

SUBFAM. 3. CLAVELLINÆ.—Antennæ anticæ obsoletæ. Pedes thoracis postici crassi et breves.

G. CLAVELLA, *Oken*; TUCCA, *Kr.*; PENICULUS, *Nordmann*; ÆTHON, *Kr.*

FAM. II. ANCORELLIDÆ.*

Antennæ posticæ feminarum ad apicem et sæpe per latera connatæ et disco ancorali confectæ.

SUBFAM. 1. ANCORELLINÆ.—Antennæ posticæ feminarum per latera usque ad basin connatæ.

G. ANCORELLA, *Cuvier*.

SUBFAM. 2. LERNÆOPODINÆ.—Antennæ posticæ feminarum versus apicem connatæ tantum.

G. LERNÆOPODA, *Kr.*; BRACHIELLA, *Cuvier*; ACHTHERES, *Nordmann*; TRACHELIASITES, *Nordmann*; BASANISTES, *Nordmann*.

FAM. III. PENELLIDÆ.†

Pedes obsoleti. Caput 2–4 appendicibus brevibus non articulatis munitum.

SUBFAM. 1. PENELLINÆ.—Pedes pauci rudimentarii vix obsoleti.

G. PENELLA, *Cuvier*; LERNEONEMA, *Edw.*

SUBFAM. 2. LERNEOCERINÆ.—Pedes omnino obsoleti.

G. LERNEOCERA, *Blainville*; LERNÆA, *Linn.*

* *Lernæopodiens*, *Edw.*, *Crust.*, iii. 505; *Anchoracarpacea*, *W. Baird*, *Brit. Entomost.*, 331; *Ancorellidæ* is a more euphonious and more suggestive word than the preceding.

† *Lerneocérens*, *Edw.*, *Crust.*, iii. 521; *Anchoraceracea*, *W. Baird*, *Brit. Entomost.*, 338. The name above adopted is that proposed by *Burmeister*, the last vowel only being changed.

The subdivisions of the last two families are indicated by Edwards in his table, Crust., iii. p. 492, but not instituted into subfamilies. Baird adopts them as *family* divisions. It is doubtful whether the males of the Penellidæ are not in some cases, at least, furnished with appendages like the Chondracanthidæ, although somewhat less perfect; and in this case, the characteristic distinguishing the group, is based upon the females.

LERNÆOPODA CALIFORNIENSIS.

Corpus latum, parce oblongum, capite transverso. Brachia latitudine corporis vix longiora. Sacculi ovigeri cylindrici, corpore dimidio longiores.

Body broad, but little longer than its breadth, head transverse. Arms about as long as breadth of body. Ovigerous sacs cylindrical, half longer than the body.

Plate 96, fig. 1 *a, b*, different views.

From the body of a salmon, taken in the Tlamath River, California.

The head is nearly twice as broad as long, as seen in a vertical view, and is triangular in outline. The rest of the body is at middle nearly twice as broad as the head. The arms are rather short, and are connected with the terminal disk by a slender process. The body appeared to be full of eggs, as well as the external tubes. These tubes contain the ova in several series, probably eight or ten.

APPENDIX TO THE ENTOMOSTRACA.

Figures 7 to 10, Plate 95, represent young individuals of species of genera yet undetermined.

The general form in figures 9 and 10 is the same, the carapax being triangular nearly, the anterior angles produced into very long spines, and the posterior or caudal extremity furnished with a very long spine lying in the plane of the body, besides another in the same longitudinal plane, arising from below the base of the caudal spine, and reflexed downward and backward with a curve.

In fig. 9 *a*, the mouth is distinctly a moveable trunk, as represented in fig. 96. There is a single eye. The number of appendages is six, as in the young Cyclopoidea. Two of these appendages are antennary, as they are situated anterior to the mouth. The next two may correspond to the mandibles, maxillæ, or the first pair of legs of *Caligus*, we have not determined to which of these organs; the following two are subprehensile, and probably represent the prehensile pair of legs—the second in *Caligus* (or first in the Cyclopoids).

The first pair (normally the second antennæ) is four-jointed, as long as the body exclusive of the caudal spines, and furnished with setæ. It projects directly forward. The second pair is still longer and has much longer plumose setæ, one or two proceeding from each of seven small joints terminating the organ. The third pair is rather short, and has three joints, besides a claw or moveable finger. The buccal trunk is quite long, and pointed behind. The caudal spine is five or six times as long as the body, and the inferior caudal about one-half the other.

This animal was taken east of the entrance of the Straits of Sunda, on the 5th of March, 1842.

In figure 10, the six appendages are shorter, and the second and third pairs are two-branched. The antennæ project laterally and are four-jointed, the joints nearly equal in length. The second pair is six-jointed, and a little longer than the antennæ; and at apex there are a few setæ as long as the leg. From the second joint behind there is a second branch, consisting of about seven short joints, and furnished with long setæ. The third pair has two nearly equal branches on a two-jointed base, each consisting of five joints, the first of the joints oblong, the others short. Both branches are setigerous, but the posterior has quite long setæ, reaching as far back as the caudal spines. No siphon mouth was detected. The two caudal spines are about equal in length; the spines of the anterior angles pass off

more nearly transversely than in the preceding, and are as long as the caudal spines.

Individuals of this species were very abundant, in latitude 6° north, longitude 180° , on the 24th of May, 1841. Length, one-fortieth of an inch.

Figures 11 *a, b, c*, represent a very different kind of animal. It has a carapax like a neatly curved hemisphere, flattened in front, and with slightly projecting antero-lateral angles. In a lateral view, the extremity of the abdomen projects a little, and below the middle of the body the extremity of the trunk is seen. There is a single eye on the medial line near the front.

The abdomen is short and obtuse, and resembles much the abdomen of *Conchoecia*, so nearly, indeed, that we might suspect the animal to be young of a species of that genus, if the character of the mouth and shell were consistent with such a view. It has two series of short spines, the terminal pair being the longest; and above these a short distance there is another spine, as seen in the profile view.

The mouth has the form of a large trunk, which is truncate and broad at the extremity, and has a short spine at the angles of the extremity, with a ciliate margin between. The exact nature of this trunk we do not understand.

There are six pairs of jointed appendages, two antennary, one pair probably maxillary, and one pair corresponding to a pair of feet. The antennæ are five-jointed and setigerous; the third joint is largest, being broad and nearly obovate. The second and third pairs are two-branched. The base of the second has an oblique process directed inward below, and furnished with short setæ, which resembles the inner process of a maxilliped, and shows the normal relations of the legs to a pair of maxillæ, if not to the mandibles. One of the branches has five very short transverse terminal joints, and is furnished with longish setæ. The other branch is three-jointed and setigerous; the first joint of the three has a short process on the posterior side. The third pair has two equal three-jointed branches on a stout base, and the setæ of the two are nearly equal in length. The length of the animal was one-fortieth of an inch.

Found abundantly off the north side of Upolu, February 24th, 1841. It is provisionally named by the author *Aspistes scabricaudis*.

Figures 7 *a*, *a'*, *b*, *c*, represent a young individual probably of the *Corycæus deplumatus*. It was obtained October 13, 1838, along with that species. Fig. 7 *a'* is a side view of the abdomen and posterior part of thorax; *b*, the antenna; *c*, the organs of the following pair.

Figure 8 may possibly be young of a Schizopod. It was obtained at the east entrance of the Straits of Sunda, March 5, 1842.

In all the young animals of the Cyclops and Caligus groups of species, there are six pairs of appendages in their earliest state, and the anterior of these pairs, in the species examined by the author, is a *pair of antennæ*, corresponding evidently to the posterior antennæ of adults. We draw attention to this fact, from its bearing upon the homologies of the young in other groups.

II. ARACHNOPODA OR PYCNOGONOIDEA.

THE Arachnid Entomostraca have been made a special study by Johnston,* Kröyer,† and Quatrefages;‡ Johnston drew out the first lucid description and arrangement of the genera; Kröyer gave more definiteness to our knowledge of the external structure of these animals, and corrected some erroneous notions with regard to the relations of the parts; and Quatrefages has developed with much beauty their internal anatomy. Other authors have contributed to this branch of science, among whom Edwards,§ Erichson,|| and Good-sir,¶ are the more prominent.

* G. Johnston, M.D., *Miscellanea Zoologica*, *Mag. of Zool. and Botany*, i. 368.

† *Nat. Tidsskr.*, iii. 299, and [2], i. 95, and Oken's *Isis*, 1841, 714, 1846, 429.

‡ *Ann. des Sci. Nat.* [3], 1844, iv. 69.

§ *Crust.*, iii. 530.

|| *Entomographie*.

¶ *Jameson's New Edinb. Phil. Jour.*, xxxii. 136, 1842, xxxiii. 367; *Ann. Mag. N. Hist.*, xv. 293, 1845.

Affinities of the Arachnoid Entomostraca.—Much doubt has existed with reference to the place of the species in the subkingdom Articulata, whether they belong with the Arachnida or Crustacea. Johnston, Edwards, Kröyer, and Quatrefages, arrange them with the Crustacea, though Edwards* observes, that he does it with much hesitation; while nearly all the earlier authors, with Latreille,† and more lately Erichson, have placed them among Arachnida.

The Articulata are naturally divided into two parallel series—one consisting of species fitted especially for terrestrial life, and using the air directly in respiration, and the other fitted for aquatic habits, and using the water in respiration. Among the former, there may be aquatic species; but the mode of respiration is still but a slight modification of the general type for the group. So there are terrestrial species in the second division; but these have the same organs essentially as the aquatic, and require moisture in the air in order to carry on their functions of respiration. Crustacea in the second division are parallel with Insects and Arachnida in the first; while Annelida in the second, are analogues of Myriapoda in the first.

The Pycnogonoidea are those aquatic species that most resemble Arachnida. Yet along with the resemblance, there is the grand distinction which lies between the two sections of Articulata above explained. The mode of respiration is Crustacean; it is aquatic in *type*, and not merely by adaptation. In Crustacea, respiration takes place by means of the surface of some part of the body, or of its appendages, these parts having thin integuments, so as to allow of the circulating fluid taking air from the water in which the parts are bathed; some species have proper gills, others lamellar appendages to the thoracic or abdominal legs, others expose only the surface of the body for this action. Of this last class are nearly all the Entomostraca, and with them the Pycnogonoids.

On this ground these species are properly arranged with Crustacea, and among them they have their closest analogies, although presenting other relations to the Arachnida.

Structure.—Kröyer has drawn out an excellent general view of the succession of parts in the species of this group.

They are as follows:—

* Edwards, Crust., i. 230, iii. 530.

† Cuvier's Animal Kingdom.

1. The trunk, with the mouth aperture at its extremity.

2. The ophthalmic segment, as he names it ("Augenring") or *cephalic*, as we should call it, bearing 1, *above*, the eyes, four in number coalesced on a spot of pigment; 2, *below*, three pairs of appendages, some or all of which may be obsolete.

These appendages are, *first*, a jointed organ, usually stout and elongate, and generally subchelate, arising from the anterior part of the segment; *second*, a more slender palpiform organ, five- to nine-jointed, adjoining the preceding, and generally considered a palpus to the same normal pair of organs; *third*, another pair of jointed organs, folding up below the body, proceeding from the posterior and inferior part of the segment, and occurring usually in both sexes, according to Kröyer, though obsolete in some genera: these organs are seven- to eleven-jointed, and smaller than the following pairs of legs, and end commonly in a claw.

3, 4, 5, 6, are transverse segments, bearing each a pair of long terete legs, consisting of nine joints, the last being a claw.

7. A caudal appendage, which in a single genus, *Zetes*, Kröyer, consists of two distinct segments, the first with several setæ at apex.

The homologies of these parts have been variously interpreted by different authors. The trunk is described as the *head*, by Milne Edwards,* and the following four segments as the thorax, the first of these segments, including both the ophthalmic and the first leg-bearing segment behind it, the two being generally imperfectly separated. Kröyer calls the trunk and ophthalmic ring together the head, and the following four leg-bearing segments the thorax. Johnston describes the ophthalmic segment as the proper head, and the trunk as an appendage to it or proboscis.

Of these views, that of Dr. Johnston appears to be most correct. For the elucidation of the subject of homologies we should compare the species with other sucking Crustacea. Here are their truest homologues, and not among Spiders, a distinct series of Articulata.

In the Caligoidea, we find, in the *first* place, a *moveable trunk*. This trunk contains a pair of mandibles, enclosed by the transformed upper and lower lips; and either side there is a single pair of maxillæ. In *Argulus*, the maxillæ are wanting, unless they are represented in the spiculum and its sheath, a suggestion made on a former page.

* Crust., iii. 530.

The following organs in the Caligoidea are legs. The mouth organs hence correspond to but two normal segments, the mandibular and maxillary. The legs are twelve in number, and with the preceding, make in all *sixteen* appendages.

For farther comparison, we observe, that in the Cyclopoidea, the mouth organs include two pairs of organs, besides the mandibles, and the legs are ten or twelve in number, making in all *sixteen* or *eighteen*. In the Cyproidea, the number of appendages counting from the mandibles is *ten*. In *Limulus*, the number is *ten*, besides five thoracic lamellæ behind, corresponding to five additional pairs. In the Pycnogonoids, the proboscis appears to correspond to the buccal trunk of *Caligus*; and all that exists of the anterior segment of the body, or the head if we may so call it, is the small segment bearing the eyes. If, therefore, we should cut out a small medial portion from the *Caligus*, so as to keep the eyes and trunk, and perhaps some adjoining appendages, we should have, in some respects, a representative of the Pycnogonum structure, which would be rendered more complete by elongating the trunk, and reflexing the segment, so as to make the trunk terminal upon the head.*

The *anterior appendages of the* cephalic or ophthalmic ring next demand consideration. As this segment bears the trunk as an appendage, instead of being a posterior ring, its appendages are not necessarily posterior to the mouth in their normal relations. On the contrary, it is quite as probable, that the first pair of organs may be normally *antennæ*, anterior to the mouth or the mandibular ring. In fact, they are often somewhat higher in position, rising more nearly from the upper part of the segment, as if of this character, and this view is sustained by various considerations. The prehensile form is in favour of it; for it is the prevailing form throughout the sucking Crustacea, as well as in other species, as the *Corycæi*, *Sapphirinæ*, and *Limuli*.† This then is no objection. In *Dichelestion*, which has the narrow articulated body almost of a Pycnogonoid, although of another type in its legs, these organs project in front, and are ancoral.

The study of the young or embryonic forms of the species gives

* The usual coalescence of the cephalic segment with the first thoracic segment finds an analogy in the genera *Tanais*, *Caprella*, and many others.

† No organs undergo wider variations of structure; they may be legs, hands, oars, or simply antennæ, according to the group: and in most of the Entomostraca they are in some way used for attachment or for prehension.

still stronger support to this view. Kröyer has figured the young of several species in his *Tidsskrift*, vol. iii., and has given other figures in the *Crustacea of the Scandinavian Voyage*. The early young have three pairs of appendages, like those of *Caligus* and the *Cyclopoidea*; and as in those groups, the first pair is evidently second-antennary. The figures show that it is plainly anterior or superior to the trunk or mouth. Moreover, the organs have the chelate form found in adults, so that there is no doubt as to their being the same organs in the two.

The common idea that these organs are mandibular is unsustained by any observations. Before admitting this as their character, it would be necessary to discover that the base or a process from it contributes to the mandibular function within the trunk. But of this there is no proof, and more than this, there is no reason to suspect it. There is no instance of a mandible becoming so completely a leg, as to lose wholly the mandibular function, even of its basal portion; this would be a violation of analogy. Even in *Limulus*, where the transformation of the mandible is most complete, the basal joint retains the mandibular character. Neither have we better evidence that the organs are maxillary.

The *second pair of appendages* arises from alongside of the first, and so closely upon the same base, that one has been called the palpus to the other. In some cases the cephalic segment projects either side, like the thoracic segments, and upon this projection or common base stands the chelate organ and its so-called palpus; and Goodsir figures a species, which he calls *Pephirodo capillata*, with the palpus arising from the side of the first joint of the chelate branch.* There is reason, therefore, for considering the second organ as a part of the first, and so we deem it. It appears to be the accessory branch, similar to what occurs in many *Cyclopoidea* and other *Entomostraca*. In *Argulus*, there are the two branches similarly related; the anterior is prehensile and like the second antenna in *Caligus*, while the posterior is palpiform.

We therefore conclude, that both organs are parts of a pair of antennæ, and normally the second antennæ, those of the first pair, as in *Argulus*, being wanting.

The *third pair of appendages* of the same segment, are evidently

* Jameson's *Jour.*, xxxii. pl. 3, fig. 9.

posterior to the trunk in their normal relations. If the trunk, like that of *Caligus*, corresponds to the mandibles and lips alone, then these legs may be analogues of the maxillæ, organs which in *Caligus* are a little remote from the trunk. But if the maxillæ are obsolete, or the trunk includes them in its constitution, as is possible and even probable, considering that the maxillæ in the Caligoidea are obsolescent and never elongated into proper legs, it will then follow, that the legs referred to correspond to the slender didactyle legs (first pair) of *Caligus*, or the tubular legs of *Argulus*, and to the maxillipeds (or second pair of maxillæ) in the Cyclopoidea and Cyproidea.

The four pairs of legs which follow, will, on the first supposition, correspond to the first four pairs in *Caligus*, two subprehensile pairs and two natatory, making the whole number of normal appendages *twelve*: on the second, to the second or prehensile pair, and three pairs of natatories, making the total *fourteen*. In *Cythere*, among the Cyproidea, we find ten appendages behind the antennæ, the six posterior of which are proper feet, and not natatory appendages; and this group may perhaps illustrate this point in the structure of the Pycnogonoids, rather than the Caligi. In fact, the Entomostraca take this pediform character for the feet and lose the natatory pairs, only among the Cyproidea and Limuli; and hence we may properly trace the transitions to the terrestrial Articulata, through these few-footed species.

On this ground, we make out the most probable view of the homologies of the parts in the Pycnogonoids to be as follows:—

APPENDAGES.	NORMAL HOMOLOGUES.
1. First and second pairs.	Second antennæ, two-branched.
2. Moveable trunk.	Mandibular and first maxillary segment.
3. Inferior or ovigerous legs.	Second maxillary (first pair of feet in <i>Caligus</i>).
4, 5, 6, 7. Pairs of feet.	Next four segments following.

If we should suppose still another pair of maxillæ embraced normally in the moveable trunk, then the four pairs of legs would be homologous with the four pairs of natatories in *Caligus* and *Cyclops*, and the inferior legs, with the first or prehensile pair in these genera. But of this we have no evidence.

The legs in the Pycnogonoids consist each of *nine* joints, the antepenult of which is very short, and the last a claw. From the cha-

racter of the legs of insects, and the usual structure of the antennæ in Crustacea, we may justly infer that this abnormal number arises in part, at least, from a subdivision of the terminal part of the legs. In a figure which Kröyer gives of a young of *Nymphon grossipes*,* the first pair of these legs has the full number *nine*; the first three of these short, the next three long, the seventh short, eighth long, the ninth a claw; the second pair has but seven joints, the first three short and the next three long, just like those of the first pair; the leg in this condition has seven joints, and looks like ordinary Crustacea legs, with the terminal claw. It hence follows that the additional joints are formed at or near the extremity, and probably by a subdivision of the penult.

The *third pair of legs* in the same figure are represented as partly developed, being only four-jointed; the first joint is here the longest, and evidently includes the first three of the perfect leg, and these result by natural fission. The second pair of legs is therefore normal in its joints, except that it has one too many; but this is probably the first, for in many Amphipoda and Isopoda the epimeral segment is properly a basal joint to the legs, and if counted, would make the number *seven*. The first joint in the legs may therefore correspond to the epimeral segment in other Crustacea.

This subject derives much interest and some elucidation from a comparison with the structure in the Arachnida, and also reflects light upon that and other departments of Articulata.

In the Arachnida, the mouth organs consist of—

1. A pair of mandibles.
2. A pair of maxillæ.
3. A lower lip corresponding to a second pair of maxillæ. There is also a simple upper lip which comes into the series.

Judging both from embryology and the simplest forms of articulate life, the Rotatoria, we may believe the mandibles to be the fixed determinate centre through the whole series. The simplest form of life above vegetation, has a mouth opening, and the first step above this, consists in the presence of a pair of mandibles; and from this pair as the centre, developments go on towards the more complex forms. This fact gives the highest importance to these organs as marking a

* Voy. Scand., pl. 39, f. 1 *d*.

definite equatorial line, so to speak, from which to reckon in either direction. Hence, in tracing the homologies in view, only parts posterior to the mandibles, in one section of the Articulata, can correspond to parts so situated in another section. On this account, the upper lip need not be brought into our comparison, even were it a transformed pair of appendages; and for the same reason also, we may doubt strongly its having this supposed relation, as it exists also in Crustacea anterior to the mandibles, and notwithstanding the various transformations which the other parts undergo, it retains quite uniformly the same general character through all the grades of species.

There is also in Insects or Arachnida a languette, adjoining the lower lip, which it has been suggested may be analogous to another pair of maxillæ. It seems more probably to be an appendage of the lip, if not of the fleshy parts below, and has been so considered by different entomologists. The lower lip itself is evidently a true pair of maxillæ, as the attached palpi present in Insects show. Yet it does not follow that the lower lip in Crustacea has the same relations, although having the same name. We have given reasons for rejecting this conclusion with regard to Crustacea in another place, where we sustain the common view, that it is a mere fold of the skin. Another strong reason for this opinion is found in *Limulus*, in which the lower lip, instead of following, as usual, the mandibular legs, is situated posterior to the fifth pair of legs, the basal joint of all these legs occupying the mouth opening. The lip, therefore, takes its position from the character of the mouth, and is not fixed in position like a pair of normal appendages.

These remarks have been thought necessary to remove objections that might come up, to the view we would present. The facts thus lead us to conclude that the normal parts essential to the mouth of Arachnida are but three pairs—a pair of mandibles and two pairs of maxillæ; and this conclusion is essentially the same that is presented by Latreille.* The number of organs in Arachnida, counting from the mandibles, will hence be fourteen, the same number as in the Pycnogonoids, and the two groups will be parallel, as follows:—

* Cuv., Règne Animal, notes to General Remarks on Insects and Crustacea, and Arachnida.

ARACHNIDA.

1. Mandibles.
2. Maxillæ.
3. Labium or second maxillæ.
- 4, 5, 6, 7. Legs.

PYCNOGONOIDEA.

- | | |
|--------------------|--|
| 3. Ovigerous legs. | { Trunk corresponding to 1, mandibles, and 2, maxillæ. |
| 4, 5, 6, 7. Legs. | |

Internal Structure.—Upon this subject, we enter into no discussions, simply referring to our figure 2, Plate 96, made February, 1842 (and therefore, before having seen the researches by Quatrefages, which were published in 1844). It represents the alimentary cavity as a tube running the length of the body, and sending a branch into each leg to its extremity, besides two branches into the trunk.

Arrangement of the Pycnogonoidea.

FAM. I. NYMPHIDÆ.

Antennæ elongatæ, 1-2-ramææ.

- G. 1. NYMPHUM, *Fabr.**—Antennæ biramææ, ramo crassiore chelato, altero 5-articulato. Truncus ad basin vix angustior. Abdomen uni-articulatum.
- G. 2. AMMOTHEA, *Leach.*—*Nympho* affinis. Ramus antennæ longior 9-articulatus.
- G. 3. ZETES, *Kröyer.*†—Antennæ biramææ, ramis gracilibus. Truncus ad basin multo angustior. Abdomen 2-articulatum.
- G. 4. PALLENE, *Johnston.*—Antennæ uniramææ, chelatæ, sat crassæ. Abdomen 1-articulatum. Pedes 1mi (ovigeri) 11-articulati.
- G. 5. PHOXICHILIDIUM, *Edw.*‡—*Pallene* affinis. Pedes 1mi (ovigeri) 5-articulati.
- G. 6. PASITHOE, *Goodsir.*§—Antennæ uniramææ, non chelatæ, graciles.

FAM. II. PYCNOGONIDÆ.

Antennæ nullæ.

- G. 1. PYCNOGONUM, *Brünnich.*—Pedes breves. Pedes ovigeri 10-11-articulati.
- G. 2. PHOXICHILUS, *Latr.*—Pedes prælongi, gracillimi.

* *Pepredo*, H. D. S. Goodsir, Jameson's J., xxxii. 137.

† Tidsskr. [2], i.

‡ *Orythia*, Johnston, Mag. Zool. Bot., i. 378.

§ Jameson's Jour., xxxiii. 367.

PYCNOGONUM ORIENTALE.

Cephalothorax stellatus, segmentis medio connatis, deinde liberis. Abdomen breve, posticè angustius, obtusum. Truncus buccalis oblongus, subcylindricus, corpore vix brevior. Segmentum cephalicum non transversum, posticè angustius e segmento sequente non discreto. Pedes crassiusculi, nudiusculi, articulo primo vix oblongo, sequentibus quinque subæquis, tertio paulo brevior.

Cephalothorax stellate, segments connate only at middle. Abdomen short, narrowing behind, obtuse. Buccal trunk oblong, subcylindrical, hardly shorter than body. Cephalic segment not transverse, narrowing behind, not separated from the following segment. Feet rather stout, nearly naked, first joint hardly oblong, next five subequal, third a little shorter.

Plate 96, fig. 2 *a*, animal (mutilated), enlarged; *b*, body of same, more enlarged, showing the branching of the alimentary cavity; *c*, appendage to cephalic segment, corresponding to the ovigerous legs.

From a coral reef in the Balabac Passage. Collected, February 11, 1842.

Length of body, including trunk, nearly one and a half lines; span of legs, two and a half lines.

In a paper in the Proceedings of the American Academy of Sciences, we made for this species the new genus *Astridium*, based on the small size of the appendages on the under side of the cephalic segment, properly the ovigerous legs. It is still possible that the genus is a good one. Yet we suspect that these legs may have been in a half-developed state; and that the species may be a true Pycnogonum. They were imperfectly three-jointed, and quite short, not exceeding in length the breadth of the cephalic segment. The form of the cephalic segment is a little peculiar, being much narrower at base than anteriorly. On either side, in front, there was a slight protuberance and an obscure spot within, but the antennæ were wanting. The legs have a few short setæ, none half as long as breadth of joints.

Astridium orientale, DANA, Proc. Amer. Acad. Sci., ii. 61, 1849.

SUBCLASS III.

C I R R I P E D I A.

THE relations of the Cirripeds to Crustacea are mentioned in an early page of this Report. This therefore is the proper place for the description of the species of the Expedition. The author has, however, paid the subject little attention beyond the examination and figuring of a few species, represented on Plate 96; they have been in better hands, those of Dr. A. A. Gould, who has treated of this department in his Report on the Mollusca of the Expedition. The subject, moreover, is receiving a thorough revision from C. Darwin, Esq. →

Among the figures of the Plate referred to, there are several of Cirripeds in the young state. Figures 5 *b*, 6, 7, 8, represent different species in their free swimming state, and 6 *e*, *f*, show the characters of the thorax and abdomen in this state, the six pairs of swimming legs, and the two-jointed abdomen, with a pair of short caudal stylets, ending in plumose setæ. In 6 *c* and 7 *b*, the position of the two eyes is seen, either side of the anterior part of the body. 6 *d* shows the form and character of the arms, which correspond to the second pair of antennæ in the Cypris and other Entomostraca. There are five joints and a disk for attachment on the side of the third of these joints.

After a change of skin, these arms are seen to be combined in a single organ for attachment, as in fig. 69, with each of the component arms still in part distinct, the two terminating in a broad disk, which is two-lobed, being in form like two united disks. 3 *a*, exhibits the animal thus attached to a supporting surface. After another change of skin, the two valves of the young animal were observed at the base of the pedicel, and the Cirriped had taken on its mature form.

From these transitions the relation of the antennæ of the young to the pedicel of the mature animal is obvious. Both have the same base; and the lower part of the pedicel at least is the homologue of the disk terminating these antennæ. The upper part may be, as Darwin suggests, an elongation of the proper head of the Cirriped.

Of the figures here referred to, figure 3, is from a species collected off Tierra del Fuego, on floating sea-weed; 5, was taken in the Pacific, latitude 30° north, longitude 179° east; 6, January 21, 1839, in latitude 40° south, longitude 55½° west; figures 7, 8, in latitude 2° north, longitude 18° west, on October 30, 1838.

A REVIEW

OF THE CLASSIFICATION OF CRUSTACEA, WITH REFERENCE TO CERTAIN PRINCIPLES OF CLASSIFICATION.

THE class Crustacea exhibits a clearness of outline in its types, and a display of relations, transitions, and distinctions, among its several groups, exceeding any other department of the animal kingdom. This fact arises from the very great range in structure occupied by the species. The limits in size exceed those of any other class, exclusive of the Radiata; the length varying from nearly two feet to a small fraction of a line, the largest exceeding the smallest lineally more than a thousand-fold. In the structure of the limbs, the diversity is most surprising, for even the jaws of one division may be the only legs of another; the number of pairs of legs may vary from fifty to one, or none. The antennæ may be either simple organs of sense or organs of locomotion and prehension; and the joints of the body may be widely various in number and form. In the branchial and the internal systems of structure, the variety is equally remarkable; for there may be large branchiæ, or none; a heart, or none; a system of distinct arterial vessels, or none; a pair of large liver glands, or but rudiments of them; a series of ganglions in the nervous cord, or but one ganglion for the whole body.

Taking even a single natural group, the Decapods;—the abdomen may be very small, without appendages, and flexed beneath the broad cephalothorax out of view, or it may be far the larger part of the body, and furnished with several pairs of large natatory appendages;

the inner antennæ may be very small, and retractile into fissures fitted to receive them, or they may be very long organs, constantly thrown forward of the head; and descending but a single step, we come to species of Decapoda without proper branchiæ, some having the abdominal legs furnished with branchial appendages, and others with no abdominal members at all.

When we consider, that these diversities occur in a class that may not embrace in all over ten thousand species (not half of which are now known), we then comprehend the wide diversity in the distinctions that exist. The series of species followed through, gives us an enlarged view of those distinctive characteristics upon which the limits and relations of groups depend. The network of affiliations, it is true, is like that in other departments; but it is more magnified to the view.

Moreover, the distinctions are obviously distinctions of rank. There is no ambiguity as to which is the higher or superior group, as among Insecta. The variations are manifestly variations in grade, and we may readily trace out the several steps of gradation, as we descend from the highest Brachyura to the lowest Lernæa. And while we so readily distinguish these gradations, we as plainly see that they are not steps of progress followed by nature in the production of species; but, simply successive levels (grades of types), upon which species have been multiplied.

We, therefore, may consider the class Crustacea as especially well adapted for instruction in some of the higher principles of classification in Zoology; and, if we mistake not, laws may be educed which have not hitherto taken form in science. These have already been partially alluded to in the previous pages of this volume. But we here bring together the facts in a connected view, in order to state the principles more definitely, and exhibit the full extent of their bearing. We leave out, however, a large part of the details, which may be found elsewhere in this Report.

The fundamental idea, which we shall find at the basis of the various distinctions of structure among the species is, the *higher centralization of the superior grades, and the less concentrated central forces of the inferior*,—a principle which has been applied to the animal kingdom in some of its larger subdivisions, but which has not been followed out into all the details of structure exemplified among Crustacea.

This centralization is literally a *cephalization* of the forces. In the higher groups, the larger part of the whole structure is centred in the head, and contributes to head functions, that is, the functions of the senses and those of the mouth. As we descend, the head loses one part after another, and with every loss of this kind, there is a step down in rank. This centralization may be looked for in the nervous cords; but the facts are less intelligibly studied there, than in the members, the production and position of which measure the condition of the forces:—just as we can better measure the forces of a galvanic battery by the work done, than by the size or external appearance of the plates which constitute it.

In the Crustacea type, there are normally twenty-one segments, and correspondingly twenty-one pairs of members, as laid down by Milne Edwards, the last seven of which pertain to the abdomen, and the first fourteen to the cephalothorax. Now, we may gather from an examination of the crab, or Macroural Decapod, acknowledged to be first in rank, what condition of the system is connected with the highest centralization in Crustacea.

In these highest species, *nine* segments and nine pairs of appendages out of the *fourteen* cephalothoracic, belong to the senses and mouth, and only *five* pairs are for locomotion. Of these *nine*, three are organs of senses, six are the mandibles and maxillæ. Moreover, these organs are clustered into the smallest possible space, so that the six pairs of mouth organs hardly occupy more room than the first pair of legs. The organs are all small, the antennæ exceedingly short, the maxillæ small lamellar organs sparingly jointed. The vegetative powers of growth have had but little play. The inner antennæ are rather large as regards the basal joint, which is devoted to one of the senses, but the rest is nearly rudimentary, and the whole is snugly boxed away, to be extruded at the will of the animal. The exterior maxillæ (or outer maxillipeds) cover exactly the other pairs, and shut closely down over the mouth, like a well-fitting operculum to the buccal area.

We hence learn, that the condition of highest centralization in Crustacea, is where the cephalic part embraces the largest portion of the normal structure of the cephalothorax, and the whole is contracted within the smallest compass, with the least vegetative growth or elongation of the parts. The forces are concentrated in the more perfectly developed senses and the higher functions of the animal—not in giving size to the organs of the senses, but acuteness to the

sensorial function. The perfection of the senses is evinced by the small antennæ; for we infer therefrom, not only that the organ is exclusively an organ of sense, but also, that the delicacy of the sense itself is such, as not to require a long-jointed appendage to aid the function.

This *cephalization* of the animal is farther observed in the structure of the rest of the thorax and the abdomen. The abdomen, in the first place, is reduced to its minimum size. Vegetative elongation is here cut short, as in the anterior part of the animal; and the sphere of growth has a narrow limit, owing to the very intensity of its concentration; and we find that the limit widens as the intensity diminishes.

Again: the central power is indicated by the fact, that the first pair of legs is the strong pair; being properly hands, they contribute especially to the higher functions, that is, the support of the living animal, through their strength and powers of prehension, and not like the following, to locomotion. Thus, as we pass from the centre, the organs are of more and more humble function.

This *centre*, as we have observed in another place, is properly between the second antennæ and mandibles. The second antennæ and the rudimentary mouth, are among the first parts that appear in the embryo. If we look at it as a centre of force or of growth, we remark that the radii on opposite sides of this centre, before and behind, are very unequal, the latter being six or eight times as long as the former, —a relation which is the inverse of the functional importance of the parts pertaining to each.

Our idea of the condition of highest centralization is thus drawn from a study of the species.

The most perfect state of it is seen in the *Maia* group, in which the bases of the antennæ and eyes are crowded into the narrowest possible compass, and the mouth organs are well compacted within the buccal area, and the legs and whole system have the highest completeness.

The form of the body of a *Maia* is a somewhat flattened ovoid, narrowest in front; and the middle point between the mouth and the second antennæ, which we call the potential centre of the animal, is situated near the front, say about half an inch from the front outline (excluding the beak), supposing the cephalothorax three inches long. We may call the part anterior to this centre, *A*; the part posterior, *B*; and the length of the former, measured on the axis, *a*; of the latter, *b*. These parts may be viewed, as regards development, as

potentially equal; and yet the anterior, A, is six times shorter and as much narrower and lower than the following. It would not, therefore, be far out of the way to say, in mathematical language, that the functional importance of the two parts varies inversely as the cubic contents of the parts.

We pass now to the degradations from this, the highest type.

These degradations are seen—

First, in a widening of the space between the antennæ.

Second, in a slight enlargement of the outer maxillipeds, so that they do not fit snugly over the buccal area.

Third, in an elongation of the antennæ.

These are all evidences of a slight relaxing of the concentrating element. The *first*, marks the transition of the Maia group to the Parthenopidæ, and thence to the Cancridæ. The *second*, carries the grade a step lower, to species of the old genus Cancer, also to the swimming crabs and the Corystoids; and the *third*, marks off the Corystoids as the lowest of the true Brachyura.

While there are such marks of degradation exhibited through the growth or elongation of parts, there is also a mark, equally significant, in the obsolescence of the posterior thoracic legs, a peculiarity of many Grapsoids. In the Maioids, the species are well balanced; the type is perfect in its development: the sustaining of the central functions allows of the full and complete growth of all the other parts. But the diminution of force may not only be attended with a loosening of the cephalic hold on the remoter of the cephalic organs, but also, in a failure in the production of the posterior organs of the body, or those on the outer limits of the system: and this is what happens in many Grapsoids. The swimming form of the legs in Lupa and allied species is a similar mark of inferiority.

Besides the above evidences of degradation, there are still others in the Brachyural structure, which act conjointly with the preceding, producing lower grades of species. They are all marks of a relaxation of the centralization.

Fourth. An enlargement or widening of the sternum and abdomen.

Fifth. The abdomen becoming somewhat relaxed from the venter instead of remaining close-appressed to it.

Sixth. The vulvæ becoming more remote from one another, being situated in the bases of the third pair of legs, instead of the sternum.

Seventh. The inner antennæ losing their fossettes, and being constantly exsert.

Eighth. The branchiæ being more than nine in number on either side.

The first of these peculiarities distinguishes many of the Grapsoids, as well as lower species. The second is observed in the Corystoids, and is an additional mark of their inferior grade. The third occurs in *Dromia* and allied. The fourth, in *Latreillia*. The fifth, in *Dromia*. *Dromia* and *Latreillia* have the posterior legs abbreviated, and in *Dromia*, this evidence of degradation is still stronger, in that the fourth as well as fifth pair is short and dorsal.

The last three characteristics, above mentioned, mark a transition towards the Macroural type, and the genera of this kind belong with the Anomoura. This transition is seen further in—

Ninth. The eyes being without fossettes.

Tenth. The second pair of antennæ becoming exterior to the eyes.

Eleventh. The outer maxillipeds more enlarged and subpediform.

Twelfth. The abdomen more lax and furnished with a pair of caudal appendages.

Thirteenth. The abdomen more elongated, and hardly inflexed.

These several changes exhibit a continuation of the process of relaxation in the central forces. There is thereby an enlargement of the antennæ, and their more remote position at the anterior extremity of the animal; and also, an enlargement of the posterior or abdominal parts of the animal, and a development of appendages in the posterior direction. These marks of degradation, excepting the thirteenth, are found in the Hippa and Porcellana groups, and the thirteenth in the Paguridea. At the same time that these Macroural characteristics appear, the body becomes elongated. The species all bear a stamp of imperfection in the abbreviated posterior legs, as explained above, as well as in the other points alluded to. The subordination of the nine anterior annuli to cephalic functions, which is so striking in the Maioids, has become less and less complete, and the organs less perfect; moreover, the habits of the animals are more sluggish, and they are less fitted for self-preservation. The large *Dromia* picks up a waste shell, and by means of its hind legs, lifts it over its body for protection, and the *Pagurus* finds shelter in the water-worn univalves of a coast.

The degradation pointed out, is hence, not merely a variation in the position and size of certain organs, but an actual deterioration in rank and intelligence.

Other minor points exhibiting difference of grade, might be mentioned: but they have already been subjects of remark. We state here only one—the character of the fingers of the large hands. In the higher species, these fingers are pointed; in a grade below, in some groups, they have a spoon-like extremity. This excavate form is often more perfect in young individuals than in adults, which is one evidence that it is in fact proof of inferiority. By this mark we learn that the *Chlorodinæ* are of lower grade than the *Xanthinæ*; the *Paguri*, than the *Bernhardi*; the *Mithracidæ*, than the *Maiadæ*, etc.

Let us pass now to the *Macroura*. In the typical Macroural species, the antennæ, instead of being minute, with the inner retractile, are long exsert organs, and the outer have a large plate as an appendage at base; the eyes are without sockets; the outer maxillipeds are pediform, and do not closely cover the other mouth organs; the abdomen is often longer than the rest of the body, and has its six regular pairs of appendages. All these points show a still further relaxing of the centralization or cephalization of the species. There is an elongation of the parts anterior to the mouth, and also of those posterior, and this elongation of the two extremities is approximately proportional to the relative dimensions of the corresponding parts in the Brachyura. If we were to draw out an ovoid with the relative length and breadth of a Macroural cephalothorax, and place its focus so as to correspond with the position of the posterior margin of the epistome, in a manner like that proposed for the Maia among Brachyura, the ovoid would be very narrow, and the focus or centre proportionally farther from the front than in the Brachyura.

In following down the degradation of the Brachyura to the Anomoura, we have found the posterior legs becoming abbreviated, and the whole structure in its aspect imperfect. But, in the typical Macroura, there is nothing of this seeming imperfection. The legs are all fully formed; the animals are exceedingly quick in their motion, instead of being sluggish; and every organ is apparently in its most perfect state for the uses of the system to which it is tributary. We should, therefore, understand, that the process of degradation, alluded to above, is not one actually passed through in the system of creation;

for by its progress we should never reach the Macroural structure; nor, in the reverse order, should we from the Macroural reach the Brachyural structure. In the remarks above, we speak only of the comparative actual conditions of the species as regards centralization.

The Macroura and Brachyura belong to subordinate, yet correlated types of structure, each perfect in itself, and admitting of wide modifications, and having its own system of degradations. We add a few words on these degradations among the Macroura. We have seen that, in the Brachyura, the powerful prehensile legs are those of the *first pair*, these acting for the collection of food, and so contributing to the mouth. In the Macroura, there are species of high rank that have the anterior legs strong-handed, like the Macroura. There are others, in which the second or third pair is the strong-handed pair; others having all the legs weak appendages, with only rudimentary hands or none. The several marks of degradation are as follows:—

First. The outer maxillipeds pediform.

Second. The maxillipeds next anterior pediform.

Third. Second pair of legs cheliform and stouter than the first.

Fourth. The third pair of legs cheliform and stouter than either of the preceding.

Thus as we descend, we find one and even two pairs of mouth appendages beginning to pass from the mouth series to the foot series, and the cephalic portion is thus losing its appendages and high centralized character. Moreover, the power belonging to the first pair of legs in the higher species is transferred to the second pair of legs, as in the Palæmons; or, to the third pair, as in the Penæidæ; indicating a further decrease of that centralization so remarkable in the Brachyura. Still lower among the species, as in the Sergestidæ, all the legs are weak, and the posterior pair may be short or obsolete,—the same deterioration that occurs in the lower Brachyura.

As we descend farther, there is an increased obsolescence of organs, and every step is one of marked imperfection as well as degradation.

Fifth. The branchiæ become external and small.

Sixth. The branchiæ become wholly wanting, or part of the abdominal appendages.

Seventh. The last two pairs of thoracic legs become obsolete.

Eighth. The abdominal appendages become obsolete.

Ninth. The eyes and antennæ have separate segments, and the abdomen is very long and large.

The fifth point of degradation is seen in the *Euphausidæ*; the sixth, in the *Mysidæ* and other Anomobranchiates; the seventh is found in several genera of the same group; the eighth in certain *Mysidæ*. The Anomobranchiates are thus degraded Macroura. There is not merely a relaxing of the centralization; but the forces are so weakened as not to succeed in finishing out the members in the system of structure to which they pertain. The species consequently are not modifications upon the level of the Macroural type, nor upon a distinct level or distinct type; but simply imperfect developments of the Macroural structure below the true level of that type. They bear nearly the same relation to the Macroura, that the Anomoura bear to the Brachyura. The *ninth* step is seen in the Squilloidea, whose relaxation of system and elongation in the cephalic part, as well as abdomen are remarkable.

The continuation of the line of degradation represented in the Anomoura, is not to be found, as we have remarked, among the typical Macroura. But the structure of the Paguri may be traced into the aberrant Macroura, called *Thalassinidea*; and thence, both in the abdomen, the legs, and the branchiæ, we observe a transition to the Squilloids, one division of the Anomobranchiates. If then, we were to trace out the lines of affinity in the species, it would be from the Mysis group to the typical Macroura, and from the Squilla group to the Thalassinidea, as elsewhere explained. From the latter, the lines lead mainly to the Anomoura and higher species.

In our review, thus far, we recognise one only of the *primary* types of structure among Crustacea. This primary type is characterized by having *nine* normal annuli or segments devoted to the senses and mouth, that is, to the cephalic portion of the body. It includes *two*, or, we perhaps may say, *three* secondary types. The first of these secondary types is the Brachyural; it has the antennæ small, the inner pair in fossettes, the abdomen without appendages. In the other type (or other two, if so considered), the antennæ are elongated, and both pairs free, the abdomen is elongated, and furnished with a series of appendages. This, the second type, is the Macroural; or, if we assume that it embraces two distinct types (a second and third), the two correspond to the typical Macroura and the Thalassinidea.

Each secondary type embraces types of more subordinate character, which it is unnecessary here to dwell upon.

There is a tendency in the lowest species to a transfer of the two posterior mouth appendages to the foot series, so as to leave but seven cephalic annuli; but it is only a modification of the primary type, as the species have every mark of being degraded or imperfect forms, and are not examples of a new type.

In this primary type, the species vary in length from half an inch to twenty inches. Two inches may be set down as the average length and breadth for the Brachyura; while three inches is the average length of the Macroura, the average breadth being half an inch or less.

The *second primary type* among Crustacea is as well defined in its limits, and as distinct in its characters as the first. Instead of having *nine* annuli devoted to the senses and mouth, there are but *seven*, the mouth, including a pair of mandibles, two pairs of maxillæ, and one of maxillipeds. The number is permanent and characteristic. There are, consequently, seven pairs of legs in these species, instead of five, the Decapod number; and the species have been appropriately styled the *Tetradecapoda*. Instead of exhibiting any appearance of imperfection, or any obsolescent organs, like those lower Macroura that show a transition to a fourteen-footed structure, the organs are all complete, and the whole structure is perfect in symmetry and unique in character. They have not a Macroural characteristic. The eyes are not pedicellate; there is no carapax, but a body divided into as many segments as there are legs (whence our name *Choristopoda*); the antennæ, legs, and whole internal structure are distinct in type. The branchiæ are simple sacs, either thoracic or abdominal.

We have, therefore, in the Tetradecapods an expression of that structure of body, and that size, which belongs to a system, in which but seven annuli or segments are concentrated in the cephalic portion of the structure. The structure is far inferior to the Decapodan. The size rarely exceeds two inches, though in extreme cases three to four inches; and probably *half an inch* is the average length. The contrast between the first and second of the primary types, is therefore as distinct in the average size of their structures, as in their actual grade or rank.

Superior rank among the Tetradecapods may be distinguished by some of the same points as in the Decapods. The short antennæ,

short compact bodies, and abbreviated abdomen of the Isopods, are proofs of their superiority of grade. The abdominal appendages are simply branchial, and in the higher species are naked or non-ciliated lamellæ. The transitions to a lower grade are seen in the elongation of these abdominal lamellæ, their becoming ciliated, and the abdomen being also more elongated and flexible; then in the abdominal lamellæ becoming elongated natatory appendages, and the abdomen taking a length usually not less than that of the thorax, as in the Amphipods, in which the branchiæ are appendages to the thoracic legs. And while this elongation goes on posteriorly, there is also anteriorly an enlargement of the antennæ, which in the Amphipoda are usually long organs. There are thus two secondary types of structure among the Tetracapods, as among the Decapods; a transition group between, analogous to the Anomoura, partakes of some of the characters of both types, without being a distinct type itself. These are our Anisopoda. The species graduate from the Isopod degree of perfection to the Bopyri, the lowest of the Tetracapods. There is thus another analogy between this group and the Anomoura.

The Trilobita probably belong with the second type, rather than the third. Yet they show an aberrant character in two important points. First, the segments of the body multiplied much beyond the normal number, as in the Phyllopoda among the Entomostraca; and Agassiz has remarked upon this as evidence of that larval analogy which characterizes in many cases the earlier forms of animal life. In the second place, the size of the body far transcends the ordinary Isopodan limit. This might be considered a mark of superiority; but it is more probably the reverse. It is an enlargement beyond the normal and most effective size, due to the same principle of vegetative growth, which accords with the inordinate multiplication of segments in the body.*

The *third primary type* (the Entomostracan) includes a much wider variety of structure than either of the preceding, and is less persistent

* Prof. Guyot very happily names the three great periods of geological history—usually denominated the Palæozoic, Secondary, and Tertiary, or, by Agassiz, the age of Fishes, that of Reptiles, and that of Mammals,—the *Vegetative*, the *Motorial*, and the *Sensorial* epochs;—the first, being the period characterized prominently by vegetative growth in animal life; the second, by the increased development of the muscular system, as exemplified by the enormous reptiles of the epoch; the third, by the development of the higher functions of the brain, exhibited in the appearance of mammals.

in its characteristics. It is, however, more remote in habit from the Tetracapods, than from the lowest Decapods, and is properly a distinct group. Unlike the Decapods and Tetracapods, there are normally but *six* annuli devoted to the senses and mouth in the highest of the species, and but *five* in others, the mouth including a pair of mandibles, and either one or two pairs of maxillæ (or maxillipeds). This is an abrupt step below the Tetracapods. We exclude from these mouth organs the prehensile legs, called maxillipeds by some authors, as they are not more entitled to the name than the prehensile legs in Tanais, and many other Tetracapods. There is an exception to the general principle in a few species. A genus of Cyproids has three pairs of maxillæ; but this may be viewed as an example of the variations which the type admits of, rather than as an essential feature of it,—possibly a result of the process of obsolescence which marks a low grade, as in the Mysidæ, whose abdomen by losing its appendages, approximates in this respect to the Brachyural structure, though, in fact, far enough remote.

The species of the Entomostracan type show their inferiority to either of the preceding in the absence of a series of abdominal appendages, and also in having the appendages of the eighth, ninth, tenth, and eleventh normal rings, when present, natatory in form.

The range of size is very great,—and this is a mark of their low grade, for in this respect they approach the Radiata, whose limits of size are remarkably wide. Nearly all of the species, and those which, by their activity, show that they possess the typical structure in its highest perfection, are minute, not averaging over a line in length, or perhaps more nearly three-fourths of a line.

Taking this as the true expression of the mean normal size of the type, the three primary types will vary in this respect as 24 (two inches) : 6 : 1.

The size in this third type, reaches its maximum in the Limuli; and these are unwieldy species, whose very habits show that vegetative growth has given them a body beyond the successful control of its weak system, that is, a larger frame than it has power to wield with convenience or defend, for it is at the mercy even of the waves upon a beach.

This type has its highest representatives among the Cyclopoids, which remind us of the Mysis group of the higher Crustacea. In these, the cephalic part includes *six* out of the fourteen cephalotho-

racic annuli. In the Daphnioids and the Caligoids, they include only *five*. In *Limulus*, only the first *four* can properly be counted as of the cephalic series. In many other Entomostraca, the mouth organs are nearly as perfect legs as in *Limulus*, and the species, although evidently of a low grade, cannot properly be removed from the group. *Limulus* has its nearest ally in *Apus*, although this genus has the mouth organs of a *Daphnia*.

The lowest species of the type are the Lernæoids.

A *fourth primary type* includes the Cirripeds. It is of the same rank as regards cephalization as the Entomostraca; yet, it has so many peculiarities of structure, that it should be regarded as a distinct type, rather than a subordinate division of the *third* type.

The mean size of the species of this group is much greater than the same among the higher Entomostraca. But if we regard the young in its active Cypris state, and compare it with the corresponding condition of species of Cyproids, we shall discover that the species have, in fact, an abnormal growth; a growth which takes place at the expense of the powers of motion or action in the individuals. The body, when it commences a sedentary life, increases in magnitude far beyond the Cypris or *Daphnia* size; and there is a corresponding loss of *power*. The same force will not move a heavy structure, that is sufficient for the tiny model; and when the model is enlarged without a corresponding increase in the seat of power, sluggish motion is the necessary consequence. Thus it is with the Medusæ. Individuals of the minuter species, or the larger species, when in the young state, are gifted with active powers of motion; the structure conforms to the forces within: but as the species enlarge, they become slow in movement, or lose almost every attribute of life. The same principle is illustrated again in the Bopyri. The male is a small active animal, related to *Jæra* and *Tanais*. The female, of sedentary habits, becomes grossly enlarged and corpulent, so as to exceed by twenty-fold lineally the length of the male, and nearly ten thousand times its bulk. It is manifest, that the nervous system, or motive power of the female, is absolutely no greater than that of the male; and consequently, the capabilities of locomotion will be ten thousand times less, or the female will move but a ten-thousandth of an inch at the most, while the male is moving one inch, a fact with regard to them, as any one is aware of who has seen the incapability of the female to make any

progress by locomotion. This then, is an example beyond dispute, of a system overgrown through the vegetative process, so as to be too much for the motive energies within. The Lernæoids afford a similar illustration of this principle.

For the same reason, therefore, as in the Bopyri, the Medusæ, the Lernæoids, and the Limuli, we cannot compare the actual mean size of the adult Cirripeds with those of the other primary types. We should rather infer the mean normal size for such a comparison, from the size of the young before it becomes sedentary, or from that of free males, if such exist. Such males are announced by Darwin, as actually occurring in some species. Moreover, they are very minute, varying from a line to half a line or less in length. This, therefore, is some reason for taking as the mean normal size, the same as given for the Entomostraca.

A *fifth primary type* includes the ROTATORIA. In these animalcular species, the mouth includes a pair of mandibles and often a rudimentary pair of maxillæ; and consequently, the cephalic portion may contain the same number of annuli as in the Daphnia group, with which group many of them have near relations. They have usually an articulated abdomen, furcate at extremity, like the Cyclopoids. The grand point of inferiority to the Entomostraca, evincing the more infinitesimal character of the system of life within, is the absence of all thoracic appendages or legs. The organs of locomotion are simply ciliæ arranged about the head; and it is quite probable that two sets (or more) of them correspond to the second pair of antennæ, as these are organs of prehension and motion in many Entomostraca. In Calidina, there are two sets, some distance from the extremity of the head, which may have this relation; and the two sets in the true Rotifers may also be of this character. In others, the corresponding parts are actually somewhat elongated.

The species vary in size from a line to a sixtieth of a line. Probably *one-ninth* of a line is the average size.

The actual relation of the Rotatoria to the Entomostraca (which view the author sustained in his Report on Zoophytes (1845)), can hardly be doubted by those who have the requisite knowledge of the lower Crustacea for comparison. The structure of the body, the jointing and form of the abdomen, when it exists, the mandibles, and alimentary system, the eyes when present,—all are Crustacean; and

a slight transformation of some Entomostraca—an obliteration of the legs and substitution of locomotive ciliæ—would almost turn them into Rotatoria.

In the classification which has been developed, we have made out *five* primary types of structure among Crustacea. A grand distinction has been shown to consist in the different degrees of cephalization of the normal Crustacean structure. The consecration of *nine* annuli, out of the fourteen cephalothoracic, to the senses and mouth, distinguishes the highest type; of *seven*, the second type; of *six* or *five*, the third and fourth; of *five* or *four*, the fifth. In connexion with other distinctions in these types, we find that they correspond to structures of different size, the size being directly related to the grade. These particulars may be tabulated as follows:—

		Typical number of cephalic an- nuli.	Mean normal length, in twelfths of inches or lines.
Type I. PODOPTHALMIA } or DECAPODA, }	Subtype I. Brachyura, } II. Macroura, }	9	{ 24 (and breadth, 24). 36 (and breadth, 6).
Type II. TETRADECAPODA,	.	7	6
Type III. ENTOMOSTRACA,	.	6-5	1
Type IV. CIRRIPIEDIA,	.	6-5	1
Type V. ROTATORIA,	.	5-4	$\frac{1}{2}$

The first type is alone in having true thoracic branchiæ, and pedicellate eyes.

The second type has branchial sac-like appendages, either abdominal or thoracic, and sessile eyes.

The third type has generally no branchiæ, the surface of some part or all of the body serving for aeration. A few species, however, are furnished with special organs for this function. This is, however, no mark of superiority in such species, for they occur even in the Limuli, among the lowest of the Entomostraca. The necessity of them in this case arises from the abnormal size of the species, both the mark and occasion of its inferiority; for the system is thus too large for the mode of surface aeration, found among ordinary Entomostraca; moreover, the shell, which so large an animal possesses and requires for the attachment of its muscles and its movements, is thick and firm, and this is inconsistent with aeration by the exterior surface of the body. The same remarks apply to the liver glands, which are very small or wanting in the small species.

The third and fourth types show their inferiority to the second, by the absence of a series of abdominal appendages; and the fifth a lower state still, in the absence of both thoracic and abdominal legs. The more degraded *Macroura* (certain *Mysidæ*) show a transition in this obsolescence of abdominal organs to the third type.

Some of the conclusions from these facts are the following.

I. Each type corresponds to a certain system of force, more or less centralized in the organism, and is an expression of that force,—the higher degree being such as is fitted for the higher structures developed, the lower such as is fitted for structures of inferior grade and size. In other words, the life-system is of different orders for the different types, and the structures formed exhibit the extent of their spheres of action, being such as are adapted to use the force most effectively, in accordance with the end of the species.

II. In a given type, as the first, for example, the same system may be of different dimensions, adapted to structures of different sizes. But the size in either direction for structures of efficient action is limited. To pass these limits, a life-system of another order is required. The *Macroura*, as they diminish in size, finally pass this limit, and the organisms (*Mysidæ*, for example) are no longer perfect in their members; an obsolescence of some parts begins to take place, and species of this small size are actually complete only when provided with the structure of a *Tetradecapod*.

The extreme size of structure admitting of the highest efficient activity is generally three to six times lineally the average or mean typical size. Of these gigantic species, three or four times longer than the mean type, there are examples among the *Brachyura* and *Macroura*, which have all the highest attributes of the species. There are also *Amphipoda* and *Isopoda* three inches in length, with full vigorous powers. Among *Entomostraca*, the *Calanidæ*, apparently the highest group, include species that are three lines long, or three times the length of the mean type.

III. But the limit of efficient activity may be passed; and when so it is attended with a loss of active powers. The structure, as in the female *Bopyrus* and *Lernæoids*, and the *Cirripeds*, outgrows vegetatively the proper sphere of action of the system of force within. This result is especially found in sedentary species, as we have exemplified in our remarks on the *Cirripeds*.

IV. Size is, therefore, an important element in the system of animal structures. As size diminishes, in all departments of animal life, the structure changes. To the human structure there is a limit; to the quadruped also, beyond which the structure is an impossibility; and so seems the case among Crustacea. The Decapod, as the size diminishes, reaches the lowest limit; and then, to continue the range of size in species, another structure, the Tetradecapodan, is instituted; and as this last has also its limit, the Entomostracan is introduced to continue the gradation; and, as these end, the Rotatoria begin. Thus Crustacea are made to embrace species, from a length of nearly two feet (or two hundred and fifty lines) to that of a one-hundred-and-fiftieth of a line. These several types of structure among Crustacea do not graduate, as regards size, directly from one to another, but they constitute overlapping lines, as has been sufficiently shown.

V. In the opposite extreme of organic beings, the vegetable kingdom, the same principle is illustrated. Plants may be so minute as to have free motion and activity, as in animals. The spores of certain Algæ are known to have powers of locomotion, and some so-called Infusoria, are now admitted to belong to the vegetable kingdom. These are examples of locomotive plants. Now, ordinary plants, like Cirripeds, are examples of sedentary species, that have outgrown the limits of activity. The life-system of a plant, is in fact sufficient in power to give locomotion only to the minute plant-individuals alluded to; and infusorial species of plants retain it, as long as they live. But when, as in the Algæ, vegetative growth proceeds in the enlargement of the minute infusorial spore, it immediately outgrows its activity, and becomes a sedentary plant. In most other plants, the seed have never the minute size which admits of motion.

The mean size of the Entomostracan type was stated to be *one line*; of the Rotatorial type, *one-sixth* of a line; and we may add, that the mean size of the plant type—understanding by this, as in other cases, the mean size admitting of the highest activity—if deduced from the size of plant-infusoria, would be about one-sixtieth of a line.

We observe, that the smallest size of the perfect Macroura (first type) is very nearly the mean size as to length of the animals of the second type. So also, the smallest size of the perfect animal of the second type (Tetradecapoda) is very nearly the mean size of the most perfect animals of the third type; and the smallest size of the perfect animal of the third type is nearly the largest size in the fifth type.

In order to compare allied animals of different sizes, it should be noted, that while there is some foundation for the conclusion, that under certain limitations, size is a mark of grade, rapidity of movement or action should also be considered; and the more proper comparison would be between multiples of size and activity. This deduction, is, however, true only in the most general sense, and rather between species of allied groups than those of different types. We may occasionally find something like an exemplification of the law among bipeds, ludicrous though the idea may be.

VI. We observe with regard to the passage in Crustacea to inferior grades under a given type, that there are two methods by which it takes place.

1. A diminution of centralization, leading to an enlargement of the circumference or sphere of growth at the expense of concentration, as in the elongation of the antennæ and a transfer of the maxillipeds to the foot series, the elongation of the abdomen and abdominal appendages, etc.

2. A diminution of force as compared with the size of the structure, leading to an abbreviation or obsolescence of some circumferential organs, as the posterior thoracic legs or anterior antennæ, or the abdominal appendages (where such appendages exist in the secondary type embracing the species). These circumstances, moreover, are independent of a degradation of intelligence, by an extension of the sphere of growth beyond the proper limits of the sphere of activity.

VII. A classification by grades, analogous to that deduced for Crustacea, may no doubt be laid out for other classes of animals. But the particular facts in the class under consideration, are not to be forced upon other classes. Thus, while inferiority among Crustacea is connected with a diminished number of annuli cephalically absorbed (for the senses and mouth), it by no means follows, that the Insecta, which agree in the number of cephalic annuli with the lower Crustacea, are allied to them in rank, or inferior to the higher species. On the contrary, as the Insecta pertain to a distinct division, being aerial instead of aqueous animals, they can be studied and judged of, only on principles deduced from comparison among insects themselves. They are not subject to Crustacean laws, although they must exemplify beyond doubt, the fundamental idea at the basis of those laws.

The views which have been explained, lead us to a modification, in some points, of the classification of Crustacea, adopted in the early

part of this Report, and followed out through the subsequent pages. The question, whether the eyes are pedicellate or not, upon which the names Podophthalmia and Edriophthalmia are based, proves to be one of secondary importance. And although still available in distinguishing almost infallibly the species of the first type, it is far from rendering it necessary or natural to embrace together under a common division the species that have *sessile* eyes (so-called Edriophthalmia), as done by most writers on this subject.

The term Decapoda, in view of these principles, has a higher significance than has been suspected, since by expressing the number of feet, it implies the number of cephalic annuli characterizing the species. It would not be employing it inconveniently, therefore, if it were extended to embrace all the Podophthalmia, or all species of the first type, including the Mysis and Squilla groups.

For a like reason, the term *Tetradecapoda* has a high significance, as applied to the species of the second type. The position of the Trilobita still remains in doubt. The Cirripedia and Entomostraca, third and fourth types, stand properly on nearly the same level.

On the following pages, we offer a review of the classification of Crustacea, with the characters of the several subdivisions.* We first present the characters of the higher divisions of the class, that is

The SUBCLASSES, ORDERS, and TRIBES of Crustacea.

* References and synonymy are omitted beyond, as they have been given fully in other parts of the work.

CRUSTACEA.

SUBCLASSIS I. PODOPHTHALMIA (VEL DECAPODA)..

Annuli cephalothoracis cephalici (ad sensus et appendices buccales pertinentes) numero *novem*. Oculi pedunculati. Branchiæ aut foliosæ aut filosæ, sub thoracis lateribus dispositæ, raro obsoletæ vel abdominales. Cephalothorax carapace plus minusve tectæ.

ORDO I. EUBRANCHIATA.

Branchiæ apud thoracis latera dispositæ, carapace tectæ.

TRIBUS I. BRACHYURA.—Corpus latum. Abdomen in sternum inflexum et stricte appressum, appendicibus carens. Branchiæ utrinque numero novem. Vulvæ in sternum excavatæ. Carapax suturâ longitudinali infra utrinque notatus, antice cum epistomate coalitus.

TRIBUS II. ANOMOURA.—Corpus sive latum sive multum elongatum. Abdomen sæpe ac in *Brachyuris*, sæpe ad sternum laxè appressum, interdum elongatum, et non inflexum, et appendicibus caudalibus instructum raro appendicibus aliis. Branchiæ utrinque numero novem vel plures. Vulvæ in pedum 3tiorum bases excavatæ, ac in *Macrouris*. Carapax suturâ longitudinali utrinque notatus, ac in *Brachyuris*.

TRIBUS III. MACROURA.—Corpus multum elongatum. Abdomen elongatum et appendicibus seriatis instructum, vix inflexum, vel

rectum. Branchiæ numero sæpius plures quam novem. Vulvæ in pedum 3tiorum bases excavatæ. Carapax sutura longitudinali raro utrinque notatus.

ORDO II. ANOMOBRANCHIATA.

Branchiæ sive apud pedum bases thoracis dispositæ et apertæ, sive appendicibus abdominis appendiculatæ, sive omnino obsoletæ.

TRIBUS I. MYSIDEA.—Corpus formâ fere Caridoideum, non depressum. Pedes thoracis et maxillipedes nulli prehensiles, graciles, sæpius palpigeri, palpo prope thoracem insiti.

TRIBUS II. AMPHIONIDEA.—Corpus depressum, sæpe latum. Pedes thoracis et maxillipedes nulli prehensiles, palpigeri, palpo a thorace remoto.

TRIBUS III. SQUILLOIDEA.—Corpus valde depressum. Pedes quatuor et maxillipedes quatuor monodactyli prehensiles.

SUBCLASSIS II. TETRADECAPODA.

Annuli cephalothoracis cephalici numero *septem*. Oculi sessiles. Appendices branchiales simplicissimæ, sive thoracicæ sive abdominales. Cephalothorax multi-annulatus, carapace carens, pedibus seriatis instructus. Abdomen appendicibus seriatis instructum, raro obsolescens.

ORDO I. CHORISTOPODA.

Cephalothorax pedibus unguiculatis interdum partim chelatis instructus, pare utroque ad anulum singulum pertinente.

TRIBUS I. ISOPODA.—Pedes thoracis seriei anterioris numero sex seriei posterioris octo, appendicibus branchialibus non instructi. Abdomen breve, appendicibus decem anticis branchialibus, duobus posticis styliformibus vel lamellatis.

TRIBUS II. ANISOPODA.—Pedes thoracis seriei anterioris numero octo, seriei posterioris numero sex, appendicibus branchialibus non instructi. Abdomen sat breve, appendicibus decem anticis branchialibus vel subnatatoriis, duobus posticis ac in *Isopodis*.

TRIBUS III. AMPHIPODA.—Pedes thoracis seriei anterioris numero octo, seriei posterioris numero sex, appendicibus branchialibus partim instructi. Abdomen elongatum, appendicibus sex natatoriis sex styliformibus instructi.

ORDO II. TRILOBITA.—(An hujus sedis?)

?—Cephalothorax appendicibus lamellatis infra instructus haud pedibus unguiculatis. Segmenta corporis numero ab normâ sæpe multiplicata.

SUBCLASSIS III. ENTOMOSTRACA.

Annuli cephalothoracis cephalici numero sex vel quinque. Oculi sæpissime sessiles. Appendices branchiales sæpissime nullæ. Abdomen appendicibus seriatis non instructum. Cephalothorax pedibus seriatis instructus, octo vel decem posticis ad annulos 8vum–11mum vel 12mum pertinentibus (si non obsoletis), sæpius natatoriis.

ORDO I. GNATHOSTOMATA.

Os mandibulis maxillisque normalibus instructum, non trunciforme nec suctorium.

LEGIO I. LOPHYROPODA.—Appendices cephalothoracis et segmenta numerum normalem non superantes.

TRIBUS I. CYCLOPOIDEA.—Cephalothorax annulatus et carapace non instructus. Abdomen rectum et non inflexum. Appendices

cephalothoracis mandibulares et sequentes numero 16–18, posticis 8–10 natatoriis.

TRIBUS II. DAPHNIOIDEA.—Corpus carapace plerumque tectum, abdomine plus minusve inflexo. Appendices cephalothoracis mandibulares et sequentes numero 12–16, 6–8 posticis subnatatoriis.

TRIBUS III. CYPROIDEA.—Corpus carapace bivalvi omnino tectum et bene clausum, abdomine bene inflexo. Appendices cephalothoracis mandibulares et sequentes numero 10, nullis natatoriis.

LEGIO II. PHYLLOPODA.—Appendices segmentoque cephalothoracis numerum normalem superantes, corpore immodicè annulato.

TRIBUS I. ARTEMIOIDEA.—Corpus fere rectum. Cephalothorax multiannulatus testâ sive tectus sive non tectus. Appendices cephalothoracis plerumque foliaceæ. Oculi pedunculati. Styli caudales fere ac in *Cyclopoideis*.

TRIBUS II. APODOIDEA.—Cephalothorax testâ scutiformi tectus. Appendices cephalothoracis posteriores lamellatæ. Oculi sessiles. Abdomen multiannulatum. Extremitas caudalis formâ mirabilis.

TRIBUS III. LIMNADIOIDEA.—Corpus testâ omnino tectum capite abdomineque inclusis ac in *Cyproideis*. Oculi sessiles. Extremitas caudalis ac in *Cyproideis*.

ORDO II. CORMOSTOMATA.

Os trunciforme et suctorium, basi sæpe mobile.

SUBORDO I. PÆCILOPODA.

Quoad formam corporis *Cyclopoideis* plerumque affinia, sæpe peltata, interdum subcylindrica, quoque vermiformia. Os inferius.

TRIBUS I. ERGASILOIDEA.—Cephalothorax annulatus, carapace non tectus. Truncus buccalis non mobilis, brevis, mandibulis interdum obsoletis (?). Pedes 8 postici bene natatorii ac in *Cyclopoideis*. Ova externa in sacculos gesta. Corpus sæpius non depressum.

TRIBUS II. CALIGOIDEA.—Cephalothorax sive annulatus sive carapace tectus. Truncus buccalis mobilis, mandibulis armatus. Pedes 8 postici plus minusve natatorii, sæpe partim in laminis coaliti. Ova externa in tubos longos uniseriatim gesta, tubis raro obsoletis. Corpus sæpius valde depressum et peltatum.

TRIBUS III. LERNÆOIDEA.—Cephalothorax vix annulatus. Corpus sive breve et obesum sive elongate vermiforme. Pedes natatorii obsoleti. Ova externa sive in sacculos aggregata sive in tubos uniseriata.

SUBORDO II. ARACHNOPODA.

Quoad formam corporis fere Arachnoidea, abdomine plerumque obsoleto, cephalothorace brevi, annulato, pedibus longis diffusis. Os trunciforme frontale.

TRIBUS PYCNOGONOIDEA.

ORDO III. MEROSTOMATA.

Os pedum basibus in locis mandibularum et maxillarum instructum.

TRIBUS LIMULOIDEA.

SUBCLASSIS IV. CIRRIPEDIA.

Annuli cephalothoracis cephalici numero sex vel quinque. Oculi sessiles vel obsoleti. Appendices branchiales nullæ. Abdomen obsoletum. Animal sessile in testam multivalvatam inclusum quæ nunquam in nullâ parte extus exuitur. Cephalothorax pedibus seriatis tenuibus multiarticulatis instructus.

SUBCLASSIS V. ROTATORIA.

Corpus minutum, pedibus totis carens et ciliis motum. Abdomen sæpe 2-3 annulatum et apice furcatum, interdum obsoletum. Annuli cephalothoracis cephalici numero quinque vel quatuor.

After this exposition of the subclasses, orders, and tribes, of the class Crustacea, here follows

A S Y N O P S I S

OF THE FAMILIES AND SUBFAMILIES OF THE HIGHER
SUBDIVISIONS OF CRUSTACEA.

SUBCLASSIS I. DECAPODA.

ORDO I. EUBRANCHIATA.

TRIBUS I. BRACHYURA.

SUBTRIBUS I. MAIOIDEA.

LEGIO I. MAINEA vel MAIOIDEA TYPICA.—Corpus sæpissime oblongum, sæpius antice angustum et rostratum. Articulus antennarum externarum Imus sub oculo insitis, anterieusque productus, testâ externâ sine suturâ coalitus. Pedes formâ normales.*

* We have modified the arrangement of the Maioidea, by separating from the family Maiadæ, the families *Inachidæ* and *Mithracidæ*. The peculiarity of the outer maxillipeds, adopted by De Haan as the characteristic of the *Inachidæ*, appears to be of sufficient value to authorize the separation of the genera of this kind from the other Maiidæ, although not so important as to require the union of the Eurypodii with the *Inachidæ*, as done by this author. The *Mithraces* have a distinct character, removing them from the other Maioids. There is in the species *Mithrax*, a singular diversity of form

Fam. I. INACHIDÆ.—Oculi in orbitis retractiles. Articulus maxillipedis externi 3tius apice 4tum gerens. Digi acuminati. [Pedes prælongi.]

1. MACROCHEIRINÆ.—Carapax late ovatus. Rostrum furcatum. Oculi oblongi.—G. *Macrocheira*, De H.
2. INACHINÆ.—Carapax triangulato-ovatus. Rostrum emarginatum aut integrum.—G. *Inachus*, Fab., *Microrhynchus*, Bell.
3. SALACINÆ.—Oculi perbreves. Rostrum fere obsoletum, non bifidum. Corpus non oblongum. Pedes 8 postici longi et crassi.—G. *Salacia*, E. and Lucas.

Fam. II. MAIIDÆ.—Oculi in orbitis retractiles. Articulus maxillipedis externi 3tius angulo interno 4tum gerens. Digi acuminati.

1. *Oculi latera capitis insiti et plus minusve lateraliter porrecti.*

1. LIBININÆ.—Rostrum apice emarginatum. Corpus paulo oblongum, subglobosum, lateribus altis. Oculi perbreves. Pedes sive longi sive mediocres.—G. *Egeria*, Lat., *Doclea*, Leach, *Libidoclea*, E. and L., *Libinia*, Lh.
2. MAIINÆ.—Carapax orbiculato-ovatus, rostro prominente profundè bifido. Pars antennarum externarum mobilis margine orbitæ orta.—G. *Maiia*, Lk., *Dione*, De H.
3. PISINÆ.—Carapax triangulato-ovatus, rostro bifido, non deflexo. Pars antennarum externarum mobilis margine orbitæ exclusa, et sub rostro non celata.—G. *Paramithrax*, E., *Pisa*, Lh., *Pelia*, Bell, *Lissa*, Lh., *Rhodia*, Bell, *Hyas*, Lh., *Pisoides*, E. and L., *Herbstia*, E., *Thoe*, Bell, *Dehaanius*, M'L.
4. PRIONORHYNCHINÆ.—*Pisinis* affines. Rostrum breve, latissimum, bilobatum, non deflexum.—G. *Prionorhynchus*, H. and J.
5. MICIPPINÆ.—Rostrum latum, deflexum.—G. *Micippa*, Lh.
6. CHORININÆ.—Carapax triangulato-ovatus. Rostrum furcatum. Pars antennarum externarum mobilis sub rostro celati.—G. *Chorinus*, Lh., *Chorilia*, D., *Lahaina*, D., *Naxia*, E., *Scyra*, D., *Hyastenus*, White, *Pyria*, D.

2. *Oculi frontales et porrecti longitudinales, carapace antice truncato.*

7. OTHONINÆ.—Oculi elongati, cylindrici.—G. *Othonia*.
[Cujus sedis est *Siphonæcetes*, Kr.]

Fam. III. MITHRACIDÆ.—Oculi et maxillipedes externi ac in *Maiidis*. Digi versus apicem excavati et non acuminati.

1. MITHRACINÆ.—Oculi longitudine mediocres.—G. *Mithrax*, Lh., *Mithraculus*, W.
2. CYCLACINÆ.—Oculi longi.—G. *Cyclax*, D.

exceeding what is found in any other genus of Maiioidea. This fact, in connexion with the habits of the species, and the peculiarity of the fingers, seems to require the institution of a distinct family of Mithracidæ.

Fam. IV. TYCHIDÆ.—Oculi retractiles sed orbitis carentes, infra carapacem sese latentes.

1. CRIOCARCININÆ.—Rostrum valde deflexum. Carapax oblongus.—G. *Criocarcinus*, Guer.
2. TYCHINÆ.—Carapax oblongus, antice latus, latitudine trans-orbitali magnâ, rostro non deflexo, sat longo, furcato. Oculi apice paululum exserti.—G. *Tyche*, Bell.
3. CAMPOSCINÆ.—Carapax oblongus, rostro fere obsolete, emarginato. Pedes 8 postici longi. Oculi elongatè pedunculati et exserti.—G. *Camposcia*, Lat.

Fam. V. EURYPODIDÆ.—Oculi retractiles ad carapacis latus, non sese latentes.

1. EURYPODINÆ.—Antennæ externæ apertæ. Carapax triangulato-ovatus, rostro longo, furcato. Pedes longi. Oculi longi et elongate salientes. Spina post-orbitalis oblonga.—G. *Eurypodius*, Guer., *Oregonia*, D.
2. AMATHINÆ.—[An oculi retractiles et species hujus sedis?] Antennæ externæ sub rostro celatæ. Carapax triangulato-ovatus, rostro furcato, latitudine trans-orbitali perangustâ. Pedes longi.—G. *Amathia*, Roux.

Fam. VI. LEPTOPODIDÆ.—Oculi non retractiles. Pedes prælongi.

A. *Antennæ externæ apertæ.*

1. ACHÆINÆ.—Carapax triangulato-ovatus, rostro perbrevis, bifido. Oculi longi et elongate salientes. Pedes 4 postici subprehensiles.—G. *Achæus*, Lh.
2. INACHOIDINÆ.—Carapax triangulato-ovatus, rostro elongato, simplice.—G. *Inachoides*, E. and L.

B. *Antennæ externæ sub rostro celatæ.*

3. LEPTOPODINÆ.—Carapax triangulato-ovatus, rostro elongato, simplice. Pedes longissimi.—G. *Leptopodia*, Lh.
4. STENORHYNCHINÆ.—Carapax triangulato-ovatus, rostro breve, bifido.—G. *Stenorhynchus*, Lk.

Fam. VII. PERICERIDÆ.—Oculi non retractiles. Pedes longitudine mediocres.

A. *Antennæ externæ apertæ.*

1. PARAMICIPPINÆ.—Rostrum valde deflexum. *Micippæ* aspectu similes.—G. *Paramicippa*, E.
2. PERICERINÆ.—Rostrum profundè bifidum, non deflexum.—G. *Pericera*, Lat., *Tiarinia*, D., *Perinia*, D., *Halimus*, Lat., *Pugettia*, D.

3. MENÆTHINÆ.—Rostrum integrum vel subintegrum.—G. *Menæthius*, E., *Acanthonyx*, Lat., *Antilibinia*, M'L., *Peltinia*, D.

B. *Antennæ externæ sub rostro celatæ.*

4. STENOCIONOPINÆ.—Oculi prælongi. Rostrum longum, furcatum, cornibus styliformibus, divaricatis.—G. *Stenocionops*, Lat.
5. EPIALTINÆ.—Oculi longitudine aut mediocres aut perbreves. Rostrum oblongum, crassum, sive integrum, sive emarginatum. Antennæ externæ apicem rostri sæpius non attingentes. Pedes 8 postici subcylindrici.—G. *Epialtus*, E., *Huenia*, De H., *Xenocarcinus*, W., *Leucippa*, E.

LEGIO II. PARTHENOPINEA vel MAIOIDEA CANCRIDICA.—Corpus sive breviter triangulatum sive valde transversum et antice arcuatum. Articulus antennarum externarum 1mus oculo interior, rarissimè solutus, sæpius suturâ infixus, raro sine suturâ externâ coalescens. Pedes antici longiores, toti formâ normales.

Fam. I. PARTHENOPIDÆ.—Oculi retractiles. Carapax lateraliter non bene expansus.

G. *Parthenope*, Fab., *Lambrus*, Lh., *Eurynome*, Lh.

Fam. II. EUMEDONIDÆ.—Oculi non retractiles. Carapax lateraliter non bene expansus.

G. *Eumedonus*, E., *Ceratocarcinus*, W. (Harrovia, W.) [An hujus sedis *Gonatonotus*, A. and W. Crust. Sam., tab. vi. f. 7.]

Fam. III. CRYPTOPODIDÆ.—Oculi retractiles. Carapax lateraliter valde expansus, pedes 8 posticos plerumque tegens.

G. *Cryptopodia*, E., *Eurynolambrus*, E., *Tlos*, W.

Fam. IV. TRICHIDÆ.—*Parthenopidis* quoad oculos carapacemque affinis; sed quoad maxillipedes externos *Dromiis*.

G. *Trichia*, De H.

LEGIO III. ONCININEA vel MAIOIDEA DROMIDICA.—Corpus triangulatum. Antennæ externæ e basi solutæ, cylindricæ. Pedes postici breviores, subdorsales, uncinato-prehensiles.

Fam. I. ONCINOPIDÆ.

G. *Oncinopus*, De H.

SUBTRIBUS II. CANCROIDEA.

LEGIO I. CANCRINEA vel CANCROIDEA TYPICA.—Species marinæ vel maritimæ. Antennæ quatuor conspicuæ. Cavitas branchialis superficie non papillo-spongiosa.

1. *Pedes postici gressorii.*

Fam. I. CANCRIDÆ.—Palatum colliculo longitudinali utrinque non bene divisum. Carapax sæpius late transversus, interdum angustus. Antennæ internæ plus minusve longitudinales.

1. CANCRINÆ.—Frons interorbitalis perangustus. G. *Cancer*, Leach, *Perimela*, Lh.

Fam. II. XANTHIDÆ.—Palatum et carapax ac in *Cancridis*. Antennæ internæ plus minusve transversæ.

1. XANTHINÆ.—Antennæ externæ basi firmè infixæ, parte mobili ex hiatu orbitæ non exclusâ. Frons interorbitalis latior. Digiti acuminati.—G. *Atergatis*, De H., *Carpilius*, Lh., De H., *Liomera*, D., *Liagora*, De H., *Actæa*, De H., D., *Xantho*, Lh. (subgenera *Xantho*, *Euxanthus*, D., *Xanthodes*, D., *Paraxanthus*, Lucas), *Menippe*, De H., *Panopæus*, E., *Medæus*, D., *Halimede*, De H.

2. CHLORODINÆ.—Antennæ internæ transversæ. Antennæ externæ basi firme infixæ, parte mobili ex hiatu orbitæ raro exclusâ. Frons interorbitalis latior. Digiti instar cochlearis excavati. [Quoad genera Xanthinæ et Chlorodinæ ferme parallelæ.]—G. *Ethisus*, Lh., *Carpilodes*, D., *Zozymus*, Lh., *Actæodes*, D., *Daira*, De H., *Chlorodius*, Lh. (subgenera *Chlorodius*, *Pilodius*, D., *Cyclodius*, D.), *Cymo*, De H.

3. POLYDECTINÆ.—Antennæ internæ transversæ. Antennæ externæ basi solutæ et liberæ.—[Ad *Pilumnis* propinquior.]—G. *Polydectus*, E.

Fam. III. ERIPHIDÆ.—Palatum colliculo longitudinali utrinque bene divisum. Carapax sæpius angustus, interdum latus, margine antero-laterali raro longiore quam postero-lateralis, latitudine antemedianâ sæpissimè longiore, oculis remotis.

1. ÆTHRINÆ.—Carapax transversus, lateribus valde dilatatis et rotundatis. Antennæ internæ fere longitudinales.—G. *Æthra*, Lh.

2. OZINÆ.—Carapax plus minusve transversus, lateribus non dilatatis. Digiti acuminati. Antennæ internæ transversæ. Orbita hiatu interno basi antennæ occupato instructa. Abdomen maris 7-articulatum.—G. *Galene*, De H., *Ozius*, E., *Pseudozius*, D., *Pilumnus*, Lh., *Pilumnoides*, E. and L., *Melia*, E. [An hujus sedis *Acanthodes*, De H. ?]

3. ACTUMNINÆ.—Orbita *Ozinis* similes. Digiti instar cochlearis excavati.—G. *Actumnus*, D.

4. ERIPHINÆ.—Orbita infra bene clausa, hiatus interno carens, articulo antennæ basali ex orbitâ omnino excluso. Carapax sive paulo transversus sive subquadratus. G. *Ruppellia*, E., *Eriphia*, Lat., *Domæcius*, Souleyet, *Trapezia*, Lat., *Tetralia*, D., *Quadrella*, D.

2. *Pedes postici natatorii.*

Fam. IV. PORTUNIDÆ.—Ramus maxillipedis 1mi internus lobo interno instructus. Palatum sæpius colliculo longitudinali utrinque divisum.

1. LUPINÆ.—Sutura sterni mediana tria segmenta intersecans. Palatum colliculis prominentibus.—G. *Scylla*, De H., *Lupa*, Lh., *Amphitrite*, De H., D., *Carupa*, D., *Thalamita*, Lat., *Charybdis*, De H., D., *Lissocarcinus*, W.
2. ARENÆINÆ.—Sutura sterni mediana tria segmenta intersecans. Palatum colliculis non divisum. Ramus maxillipedis 1mi internus ad apicem late transversim triangulatus, ramis duobus inter se fere convenientibus.—G. *Arenæus*, D.
3. PORTUNIDÆ.—Sutura sterni mediana duo segmenta intersecans. Palatum colliculis sæpe obsoletis.—G. *Portunus*, Fab.

Fam. V. PLATYONYCHIDÆ.—Ramus maxillipedis 1mi internus non lobatus. Palatum colliculis non divisum.

G. *Carcinus*, Lh., *Portumnus*, Lh., *Platyonychus*, Lat., *Polybius*, Lh.

LEGIO II. TELPHUSINEA vel CANCROIDEA GRAPSIDICA.—Species fluviales. Antennæ quatuor conspicuæ. Cavitas branchialis permagna ac in *Grapsoideis*, superficie sæpe papillo-spongiosis.

Fam. I. TELPHUSIDÆ.

G. *Telphusa*, Lat., *Valdivia*, W., *Potamia*, Lat., *Trichodactylus*, Lat., *Orthostoma*, Randall.

LEGIO III. CYCLINEA vel CANCROIDEA CORYSTIDICA.—Antennæ externæ obsoletæ. Carapax angustus vel suborbicularis.

Fam. I. ACANTHOCYCLIDÆ.

G. *Acanthocyclus*, Lucas.

SUBTRIBUS III. CORYSTOIDEA.

Fam. I. TRICHOCERIDÆ.—Carapax formâ Cancroideus, fronte non rostratus. Antennæ internæ longitudinales. Antennæ externæ

breves, flagello parce piloso. Maxillipedes externi super epistoma non producti, sed marginem areæ buccalis bene adaptati.

G. *Trichocera*, De H.

Fam. II. THIIDÆ.—Carapax suborbicularis, non oblongus, fronte non rostratus. Antennæ internæ transversæ vel obliquæ. Antennæ externæ breves, flagello parce piloso. Maxillipedes externi super epistoma producti.

G. *Thia*, Lh., *Kraussia*, D.

Fam. III. CORYSTIDÆ.—Carapax sive suborbicularis sive multum angustus, fronte plus minusve rostrato. Maxillipedes externi super epistoma producti.

G. *Telmessus*, W., *Atelecyclus*, Lh., *Peltarion*, H. and Jacq., *Pseudocorystes*, E., *Gomezia*, Gray, *Æidia*, De H. (partim), *Corystes*, Lat., *Dicera*, De H.

SUBTRIBUS IV. GRAPSOIDEA.

1. *Articulus maxillipedis externi 4tus cum angulo 3tio interno articulatus.*

Fam. I. GONOPLACIDÆ.—Carapax transversus. Frons 4tâ parte latitudinis carapacis longior, paulo deflexus, lamellatus. Antennæ internæ transversæ. Articulus abdominis *maris* 2dus sterno contiguo angustior.

G. *Eucrate*, De H., *Curtonotus*, De H., *Gonoplax*, Lh.

2. *Articulus maxillipedis externi 4tus cum angulo 3tii apicali interno non articulatus sed medio marginis apicalis sive angulo externo.*

Fam. II. MACROPHTHALMIDÆ.—Oculi 3tiâ parte carapacis non breviores. Carapax subquadratus, sæpissime transversus, antice latissimus, angulis anticis acutis, lateribus non arcuatis. Antennæ internæ sive transversæ sive longitudinales. Articulus abdominis *maris* 2dus sterno contiguo angustior. Articulus maxillipedis externi 3tius cristâ obliquâ piliferâ nunquam ornatus.

1. MACROPHTHALMINÆ.—Antennæ internæ transversæ sub fronte insitæ. Antennæ externæ basi ad frontem appressæ. Articulus maxillipedis externi 4tus apertus.—G. *Cleistostoma*, De H., *Macrophthalmus*, Lat.

2. OCYPODINÆ.—Antennæ internæ longitudinales, juxta frontem utrinque insitæ.

Antennæ externæ a fronte paulum remotæ. Articulus maxillipedis externi 4tus apertus, 3tius 2do minor.—G. *Gelasimus*, Lat., *Helæcius*, D., *Ocypoda*, Fab., *Scopimera*, De H.

3. DOTINÆ.—Articuli maxillipedis externi 4tus et sequentes 3tio celati.—G. *Doto*, De H.

Fam. III. GRAPSIDÆ.—Oculi 3tiâ parte latitudinis carapacis breviores. Carapax subquadratus, sæpius depressus, lateribus aut rectis aut arcuatis. Antennæ internæ transversæ. Articulus abdominis *maris* 2dus sterno contiguo sæpius vix angustior. Articulus maxillipedis externi 3tius sive inornatus sive cristâ obliquâ piliferâ ornatus. Palatum colliculis (viarum efferentium limitibus) instructum.

1. GRAPSIDINÆ.—Antennæ internæ fronte tectæ. Articulus maxillipedis externi 3tius cristâ obliquâ in 2dum productâ non ornatus.—G. *Pseudograpsus*, E., *Heterograpsus*, Lucas, *Platynotus*, De H., *Brachynotus*, De H., *Trichopus*, De H., *Grapsus*, Lk., *Goniograpsus*, D., *Planes*, Lh., *Hemigrapsus*, D., *Cyrtograpsus*, D.
2. SESARMINÆ.—Antennæ internæ fronte tectæ. Articulus maxillipedis externi 3tius cristâ obliquâ in 2dum productâ notatus.—G. *Sesarma*, Say, *Sarmatium*, D., *Cyclograpsus*, E., *Chasmagnathus*, De H., *Helice*, De H.
3. PLAGUSINÆ.—Antennæ internæ sinubus frontis longitudinalibus apertæ.—G. *Acanthopus*, De H., *Plagusia*, Lat.

Fam. IV. GECARCINIDÆ.—Oculi breves. Carapax obesus, paulo transversus, antice latus, curvatim declivis, lateribus arcuatis et pone oculos largè rotundati et vix dentatis. Antennæ internæ transversæ. Articulus abdominis *maris* 2dus sterno postico vix angustior. Articulus maxillipedis externi 3tius cristâ obliquâ piliferâ non ornatus. Palatum colliculis (viarum efferentium limitibus) non instructum.

1. UCAINÆ.—Articulus maxillipedis externi 4tus apertus.—G. *Uca*, Lh., *Gecarcinicus*, E., *Cardisoma*, Lat., *Gecarcoidea*, E.
2. GECARCININÆ.—Articuli maxillipedis externi 4tus et sequentes 3tio celati.—G. *Gecarcinus*, Lat.

Fam. V. PINNOTHERIDÆ.—Oculi perbreves orbitis insiti, raro non retractiles. Carapax sive obesus sive depressus, raro paulo oblongus et interdum parce rostratus, lateribus valde rotundatis. Antennæ internæ aut transversæ aut obliquæ. Abdomen *maris* angustum, versus basin sterno contiguo valde angustius. Palatum colliculis (viarum efferentium limitibus) instructum. [Species totæ parvæ.]

1. PINNOTHERINÆ.—Articulus maxillipedis externi 2dus parvulus aut obsoletus.

Corpus sive obesum sive depressum.—G. *Pinnothera*, Lat., *Fabia*, D., *Xenophthalmus*, W., *Xanthasia*, W., *Pinnixa*, W., *Pinnotherelia*, Lucas.

2. HYMENICINÆ.—Corpus sæpius parce rostratum, depressum. Articulus maxillipedis externi 2dus dimidio 3tii major.—G. *Hymenosoma*, Lh., *Halicarcinus*, W., *Hymenicus*, D., *Elamena*, E.

Fam. VI. MYCTIRIDÆ.—Corpus obesum. Carapax antice perangustus, vix rostratus, orbitis carentes. Antennæ internæ parvulæ, longitudinales.

G. *Myctiris*, Lat.

SUBTRIBUS V. LEUCOSIDEA.

1. *Appendices maris genitales basi pedum 5torum ortæ.* [*Via afferens pone regionem pterygostomianam ingrediens.*]

Fam. I. CALAPPIDÆ.—Articuli maxillipedis externi terminales non celati.

1. CALAPPINÆ.—Pedes nulli natatorii.—G. *Calappa*, Fab., *Platymera*, E., *Mursia*, E., *Cycloes*, De H.
2. ORITHYINÆ.—Pedes 8 postici natatorii.—G. *Orithyia*.

Fam. II. MATUTIDÆ.—Articuli maxillipedis externi terminales celati, 3tio triangulato, palpo vix longiore quam articulus 2dus.

G. *Hepatus*, Lat., *Thealia*, Lucas, *Matuta*, Fab.

2. *Appendices maris genitales sterno ortæ.*

Fam. III. LEUCOSIDÆ.—Via afferens apud angulum palati antero-lateralem ingrediens. Articuli maxillipedis externi terminales precedentibus tecti. Pedes postici ad normam gressorii.

G. *Philyra*, Lh., *Leucosia*, Fab., *Leucisca*, M'L., *Ebalia*, Lh., *Nucia*, D., *Nursia*, Lh., *Ilia*, Lh., *Myra*, Lh., *Persephona*, Lh., *Ixa*, Lh., *Iphis*, Lh., *Arcania*, Lh., *Oreophorus*, Rüppell.

Fam. IV. DORIPPIDÆ.—Via afferens partem regionis pterygostomianæ posticam ingrediens. Articuli maxillipedis externi terminales precedentibus non tecti. Pedes 2–4 postici subdorsales prehensiles.

G. *Dorippe*, Fab., *Ethusa*, Roux.

TRIBUS II. ANOMOURA.

SECTIO I. ANOMOURA SUPERIORA.

Oculi antennis 1mis non anteriores. Antennæ 2dæ oculis interdum posteriores non exteriores. Abdomen angustum, ad sternum sæpius appressum, appendicibus caudalibus carens.

SUBTRIBUS I. DROMIDEA, vel ANOMOURA MAIIDICA SUPERIORA.

Carapax subtriangulatus vel subquadratus vel suborbiculatus, fronte angusto, oculis approximatis. Pedes postici subdorsales. Via afferens uti in Maiioideis.

Fam. I. DROMIDÆ.

G. *Dynomene*, Lat., *Dromia*, Fab., *Latreillia*, Roux, *Homola*, Lh.

Fam. II. CYMOPOLIDÆ.—[An hujus sedis?] *Dromia*

G. *Cymopolia*, Roux, *Caphyra*, Guer.

SUBTRIBUS II. BELLIDEA, vel ANOMOURA CANCRIDICA.

Carapax parce oblongus, subellipticus. Pedes 8 postici inter se similes. Via efferens uti in *Dromideis*.

Fam. I. BELLIDÆ. *Dromideis*

G. *Corystoides*, Lucas, *Bellia*, E.

SUBTRIBUS III. RANINIDEA, vel ANOMOURA LEUCOSIDICA.

Carapax oblongus. Via efferens osque uti in *Leucosoides*.

Fam. I. RANINIDÆ.

G. *Raninoides*, E., *Ranina*, Lk., *Ranilia*, E., *Notopus*, De H., *Lyreidus*, De H., *Cosmonotus*, W.

SECTIO II. ANOMOURA MEDIA.

Oculi antennis 1mis non anteriores. Antennæ 2dæ oculis posteriores et exteriores. Abdomen inflexum, sed non stricte appressum, appendicibus caudalibus instructum. Os nunquam uti in Leucosoides.

SUBTRIBUS IV. HIPPIDEA, vel ANOMOURA CORYSTIDICA.

Carapax oblongus. Maxillipedes externi operculiformes, articulo 3tio elongato et lato. Pedes 2di 3tii 4tique natatorii, 5ti debiles inflexi.

Fam., HIPPIDÆ.

G. *Albunæa*, Fab., *Albunhippa*, E., *Remipes*, Lat., *Hippa*, Fab.

SUBTRIBUS V. PORCELLANIDEA, vel ANOMOURA GRAPSIDICA.

Carapax suborbiculatus. Maxillipedes externi male operculiformes, articulo 3tio paulo minore quam 2dus. Pedes 2di 3tii 4tique gressorii, 5ti debiles, inflexi.

Fam. PORCELLANIDÆ.

G. *Porcellana*, Lamarek.

SECTIO III. ANOMOURA SUBMEDIA.

Oculi antennis 1mis plane anteriores. Abdomen valde dilatatum, inflexum sed stricte non appressum, appendicibus caudalibus carens.

SUBTRIBUS VI. LITHODEA, vel ANOMOURA MAIIDICA SUBMEDIA.

Carapax subtriangulatus uti in Maioides. Abdomen latum, vix symmetricum. Pedes nulli natatorii, 2dis 3tiis 4tisque consimilibus, 5tis parvulis, sub carapace inflexis.

Fam. LITHODIDÆ.

G. *Lithodes*, Lat., *Lomis*, De H., *Echidnocerus*, W.

SECTIO IV. ANOMOURA INFERIORA.

Oculi antennis Imis anteriores. Antennæ 2dæ oculis posteriores et exteriores. Abdomen elongatum, vix inflexum, appendicibus caudalibus instructum, sæpe appendicibus quoque ventralibus.

SUBTRIBUS VII. PAGURIDEA, vel ANOMOURA MAIDICA INFERIORA.

Carapax oblongus, postice mollior. Abdomen plerumque molle vel carnosum, appendicibus imparibus sæpius instructum. Pedum pares 3tii 4ti dissimiles.

Fam. I. PAGURIDÆ.—Antennæ internæ mediocres, articulo 1mo brevissimo. Maxillipedis externi palpus flagello multiarticulato instructus.—Species aquaticæ vel littorinæ.

1. PAGURINÆ.—Abdomen asymmetricum.—G. *Paguristes*, D., *Diogenes*, D., *Bernhardus*, D., *Pagurus*, *Calcinus*, D., *Aniculus*, D., *Clibanarius*, D.
2. CANCELLINÆ.—Abdomen symmetricum.—G. *Cancellus*, E.

Fam. II. CENOBITIDÆ.—Antennæ internæ multo elongatæ, articulo 1mo oculis sæpius longiore, valde deflexo. Maxillipedis externi palpus flagello non instructus. Species præcipue terrestriales.

G. *Cenobita*, Lat., *Birgus*, Lh.

SUBTRIBUS VIII. ÆGLEIDEA.

Carapax elongatus, texturâ omnino crustaceus. Abdomen extus crustaceum, *maris* paribus appendicum obsoletis, *feminae* elongatis, instructum. Pedum pares 3tii 4tique consimiles; 5ti debiles, sub carapace inflexi. Branchiæ filosæ.

Fam. ÆGLEIDÆ.

G. *Æglea*, Lh.

SUBTRIBUS IX. GALATHEIDEA.

Carapax elongatus, texturâ superficiei omnino crustaceus. Abdomen extus crustaceum, *maris femineæ*que paribus appendicum elongatis infra instructum. Pedum pares 3tii 4tique consimiles, 5ti debiles juxta carapacem inflexi. Branchiæ foliosæ.

Fam. GALATHEIDÆ.

G. *Munida*, Lh., *Galathea*, Fab., *Grimothea*, Lh.

APPENDIX. MEGALOPIDEA.

G. *Marestia*, D., *Monolepis*, Say, *Megalopa*, Lh., *Cyllene*, D., *Tribola*, D.

TRIBUS III. MACROURA.

SECTIO I. MACROURA PAGURO-SQUILLIDICA.

SUBTRIBUS I. THALASSINIDEA.

Carapax duabus suturis longitudinalibus subdivisus, sæpeque suturâ dorsali transversâ. Antennæ externæ squamâ basali nullâ vel parvâ instructæ. Pedes 6 postici directione non consimiles; duo antici longiores et crassiores, fossorii et sæpius chelati.

LEGIO I. THALASSINIDEA EUBRANCHIATA. — Species branchiis thoracis instructæ tantum.

Fam. I. GEBIDÆ.—Maxillipedes externi pediformes. Appendices caudales et aliæ abdominales latae.

G. *Gebia*, Lh., *Axius*, Lh., *Calocaris*, Bell, *Laomedea*, De H., *Glaucothoe*, E.

Fam. II. CALLIANASSIDÆ.—Maxillipedes externi operculiformes. Appendices caudales latae.

G. *Callianassa*, Lh., *Trypæa*, D.

Fam. III. THALASSINIDÆ. — Maxillipedes externi pediformes.
Appendices caudales lineares.

G. *Thalassina*, Lat.

LEGIO II. THALASSINIDEA ANOMOBRANCHIATA. — Pedes
abdominis appendicibus branchialibus instructi.

Fam. I. CALLISEIDÆ.

G. *Callianidea*, E., *Callisea*, Guer., D.

SECTIO II. MACROURA NORMALIA.

SUBTRIBUS I. ASTACIDEA, vel MACROURA SUPERIORA.

Carapax suturâ dorsali transversâ sæpius notatus, suturis longitudi-
nalibus obsoletis, testâ antero-laterali cum epistomate connatâ.
Antennæ externæ squamâ basali sive nullâ sive parvâ instructæ.
Pedes 6 postici directione sat consimiles; antici crassiores, sive
didactyli sive non didactyli. [Branchiæ filosæ.]

1. *Antennæ externæ squamâ basali carentes. Pedes antici monodactyli.*

Fam. I. SCYLLARIDÆ.—Carapax valde depressus, margine cepha-
lothoracis utrinque tenui, carapace lateraliter subito inflexo. An-
tennæ externæ laminatæ breves. Sternum trigonum.

G. *Scyllarus*, Fab., *Arctus*, D., *Thenus*, Lh., *Parribacus*, D., *Ibacus*, Lh.

Fam. II. PALINURIDÆ.—Carapax subcylindricus, lateraliter late
rotundatus. Antennæ externæ basi subcylindricæ, longæ. Sternum
trigonum.

G. *Palinurus*, Fab., *Panulirus*, Gray.

2. *Antennæ externæ squamâ basali instructæ. Pedes antici didactyli.*

Fam. III. ERYONIDÆ.—Carapax non oblongus, depressus, lateribus
subito inflexis, abdomine multo angustiore.

G. *Eryon*, Desmarest.

Fam. IV. ASTACIDÆ.—Carapax oblongus, subcylindricus, abdomine parce angustiore. Sternum angustum.

1. ASTACINÆ.—Manus crassæ et latæ, superficie convexæ.—G. *Homarus*, E., *Astacoides*, Guer. (subgenera *Astacoides*, *Cheraps*, Erich.) *Astacus* (subgenera *Astacus*, *Cambarus*, Erich.)
2. NEPHROPINÆ.—Manus prismaticæ, lateribus fere rectæ.—G. *Nephrops*, Lh. *Paranephrops*, W.

SUBTRIBUS II. CARIDEA, vel MACROURA TYPICA.

Carapax suturâ nullâ notatus, epistomate antice non connatus. Antennæ externæ squamâ basali magnâ instructæ. Pedes 6 postici directione sat consimiles; 1mi vel 2di crassiores et chelati, 3tii 4tis similes. [Branchiæ foliosæ.]

1. *Maxillipedes 2di breves et lamellati.*

Fam. I. CRANGONIDÆ.—Mandibulæ graciles, valde incurvatæ, non palpigeræ, coronâ perangustâ, non dilatâtâ. Pedum pares 1mi 2dique inter se valde inæqui.

1. CRANGONINÆ.—Pedes 1mi 2dis crassiores. Maxillipedes externi pediformes. Digitus mobilis in manus marginem claudens; immobilis spiniformis. Pedes 2di non annulati.—G. *Crangon*, Fab., *Sabinea*, Owen, *Argis*, Kr., *Paracrangon*, D.
2. LYSMATINÆ.—Pedes 1mi 2dis crassiores. Maxillipedes externi pediformes. Digiti subæqui, uno ad alterum claudente. Pedes 2di annulati.—G. *Nika*, Risso, *Lysmata*, Risso, *Cyclorhynchus*, De H.
3. GNATHOPHYLLINÆ.—Pedes 2di 1mis crassiores. Maxillipedes externi lati, operculiformes.—G. *Gnathophyllum*.

Fam. II. ATYIDÆ.—Mandibulæ crassæ, non palpigeræ, coronâ latâ, parce bipartit, processu terminali brevi et dilatato. Pedum pares 1mi 2dique inter se æqui, carpo nunquam annulato.

1. ATYINÆ.—Pedes thoracici palpo non instructi.—G. *Atya*, Lh., *Atyoida*, Randall, *Caridina*, E.
2. EPHYRINÆ.—Pedes thoracis palpo instructi.—G. *Ephyra*, Roux.

Fam. III. PALÆMONIDÆ.—Mandibulæ crassæ, sive palpigeræ sive non palpigeræ, supra profunde bipartitæ, processu apicali oblongo, angusto.

1. ALPHEINÆ.—Pedes 1mi crassiores, chelati; 2di filiformes, carpo sæpius annulato, plerumque chelato. Mandibulæ palpigeræ.—G. *Alpheus*, Fab., *Betæus*, D., *Alope*, W., *Athanas*, Lh., *Hippolyte*, Lh., *Rhyncocinetes*, E.
2. PANDALINÆ.—Pedes 1mi gracillimi, non chelati, 2di filiformes, carpo annulato.—G. *Pandalus*, Lh.
3. PALÆMONINÆ.—Pedes 4 antichi chelati, 2di 1mis crassiores, carpis nullis annulatis. Pedes nulli palpigeri.—G. *Pontonia*, Lat., D., *Ædipus*, D., *Harpilius*, D., *Anchistia*, D. (An *Periclimeni* Costæ similis?) *Palæmonella*, D., *Palæmon*, Fab., *Hymenocera*, Lat., *Cryphiops*, D. [Hic *Typton* Costæ, si non squama antennarum basalis nulla.]
4. OPLOPHORINÆ.—Pedes 1mi sive didactyli sive monodactyli; 2di chelati, crassiores. Squama antennarum externarum acuminata, extus spinis armata.—G. *Oplophorus*, E., *Regulus*, D. = ~~*Alpheus*~~
[Cujus sedis *Autonomea*, Risso?]

2. *Maxillipedes 2di tenuiter pediformes.*

Fam. IV. PASIPHÆIDÆ.—Mandibulæ uti in *Atyidis*.

G. *Pasiphæa*, Sav.

SUBTRIBUS III. PENÆIDEA, vel MACROURA INFERIORA.

Carapax suturâ nullâ notatus, cum epistomate antice non connatus. Antennæ externæ squamâ basali magnâ instructæ. Pedes 1mi 2dique 3tiis non crassiores, 3tii sæpius crassiores longiores et chelati; raro pedes toti debiles et tenues, 3tiis sive obsolete chelatis sive non chelatis.

Fam. I. PENÆIDÆ.—Pedes 6 antichi chelati, 3tii longiores et plus minusve validiores.

G. *Sicyonia*, E., *Penæus*, Lat., *Aristeus*, Duv., *Stenopus*, Lat., *Spongicola*, De H.

Fam. II. SERGESTIDÆ.—Pedes toti debiles, 2di 3tisque consimiles, sive obsolete didactyli sive non didactyli. Maxillipedes externi tenues.

G. *Sergestes*, E., *Acetes*, E., *Euphema*, E. (An hujus sedis?)

Fam. III. EUCOPIDÆ.—Pedes toti debiles, 2di 3tisque non chelati, 1mi maxillipedesque externi monodactyli et subprehensiles.

G. *Eucopia*, D.

ORDO II. ANOMOBRANCHIATA. 1411

TRIBUS I. MYSIDEA. 1411

Fam. I. EUPHAUSIDÆ.—Cephalothorax formâ Caridoideus. Pedes thoracis bifidi, appendicibus branchialibus externis.

G. *Thysanopoda*, E., *Euphausia*, D., *Cyrtopia*, D.

Fam. II. MYSIDÆ.—Cephalothorax formâ Caridoideus. Pedes thoracis bifidi, appendicibus branchialibus carentes.

1. CYNTHINÆ.—Pedes abdominis appendicibus branchialibus instructi. Antennæ internæ birameæ, externæ squamâ basali instructæ.—G. *Cynthia*, Thompson.
2. MYSINÆ.—Pedes abdominis appendicibus branchialibus carentes. Antennæ internæ birameæ, externæ squamâ basali instructæ.—G. *Mysis*, Lat., *Promysis*, D., *Macromysis*, W., *Siriella*, D., *Loxopsis*, D.
3. SCELETININÆ.—Pedes abdominis appendicibus branchiiformibus carentes. Antennæ internæ simplices, externæ birameæ, squamâ basali carentes.—G. *Sceletina*, D., *Rachitia*, D., *Myto*, Kr.

Fam. III. LUCIFERIDÆ.—Segmentum antennale valde elongatum carapace per suturam fere discretum. Pedes simplices.

G. *Lucifer*.

APPENDIX TO THE MYSIDEA.—G. *Furcilia*, D., *Calyptopsis*, D., *Zoea*. Bose.

TRIBUS II. AMPHIONIDEA.

Fam. I. AMPHIONIDÆ.

G. *Phyllosoma*, Leach, *Amphion*, Edw.

TRIBUS III. SQUILLOIDEA. 1415

Fam. I. SQUILLIDÆ.—Rostrum carapaxque per suturam disjuncti.

G. *Lysiosquilla*, D., *Squilla*, *Pseudosquilla*, *Coronis*, Lat., *Gonodactylus*, Lat.

Fam. II. ERICHTHIDÆ.—Rostrum est carapacis frons productus et acuminatus, carapace et rostro non disjunctis.

G. *Squillerichthus*, Edw., *Erichthus*, Lat., *Alima*, Lh.

SUBCLASSIS II. TETRADECAPODA.

ORDO I. CHORISTOPODA.

TRIBUS I. ISOPODA. 1215

SUBTRIBUS I. IDOTÆIDEA.

Appendices abdominales duæ posticæ bene operculiformes, appendices alias optime tegentes.

Fam. I. IDOTÆIDÆ.—Pedes fere consimiles, plus minusve ambulatorii.

G. *Idotæa*, Fab., *Edotea*, Guer., *Erichsonia*, D., *Cleantis*, D., *Epelys*, D.

Fam. II. CHÆTILIDÆ.—Pedes 6 postici non subæqui, pari uno longissimo, et multiarticulato.

G. *Chætilia*, D.

[An hujus sedis *Anthuridæ*.]

SUBTRIBUS II. ONISCOIDEA.

Appendices abdominales duæ posticæ styliformes et non operculiformes alias appendices tegentes sat terminales, raro obsoletæ.

Fam. I. ARMADILLIDÆ.—Corpus bene convexum, stricte articulatum. Abdomen multiarticulatum, segmento ultimo parvo. Appendices caudales ultra abdomen non exsertæ, lamellatæ. Mandibulæ non palpigeræ. Antennæ internæ inconspicuæ.

1. TYLINÆ.—Appendices caudales infra abdominis segmentum posticum celatæ et operculiformes sed parvæ et alias appendices non tegentes.—G. *Tylus*, Lat.

2. ARMADILLINÆ.—Appendices caudales inter duo abdominis segmenta postica partim visæ.—G. *Armadillo*, Lat., *Spherillo*, D., *Armadillidium*, Br., *Diploexochus*, Br.

Fam. II. ONISCIDÆ.—Corpus sæpius minus convexum, vel stricte vel laxè articulatum. Abdomen multiarticulatum, segmento ultimo

parvo. Appendices caudales valde exsertæ, styliformes. Mandibulæ non palpigeræ. Antennæ internæ conspicuæ.

1. ONISCINÆ.—Maxillipedes 3-articulati, articulis duobus ultimis brevibus et parvulis. Antennæ externæ ad articulationem 5tam bene geniculatæ. Basis appendicum caudalium perbrevis, duos stylos multum inæquos gerens, stylo interno sub abdomine partim celato.—G. *Oniscus*, Linn. (subgen. *Trichoniscus*, Br., *Porcellio*, Lat., *Oniscus*), *Philoscia*, *Platyarthrus*, Br., *Deto*, Guer.
2. SCYPHACINÆ.—Maxillipedes 2-articulati, articulo 2do lamellato. Antennæ externæ ad articulationem 5tam non geniculatæ. Basis appendicum caudalium aut brevis aut oblongus, ramo interno interdum omnino aperto.—G. *Scyphax*, D., *Styloniscus*, D.
3. LYGINÆ.—Maxillipedes 4-articulati, elongati. Antennæ externæ ad articulationem 5tam non bene geniculatæ. Styli caudales longi, basi longè exserto, ramis setiformibus, subæquis et æque apertis.—G. *Lygia*, Fab., *Lygidium*, Br.

Fam. III. ASELLIDÆ.—Corpus sæpius plus depressum et laxè articulatum. Abdomen 1-6-articulatum, segmento ultimo magno, scutellato. Appendices caudales styliformes, interdum brevissimæ. Mandibulæ palpigeræ. Antennæ internæ conspicuæ.

1. LIMNORINÆ.—Abdomen 5-6-articulatum.—G. *Limnoria*, Lh.
2. ASELLINÆ.—Abdomen 1-2-articulatum.—G. *Jæra*, Lh., *Jæridina*, E., *Asellus*, G., *Janira*, Lh., *Henopomus*, Kr., *Munna*, Kr.

SUBTRIBUS III. CYMOTHOIDEA.

Appendices abdominales duæ posticæ lamellatæ, apud abdominis latera dispositæ.

Fam. I. CYMOTHOIDÆ.—Maxillipedes breves, 3-4-articulati, operculiformes, articulis terminalibus angustis brevibus. Appendices caudales liberæ, marginibus rarissimè ciliatæ. Antennæ sub capite infixæ. Abdomen 4-6-articulatum, segmentis anterioribus raro connatis. Pedes toti ancorales. Branchiæ sæpissime non ciliatæ. Epimeræ conspicuæ.

1. CYMOTHOINÆ.—Lamellæ caudales nudæ. Abdomen multiarticulatum, segmentis liberis.—G. *Cymothoa*, Fab., *Ceratothoa*, D., *Livoneca*, Lh., *Anilocra*, Lh., *Nerocila*, Lh., *Oleocira*, Lh.
2. OROZEUKTINÆ.—Segmentum abdominis posticum ac in *Cymothoâ*; segmenta alia coalita et non libera.—G. *Orozeuktes*, E.
3. ÆGATHOINÆ.—Lamellæ caudales ciliatæ. Abdomen multiarticulatum, segmentis liberis.—G. *Ægathoa*, D.

Fam. II. *ÆGIDÆ*.—Maxillipedes elongati, 4–6-articulati, articulis totis lamellatis, terminalibus latis et brevibus. Appendices caudales liberæ, marginibus ciliatæ. Antennæ ad frontis marginem capitis affixæ, apertæ. Abdomen 4–6-articulatum. Pedes 6 antici interdum ancorales aut prehensiles, sæpius simpliciter unguiculati, 8 postici unguiculati et nunquam ancorales. Branchiæ ciliatæ. Epimeræ conspicuæ.

1. *ÆGINÆ*.—Pedes 6 antici ancorales, unguibus validis, reliquis unguibus parvulis confecti.—G. *Æga*, Lh. (Subgen. *Æga*, *Conilera*, Lh., *Rocinela*, Lh.), *Acherusia*, Lucas, *Pterelas*, Guer.
2. *CIOROLANINÆ*.—Pedes nulli ancorales.—G. *Cirolana*, Lh., *Corallana*, D., *Alitropus*, E.

Fam. III. *SPHEROMIDÆ*.—Maxillipedes elongatè 5–6-articulati et palpiformes. Appendices caudales margine abdominis laterali connatæ. Antennæ ad frontis marginem capitis affixæ, apertæ. Abdomen 1–2-articulatum. Pedes non ancorales (raro 4 antici ancorales). Branchiæ ciliatæ. Epimeræ non discernendæ.

1. *SPHEROMINÆ*.—Lamella appendicis caudalis externa sub internâ se latens.—G. *Spheroma*, Lat., *Cymodocea*, Lh., *Cerceis*, E., *Cassidina*, E., *Amphoroideum*, E.
2. *NESÆINÆ*.—Lamella appendicis caudalis externa saliens, sub internâ se non latens, usquam aperta. Pedes nulli ancorales.—G. *Nesæa*, Lh., E., *Campecopea*, Lh.
3. *ANCININÆ*.—Pedes 4 antici ancorales.—G. *Ancinus*, E.

TRIBUS II. ANISOPODA.

SUBTRIBUS I. SEROLIDEA, vel ANISOPODA CYMOTHOICA.

Appendices duæ posticæ abdominales lamellatæ, apud abdominis latera dispositæ.

Fam. I. *SEROLIDÆ*.—Appendices abdominales sex anticæ liberæ, subnatatoriæ, quatuor sequentes branchiales, bene lamellatæ, ultimæ ac in Cymothoidis. Antennæ 1mæ sub capite insitæ.

G. *Serolis*, Lh.

Fam. II. *PRANIZIDÆ*.—Appendices abdominales totæ ac in *Ægidis*. Antennæ 1mæ sub capite insitæ. Pedes thoracis numero decem, paribus duobus anticis rudimentariis. Thoracis segmenta numero quinque non superantia.

1. PRANIZINÆ.—Caput parvum. Mandibulæ vix salientes.—G. *Praniza*, Lh.
2. ANCEINÆ.—Caput grande. Mandibulæ ultra caput longè exsertæ.—G. *Anceus*, Risso.

SUBTRIBUS II. ARCTURIDEA, vel ANISOPODA IDOTÆICA.

Appendices duæ posticæ abdominales lamellatæ et bene operculiformes, appendices branchiales tegentes.

Fam. I. ARCTURIDÆ.

1. ARCTURINÆ.—Opercula abdominis ad ventrem strictè appressa.—G. *Arcturus*, Lat., *Leachia*, Johnston.
2. ANTHURINÆ.—(An Idotæideorum?) Opercula abdominis ad ventrem non bene appressa, sed libera et latera abdominis partim tegentia.—G. *Anthura*, Lh.

SUBTRIBUS III. TANAIDEA, vel ANISOPODA ONISCICA.

Appendices duæ posticæ abdominales plus minusve styliiformes, subterminales, interdum obsoletæ.

Fam. I. TANAIIDÆ.—Pedes Imi 2dive subchelati, sequentes non ancorales. Abdomen paribus 5 appendicum subnatatoriis unoque postico stylorum instructum.

1. TANAINÆ.—Corpus lineare, segmento thoracis Imo sæpe oblongo capiteque parvulo. Styli caudales longi. G. *Tanais*, E., *Paratanais*, D., *Leptocheilia*, D., *Apsuedes*, Lh., *Rhœa*, E.
2. LIRIOPINÆ.—Corpus antice latius, postice sensim angustans, segmento thoracis Imo reliquis vix longiore, capite sat grandi. Appendices abdominales numero decem elongatæ.—G. *Liriope*, Rathke, *Cryptothir*, D.
3. CROSSURINÆ.—Corpus antice latius, postice sensim angustatum, segmento thoracis Imo vix longiore, capite sat grandi. Appendices abdominales inferiores numero sex, ciliatæ.—G. *Crossurus*, Rathke.

Fam. II. BOPYRIDÆ.—Pedes toti plerumque aliquo modo subprehensiles vel ancorales. *Maris* corpus angustum; abdomen 1–6-articulatum, appendicibus subnatatoriis stylisque duobus sæpe instructum, totis appendicibus interdum obsoletis. *Feminæ* corpus latum et obesum, oculis carens, et quoad pedes sæpe partim obsoletum.

1. BOPYRINÆ.—Thorax *feminae* appendicibus branchialibus carens. G. *Bopyrus*, Lat., *Phryxus*, Rathke, *Cepon*, Duv., *Dajus*, Kr.
2. IONINÆ.—Pedes thoracis *feminae* ad basin appendices simplices branchiales gerentes.—G. *Ione*, Lat., *Argeia*, D.

TRIBUS III. AMPHIPODA.

SUBTRIBUS I. CAPRELLIDEA.

Maxillipedes elongati, palpiformes. Caput oculique mediocres. Abdomen obsolescens.

Fam. I. CAPRELLIDÆ.—Corpus longum et fere filiforme. Antennæ 2dæ longitudine mediocres. [Species non parasiticæ.]
G. *Proto*, Lh., *Protella*, D., *Caprella*, Lk., *Ægina*, Kr., *Cercops*, Kr., *Podalirius*, Kr.

Fam. II. CYAMIDÆ.—Corpus latum, depressum. Antennæ 2dæ obsoletæ. [Species parasiticæ.]
G. *Cyamus*.

SUBTRIBUS II. GAMMARIDEA.

Maxillipedes elongati, palpiformes. Caput oculique mediocres. Abdomen appendicibus sex natatoriis et sex styliformibus instructum.

Fam. I. DULICHIDÆ.—Gressoriæ, habitu Caprelloideæ. Corpus lineare, epimeris obsoletis. Pedes sex posteriores longi, subprehensiles. Abdomen 5-articulatum.
G. *Dulichia*, Kr.

Fam. II. CHELURIDÆ.—Corpus fere cylindricum, epimeris mediocribus. Abdomen segmentis 4to 5toque coalitis et oblongis, stylis caudalibus inter se valde dissimilibus.
G. *Chelura*, Philippi.

Fam. III. COROPHIDÆ.—Gressoriæ, pedibus partim lateraliter porrectis. Corpus plus minusve depressum, sæpe latum, epimeris perbrevibus, interdum obsoletis. Abdomen formâ appendicibusque normale et perfectum. Antennæ sæpe pediformes.

1. CLYDONINÆ.—Styli caudales 1mi 2dique simplices, subulati.—G. *Clydonia*, D.
2. COROPHINÆ.—Antennæ plus minusve pediformes. Styli caudales 1mi 2dique biramei.—G. *Corophium*, Lat., *Siphonocetes*, Kr., *Platophium*, D., *Cyrtophium*, D., *Unciola*, Say, *Podocerus*, Lh., *Cratophium*, D., *Cerapus*, Say, *Cerapodina*, E., *Erichthonius*, E.
3. ICILINÆ.—Antennæ non pediformes nec subpediformes, flagellis sat longis basi- que sat brevi instructæ. Styli caudales ac in *Corophinis*.—G. *Icilius*, D., *Ptery- gocera*, Lat.

Fam. IV. ORCHESTIDÆ. — Saltatoriæ, pedibus nullis lateraliter porrectis. Corpus compressum, epimeris magnis. Abdomen appendicibus normale. Antennæ non bene pediformes. Styli caudales 1mi 2dique biramei; 3tii simplices brevissimi et ultra 2dos non producti. Mandibulæ non palpigeræ. Maxillæ 1mæ palpo instructæ sive parvulo sive obsoleto.

G. *Orchestia* (subgen. *Talitrus*, *Talorchestia*, *Orchestia*), *Allorchestes*, D.

Fam. V. GAMMARIDÆ.—Saltatoriæ vel natatoriæ, pedibus nullis lateraliter porrectis. Corpus sæpius compressum, raro subde- pressum, epimeris sive magnis sive parvis. Styli caudales laxiores, duobus ultimis oblongis sæpiusque ultra 2dos productis, interdum simplicibus. Mandibulæ sæpissime palpigeræ. Maxillæ 1mæ palpo magno 2–3-articulato (rarissime 1-articulato) instructæ.

1. *Pedes 10 postici non prehensiles.*

1. STEGOCEPHALINÆ.—Antennæ breves, superiores basi crassæ. Mandibulæ acie denticulatâ instructæ, palpo brevi uniarticulato intus dentato. Epimeræ per- magnæ.—G. *Stegocephalus*, Kr.
 2. LYSIANASSINÆ.—Antennæ breves, superiores basi crassæ. Mandibulæ apice parce dentatæ et acuminatæ, acie vix instructæ, palpo 2–3-articulato. Maxilli- pedes lamellis internis magnis. Epimeræ permagnæ.—G. *Lysianassa*, E., *Phlias*, Guer., *Opis*, Kr., *Uristes*, D., *Anonyx*, Kr., *Urothoe*, D.
 3. LEUCOTHOINÆ.—Antennæ superiores basi plus minusve graciles. Maxillipedes elongati, perangusti, articulo longo unguiformi confecti, lamellis internis perbre- vibus. Mandibulæ sive palpigeræ sive non palpigeræ, processu molari carentes (An semper?). Epimeræ magnæ.—G. *Stenothoe*, D., *Leucothoe*, Lh.
- [An hujus sedis, genus *Microcheles*, Kr., et *Amphithoe marionis*, Edw. ?]
4. GAMMARINÆ.—Antennæ 1mæ basi graciles. Maxillipedes sat lati, lamellis quoque processu molari et palpo 3-articulato. Pedes 10 postici non subprehen- siles.—G. *Acanthonotus*, Owen, *Alibrotus*, E., *Leptochirus*, Zad., *Iphimedia*, Rath., D., *Ædicerus*, Kr., *Amphithoe*, Lh., D., *Gammarus*, Fab., D., *Photis*, Kr.,

Melita, Lh., D., *Mæra*, Lh., D., *Dercothoe*, D., *Pyctilus*, D., *Atylus*, Lh., *Ischyrocerus*, Kr. [An hujus sedis *Pardalisca*, Kr. ?]

2. *Pedes 10 postici partim prehensiles.*

5. PONTOPOREINÆ.—*Pedes 3tii 4tique plus minusve prehensiles; 6 postici non prehensiles.*—G. *Lepidactylis*, Say, *Pontiporeia*, Kr., *Ampelisca*, Kr., *Protomedeia*, Kr., *Aora*, Kr., *Phoxus*, Kr.
6. ISÆINÆ.—*Pedes 4 vel 6 postici subprehensiles.*—G. *Isæa*, E., *Anisopus*, Tem.

SUBTRIBUS III. HYPERIDEA.

Maxillipedes abbreviati, lamellati, operculiformes. Caput grande, oculorum corneis plerumque tectum. Appendices abdominales ac in *Gammarideis*, latius lamellatæ.

Fam. I. HYPERIDÆ.—*Antennæ 2dæ exsertæ.* Abdomen in ventrem se non flectens. *Pedes 5ti 6ti 7mique formâ longitudineque mediocres, 5tis 6tisve non percrassis nec prehensilibus.*

1. VIBILINÆ.—*Corpus formâ paulo Gammaroideum. Caput oculique mediocres. Maxillipedes palpo parvulo instructi. Palpus mandibularis tenuis.*—G. *Vibilia*, E.
2. HYPERINÆ.—*Caput tumidum. Oculi pergrandes. Palpus mandibularis tenuis.*—G. *Lestrigonus*, E., *Tyro*, E., *Hyperia*, Lat., *Metæcus*, Kr., *Tauria*, D., *Dairinia*, D. (= *Daira*, Edw.), *Cystisoma*, Guer.
3. SYNOPINÆ.—*Corpus gracilius. Palpus mandibularis sat brevis, latissimus. Oculi grandes.*—G. *Synopia*, D.

Fam. II. PHRONIMIDÆ.—*Antennæ 2dæ exsertæ.* Abdomen in ventrem se non flectens. *Pedes 5ti 6tive sive crassi sive elongati, sæpius prehensiles, quoque 3tii 4tique sæpe prehensiles.*

1. PHRONIMINÆ.—*Abdomen versus basin sat gracile. Pedes 5ti magnâ manu didactylâ vel monodactylâ confecti; 3tii 4ti extremitate graciles, non prehensiles. Antennæ breves.* G. *Phronima*, Lat., *Primno*, Guer.
2. PHROSININÆ.—*Abdomen versus basin sat crassum. Pedes 5ti prehensiles, monodactyli; quoque 3tii 4tique prehensiles.*—G. *Anchylomera*, E., *Phrosina*, Risso, *Themisto*, Guer.
3. PHORCINÆ.—*Pedes 5ti 6tive valde elongati, et crassi, sed manu non confecti.*—G. *Phorcus*, E.

Fam. III. TYPHIDÆ.—*Antennæ 2dæ sub capite thoraceve celatæ et sæpius replicatæ.* Abdomen in ventrem sæpe se flectens. *Pedes*

6 postici interdum abbreviati cum articulo Imo operculiformi, interdum longitudine mediocres.

1. TYPHINÆ.—Abdomen in ventrem se flectens.—G. *Dithyrus*, D., *Typhis*, R. *Thyropus*, D.
2. PRONONÆ.—Abdomen in ventrem se non flectens. Caput non oblongum, antennis in capitis frontem insitis.—G. *Pronoe*, Guer., *Lycæa*, D.
3. OXYCEPHALINÆ.—Abdomen in ventrem se non flectens. Caput oblongum antennis Imis in superficiem capitis inferiorem insitis.—G. *Oxycephalus*, E. *Rhabdosoma*, W.

ORDO II. (?) TRILOBITA.

SUBCLASSIS III. ENTOMOSTRACA.

ORDO I. GNATHOSTOMATA.

LEGIO I. LOPHYROPODA.

TRIBUS I. CYCLOPOIDEA.

Fam. I. CALANIDÆ.—Oculi duo simplices minutissimi, pigmentis sive coalitis sive discretis; interdum oculi alii in uno coaliti infra caput deorsum spectantes. Mandibulæ maxillæque elongati palpi geræ. Pedes Imi nunquam prehensiles.

1. CALANINÆ.—Oculi inferiores nulli. Antennæ Imæ longæ, fere transversim porrectæ; dextra maris articulatione non geniculans; 2dæ non prehensiles. Maxillæ latere interiore setigeræ. Abdomen longitudine mediocre.—G. *Calanus*, Leach, *Rhincalanus*, D., *Cetochilus*, *Euchæta*, Philippi, *Undina*, D.
2. PONTELLINÆ.—Oculi inferiores distincti. Antennæ Imæ longæ sæpe oblique porrectæ; dextra maris articulatione sæpius geniculans; 2dæ non prehensiles. Maxillæ abdomenque ac in *Calaninis*. G. *Hemicalanus*, D., *Diaptomus*, Westw., *Candace*, D., *Pontella*, *Acartia* D., *Catopia*, D.
3. OITHONINÆ.—Oculi et antennæ fere ac in *Calaninis*. Abdomen prælongum, cephalothorace vix brevius. Maxillæ latere interiore digitatæ.—G. *Oithona*, Baird.
4. NOTODELPHINÆ.—Antennæ 2dæ prehensiles, vel monodactylæ.—G. *Notodelphys*, Allman.

Fam. II. CYCLOPIDÆ.—Oculi duo simplices minutissimi coaliti tantum. Mandibulæ palpo parvulo vel obsoleto. Pedes lmi plus minusve subprehensiles.

1. CYCLOPINÆ.—Sacculi ovigeri externi duo.—G. *Cyclops*.
2. HARPACTICINÆ.—Sacculus oviger unicus.—G. *Harpacticus*, Edw., *Clytemnestra*, D., *Canthocampus*, Westw., *Setella*, D.

Fam. III. CORYCÆIDÆ.—Oculi duo simplices minutissimi coaliti; quoque alii duo portentosæ magnitudinis, lenticulo prolato interno corneâque magnâ oblatâ in testam insitâ instructi. Sacculi ovigeri sive duo sive unicus. Pedes lmi sæpius subprehensiles.

1. CORYCÆINÆ.—Sacculi ovigeri duo.—G. *Corycæus*, D., *Antaria*, D., *Sapphirina*, Thompson.
2. MIRACINÆ.—Sacculus oviger unicus.—G. *Miracia*, D.

TRIBUS II. DAPHNIOIDEA.

Fam. I. PENILIDÆ.—Pedes foliacei numero duodecim, angustiores. Antennæ anticæ obsolescentes.

G. *Sida*, Straus, *Daphnella*, Baird, *Penilia*, D., *Latona*, Str.

Fam. II. DAPHNIDÆ.—Pedes foliacei numero decem, latiores. Antennæ anticæ 1-2-articulatæ, raro multiarticulatæ.

G. *Daphnia*, M., *Ceriodaphnia*, D., *Moina*, Baird, *Macrothrix*, B., *Acanthocercus*, Schödler, *Eurycercus*, B., *Lynceus*, M., *Alona*, Baird, *Bosmina*, Baird.

Fam. III. POLYPHEMIDÆ.—Caput grande, oculis repletum. Pedes numero octo, fere teretes. Antennæ anticæ obsolescentes.

G. *Polyphemus*, M., *Evadne*, Loven, *Pleopis*, D.

TRIBUS III. CYPROIDEA.

Fam. I. CYPRIDÆ. — Antennæ 2dæ subteretes, 3-5-articulatæ. Mandibulæ apice productæ et denticulatæ, et lateraliter palpigeræ, palpo a mandibulæ apice remoto. Oculi pigmento unico minuto conjuncti, lenticulis duobus sphericis. Pedes duo vel plures tenuiter pediformes.

1. CYPRINÆ.—Pedes numero quatuor; anteriores tenues pediformes, posteriores debiles. Abdomen elongatum, stylis duobus confectum.—G. *Cypris*, Müller, *Candona*, Baird.
2. CYTHERINÆ.—Pedes numero sex, consimiles, pediformes. Abdomen breve.—G. *Cythere*, Müller.

Fam. II. HALOCYPRIDÆ.—Antennæ 2dæ basi crassæ, sæpius biramæ, ramo longiore 5–7-articulato elongatè setigero. Appendices mandibulares omnino pediformes, processu molari parvo.

1. CYPRIDININÆ.—Pedes quatuor, articulati. Maxillæ quatuor.—G. *Cypridina*, E.
2. HALOCYPRINÆ.—Pedes duo, vermiformes. Maxillæ sex.—G. *Halocypris*, D., *Conchocia*, D.

LEGIO II. PHYLLOPODA.

TRIBUS I. ARTEMIOIDEA.

Fam. I. ARTEMIADÆ.—Cephalothorax multiannulatus usque ad caput, testâ nusquam tectus. Pedes numerosi, foliacei.

1. CHIROCEPHALINÆ.—Corpus gracile. Abdomen longum et multiarticulatum. Antennæ 2dæ breves sed percrassæ, maris prehensiles.—G. *Chirocephalus*, Prevost, *Artemia*, Leach.
2. EULIMENINÆ.—Abdomen fere obsoletum. Antennæ quatuor fere filiformes.—G. *Eulimene*, Lat.

Fam. II. NEBALIADÆ.—Cephalothorax testâ fere bivalvi bene tectus. Abdomen non inflexum, pauci-annulatum. Pedes plures posteriores biremes, ac in *Cyclopoideis*, reliqui anteriores foliacei, branchiales.

G. *Nebalia*, Leach.

TRIBUS II. APODOIDEA.

Fam. APODIDÆ.—Oculi duo compositi. Appendices duæ caudales rigidè setiformes. Testa scutiformis.

G. *Apus*, Schœffer.

TRIBUS III. LIMNADIOIDEA.

Fam. LIMNADIDÆ.

G. *Limnadia*, Br., *Cyzicus*, Aud., *Limnetis*, Loven (*Hedessa*, Lievin).

ORDO II. CORMOSTOMATA.

SUBORDO I. PÆCILOPODA.

TRIBUS I. ERGASILOIDEA.

Fam. I. MONSTRILLIDÆ.—Corpus elongatum fere cylindricum. Abdomen 5–6-articulatum, segmentis 1mo 2doque appendicibus setosis munitis ac in *Setellâ*. Maxillæ, antennæ posticæ et pedes antici obsoleti, pedes octo maxime biremes.

G. *Monstrilla*, D.

Fam. II. ERGASILIDÆ. — Corpus breviusculum, cephalothorace crasso, abdomine stylis caudalibus minutis setigeris confecto. Antennæ posticæ subprehensiles ac in *Corycæo*, pedes octo postici bene biremes.

G. *Ergasilus*, Nordmann.

Fam. III. NICOTHOIDÆ.—*Ergasilidis* affinis. Antennæ posticæ perbreves vel rudimentariæ. [Corpus lobis tumidis prodigiosis lateraliter prolongatum.]

G. *Nicthoe*, Aud. et Edw.—[Cujus sedis est *Bomolocus*, Nordmann?]

TRIBUS II. CALIGOIDEA.

Fam. I. ARGULIDÆ.—Corpus late depressum, peltatum. Antennæ 1mæ obsoletæ. Pedes 1mi tubulati, 2di unguiculati. Ova in tubis vel sacculis externis non gesta.

G. *Argulus*, Müller.

Fam. II. CALIGIDÆ.—Corpus late depressum, peltatum, segmento

antico pergrandi. Antennæ 1mæ breves, 2-3-articulatæ; 2dæ corpore tectæ. Pedes 1mi graciles, 2di prehensiles vel ancorales. Ova externa in tubis gesta.

1. CALIGINÆ.—Truncus buccalis ovoideus, paulo oblongus, aperturâ oris inferiore. Maxillæ ab orâ remotæ, brevissimæ, crassæ. Tubi ovigeri externi recti. Antennæ anticæ 2-articulatæ.—G. *Caligus*, Müller, *Lepeophtheirus*, Nord., *Caligeria*, D., *Calistes*, D., *Trebius*, Kr.
2. PANDARINÆ.—Truncus buccalis acuminatus, aperturâ terminali. Maxillæ parvulæ lamellares ad truncum appressæ. Tubi ovigeri externi recti.—G. *Pandarus*. Lh., *Nogagus*, Lh., *Phyllophora*, E., *Dinematura*, Lat., *Euryhporus*, Nord., *Lepidopus*, D.
3. CECROPINÆ.—*Pandarinis* affines. Tubi ovigeri externi sub abdomine convoluti.—G. *Cecrops*, *Læmargus*.
4. SPECILLIGINÆ.—*Pandarinis* affines. Oculi duo ac in Sapphirinis. G. *Specilligus*, D.

Fam. III. DICHELESTIDÆ.—Corpus angustum, segmento antico parvo. Antennæ 1mæ breves, 5-10-articulatæ; 2dæ fere frontales, ultra caput exsertæ. Pedes 1mi graciles, 2di prehensiles. Ova externa in tubis gesta.

1. DICHELESTINÆ.—Segmenta corporis angusta, non foliosè producta.—G. *Dichelestium*, Herm., *Nemesis*, Roux.
2. ANTHOSOMATINÆ.—Segmenta corporis foliosè producta.—G. *Anthosoma*, Leach.

TRIBUS III. LERNÆOIDEA.

Fam. I. CHONDRACANTHIDÆ. — Appendices cephalothoracis numero quatuor vel plures, unguibus plus minusve ancorales.

1. SELINÆ.—Antennæ anticæ et pedes thoracis postici graciles.—G. *Selius*, Kr.
2. CHONDRACANTHINÆ.—Antennæ anticæ graciles vel perbreves. Pedes thoracis postici breviter et crasse ancorales.—G. *Chondracanthus*, de la Roche, *Lernanthropus*, Bl., *Lernentoma*, Bl., *Cycnus*, E.
3. CLAVELLINÆ.—Antennæ anticæ obsoletæ. Pedes thoracis postici crassi et breves.—G. *Clavella*, Oken, *Peniculus*, Nord., *Æthon*, Kr.

Fam. II. ANCORELLIDÆ.—Antennæ posticæ feminarum ad apicem sæpeque per latera connatæ et disco ancorali confectæ.

1. ANCORELLINÆ.—Antennæ posticæ feminarum per latera connatæ et disco ancorali confectæ.—G. *Ancorella*, Cuv.
2. LERNÆOPODINÆ.—Antennæ posticæ feminarum versus apicem connatæ tantum.—G. *Lernæopoda*, Kr., *Brachiella*, Cuv., *Achtheres*, N., *Tracheliastes*, N., *Basanistes*, N.

Fam. III. PENELLIDÆ.—Pedes obsoleti. Caput 2-4 appendicibus brevibus non articulatis munitum.

1. PENELLINÆ.—Pedes pauci rudimentarii vix obsoleti.—G. *Penella*, Oken, *Ler-
neonema*, Edw.
2. LERNEOCERINÆ.—Pedes omnino obsoleti.—G. *Lerneocera*, Bl., *Lernea*.

SUBORDO II. ARACHNOPODA VEL PYCNOGONOIDEA.

Fam. I. NYMPHIDÆ.—Antennis munitæ.

G. *Nymphum*, Fabr., *Ammonothea*, Lh., *Pallene*, J., *Phoxichilidium*, J.

Fam. II. PYCNOGONIDÆ.—Antennis carentes.

G. *Pycnogonum*, Brunnich, *Phoxichilus*, Lat.

SUBCLASSIS IV. CIRRIPEDIA.

SUBCLASSIS V. ROTATORIA.

A P P E N D I X.

THE following references are here added to genera of Fossil Crustacea, not mentioned in the preceding classification, excluding the Trilobite group.

1. XANTHIDÆ.—*Arges* of De Haan (Faun. Japon., 21 and 52, pl. 5,

f. 4), a genus near *Pilumnus* and *Menippe*. Maxillipeds Cancroid, abdomen in both sexes seven-jointed; lateral margins of carapax parallel and entire, so as to resemble *Cyclograpsus Audouinii*. Distance between the eyes one-fifth the breadth of the thorax.

Etycea, Leach (Mantell's Geol. of Sussex, Pl. 29, f. 11, 12), has the transverse form of *Xantho*.

2. ERIPHIDÆ (?)—*Zanthopsis*, M'Coy (Ann. Mag. N. H. [2], iv. 162), approaches *Actumnus* in nearly orbicular outline and convexity of carapax, but has the fingers acuminate; the basal joint of the outer antennæ just reaches the front.

Podopilumnus, M'Coy (loc. cit., p. 165), very near *Galene* of De Haan. It has the slender legs of our *Pilumnus tenellus*.

3. ANOMOURA.—*Dromilites* and *Ogydromites* of Edwards; *Hela* of Count Münster; *Basinotopus* and *Notopocorystes* of M'Coy (Ann. Mag. N. H. [2], iv. 167, 169). The form and sutures of the carapax, in M'Coy's genera, and the character of the arms and of the posterior legs, are very nearly as in *Æglea*.

4. THALASSINIDEA.—*Magila*, *Aura*, *Cancrinus*, *Orphnea*, *Brisa*, and *Brome* of Münster; *Megachirus* and *Pterochirus* of Brown.

5. ASTACIDEA.—*Coleia*, Broderip (Geol. Trans. [2], v.); *Glyphea* and *Pemphix*, von Meyer (Foss. Krebse); *Bolina*, Münster; *Podocratus*, Becks; *Archæocarabus* and *Hoploparia* of M'Coy (Ann. Mag. N. H. [2], iv. 173, 175). The species have the transverse suture across the carapax, which distinguishes the Astacidea and most Thalassinidea from the Caridea and Penæidea.

6. PENÆIDEA.—The following genera are referred to the *Penæus* group by De Haan (Faun. Japon., 187): *Antrimpos*, *Bylgia*, *Drobna*, *Dusa*, *Blaculla*, *Æger*, *Udora*, *Kolga*, *Hefriga*, *Elder* of Count Münster, and possibly, *Rauna* and *Bombur* of the same author. In the first seven of these genera all the legs are didactyle, and in *Hefriga* and *Elder* all are monodactyle. The genus *Saga* of Count Münster, De Haan refers to the Mysidea.

7. SQUILLOIDEA.—*Naranda* and *Reckur* of Count Münster are referred here by H. G. Bronn (Index Palæontologicus, ii. 575); and also, with a query, *Norna* and *Urda* of the same author.

8. ISOPODA.—*Archæoniscus* and *Palæoniscus* of Edwards (Ann. des Sci. Nat., xx. 326). *Archæoniscus*, according to Edwards, is between *Spheroma* and *Ancinus*.

9. ENTOMOSTRACA.—T. Rupert Jones adds to the Cytherinæ the genera (or "subgenera") *Cytherella* and *Cythereis*, based on the form of the shell. *Cyprella* and *Cypridella* of Koninck (Descript. An. Foss.) are genera proposed for Cyproid species found in the Belgian carboniferous beds; and *Dithyrocaris*, Scouler (Portlock's Geol. Rep., Londonderry, and Wm. King's Permian Fossils of England, p. 64, Palæontograph. Soc., Pub. 1850), includes Carboniferous or Permian species, which have been referred both to the Cyproidea and Apodoidea, it being uncertain whether the shell is properly bivalve or not. *Cytheropsis*, M'Coy, includes Palæozoic species that have been referred to Cytherina; *Beyrichia* and *Ceratiocaris*, M'Coy (Brit. Pal. Fossils, Mus. Camb., 4to, 1851, 135), are genera of other Palæozoic species. All the carboniferous and Palæozoic species are referred to the section Phyllopoda, near the bivalve genus *Limnadia*, by Burmeister and M'Coy. The abnormal number of segments in other Palæozoic Crustacea render it probable that this reference of them is right.

Entomoconchus, M'Coy (Jour. Geol. Soc. Dublin, ii.), and *Daphnoidea*, Hibbert (On the Burdie House Limestone, Trans. Roy. Soc. Edinb., xiii. 180), are other related genera. The latter may be near *Apus*.

Eurypterus, Harlan, and *Pterygotus*, M'Coy, are other Palæozoic genera, probably of Entomostraca. *Eurypterus* has been supposed to be related to *Limulus*.

Belinurus, Köninck, *Halicynne*, von Meyer, are other genera, referred to the Pœcilopoda.

ON THE
GEOGRAPHICAL DISTRIBUTION
OF
CRUSTACEA.

I. PRELIMINARY CONSIDERATIONS ON THE TEMPERATURE
OF THE OCEANS.

THE temperature of the waters is well known to be one of the most influential causes limiting the distribution of marine species of life. Before therefore we can make any intelligent comparison of the Crustacea of different regions, it is necessary to have some clear idea of the distribution of temperature in the surface waters of the several oceans; and, if we could add also, the results of observations at various depths beneath the surface, it would enable us still more perfectly to comprehend the subject. The surface temperature has of late years been quite extensively ascertained, and the lines of equal temperature may be drawn with considerable accuracy. But in the latter branch of thermometric investigation almost everything yet remains to be done: there are scattering observations, but none of a systematic character, followed through each season of the year.

The Map which we have introduced in illustration of this subject, presents a series of lines of equal surface temperature of the oceans. The lines are isocheimal lines, or, more properly, *isocrymal* lines; and where they pass, each exhibits the mean temperature of the waters along its course for the coldest thirty consecutive days of the year.

The line for 68° F., for example, passes through the ocean where 68° F., is the mean temperature for extreme cold weather. January is not always the coldest winter month in this climate, neither is the winter the coldest season in all parts of the globe, especially near the equator. On this account, we do not restrict the lines to a given month, but make them more correctly the limit of the extreme cold for the year at the place.* Between the line of 74° north and 74° south of the equator, the waters do not fall for any one month below 74° F.; between 68° north and south, they do not fall below 68° .

There are several reasons why *isocrymal* are preferable to summer or *isothermal* lines. The cause which limits the distribution of species northward or southward from the equator is the cold of winter, rather than the heat of summer, or even the mean temperature of the year. The mean temperature may be the same when the extremes are very widely different. When these extremes are little remote, the equable character of the seasons, and especially the mildness of the winter temperature, will favour the growth of species that would be altogether cut off by the cold winters where the extremes are more intense. On this account, lines of the greatest cold are highly important for a chart illustrating the geographical distributions of species, whether of plants or animals. At the same time, summer lines have their value. But this is true more particularly for species of the land, and fresh-water streams, and sea-shore plants. When the summer of a continent is excessive in its warmth, as in North America, many species extend far from the tropics that would otherwise be confined within lower latitudes. But in the ocean, the extremest cold in the waters, even in the Polar regions, wherever they are not solid ice (and only in such places are marine species found), is but a few degrees below 32° Fahrenheit. The whole range of temperature for a given region is consequently small. The region which has 68° F. for its winter temperature, has about 80° for the hottest month of summer; and the line of 56° F. in the Atlantic, which has the latitudes of the state of New York, follows the same course nearly as the

* The word *isocrymal* here introduced is from the Greek *ισος*, *equal*, and *κρυμνος*, *extreme cold*, and applies with sufficient precision to the line for which it is used. These lines are not *isocheimal* lines, as these follow the *mean winter* temperature; and to use this term in the case before us, would be giving the word a signification which does not belong to it, and making confusion in the science.

summer line of 70° F. In each of these cases the whole extent of the range is small, being twelve to fourteen degrees.*

In fresh-water streams, the waters, where not frozen, do not sink lower than in the colder oceans, reaching at most but a few degrees below freezing. Yet the extremes are greater than for the ocean; for in the same latitudes which give for the ocean 56° and 70° F. as the limits, the land streams of America range in temperature between 30° and 80° F., and the summer warmth in such a case, may admit of the development of species that would otherwise be excluded from the region.

While then both isocrymal and isothermal lines are of importance on charts illustrating distribution over the continents, the former are pre-eminently important where the geography of marine species is to be studied.

The lines of greatest cold are preferable for marine species to those of summer heat, also because of the fact that the summer range for 30° of latitude either side of the equator is exceedingly small, being but three to four degrees in the Atlantic, and six to eight degrees in the Pacific. The July isothermal for 80° F. passes near the parallel of 30°; and the extreme heat of the equatorial part of the Atlantic Ocean is rarely above 84°. The difficulty of dividing this space by convenient isothermals with so small a range is obvious.

It is also an objection to using the isotheres, that those towards the equator are much more irregular in course than the isocrymes. That of 80° for July, for example, which is given on our Map from Maury's Chart, has a very flexuous course. Moreover, the spaces between the isotheres fail to correspond as well with actual facts in geographical distribution. The courses of the cold water currents are less evident on such a chart, since the warm waters in summer to a great extent overlies the colder currents.

It is also to be noted that nothing would be gained by making the mean temperature for the year, instead of the extremes, the basis for laying down these lines, as will be inferred from the remarks already made, and from an examination of the chart itself.

The distribution of marine life is a subject of far greater simplicity

* Moreover, the greatest range for all oceans is but 62° of Fahrenheit, the highest being 88°, and the lowest 26°; while the temperature of the atmosphere of the globe has a range exceeding 150°.

than that of continental life. Besides the influence on the latter of summer temperature in connexion with that of the cold seasons, already alluded to, the following elements or conditions have to be considered:—the character of the climate, whether wet or dry;—of the surface of the region, whether sandy, fertile, marshy, etc.;—of the vegetation, whether that of dense forests, or open pasture-land, etc.;—of the level of the country, whether low, or elevated, etc. These and many other considerations come in, to influence the distribution of land species, and lead to a subdivision of the Regions into many subordinate Districts. In oceanic productions, depth and kind of bottom have an important bearing: but there is no occasion to consider the moisture or dryness of the climate; and the influence of the other peculiarities of region mentioned is much less potent than with continental life.

We would add here, that the data for the construction of this chart have been gathered, as regards the North Atlantic, from the isothermal chart of Lieutenant Maury, in which a vast amount of facts are registered, the result of great labour and study. For the rest of the Atlantic and the other oceans we have employed the Meteorological volume of Captain Wilkes of the Exploring Expedition Reports, which embraces observations in all the oceans and valuable deductions therefrom; also, the records of other travellers, as Humboldt, Duperrey of the *Coquille*, D'Urville of the *Astrolabe*, Kotzebue, Beechey, Fitzroy, Vaillant of the *Bonite*, Ross in his *Antarctic Voyage*, together with such isolated tables as have been met with in different Journals. The lines we have laid down, are not however, those of any chart previously constructed, for the reason stated, that they mark the positions where a given temperature is the mean of the coldest month (or coldest thirty consecutive days) of the year, instead of those where this temperature is the mean annual or monthly heat; and hence, the apparent discrepancies, which may be observed, on comparing it with isothermal charts.

The isocrymal lines adopted for the chart are those of 80° , 74° , 68° , 62° , 56° , 50° , 44° , and 35° of Fahrenheit. They diminish by 6° , excepting the last, which is 9° less than 44° .

In adopting these lines in preference to those of other degrees of temperature, we have been guided, in the first place, by the great fact, that the isocryme of 68° is the boundary line of the coral-reef seas, as

explained by the author in his Report on Zoophytes.* Beyond this line either side of the equator, we have no species of true Madrepora, Astræa, Meandrina or Porites; below this line, these corals abound and form extensive reefs. This line is hence an important starting point in any map illustrating the geography of marine life. Passing beyond the regions of coral reefs, we leave behind large numbers of Mollusca and Radiata, and the boundary marks an abrupt transition in zoological geography.

The next line below that of 68° F., is that of 74° F. The corals of the Hawaiian Islands, and the Mollusca also to a considerable extent, differ somewhat strikingly from those of the Feejees. The species of Astræa and Meandrina are fewer, and those of Porites and Pocillopora more abundant, or at least constitute a much larger proportion of the reef material. These genera of corals include the hardier species; for where they occur in the equatorial regions they are found to experience the greatest range in the condition of purity of the waters, and also the longest exposures out of water. Their abundance at the Hawaiian Islands, as at Oahu, is hence a consequence of their hardier character, and not a mere region peculiarity independent of temperature. There are grounds, therefore, for drawing a line between the Hawaiian Islands and the Feejees; and as the temperature at the latter sinks to 74½° F. some parts of the year, 74° F. is taken as the limiting temperature. The Feejee seas are exceedingly prolific and varied in tropical species. The corals grow in great luxuriance, exceeding in extent and beauty anything elsewhere observed by the writer in the tropics. The ocean between 74° F., north of the equator, and 74° F. south, is therefore the proper tropical or torrid region of zoological life.

With respect to the line of 80° F., we are not satisfied that it is of much importance as regards the distribution of species. The range from the hottest waters of the ocean 88° to 74° F. is but fourteen degrees, and there are probably few species occurring within the region that demand a less range. Still, investigations hereafter made, may show that the hot waters limited by the isocryme of 80° includes some peculiar species. At Sydney Island and Fakaafu, within this hot area, there appeared to be among corals a rather greater prevalence than usual of the genus Manopora, which as these are tender

* In the author's Report on Geology, 66° F. is set down as the limiting temperature of Coral-reef Seas: this, however, is given as the *extreme* cold. 68° appears to be the *mean* of the coldest month, and is therefore here used.

species, may perhaps show that the waters are less favourable for hardier corals than those of the Feejees, where the range of temperature is from 74° to 80° F.; but this would be a hasty conclusion, without more extended observations. The author was on these islands only for a few hours, and his collections were afterwards lost at the wreck of the Peacock, just as the vessel was terminating the voyage by entering the Columbia River.

It is unnecessary to remark particularly upon the fitness of the other isocrymals for the purposes of illustrating the geographical distribution of marine species, as this will become apparent from the explanations on the following pages.

The regions thus bounded require, for convenience of designation, separate names, and the following are therefore proposed. They constitute three larger groups: the *first*, the *Torrid* zone or *Coral-reef* seas, including all below the isocryme of 68° F.; the *second*, the *Temperate* zone of the oceans, or the surface between the isocrymes of 68° F. and 35° F.; the *third*, the *Frigid* zone, or the waters beyond the isocryme of 35° F.

I. TORRID OR CORAL-REEF ZONE.

Regions.	Isocrymal limits.
1. Supertorrid,	80° F. to 80° F.
2. Torrid,	80° to 74°
3. Subtorrid,	74° to 68°

II. TEMPERATE ZONE.

1. Warm Temperate,	68° to 62°
2. Temperate,	62° to 56°
3. Subtemperate,	56° to 50°
4. Cold Temperate,	50° to 44°
5. Subfrigid,	44° to 35°

III. FRIGID ZONE.

1. Frigid,	35° to 26°
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A ninth region—called the Polar—may be added, if it should be found that the distribution of species living in the Frigid zone requires it. There are organisms that occur in the ice and snow itself

of the polar regions; but these should be classed with the animals of the continents; and the continental isotherms or isocrymes, rather than the oceanic, are required for elucidating their distribution.

It seems necessary to state here the authorities for some of the more important positions in these lines, and we therefore run over the observations, mentioning a few of most interest. There is less necessity for many particulars with reference to the North Atlantic, as our facts are mainly derived from Lieut. Maury's Chart, to which the author would refer his readers.

1. NORTH ATLANTIC.—*Isocryme of 74° F.*—This isocryme passes near the reefs of Key West, and terminates at the northeast cape of Yucatan; it rises into a narrow flexure parallel with Florida along the Gulf Stream, and then continues on between the Little and Great Bahamas. To the eastward, near the African coast, it has a flexure northward, arising from the hot waters along the coast of Guinea, which reach in a slight current upward towards the Cape Verde Islands. The line passes to the south of these islands, at which group, Fitzroy, in January of 1852, found the sea-temperatures 71° and 72° F.

Isocryme of 68° F.—Cape Canaveral, in latitude 27° 30', just north of the limit of coral reefs on the east coast of Florida, is the western termination of the line of 68°. The Gulf Stream occasions a bend in this line to 36° north, and the polar current, east of it, throws it southward again as far as 29° north. Westward it inclines much to the south, and terminates just south of Cape Verde, the eastern cape of Africa. Sabine found a temperature of 64° to 65° F. off Goree, below Cape Verde, January, 1822; and on February 9, 1822, he obtained 66½° near the Bissao shoals. These temperatures of the cold season contrast strikingly with those of the warm season. Even in May (1831), Beechey had a temperature of 86° off the mouth of Rio Grande, between the parallels of 11° and 12° north.

Isocryme of 62° F.—This isocryme leaves the American coast at Cape Hatteras, in latitude 35½° north, where a bend in the outline of the continent prevents the southward extension of the polar currents from flowing close along the shores. It passes near Madeira, and bends southward reaching Africa nearly in the latitude of the Canaries.

Isocrymes of 56° and 50° F.—Cape Hatteras, for a like reason, is the limit of the isocrymes of 56° and 50° as well as of 62°, there being

no interval between them on the American coast. The line of 56° F. has a deep northward flexure between the meridians of 35° and 40° west, arising from the waters of the Gulf Stream, which here (after a previous east and west course, occasioned by the Newfoundland Bank, and the Polar Current with its icebergs) bends again northeastward, besides continuing in part eastward. The Polar Current sometimes causes a narrow reversed flexure, just to the east of the Gulf Stream flexure. Towards Europe, the line bends southward, and passes to the southwest cape of Portugal, Cape St. Vincent, or, perhaps to the north cape of the Straits of Gibraltar. Vaillant, in the *Bonite*, found the temperature at Cadiz in February, $49\frac{1}{2}^{\circ}$ to 56° F. (9.7° to 13.4° C.), which would indicate that Cadiz, although so far south (and within sixty miles of Gibraltar), experiences at least as low a mean temperature as 56° F. for a month or more of the winter season. We have, however, drawn the line to Cape St. Vincent, which is in nearly the same latitude. Between Toulon and Cadiz, the temperature of the Mediterranean in February, according to Vaillant, was $55\frac{1}{2}^{\circ}$ to $60\frac{1}{4}^{\circ}$ F. (13.1° to 15.7° C.), and it is probable, therefore, that Gibraltar and the portion of the Mediterranean Sea east and north to Marseilles, fall within the *Temperate* Region, between the isocrymes of 56° and 62° F., while the portion beyond Sardinia and the coast by Algiers is in the *Warm Temperate* Region, between the isocrymes of 62° and 68° F.

The line of 50° F., through the middle of the ocean, has the latitude nearly of the southern cape at the entrance of the British Channel; but approaching Europe it bends downward to the coast of Portugal. The low temperature of $49\frac{1}{2}^{\circ}$ observed by Vaillant at Cadiz would carry it almost to this port, if this were the mean sea-temperature of a month, instead of an extreme within the bay. The line appears to terminate near latitude 42° , or six degrees north of the isocryme of 56° . This allows for a diminution of a degree Fahrenheit of temperature for a degree of latitude. A temperature as low as 61° F. has been observed at several points within five degrees of this coast in *July*, and a temperature of 52° F., in February. Vigo Bay, just north of 42° north, lies with its entrance opening westward, well calculated to receive the colder waters from the north; and at this place, according to Mr. R. Mac Andrew,* who made several dredgings with reference to the geographical distribution of species, the Mollusca

* Rep. Brit. Assoc., 1850, p. 264.

have the character rather of those of the British Channel than of the Mediterranean.

Isocryme of 44° F.—This line commences on the west, at Cape Cod, where there is a remarkable transition in species, and a natural boundary between the south and the north. The cold waters from the north and the ice of the Newfoundland Banks, press the line close upon those of 50° and 56° F. But after getting beyond these influences, it rapidly rises to the north, owing to the expansion of the Gulf Stream in that direction, and forms a large fold between Britain and Iceland; it then bends south again and curves around to the west coast of Ireland.

Isocryme of 35° F.—This line has a bend between Norway and Iceland like that of 44°, and from the same cause,—the influence of the Gulf Stream. But its exact position in this part has not been ascertained.

2. SOUTH ATLANTIC.—*Isocryme of 74° F.*—This line begins just south of Bahia, where Fitzroy found in August (the last winter month) a temperature of 74° to 75½° F. During the same month he had 75½° to 76½° F. at Pernambuco, five degrees to the north. Off Bahia, the temperature was two degrees warmer than near the coast, owing to the warm tropical current, which bends the isocryme south to latitude 17° and 18°, and the cold waters that come up the coast from the south. The line gradually rises northward, as it goes west, and passes the equator on the meridian of Greenwich. Sabine, in a route nearly straight from Ascension Island, in 8° south, to the African coast under the equator, obtained in June (not the *coldest* winter month) the temperatures 78°, 77°, 74°, 72·8°, 72·5°, 73°, the temperature thus diminishing on approaching the coast, although at the same time nearing the equator, and finally reaching it within a few miles. These observations in June show that the isocryme of 74° F. passes north of the equator. The temperatures mentioned in Maury's Chart afford the same conclusion, and lead to its position as laid down.

Isocryme of 68° F.—On October 23d to 25th, 1834, Mr. D. J. Browne, on board the U. S. Ship Erie, found the temperature of the sea on entering the harbour of Rio Janeiro, 67½° to 68½° F. Fitzroy, on July 6, left the harbour with the sea-temperature 70½° F. Beechey, in August, 1825, obtained the temperatures 68·16° to 69·66° F. off the harbour. The isocryme of 68° F. commences therefore near Rio, not far south of this harbour. Eastward of the harbour, the tem-

perature increases two to four degrees. In July, Fitzroy carried a temperature above 68° as far south as $33^{\circ} 16'$ south, longitude $50^{\circ} 10'$ west, the water giving at this time $68\frac{1}{2}^{\circ}$ to $69\frac{1}{2}^{\circ}$ F. Beechey in August obtained 68° F. in 31° south, 46° west. The isocryme of 68° F. thus bends far south, reaching at least the parallel of 30° . It takes a course nearly parallel with the line of 74° F., as different observations show, and passing just south of St. Helena, reaches the African coast, near latitude 7° south. Fitzroy, on July 10 (mid-winter), had a sea-temperature of $68\frac{1}{2}^{\circ}$ near St. Helena; and Vaillant, in the Bonite, in September found the sea-temperature 68.7° to 69.26° F.

Isocrymes of 56° and 50° F.—These two isocrymes leave the American coast rather nearly together. The former commences just north of the entrance of the La Plata. Fitzroy, in July 23 to 31, 1832, found the sea-temperature at Montevideo 56° to 58° F., and in August, 57° to $54\frac{1}{2}^{\circ}$ F. These observations would lead to 56° F. as nearly the mean of the coldest month. The temperature 56° F. was also observed in 35° south, 53° west, and at 36° south, $56^{\circ} 36'$ west. But on July 10 and 13, 1833, at Montevideo, the sea-temperature was $46\frac{1}{2}^{\circ}$ to $47\frac{1}{2}^{\circ}$, a degree of cold which, although only occasional, throws the line of 56° F. to the north of this place. The temperature near the land is several degrees of Fahrenheit lower than at sea three to eight degrees distant. East of the mouth of the La Plata, near longitude 50° west, Beechey, in July, 1828, found the temperature of the sea 61.86° F. So in April 23 to 29, Vaillant obtained the temperature 59.5° to 61.25° F. at Montevideo, while in $35^{\circ} 5'$ south, $49^{\circ} 23'$ west, on April 14, it was 66.2° F., and farther south, in $37^{\circ} 42'$ south, $53^{\circ} 28'$ west, April 30, it was 64.4° F.; and in $39^{\circ} 19'$ south, $54^{\circ} 32'$ west, on May 1, it was $57\frac{3}{4}^{\circ}$ F.; but a little to the westward, on May 2, in $40^{\circ} 30'$ south, $56^{\circ} 54'$ west, the temperature was 48° F., an abrupt transition to the colder shore waters. Beechey, in $39^{\circ} 31'$ south, $45^{\circ} 13'$ west, on August 28 (last of winter), found the temperature 57.25° F., and on the 29th, in $40^{\circ} 27'$ south, $45^{\circ} 46'$ west, it was 54.20° ; while on the next day, in $42^{\circ} 27'$ south, and $45^{\circ} 11'$ west, the temperature fell to 47.83° F. These and other observations serve to fix the position of the isocryme of 56° F. It approaches the African coast, in 32° south, but bends upward, owing to cold waters near the land. On August 20, Vaillant, in $33^{\circ} 43'$ south, $15^{\circ} 51'$ east, found the temperature 56° F.; while on the 22d, in the same latitude, and $14^{\circ} 51'$ east (or one degree farther to the westward), the temperature was 57.74° F., being nearly two degrees warmer. At Cape Town, in June

(latitude 34°), Fitzroy found 55° to 61° F., while on August 16, farther south, in $35^{\circ} 4'$ south, and $15^{\circ} 40'$ west, one hundred and fifty miles from the Cape, Vaillant found the temperature 59.36° F. The high temperature of the last is due to the warm waters that come from the Indian Ocean, and which afford 61° to 64° F. in August, off the south extremity of Africa, west of the meridian of Cape Town.

The isocryme of 50° F. leaves the American coast just south of the La Plata; after bending southwardly to the parallel of 41° , it passes east nearly parallel with the line of 56° F. It does not reach the African coast.

Isocrymes of 44° and 35° F.—Fitzroy in August (the last winter month) of 1833, found the sea-temperature at Rio Negro (latitude 41° south) $48\frac{1}{2}^{\circ}$ to 50° F. But during the voyage from the La Plata to Rio Negro, a few days before, a temperature of $44\frac{1}{2}^{\circ}$ to 46° was met with; this was in the same month in which the low temperature mentioned on a preceding page was found at Montevideo. The bend in the coast north of the entrance to the La Plata, is to some extent, a limit between the warmer waters of the north and the colder waters from the south; not an impassable limit, but one which is marked often by a more abrupt transition than occurs elsewhere along this part of the coast. The water was generally three or four degrees colder at Montevideo, than at Maldonado, the latter port being hardly sheltered from the influence of the tropical waters, while Montevideo is wholly so. The exact point where the line of 44° F. reaches the coast is somewhat uncertain, yet the fact of its being south of Rio Negro is obvious. After leaving the coast, it passes north of $47\frac{1}{2}^{\circ}$ south, in longitude 53° west, where Beechey, in July, 1828, found the sea-temperature 40.70° F.

The line of 35° F. through the middle of the South Atlantic, follows nearly the parallel of 50° ; but towards South America it bends southward and passes south of the Falklands and Fuegia. At the Falklands, Captain Ross, in 1842, found the mean temperature of the sea for July, 38.73° , and for August, 38.10° ; while in the middle of the Atlantic, on March 24, latitude $52^{\circ} 31'$ south, and longitude $8^{\circ} 8'$ east, the temperature was down to 34.3° F., and in $50^{\circ} 18'$ south, $7^{\circ} 15'$ east, it was 37° F.; March 20, in $54^{\circ} 7'$ south, on the meridian of Greenwich, it was 33.4° F. The month of March would not give the coldest temperature. The temperature of the sea along the south coasts

of Fuegia sinks nearly to 35° , if not quite, and the line of 35° therefore runs very near Cape Horn, if not actually touching upon Fuegia.

NORTH PACIFIC OCEAN.—*Isocryme of 80° F.*—The waters of the Atlantic in the warmest regions, sink below 80° F. in the colder season, and there is therefore no proper Supertorrid Region in that ocean. In the Gulf of Mexico, where the heat rises at times to 85° F., it sinks in other seasons to 74° and in some parts, even to 72° F.; and along the Thermal equator across the ocean, the temperature is in some portions of the year 78° , and in many places 74° .

But in the Pacific, where the temperature of the waters rises in some places to 88° F., there is a small region in which through all seasons, the heat is never below 80° . It is a narrow area, extending from 165° east to 148° west, and from $7\frac{1}{2}^{\circ}$ north to 11° south. In going from the Feejees in August, and crossing between the meridians of 170° west and 180° , the temperature of the waters, according to Captain Wilkes, increased from 79° to 84° F., the last temperature being met with in latitude 5° south, longitude 175° west, and from this, going northward, there was a slow decrease of temperature. The Ship Relief, of the Expedition, in October, found nearly the same temperature ($83\frac{1}{2}^{\circ}$) in the same latitude and longitude 177° west.* But the Peacock, in January and February (*summer* months), found the sea-temperature 85° to 88° F., near Fakaafu, in latitude 10° south, and longitude 171° west. In latitude 5° south and the same longitude, on the 16th of January, the temperature was 84° ; in 3° south, January 10th, it was 83° F.; on March 26th, in 5° south, and longitude 175° east, the temperature was 86° F.; on April 10th, in the same longitude, under the equator, at the Kingsmills, the temperature was $83\frac{1}{2}^{\circ}$ F.; on May 2d, at 5° north, longitude 174° east, $83\frac{1}{2}^{\circ}$ F.; May 5th, latitude 10° , longitude 169° east, 82° F. The fact that the region of greatest heat in the Middle Pacific is south of the equator, as it has been laid down by different authors, is thus evident; the limits of a circumscribed region of hot waters in this part of the Pacific, were first drawn out by Captain Wilkes.

Another Supertorrid region may exist in the Indian Ocean, about its northwestern portion; but we have not sufficient information for laying down its limits.

Isocryme of 74° F.—At San Blas, on the coast of Mexico, Beechey

* See, for these facts, Captain Wilkes's Report on the Meteorology of the Expedition.

found the mean temperature of the sea for December, 1827, 74.63° F.; for January, 73.69° F.; for February, 72.40° F. The line of 74° F. commences therefore a degree or two south of San Blas. In the winter of 1827 on January 16 to 18, the temperature of 74.3° to 74.6° F. was found by Beechey, in $16^{\circ} 4'$ to $16^{\circ} 15'$ north, $132^{\circ} 40'$ to 135° west; and farther west, in the same latitude, longitude $141^{\circ} 58'$ west, the temperature was 74.83° F. West of the Sandwich Islands, near the parallel of 20° north, the temperature rises five degrees in passing from the meridian of 165° west to 150° east, and the isocryme of 74° F., consequently rises somewhat to the north, over this part of the ocean. Between the meridians of 130° and 140° east, the temperature of the sea is quite uniform, indicating no northward flexure; and west of 130° east, nearing China, there is a rapid decrease of temperature, bending the line far south. Vaillant, of the Bonite, found the sea off Cochin China, in latitude $12^{\circ} 16'$ north, $109^{\circ} 28'$ east, to have the temperature 74.12° F.; and even at Singapore, almost under the equator, the temperature on February 17 to 21, was 77.54° to 79.34° F. The isocryme of 74° F. terminates therefore upon the southeastern coast of Cochin China.

Isocryme of 68° .—Off the Gulf of California, in 25° north, 117° west, Beechey obtained for the temperature of the sea, on December 13, 65° F.; on December 15, in $23^{\circ} 28'$ north (same latitude with the extremity of the peninsula of California), 115° west, a temperature of 69.41° F. The line of 68° will pass from the extremity of this peninsula, the temperature of the coast below, as it is shut off mostly from the more northern and colder waters, being much warmer. The temperature 69.41° in the middle of December, is probably two and a half degrees above the cold of the coldest month, judging from the relative temperatures of the latter half of December and the month of February at San Blas. Leaving California, the isocryme of 68° will therefore bend a little southerly to $22\frac{1}{2}^{\circ}$, in longitude 115° west. In $23^{\circ} 56'$ north, $128^{\circ} 33'$ west, Beechey, on January 11, found the temperature of the sea 67.83° F. The line of 68° passes north of the Sandwich Islands. The mean temperature of the sea at Oahu in February, 1827, was 69.69° F.

Near China, this isocryme is bent far south. At Macao, in winter, Vaillant found the sea-temperature, on January 4, 59° F.; on January 5 to 10, 52.7° to 50° F.; January 11, 12, 49.87° to 48.74° F.; January 13 to 16, 50.9° to 52.16° F.; and at Touranne in Cochin China, on February 6 to 24, the sea-temperature was 68° to $68\frac{1}{2}^{\circ}$ F.; in $16^{\circ} 22'$

north, $108^{\circ} 11'$ east, on January 24, it was 67° ; in $12^{\circ} 16'$ north, $109^{\circ} 28'$ east, it was 74.12° F. The very low Macao temperature is that of the surface of the Bay itself, due to the cold of the land, and not probably, as the other observations show, of the sea outside.

The line, before passing south, bends northward to the southeast shore of Nippon, which is far warmer than the southeast coast, along Kiusiu. In the Report of the Morrisons' visit to Jeddo (Chinese Repository for 1837), a coral bottom is spoken of, as having been encountered in the harbour of Jeddo. According to Siebold (Crust. Faun. Japon., p. ix.), the mean winter temperature (air) of Jeddo is 57° F., while that of Nagasaki, although farther south, is 44° F.

Isocryme of 62° F.—On January 8, 1827, Beechey found in $29^{\circ} 42'$ north, $126^{\circ} 37'$ west, the temperature 62.75° F.; while on the preceding day, $32^{\circ} 42'$ north, $125^{\circ} 43'$ west, the sea-temperature was 60.5° F. Again, on December 11, in 29° north, 120° west, the temperature was 62.58° F.

Isocryme of 56° F.—At Monterey, on January 1 to 5, the sea-temperature according to Beechey was 56° ; but the mean temperature of the sea for November 1 to 17, was 54.91° . In the Yellow Sea, the January temperature is 50° to 56° F., and the line of 56° begins south of Chusan.

Isocryme of 50° F.—At San Francisco, from November 18 to December 5, 1826, Beechey found the mean sea-temperature to be 51.14° F., and off Monterey, in longitude 123° west, the temperature was 50.75° F., on December 6. But in December of 1826, the mean sea-temperature at San Francisco was 54.78° F.; and for November, 60.16° F. The line of 50° F. (mean of the coldest thirty consecutive days), probably leaves the coast at Cape Mendocino.

Isocrymes of 44° and 35° F.—Captain Wilkes found the temperature off the mouth of the Columbia River, through ten degrees of longitude, 48° to 49° F., during the last of April, 1841. The isocryme of 44° would probably reach the coast not far north of this place. The temperature on October 21, in the same latitude, but farther west, 147° west, was 52.08° F. On October 16, in 50° north, 169° west, the temperature was 44.91° F. According to some oceanic temperatures for the North Pacific, obtained from Lieutenant Maury, the sea-temperature off northern Nippon, in 41° north and $142\frac{1}{2}^{\circ}$ east, was 44° F., in March, showing the influence of the cold Polar current; and in 42° north, and $149\frac{1}{2}^{\circ}$ east, it was 43° F. The line of 44° hence bends southward as far as latitude 40° north, on the Japan coast.

Again, in March, in $43^{\circ} 50'$ north, 151° east, the sea-temperature was 41° F.; in $44^{\circ} 50'$ north, $152^{\circ} 10'$ east, 39° F.; in $46^{\circ} 20'$ north, 156° east, 33° F.; in 49° north, 157° east, 33° F.; and at the same time, west of Kamschatka, in 55° north, 153° east, 38° F.; in $55^{\circ} 40'$ north, 153° west, 38° F. The line of 35° consequently makes a deep bend, nearly to 45° north, along the Kurile Islands.

SOUTH PACIFIC.—*Isocrymes* of 74° , 68° , and 62° F.—The temperature of the sea at Guayaquil, on August 3d, was found by Vaillant, to be, in the river, from $70\frac{1}{2}^{\circ}$ to $73\frac{1}{2}^{\circ}$ F., and at the Puna anchorage, August 5 to 12, $74\cdot7^{\circ}$ to $75\cdot2^{\circ}$ F. But off the coast, August 15, in $2^{\circ} 22'$ south, $81^{\circ} 42'$ west, the temperature was $69\cdot8^{\circ}$ F.; and the next day, in $1^{\circ} 25'$ south, $84^{\circ} 12'$ west, it was 70° F.; on the 17th, 1° south, $87^{\circ} 42'$ west, it was $71\cdot28^{\circ}$ F.; and on the 14th, nearer the shore of Guayaquil, in $3^{\circ} 18'$ south, $80^{\circ} 28'$ west, it was 78° F. Again, at Payta, one hundred miles south of Guayaquil, in 5° south, the sea-temperature was found by Vaillant, July 26 to 31, to be $60\cdot8^{\circ}$ to $61\frac{1}{2}^{\circ}$ F. The isocryme of 74° F., consequently, leaves the coast just north of the bay of Guayaquil, while those of 68° and 62° F., both commence between Guayaquil and Payta. Payta is situated so far out on the western cape of South America that it receives the cold waters of the south, while Guayaquil is beyond Cape Blanco, and protected by it from a southern current. At the Gallapagos, Fitzroy found the temperature as low as $58\frac{1}{2}^{\circ}$ F. on the 29th of September, and the mean for the day was 62° . The average for September was, however, nearer 66° . The Gallapagos appear, therefore, to lie in the Warm Temperate Region, between the isocrymes of 62° and 68° F. Fitzroy, in going from Callao to the Gallapagos, early in September, left a sea-temperature of 57° F. at Callao, passed 62° F. in $9^{\circ} 58'$ north, and $79^{\circ} 42'$ west, and on the 15th, found $68\frac{1}{2}^{\circ}$ F. off Barrington Island, one of the Gallapagos.

In the warm season, the cold waters about the Gallapagos have narrow limits; Beechey found a sea-temperature of $83\cdot58^{\circ}$ on the 30th of March, 1827, just south of the equator, in 100° west. But in October, Fitzroy, going westward and southward from the Gallapagos, found a sea-temperature of 66° F. at the same place; and in a nearly straight course from this point to 10° south, 120° west, found the sea-temperatures successively, 68° , 70° , $70\cdot5^{\circ}$, $72\cdot5^{\circ}$, $73\cdot5^{\circ}$, 74° ; and beyond this, $75\frac{1}{2}^{\circ}$, $76\frac{1}{2}^{\circ}$, $77\frac{1}{2}^{\circ}$ F., the last on November 8, in $14^{\circ} 24'$

south, 136° 51' west. These observations give a wide sweep to the cold waters of the colder seasons, and throw the isocrymes of 74° and 68° F., far west of the Gallapagos. Captain Wilkes, in passing directly west from Callao, found a temperature of 68° F., in longitude 85° west; 70° F., in 95° west; and 74° F., in 102° to 108° west. These and other observations lead to the positions of the isocrymes of 74°, 68°, and 62°, given on the Chart. The line of 74° passes close by Tahiti and Tongatabu, and crossing New Caledonia, reaches Australia in latitude 25° S.

In mid-ocean there is a bend in all the southern isocrymes.*

* The following observations by Mr. W. C. Cunningham (in connexion with those of other navigators), establish the fact of this flexure; they were sent by him to the author, in a letter, dated Talcahuano, Chili.

1. FROM THE HARBOUR OF APIA, ISLAND OF UPOLU, TO TAHITI.

DATE.	LATITUDE.	LONGITUDE.	WINDS.	SEA. †	AIR. †	WEATHER.
May 11	15°02' S.	172° W.	N.E.	78.3°	77°	Fine.
12	15 02	172 37'	S.S.E.	78½	78	Showery.
13	16 04	"	E. by S.	78.1	78	" heavy rains.
14	17 27	174 43	S.E.	78	78	Dark.
15	17 58	174 16	E.	78	77	Fine, but cloudy.
16	18 50	173 41	S.E.	78	76	" "
17	19 47	173 28	S.E.	78	76	Clear.
18	19 37	172 41	S.	77½	71	Clear and fine.
19	19 57	170 47	S.	76	75	Cloudy.
20	20 21	169 11	S. by E.	76½	74	"
21	20 16	167 21	S. by E.	76½	72	"
22	20 18	167 03	Var.	76	74	Clear.
23	21 09	166 37	S.	74½	76	Dark.
24	20 46	164 29	S.	75	75	Cloudy.
25	26 30	163 33	S.	76	74½	Fine.
26	19 52	163 01	S.	77	75	Dark.
27	19 23	161 53	S.E.	73	75	"
28	20 07	162 22	S.E.	73	76	Fine.
29	21 04	162 54	S.S.E.	72	76	Cloudy.
30	21 16	162 46	E.S.E.	71	76	"
31	23 00	162 45	N.N.E.	72	76	Clear.
June 1	22 06	160 48	Var.	74	76	Fine.
2	22 46	161 19	S.S.W.	74	74	Clear.
3	21 00	160 00	E.	74	75	Fine; at Raratonga.
11	22 21	160 20	E.	73	72	Fine.
12	22 24	160 25	E.	73	72	"
13	22 49	159 33	Var.	73	72	"
14	22 29	158 54	E. by S.	72	72	"
15	22 25	159 37	N.N.E.	71	71½	"
16	22 37	159 05	Var.	71	71	At Mangala.
17	. .	. .	Var.	70	71	Fine.
18	. .	. .	S.S.E.	68	72	"
19	21 39	156 42	S.E.	68	72	Dark.
20	21 06	155 47	S.S.E.	68	73	"
21	20 53	154 20	S.S.E.	68	74	Fine.
22	20 36	152 34	S.S.E.	68	76	"
23	20 21	151 18	S.E.	70	76	"
24	19 10	151 11	S.E.	71	76	"
25	. .	. .	E.	. .	. .	At Tahiti.

† Mean temperature.

GEOGRAPHICAL DISTRIBUTION OF CRUSTACEA. 1467

Isocrymes of 56° and 50° F.—The temperature at Callao, in July, averages 58½° or 59° F. At Iquique, near 20° south, Fitzroy had 58° to 60° F., on July 14, 1835; and off Copiapo, in the same month, 56½° F. At Valparaiso, Captain Wilkes found a sea-temperature of 52½° F., in May; and Fitzroy, in September, occasionally obtained 48° F., but generally 52° to 53°. Off Chiloe, Fitzroy found the temperature 48° to 51½° in July.

2. FROM TAHITI TO VALPARAISO.

DATE.	LATITUDE.	LONGITUDE.	WINDS.	SEA.*	AIR.*	REMARKS.
Aug. 26	18°77'	151°01'	S.E.	73°	76°	Fine.
27	20 10	151 33	S.E.	72	75	Clear.
28	22 02	152 06	S.E.	72	75	"
29	22 18	152 45	S.E.	75	73	"
30	22 30	151 38	Var.	76	72	"
31	23 15	152 47	S.E.	68	72	"
Sept. 1	24 24	152 51	S.S.E.	68	72	"
2	25 14	152 12	N.N.E.	69	72	Cloudy.
3	26 13	151 41	S.W.	69	70	Clear.
4	27 18	150 47	S.W.	65	66	Fine.
5	28 46	149 49	S.W.	63	68	Clear.
6	28 40	149 49	S.W.	62	66	"
7	29 21	150 21	W.	61	65	Rains.
8	30 19	151 40	S.E.	60	65	Cloudy.
9	31 30	152 43	S.E.	58	60	Squally; dark.
10	32 30	152 46	S.E.	58	60	"
11	33 45	151 56	Var.	58	57½	Cloudy.
12	34 42	150 37	Var.	56	58	Thick and cloudy.
13	35 43	148 53	N.E.	56	56	Cloudy.
14	36 50	147 15	N.E.	56	56	Clear.
15	38 19	146 37	Var.	55½	55	Cloudy.
16	39 23	145 38	N.N.E.	53	52	"
17	40 18	143 43	N.E.	50	51	Rain; dark.
18	40 01	141 19	N.E.	52	52	" squally.
19	39 05	139 11	N.N.E.	55	54	Clear.
20	38 24	126 58	N. by W.	56	55	Foggy.
21	38 09	134 08	N.N.W.	56	54	"
22	37 42	130 38	N.N.E.	56	55	Cloudy.
23	37 23	127 22	N.N.W.	55	54	Rains.
24	36 52	124 06	N.N.W.	56	54	"
25	37 05	121 00	N.W.	58	57	Clear.
26	37 05	117 32	W.	56	55	"
27	37 11	114 18	N.W.	56	54	Squally.
28	37 03	112 19	Var.	58	57	"
29	36 47	108 58	N.W.	57	55	Cloudy.
30	36 48	106 31	W.	57	55	" mild.
Oct. 1	36 29	104 12	Var.	58	57	Squally.
2	36 22	103 30	Var.	55	56	"
3	36 42	101 00	N.N.W.	58	56	Cloudy.
4	37 12	97 06	N.W.	58	57	"
5	36 58	94 30	W.N.W.	58	56	"
6	37 11	90 20	W.N.W.	56	54	Clear.
7	36 18	88 11	W.N.W.	57	55	"
8	35 23	84 55	N.W.	66	66	"
9	34 14	82 08	N.W.	64	66	"
10	34 06	74 25	Var.	57	57	"
11	34 03	73 03	S.W.	57	56	Fine.
12	34 48	72 10	N.N.E.	57	57	"
13	35 39	72 40	N.	56	57	"
14	35 33	72 50	N.W.	56	57	"
15	35 10	72 04	S.	56	56	"
16				55	54	"
						At Valparaiso.

* Mean temperature.

INDIAN OCEAN.—*Isocrymes* of 74° and 68° F.—Off the south extremity of Madagascar, in $27^{\circ} 33'$ south, $47^{\circ} 17'$ east, on August 4th, Vaillant found the temperature 69.26° F.; and in $29^{\circ} 34'$ south, $46^{\circ} 46'$ east, the temperature of 67.84° F.; off South Africa, August 12, in $34^{\circ} 42'$ south, $27^{\circ} 25'$ east, the temperature 63.5° F.; on August 14, in $35^{\circ} 41'$ south, $22^{\circ} 34'$ east, a temperature of 63.3° F.; while off Cape Town, two hundred miles to the west, the temperature was 50° to 54° F.

In the above review, we have mentioned only a few of the observations which have been used in laying down the lines, having selected those which bear directly on some positions of special interest, as regards geographical distribution.

The Chart also contains the *heat-equator*,—a line drawn through the positions of greatest heat over the oceans. It is a shifting line, varying with the seasons, and hence, there is some difficulty in fixing upon a course for it. We have followed mainly the Chart of Berg-haus. But we have found it necessary to give it a much more northern latitude in the western Pacific, and also a flexure in the western Atlantic, both due to the currents from the south that flow up the southern continents.

Vaillant, passing from Guayaquil to the Sandwich Islands, found the temperature, after passing the equator, slowly increase from 76° F., August 19, in $2^{\circ} 39'$ north, $91^{\circ} 58'$ west (of Greenwich), to 81.9° F., in August 31, $11^{\circ} 15'$ north, $107^{\circ} 3'$ west, after which it was not above 80° F. The same place in the ocean which gave Vaillant 76° F., in August, afforded Fitzroy (4° north, 96° west), on March 26 (when the sun had long been far north), $82\frac{1}{2}^{\circ}$ F. This shows the variations of temperature that take place with the change of season.

REMARKS ON THE SEVERAL REGIONS.

The form and varying breadth of the different regions, and the relations between the sea-temperatures of coasts in different latitudes, which they exhibit, are points demanding special remark.

1. *Atlantic Torrid Region, between 74° F. north, and 74° F. south.*—The form of this region is triangular, with the vertex of the triangle

to the east. Its least width is four degrees of latitude; its greatest width between the extreme latitudes, is forty-six and a half degrees. On the African coast it includes only a part of the coast of Guinea, and no portion is south of the equator. On the west, it embraces all the West India Islands and reefs (excepting the Little Bahama), and the South American coast, from Yucatan to Bahia,—a fact that accounts for the wide distribution of marine species on the American side of the ocean.

2. *Atlantic Subtorrid Regions, between 74° and 68° F.*—The *North Subtorrid Region* of the Atlantic is about six degrees in its average width, which is equivalent to a degree of Fahrenheit to each degree in surface. It encloses within the same temperature limits, a part of the east coast of Florida, between 24° and 27½° north, and a part of the African coast, between the parallels of 9° and 14½° north, the two related coasts differing ten degrees in latitude. The Bermudas, in latitude 33°, and the Cape Verdes, in 15½°, fall within this region.

The *South Subtorrid Region* has the same average width as the northern.

Taking the whole Atlantic Torrid or Coral-reef zone together, its width on the east is about twenty-one degrees, while on the west, it extends between the parallels of 30° south and 34° north, a breadth of sixty-four degrees. As many species will thrive under the temperature of any part of the Torrid zone, the geographical range of such species in the Atlantic may be very large, even from Florida and the Bermudas on the north, to Rio Janeiro on the south, a range of which there are many actual examples.

Atlantic Warm Temperate Regions, between 68° and 62° F.—The *northern* of these regions has a breadth of fourteen and a half degrees along the west of Africa, and about seven degrees along the United States, south of Cape Hatteras, off the Carolinas, Georgia, and northern Florida. These shores and the Canaries are therefore in one and the same temperature zone.

The *southern* of these regions averages five degrees in width. The eastern limit on the African coast is sixteen to eighteen degrees to the north of the western on the South American coast.

Atlantic Temperate Regions, between 62° and 56° F.—The *north Temperate Region* is but a narrow strip of water on the west, terminating at Cape Hatteras, on the coast of the United States. To the

east it widens, and embraces the Azores and the African coast along Morocco, together with the Straits of Gibraltar, and a large part of the Mediterranean. Madeira lies upon its southern limit. It is, therefore, natural, that the same species should occur at the Azores, Madeira, and on the African coast, and be excluded wholly from the Atlantic coast of Europe. This, according to Prof. Forbes, is the fact with the *Littorina striata*, besides other species. The coasts of Portugal and the Azores are in different regions.

The *South Temperate Region* extends to Maldonado at the mouth of the La Plata, from near the parallel of 30°; along the African coast it reaches over more than twice the number of degrees of latitude, to within five degrees of Cape Town.

Atlantic Subtemperate Regions, between 56° and 50° F.—The *northern* of these regions, like the preceding, can scarcely be distinguished on the coast of the United States, as the lines 50° and 56° F. fall nearly together at Cape Hatteras. On the eastern side of the Atlantic, it occupies the coast of Portugal to latitude 42° north, having a width of five degrees. It thus corresponds to the so-called Lusitanian Region.

The *southern* includes the mouth of the La Plata on one side, and on the other the coast near Cape Town, beyond which it extends to the Cape of Good Hope.

Atlantic Cold Temperate Regions, between 50° and 44° F.—The coast from Cape Cod to Cape Hatteras belongs to the *Northern Cold Temperate Region*. Passing easterly, this region is but a narrow line of water for thirty degrees of longitude, after which it expands, and finally terminates between Western Ireland and latitude 42° on the Spanish coast. The British Channel, the Bay of Biscay, and Vigo Bay, Spain, are within the limits of this region.

The *southern* embraces the coast of South America along by Rio Negro for about five degrees, and passes wholly to the south of Africa.

Atlantic Subfrigid Regions, between 44° and 35° F.—The coast of Massachusetts, north of Cape Cod, of Maine and Newfoundland, and all Northern Britain, the Orkneys, Shetlands, and Faroe Islands, pertain to the *Northern Subfrigid Region*; while the *southern*, includes the Falklands, Southern Patagonia, and Fuegia.

Atlantic Frigid Regions, beyond 35° F.—Greenland, Iceland, and Norway are within the *northern* of these regions, and the South Shetlands, Sandwich Land, and South Georgia, within the *southern*.

Pacific Regions.—A comparison of the regions of the Atlantic and Pacific, and especially of the limits of those commencing at the South American coasts, brings out some singular facts.

The *Torrid* region of the Pacific, near the American coast, embraces only seventeen and a half or eighteen degrees of latitude, all but three of which are north of the equator; while that of the Atlantic covers a long range of coast, and reaches to 15° south. The south *Subtorrid* Region has a breadth of about three degrees on the Peruvian coast, reaching to 4° south, while that of the Atlantic extends to Rio Janeiro, in 24° south. The *Warm Temperate* Region has a breadth of less than a degree, reaching to Cape Blanco, in 4½° south, while that of the Atlantic extends to Rio Grande, in 33° south. The next or *Temperate* Region has a longer range on the South American coast, extending to Copiapo, in 27½° south, and the Atlantic region corresponding goes to Maldonado in 35° south. The *Cold Temperate* Regions of the two oceans cover nearly the same latitudes.

On the North American coast at Cape Hatteras, the three isocrymes 62°, 56°, and 50° F., leave the coast together; and in the Pacific on the South American coast there is a similar *node* in the system of isocrymes, the three 74°, 68°, and 62°, proceeding nearly together from the vicinity of Cape Blanco.

Viewing these regions through the two oceans, instead of along the coasts, other peculiarities no less remarkable are brought out. The average breadth of the *South Torrid* Region in the Pacific, is more than twice as great as that of the same in the Atlantic; and the most southern limit of the latter is five degrees short of the limit of the former in mid-ocean. So also, the *Subtorrid* Region at its greatest elongation southward in the Atlantic, hardly extends beyond the average course of the line of 68° F. in the Pacific, and the average breadth of the former is but two-thirds that of the latter. The same is true to an almost equal extent of the Warm Temperate and Temperate Regions.

The breadth of the *Torrid* Region of the Pacific to the eastward, where narrowest, is about six degrees; and to the westward, between its extreme limits, forty-nine degrees. The *Torrid* zone or Coral-reef Seas, in the same ocean, has a breadth near America, of about eighteen degrees, and near Australia and Asia, of sixty-six degrees.

New Zealand lies within the Subtemperate and Cold Temperate Regions, excepting its southern portion, which appears to pertain like

Fuegia to the Subfrigid. Van Diemens Land, exclusive of its northern shores, is within the Cold Temperate.

Indian Ocean Regions.—The Torrid Region covers the larger part of the Indian Ocean, including all north of the equator, and embraces the larger part of Madagascar. The Subtorrid extends just beyond Port Natal on the African coast (four degrees of latitude north of Cape Town), where there are coral-reefs. The Warm Temperate and Temperate regions each claim a part of the South African coast, and the latter terminates at the Cape of Good Hope.

It hence follows that Port Natal, in latitude 30° south, the Hawaiian Islands, and Bermudas lie within regions of the same name. While Cape Town, in latitude 34° south, is in a like region with northern New Zealand, Valparaiso, the Atlantic shores of Portugal, and the sea between Cape Hatteras and Cape Cod.

Influence of Summer Heat.—The small annual range of temperature (twelve to fourteen degrees in most regions) has been remarked upon, and we have further observed, that the extreme heat has far less influence on the distribution of species than the extreme cold. There are however some cases in the colder seas, in which the range has but half the extent here mentioned, and in such, the species are likely to differ from those characterizing the same region under other circumstances, approximating to those of the region next exterior. These cases are certain islands, or the extremities of continents, which are exposed to cold ocean winds and currents. The south shores of Fuegia and New Zealand appear to be examples of this kind.

We add a table, enumerating the more important lands or coasts embraced in each of the regions, bringing together those which are of like temperature, and which consequently may be most closely related in species. It is partly in recapitulation of the preceding pages.

I. TORRID ZONE.

1. TORRID REGION.

- A. ATLANTIC.—1. West India Islands.
2. Coast of South America, from the northeastern cape of Yucatan, to a degree south of Bahia.
3. Coast of Africa, from 9° north to 5° north.

4. Red Sea, to latitude 20° (?) north.
5. East coast of Africa, to latitude $26\frac{1}{2}^{\circ}$ (?) south.
- B. INDIAN OCEAN.—6. Coast of Persia, India, Malacca, Siam, and Cochin China, to $12\frac{1}{2}^{\circ}$ north, on the eastern coast of the last-mentioned country.
7. The islands of the Indian Ocean, north of 16° south, the northern two-thirds of Madagascar.
8. The East India Islands; also, the northern coast of Australia, from 22° south on the west side, to 25° south on the east side.
- C. PACIFIC.—9. The Pacific Islands, between 20° north and 20° south, together with the Ladrones, New Caledonia, excepting the southern extremity, also the Tonga Islands, as far as Tongatabu, the Hervey Islands, the Paumotu Islands, as far as the Gambier Islands, and excluding Hawaii on the north.
10. The South American coast, from $17\frac{1}{2}^{\circ}$ north to 1° south.

2. SUBTORRID REGION.

- A. NORTH ATLANTIC.—1. The northern and western coast of Yucatan, and the coast of Mexico and Texas, within the Gulf of Mexico.
2. Key West, and the east coast of Florida to 27° north.
3. The Bermudas.
4. The coast of Africa, from 9° north to $14\frac{1}{2}^{\circ}$ north.
- B. SOUTH ATLANTIC.—5. The coast of South America, from below Bahia to a degree or two below Rio Janeiro.
6. Ascension Island and St. Helena.
7. West coast of Africa, from 5° north to 7° south.
- C. INDIAN OCEAN.—8. East coast of Africa, from $26\frac{1}{2}^{\circ}$ south to 31° south, including Port Natal; also, northern half of the Red Sea and the Persian Gulf.
9. South extremity of Madagascar, Isle of France, and Mauritius.
10. Western coast of Australia, between 22° south and $26\frac{1}{2}^{\circ}$ (?) south.
- D. NORTH PACIFIC OCEAN.—11. Coast of Cochin China, between $12\frac{1}{2}^{\circ}$ north and 15° north.
12. Formosa, Loochoo (Liukiu), and neighbouring islands, southern shore of Japan, Hawaiian Islands.
13. West coast of North America, from the southern extremity of the peninsula of California to $17\frac{1}{2}^{\circ}$ north.
- E. SOUTH PACIFIC.—14. A small part of the coast of Eastern Australia, between 25° south and $26\frac{1}{2}^{\circ}$ south.
15. The southern extremity of New Caledonia, Pylstaart's Island, Mangaia, Rimetara, Rarotonga, Rurutu, Pitcairn's, Easter Island, and possibly the Gambier Islands.
16. The west coast of South America, near Guayaquil, from 1° to 4° south.

II. TEMPERATE ZONE.

1. WARM TEMPERATE REGION.

- A. NORTH ATLANTIC.—1. Coast of Gulf of Mexico, along Louisiana, Mississippi,

Alabama, and the western side of Florida; also, the coast of the United States, from 27° north on the east side of Florida to Cape Hatteras.

2. The Canaries, and the coast of Africa, from 14½° north to 28½° north.

B. SOUTH ATLANTIC.—3. East coast of South America, from a degree south of Rio Janeiro to 30° south; also, the west coast of Africa, between 7° south and 14° south.

C. INDIAN OCEAN.—4. South Africa, between 31° south in longitude 30°, and 33° south in longitude 23° east.

5. Western coast of Australia, between 26½° south, and the southwestern cape, in latitude 34° south, including the vicinity of Swan River.

D. NORTH PACIFIC OCEAN.—6. The Tonquin Gulf, Hainan Island, and the adjoining coast of China.

7. The western coast of the peninsula of California, as far as 28½° north.

2. TEMPERATE REGION.

A. NORTH ATLANTIC.—1. Not distinguishable at Cape Hatteras.

2. Azores and Madeira, and the northwest coast of Africa, between the Straits of Gibraltar and 29° north.

3. The Mediterranean Sea, excepting probably the eastern coast and the southern coast east of Tunis, and including Algiers, Nice, Naples, and Sicily. The northern coast borders on the Subtemperate Region, or just passes into it.

B. SOUTH ATLANTIC.—4. The eastern coast of South America, from 30° south to the eastern cape of the La Plata, and not including Montevideo.

5. The western coast of Africa, between 14° south and 28° south.

C. INDIAN OCEAN.—6. Southern coast of Africa, between the Cape of Good Hope and the meridian of 23° east.

7. The southern shore of Australia.

8. The western part of Kiusiu, including the bay of Nagasaki. (Possibly Subtemperate.)

D. NORTH PACIFIC OCEAN.—9. Coast of California, between 28½° north and 34½° north, at Cape Conception, south of Monterey.

E. SOUTH PACIFIC.—10. East coast of Australia, between latitudes 26½° south and 31° south(?).

11. West coast of South America, from Cape Blanco, north of Payta, in 4½° south, to Copiapo, in 27½° south.

3. SUBTEMPERATE REGION.

A. NORTH ATLANTIC.—1. Not distinguishable at Cape Hatteras.

2. Coast of Portugal, to 42° north.

3. Black Sea, excepting northern portion?

B. SOUTH ATLANTIC.—4. Mouth of the La Plata.

5. West coast of Africa, from 28° south to Cape of Good Hope, including Table Bay.

C. NORTH PACIFIC OCEAN.—6. Southern part of eastern coast of Nippon, and the Yellow Sea, from south of Chusan.

7. Californian coast, from 34½° north to Cape Mendocino,—including the Bays of Monterey and San Francisco.

D. SOUTH PACIFIC.—8. Southeast angle of Australia, from 30° south, including Port Jackson.

9. Northern island of New Zealand, nearly or quite to Cook's Straits.

10. West coast of South America, from 27½° south to 38°, including the harbours of Coquimbo, Valparaiso, and Valdivia.

4. COLD TEMPERATE REGION.

A. NORTH ATLANTIC.—1. Coast of the United States, from Cape Hatteras to Cape Cod.

2. Southern Britain and Ireland, British Channel, Bay of Biscay, and northern coast of Spain to 42° north, including Vigo Bay(?).

B. SOUTH ATLANTIC.—3. East coast of South America, from the southern cape of the La Plata to 43° south, including the Bay of Rio Negro.

4. Island of Tristan d'Acunha.

C. INDIAN OCEAN.—5. St. Paul's and Amsterdam Island.

D. PACIFIC.—6. Van Diemens Land, Middle Island of New Zealand, excepting southern extremity, Chatham Island.

7. Middle part of Eastern Nippon to 40° north.

8. West coast of America, from Cape Mendocino to Columbia River, or possibly to the Straits of De Fuca.

9. West coast of South America, from 38° south to 49° or 50° south, including Chiloe.

5. SUBFRIGID REGION.

A. NORTH ATLANTIC.—1. Massachusetts Bay, coast of Maine, Bay of St. Lawrence, and Southern Newfoundland.

2. Northern Britain, Orkneys, Shetlands.

3. Crimea and north coast of Black Sea?

B. SOUTH ATLANTIC.—4. East coast of South America, below 43° south, including Fuegia and the Falklands.

C. INDIAN OCEAN.—5. Prince Edward's Island, Crozet, Kerguelen's Land.

D. PACIFIC.—6. North part of Nippon, Yeso, the larger part of the Japan and Okhotsk seas; also the northwest coast of America, from 55° or 56° north, nearly or quite to the Columbia River.

7. South extremity of New Zealand, with the Aucklands, and other islands in the vicinity.

III. FRIGID ZONE.

1. Eastern coast of North America, from the east cape of Newfoundland to the northward, with Greenland, Iceland, the coast of Norway, Cattegat.

2. South Shetlands, South Georgia, Sandwich Land, and other Antarctic Lands. The line runs quite close to Cape Horn.

3. The Aleutian Islands, and eastern and southern Kamschatka, and part of the Kuriles.

The areas of the Torrid, Temperate, and Frigid zones of temperature, either side of the equator, considering 27° as the normal limit between the first two of these zones, and 60° the limit between the Frigid and Temperate, are as follows:—

Torrid zone,	.	.	8,427,000 square miles (geographical)
Temperate zone,	.	.	7,641,000 " " "
Frigid zone,	.	.	2,486,300 " " "

It is hence seen that the Temperate zone, although six degrees wider than the Torrid, has not as large a surface. The species of marine life, if distributed equally over the two, would, therefore, be more numerous in the Torrid zone than in the Temperate, unless the extent of ocean and coast line were far greater in the Temperate than in the Torrid zone, which is not the case. The ocean in the southern Temperate is much more extensive than that of the southern Torrid; but the coast line is far less extensive in the former, as it does not abound in islands, like the Torrid zone.*

The range of temperature is far greater in the Temperate zone than in the Torrid, it being 20° F. in the latter, and 33° F. in the former.

In the Torrid zone, the *Subtorrid* Region has nearly one-third the

* The following table gives very closely the surface of the zones in square geographical miles, for every $2\frac{1}{2}$ degrees of latitude to the parallel of 60° : it is taken from a larger table by Berghaus, in his *Länder- und Völker-kunde*, i. 47. The first is the zone from the equator to the parallel of $2\frac{1}{2}^{\circ}$, the second, from $2\frac{1}{2}^{\circ}$ degrees to 5 degrees, and so on.

$2\frac{1}{2}^{\circ}$	.	.	809,824	|	$32\frac{1}{2}^{\circ}$	.	.	692,424
5°	.	.	808,200	|	35°	.	.	673,440
$7\frac{1}{2}^{\circ}$	.	.	805,124	|	$37\frac{1}{2}^{\circ}$	.	.	653,172
10°	.	.	800,512	|	40°	.	.	631,656
$12\frac{1}{2}^{\circ}$	.	.	794,368	|	$42\frac{1}{2}^{\circ}$	.	.	608,944
15°	.	.	786,728	|	45°	.	.	585,064
$17\frac{1}{2}^{\circ}$	.	.	777,580	|	$47\frac{1}{2}^{\circ}$	.	.	560,320
20°	.	.	766,952	|	50°	.	.	534,032
$22\frac{1}{2}^{\circ}$	.	.	754,868	|	$52\frac{1}{2}^{\circ}$	.	.	506,960
25°	.	.	740,544	|	55°	.	.	478,924
$27\frac{1}{2}^{\circ}$	.	.	726,408	|	$57\frac{1}{2}^{\circ}$	.	.	441,792
30°	.	.	710,092	|	60°	.	.	420,176

The zone from 60° to 70°	has the area,	.	.	.	1,366,748
"	70° to 80°	"	"	.	837,516
"	80° to 90°	"	"	.	282,036

surface of the *Torrid* Region, and not one-fourth as much coast line, facts which should be regarded in comparing the number of species of the two.

Before leaving this subject of the Map, we add a few brief remarks, in a popular way, on the origin of the peculiar forms and positions presented by the isothermal lines of the ocean. The great currents of the globe are admitted to be the causes that produce the flexures and modify the courses of these lines. These currents are usually of great depth, and consequently the deflecting land will be the deeply seated slopes off a coast, beyond ordinary soundings.

The *eastern* coasts of the continents either side of the equator, feel the influence of a warm equatorial current, which flows westward over each ocean, and is diverted north and south by the coasts against which it impinges, and more or less according to the direction of the coast.

The *western* coasts of the continents, on the contrary, receive a strong polar current. In the southern oceans, it flows from the westward, or southward and westward, in latitudes 45° to 65° south, and is brought to the surface by the submarine lands or the submarine slopes of islands or continents; reaching the continents of Africa and South America, it follows along the western coast towards the equator. The same current, being divided by the southern cape of America, flows also, with less volume up the eastern coast, either inside of the warmer tropical current, or else on both sides of it. In the Northern Seas, the system of polar currents is mainly the same, though less regular; their influence is felt on both eastern and western coasts, but more strongly on the *eastern*. In the Atlantic, the latter reduces the temperature of the waters three or four degrees along the north coast of South America, as far nearly as Cape St. Roque.

The cold currents are most apparent along the coasts of continents and about islands, because they are here brought to the surface, the submarine slopes lifting them upward, as they flow on. The limits of their influence towards the equator depends often on the bend of the coast; for a prominent cape or a bend in the outline will change the exposure of a coast from that favourable to the polar current to that favourable to the tropical, or the reverse. Thus it is at Cape Hatteras, on the coast of the United States; Cape Verde, on Western Africa; Cape Blanco, on western South America, etc.

These are important principles modifying the courses of the oceanic isothermal lines; we may now proceed to the application of them.

In the Atlantic, the warm tropical current flowing westward, is trended somewhat northward by the northern coast of South America, and still more so by the West India Islands, and thus it gradually curves around to parallelism with the coast of the United States. But south of Newfoundland, either wholly from the influence of the colder current which it meets with, or in part from meeting with submarine slopes that serve to deflect it, it passes eastward, and afterwards, where it is again free to expand, it spreads both eastward and north-eastward. The flexures in the isocrymes of 74° and 68° F., near the United States coast, thus have their origin. For the same reason, the line of 56° F. is nearly straight, till it reaches beyond the influence of the Newfoundland Banks, and then makes its Gulf Stream flexure. The line of 44° F. for the same reason,—the spreading of the Gulf-Stream waters—diverges far from the equator in its easterly course, and even rises in a long loop between Great Britain and Iceland.

The cold currents, flowing down the eastern coast of America, bend the isocrymes far south close along the coast, and make a remarkable southern flexure in the isocrymes of 68° and 56° F. outside of the Gulf Stream flexure. So on the western coast of Britain, the isocryme of 44° F. has a deep southern flexure, for a like cause.

The waters of the tropical current gradually cool down in their progress, through the influence of the colder waters which they encounter; and along the isocryme of 62° , they have in the colder seasons a common temperature with that of the ocean, so that the course of the Gulf Stream is but faintly marked in it. And also in the western half of the region covered by the isocryme of 56° , the colder and warmer waters have reached this as a mean temperature. Owing to the influence of the polar current on the northern coast of South America, the equator of heat lies at a distance from the land.

Up the western coast of Africa flows the cold current from the south and west, bending upward all the isocrymal lines; and passing north of the equator, it produces a large southern bend, off the coast of Africa, in the northern isocryme of 74° outside of the warm current flexure from the coast of Guinea, and also a large northern flexure in the heat-equator.*

* Along the ocean, near Africa, south and southeast of the Cape Verdes, Captain Wilkes found a current setting to the northward for much of the time until passing the equator.

The Atlantic tropical current also flows in part down the eastern coast of South America, giving a deep flexure to each of the isocrymes, besides making these lines to diverge from the equator, through all their length. Again, the polar current passes northward nearer the coast-line, bending far back the western extremity of each of the isocrymes.

In the Pacific, the *tropical* currents show their effects near the coast of New Holland and China, in a gradual divergence of the lines from the equator. The ranges of islands forming the Tarawan, Radack, and Ralick Groups, appear to divert the current northward in that part of the North Pacific, and consequently the isocrymal lines bend northward near longitudes 170° west and 180°; and near Nippon, that of 68° shows a still greater northern flexure.

The influence of the *polar* currents in this ocean is remarkably great. The southern flows from the west and south, bending upward the line of 56° F. along the South American coast, producing at Valparaiso at times a sea-temperature of 48° F. Still farther north, it throws the line of 68° F. even beyond the equator and the Gallapagos; and that of 74° F., nearly one thousand five hundred miles from the coast, and four hundred north of the equator. The line of 62° F. reaches even beyond Payta, five degrees south of the equator, the sea-temperature at this place being sometimes below 61°.

The north polar current produces the same result along the eastern coast of Asia, as on the eastern of America. The isocryme of 74° F. is bent southward from the parallel of 23° to 12° 30' north; and that of 68° F. from 34° to 15° north, and the latter deflection is even longer than the corresponding one in the Atlantic. The trend of the coast opens it to the continued action of this current until the bend in the outline of Cochin China, below which the cold waters have less influence, although still showing some effect upon the heat-equator. The isocryme of 44° is bent southward to Nippon, by the same cold waters, and from this part of the northern Pacific the current appears to flow mostly between the islands of Japan and the continent.

In the Indian Ocean, the effects of the tropical current, as it flows westward, are apparent in the southern deflection of the several isocrymes. The trend of the coast favours a continuation of the current directly along the coast, and consequently, its modifying influence on the sea-temperature reaches almost to Cape Town on the coast, and passes even beyond it at sea, carrying 56° F. to the meridian of 15° east.

By comparing the regions of the different oceans, north and south of the equator, we may arrive at the mean position of the several isocrymes, and thereby discover on a grander scale, the influence of the various oceanic movements.

For the purpose of reaching mean results, the Middle Pacific is the most favourable ocean for study. This is apparent in its greater extent, and the wide distance between the modifying continents; and also no less in the greater actual regularity of the isocrymes.

We hence deduce, that the mean position of the isocryme of 74° F. is along the parallel of 20°, this being the average between the means for the North and South Pacific. In the same manner we infer that the mean position of the isocryme of 68° F. is along the parallel of 27°.

The southern isocrymes of 56° and 62° F., are evidently thrown into abnormal proximity by the cold waters of the south. This current flows eastward over the position of the isocryme of 44° F., and consequently in that latitude has nearly that temperature, although colder south. Hence, it produces little effect in deflecting the line of 44° F.; moreover, the line of 50° F. is not pushed upward by it. But the lines of 56° and 62° F. are thrown considerably to the north by its influence, and the Warm Temperate and Temperate Regions are made very narrow. With these facts in view, we judge from a comparison of the North and South Pacific lines, that the mean position for the isocryme of 62° F. is the parallel of 32°; and for 56° F., the parallel of 37°; for the isocryme of 50° F., the mean position is nearly the parallel of 42°; for 44° F., the parallel of 47°; for 35° F., the parallel of 56°. There is thus a mean difference of five degrees of latitude for six degrees of Fahrenheit, excepting near the equator and between 35° and 44° F. These results may be tabulated as follows:*

Isocryme of 80° F.,	.	.	.	.	.	.	Parallel of 6°
" 74°,	.	.	.	.	.	.	" 20°
" 68°,	.	.	.	.	.	.	" 27°
" 62°,	.	.	.	.	.	.	" 32°
" 56°,	.	.	.	.	.	.	" 37°
" 50°,	.	.	.	.	.	.	" 42°
" 44°,	.	.	.	.	.	.	" 47°
" 35°,	.	.	.	.	.	.	" 56°

* We may hence deduce the temperatures of those isocrymes to which the parallels of latitude for every five degrees would normally correspond. They would be for 20°, 74° F.; for 25°, 70° F.; for 30°, 64.4° F.; for 35°, 58.4° F.; for 40°, 52.4° F.; for 45°, 46.4° F.; for 50°, 41° F.; for 55°, 36° F.; for 60°, 31° F.

Using these results as a key for comparison we at once perceive the great influence of the oceanic movements on climate and on the geographical distribution of marine life.

The polar current of the Southern Atlantic has a more northward course in mid-ocean than that of the Pacific. It consequently bears up the isocryme of 35° F. to the parallel of 50°, six degrees above the mean. The effect on the other isocrymes of the Atlantic is very remarkable. We perceive in the first place that the most southern point of each of these isocrymes is not far from the mean position of the same isocrymes in the Pacific, while the most northern point of each is ten to twenty-five degrees farther north. Taking the position of the isocrymes of 68° and 74° F., where they cross the meridian of 15° west, as the mean position for this ocean, we find that the former is eight degrees in latitude farther north than 68° F. in the South Pacific; and the mean for the latter is in 7° south, while for the same in the Pacific it is 20° south, making a difference of thirteen degrees. The effect of the cold southern waters is consequently not along the African coast alone, but pervades the whole ocean. It is hence obvious, how utterly untenable the common notion, that the tropical current from the Indian Ocean is the same which flows up the west African coast. With a temperature of 56° south of Cape Town, it would be wholly incapable of causing the great deflections for the whole South Atlantic which have been pointed out. It combines with the polar current, but does not constitute it. The facts thus sustain the opinions long since brought forward by the distinguished meteorologist Mr. Wm. C. Redfield, that the currents flowing north along the African and South American coasts are alike true polar or cold temperate currents.*

We may now turn to the North Atlantic. In this part of the ocean, the mean positions of the isocrymes of 74° and 68° F., are near the normal positions deduced from the Pacific. The line of 62° F. is in a somewhat higher latitude, the mean position, excluding the eastern and western deflections, being near the parallel of 36°. The line of 56° F. has the parallel of 42½° north for its mean position over the middle of the ocean, which is five and a half degrees above the normal in the Pacific. The line of 50° has in the same manner for its mean position over the mid-ocean, the parallel of 47½°, or again five and a

* American Journal of Science, xlv. 299, 1843.

half degrees above the normal position in the Pacific. The line of 44° F. may be considered as having for its mean position the parallel of 52° north, while it rises to 60° north. The lines in the North Atlantic above that of 68°, average about five degrees higher in latitude than the mean normal positions, while 68° and 74° have nearly the same place as in the Pacific. There is hence a great contrast between the Pacific, South Atlantic, and North Atlantic Oceans. This is seen in the following table containing these results:

	Normal, deduced from Pacific.	Mean position in South Atlantic.	Mean position in North Atlantic.
Isocryme of 74° F.,	20°	7° south.	21° north.
“ 68°	27°	19°	28°
“ 62°	32°	29°	36°
“ 56°	37°	36°	42½°
“ 50°	42°	39°	47½°
“ 44°	47°	44°	52° (max. 60° north).
“ 35°	56°	50°	61° (max. —?)

The influence of the warm tropical waters in the North Atlantic lifts the isocrymes of 74° and 68° as they approach the coast of America, while the same lines are depressed on the east by the colder northern currents. Moreover, north of 68° the whole interior of the ocean is raised four to five degrees in temperature above the normal grade, by the same waters spreading eastward; and between Great Britain and Iceland, the temperature is at least ten degrees warmer than in the corresponding latitude of the South Pacific, and thirteen or fourteen degrees warmer than in the same latitude in the South Atlantic.*

The influence of so warm an ocean on the temperature of Britain, and on its living productions, animal and vegetable, is apparent, when it is considered, that the winds take the temperature nearly of the waters they pass over. And the effects on the same region, that would result from deflecting the Gulf Stream in some other direction, as remarked by Prof. Hopkins† and others, and substituting in the Northern Atlantic the temperature of the Southern Atlantic, is also

* Ross, in his Antarctic Voyage, found the sea-temperature in 60° south and 3° west, 31½° F., in the month of *March*; at the South Shetlands, 61° south, the sea-temperature was 31° to 35° in January (midsummer); and in the same latitude, and 45° west, it was 30·1° in February.

† Quarterly Jour. Geol. Soc., vol. viii., p. 56, and Amer. Jour. Sci., 1853, vol. xv.

obvious, without farther illustration. The discussion of these subjects would be foreign to the topic before us.

We close these general remarks, by giving the extreme surface temperatures of the waters, as nearly as ascertained, for some places of prominent importance in marine zoological geography. The extremes in view are the means of the coldest and warmest thirty consecutive days of the year.

SOUTH AMERICA.

Venezuela and Surinam, 74°-80°.
 Pernambuco, 74°-83°.
 Bahia, 74°-83°.
 Rio Janeiro, 68½°-78°.
 Buenos Ayres, 50°-64¼°.
 Rio Negro, 46°-60°.
 Fuegia, 36°-56°.
 Falklands, 37°-50°.
 Chiloe, 48°-56¼°
 Valdivia, 50°-63°.
 Conception, 52°?-60°?
 Valparaiso, 52°-62°.
 Copiapo, 56½° (July)-68°?
 Iquique, 58° (July)-69°?
 Callao, 57½°-74°.
 Payta, 60°-74°?
 Guayaquil, 69°-81°.
 Gallapagos, 62°-80°.

NORTH AMERICA.

Panama, 74°-85°?
 San Francisco, 51°-68°?
 Monterey, 54°-70°?
 Acapulco 82½°-84° (March).
 Columbia River, 46°-60°?
 Puget's Sound, 42°?-57°.
 South of Newfoundland, 35°-63°.
 Massachusetts Bay, 37°-64°.
 Cape Henry, 46°-80°.
 Off Charleston, 64°-81°.
 Key West, 72°-85°.
 Yucatan, 71°-83°.
 Cuba, 74°-84°.

GREAT BRITAIN AND EUROPE.

Shetlands, 36°-56°?
 Scotland, west and north, 39°-58°.
 Irish Sea, 45°-63°.
 English Channel, 46°-62°.
 Cape Finisterre, 50°-66°.
 Near Gibraltar, 58°-77°.
 Azores, 60°-73°.
 Madeira, 62°-75°.
 Canaries, 64°-75°.
 Cape Verdes, 70°-82°.

AFRICA.

Sierra Leone, 78°-85°.
 Ascension, 72°-78°.
 St. Helena, 68°-74°.
 Table Bay, 54°-68°.
 Port Natal, 72°-73° (May).

INDIAN OCEAN.

South end of Madagascar, 69°-80°.
 Mauritius, 72°-83°.
 Entrance of Red Sea, 76°-88°.
 Keeling Island, 78°-83° (April).
 Singapore, 74°-84°.
 Balabac, 77°-85°.
 Manilla, 79°-85°.
 North Luzon, 74°-84°.

PACIFIC OCEAN.

Ladrones, 79°-86°.
 Salomon Islands, 77°-85°.

New Hebrides, 74°–83°.
 New Caledonia, 73°–82°.
 Kingsmills, 80°–88°.
 Feejees, 74°–85°.
 Tongatabu, 74°–82°.
 Samoan Islands, 74°–85°.
 Tahitian Islands, 74°–83°.
 Hervey Islands, 68°–76°.

Hawaiian Islands, 68°–83°.
 Island of Hawaii, 72°–83°.

NEW HOLLAND, ETC.

Port Jackson, 55°–71°.
 Hobarton, Van Diemens Land, 50°–60°.
 Bay of Islands, N. Z., 54°–67°.
 King George's Sound, 58°–68°.

A great service will be conferred on science when an isothermal chart for the continents is made out, with the most convenient subdivisions for illustrating the subject of the geographical distribution of land and fresh-water species. Dove's charts contain in part the elements as regards temperatures; but it remains to be decided which isothermal boundary lines had best be adopted for this particular purpose; and moreover, the actual curves of the isothermals dependent on the elevations of a country should be laid down. The winter lines of 68° and 74° for the ocean and air, appear to correspond very nearly, and the same lines might be used for the land chart as well as the marine. The former is the limit for the Coccoanut Palm as well as for coral-reefs, and the Torrid zone of oceanic temperature, might hence be called the *Coccoanut-palm* as well as the *Coral-reef* zone.

Temperature at depths.—With respect to the change of temperature as we descend in the ocean, we cannot present a series of facts, as those that have been ascertained are too few and isolated to be of much service. The lowest temperature reached is 39½° F., which is less than that of the Frigid Region, as here laid down. Under the equator this temperature is not reached short of seven thousand feet, and somewhere between the parallels of 45° and 60°, the position varying with the seasons and meridian, it is found at the surface as well as at all depths below.

It is a question of much interest, *how far temperature influences the range of zoological species in depth.* From a survey of the facts relating to coral-zoophytes, the author arrived at the conclusion, that this cause is of but secondary importance.* After determining the limiting temperature bounding the coral-reef seas, and ascertaining

* Exped. Report on Zoophytes, 1846, p. 103; and on Geology, p. 97.

the distribution of reefs, it was easy to compare this temperature with that of the greatest depths at which the proper reef corals occur. This depth is but one hundred feet. Now the limiting temperature, 68°, is reached under the equator at a depth of five hundred feet, and under the parallel of 10° at a depth of at least three hundred feet. There must, therefore, be some other cause besides temperature; and this may be amount of pressure, of light, or of atmospheric air dissolved in the waters.

Prof. Forbes has remarked that the deep-sea species in the Ægean have a boreal character;* and Lieut. Spratt, also, has ascertained the temperatures at different depths,† and shown that the deep-sea species are those which have the widest range of distribution, most of them occurring north, about the British shores or north of France. Yet is it true that the species which occur in deep water in the Ægean are found in shallow waters of like temperature about the more northern coasts? If so, Lieut. Spratt's conclusion, that temperature is the principal influence which governs the distribution of marine fauna, in depth as well as in latitudinal distribution, will stand as true. But we believe that facts do not bear out this conclusion. Deep-sea species live in deep seas in both regions, with but little difference in the depth to which they extend. They are boreal in character, when of Mediterranean origin, because they are cold-water species; and their wide distribution is because of the wide range of temperature for which they are fitted, rather than their fitness to endure a given temperature, which they find at considerable depths to the south, and near the surface to the north.

As this point is one of much importance, we have run over the recent tables of dredging by Prof. E. Forbes, in the Ægean and about the British Islands,‡ to see how far it is borne out; and we add other results by R. MacAndrew, Esq., at Vigo Bay, Portugal, Gibraltar, Malta and Pantellaria, Algiers and Tunis.§

The great care and thoroughness of Prof. Forbes's researches and those also of MacAndrew, give peculiar weight to the conclusions. Those species are taken from the tables which are common to these

* Report on the Ægean Invertebrata, Rep. Brit. Assoc., 1843, 130.

† Rep. Brit. Assoc., 1848, 81.

‡ Rep. Brit. Assoc., 1843; and on British Marine Zoology, *ibid.*, 1850, 192.

§ Rep. Brit. Assoc., 1850, p. 264.

several regions, and with regard to which the observations are free from doubt; and we have confined the list to the *Acephalous molluscs*, as these appear to be sufficient to test the law under discussion. The depth is given in *fathoms*.

It should be observed, that to carry out the theory, the species should be confined to *shallower* waters to the north than to the south.

	North Scotland and Shetland.	South England and I. of Man.	Vigo Bay.	Gibraltar.	Ægean.	Malta and Pantellaria.	Algiers and Tunis.
<i>Corbula nucleus</i> , . . .	3-80	5-50	5-25	8-20	7-80	6-50	8-35
<i>Neera cuspidata</i> , . . .	10-80	50	20	45*	12-185	. . .	. . .
<i>Thracia phaseolina</i> , . . .	0-80?	3-30	. . .	. . .	7-30	. . .	. . .
<i>Solen pellucidus</i> , . . .	7-100	5-50	. . .	40	. . .	. . .	35
<i>Psammobia ferroensis</i> , . . .	3-80	5-50	. . .	8*	20-40	. . .	10
<i>Tellina donacina</i> , . . .	1-80	5-40	. . .	. . .	7-45	. . .	10
<i>Maetra subtruncata</i> , . . .	0-12	0-20?	5-10	. . .	. . .	. . .	6
<i>Lutraria elliptica</i> , . . .	0-10	0-20	Low water.	. . .	. . .	. . .	. . .
<i>Cytherea chione</i>, . . .	. . .	10-20?	. . .	8	7-10	6-15	. . .
<i>Venus ovata</i> , . . .	5-100	7-50	8	6-40	29-135	6-40	6-35
<i>Venus fasciata</i> , . . .	5-80	7-50	8	8	27-40	6-50	6-35
<i>Venus verrucosa</i>, . . .	. . .	0-10	5	6	2-40	6-15	6
<i>Artemia linctia</i> , . . .	0-80	5-50	Low water.	6	. . .	6-15	6-8
<i>Cardium echinatum</i> , . . .	5-100	5-50	Littoral.	. . .	7-50	. . .	. . .
<i>Lucina flexuosa</i> , . . .	3-100	5-50	4	. . .	7-11	. . .	. . .
<i>Lucina spinifera</i> , . . .	10-100	15-30?	10-12	15-25	4-30	6-40	35
<i>Kellia suborbicularis</i> , . . .	0-90	10-40	8	. . .	29-45	35-50	. . .
<i>Modiola tulipa</i> , . . .	10-50	5-25	12	10-25	2-50	. . .	35
<i>Modiola barbata</i>, . . .	. . .	2-15	. . .	. . .	7-95	6-15	6-8
<i>Arca tetragona</i> , . . .	10-60	20-30	8*	30	20-80	35-50	35
<i>Arca lactea</i>, . . .	. . .	10-50	. . .	12-20	0-150	. . .	6-35
<i>Pectunculus glycerimis</i> , . . .	5-80	5-50	8-12	30	6-24	. . .	35
<i>Nucula nitida</i> , . . .	5-60	5-30	20-25	12-40	. . .	6-15	6-8
<i>Nucula nucleus</i> , . . .	5-100	5-50	5-25	6-20	2-10	6-40	6-35
<i>Lima subauriculata</i> , . . .	4-100	15-30	. . .	35	15-30	. . .	35
<i>Pecten similis</i> , . . .	2-80	20-50	20*	. . .	27-185	. . .	35
<i>Pecten maximus</i> , . . .	2-40	10-30	8	4-25	. . .	35-50	6-8
<i>Pecten opercularis</i> , . . .	2-100	5-60	8-20	20-40	10-70	. . .	35
<i>Pecten varius</i> , . . .	3-20	3-30	8	8	7-55	6-15	35
<i>Anomia ephippium</i> , . . .	0-80	0-60	10	. . .	20-40	35-50	6-35

To compare fairly this table, it should be noted that the dredging at the Shetlands, Orkneys, and north of Scotland, was carried to a greater depth than about Southern England, fifty fathoms being the limit in the latter region, as the waters are shallow. Making this allowance, we are still struck with the *great depth* to which the species penetrate at the most northern locality, instead of the *small* depth. Out of the twenty-one species which are here mentioned as occurring on Northern Scotland, or the Shetlands, and the Ægean, fourteen or fifteen descend to a *greater* depth in the former than in the latter; and nearly all the species common to the north and south extremities of the British Islands, are reported from the deepest waters at the north. Of the observations made at Vigo Bay, Malta, Pantellaria, Tunis, Algiers, and Gibraltar, there is but a single example among the above species of a greater range in depth than occurs in the northernmost locality examined. The dredging in the Mediterranean by MacAndrew, was not carried to as great depths; yet even allowing for this,

* Not found living at the depth stated.

the facts are not a little remarkable. One hundred fathoms appears to have been the greatest depth of the Shetland dredgings.

Now the temperature in the Ægean during the warmer months, according to Lieut. Spratt, is as follows:—

At the surface,	.	.	76°–84°.		
10	fathoms,	seldom	below 74°	in the	summer.
20	“	“	“	68°	“ “
35	“	“	“	62°	“ “
75	“	“	“	56°	“ “
100–300	“	“	“	55°–55½°	“ “

The temperature of the waters near Southern England in summer is 62°; and near the Shetlands 55° or less. Consequently the surface summer temperature of the British Channel is not found in the Ægean at a less depth than thirty-five fathoms, and the *surface summer temperature of the Shetlands, is the temperature at one- to three hundred fathoms in the Ægean*; and still species that range to a depth of one hundred fathoms about Northern Scotland are found within thirty fathoms of the surface in the Ægean, that is, where the summer temperature is 74° or more. Such facts show the hardiness of the species in enduring great ranges in temperature. We must, therefore, conclude, that it is not temperature alone or mainly which determines the *depth* to which species may live. It exerts an influence, and species fitted for cold waters may be found in the deeper seas where such waters occur; but the limit of descent depends on other influences.

Looking at this table in another way, we see, as recognised by Prof. Forbes, that species which occur at or near the surface in Northern Scotland, are generally met with only at greater depths in the Mediterranean; that is, the minimum depth is less in the former case than the latter. Thus *Corbula nucleus* has for its minimum depth in the Mediterranean six fathoms, and in the northern regions three fathoms. *Psammobia ferroensis* has ten fathoms for the former, and three for the latter. Other examples will be found in the above table, sufficient to illustrate the principle, although many exceptions exist. Thus species that have the range of one hundred fathoms beyond Scotland, may have the same in the Mediterranean, except that in many cases they do not reach as near the surface, where the waters are warm.

The Crustacea of the same seas illustrate this subject in a similar

way. But the observations upon them have been made with less thoroughness, and we have, therefore, confined our discussions to Molluscs.

Prof. Edward Forbes has with much discrimination laid down certain zones in depth, and pointed out their zoological and botanical peculiarities for certain coasts. The observations on Crustacea made by us, were not extended to any considerable depth, and they will not enable us, therefore, to recognise these several zones in the following tables.

II. GEOGRAPHICAL DISTRIBUTION OF SPECIES.

In making an application of the isothermal oceanic chart to the subject of the geographical distribution of Crustacea, we have two objects before us.

First.—To compare the zones and their regions with one another as to (a) *number of species*, (b) *number of genera*, (c) *number and size of individuals*, (d) *grade of species*, in order to arrive at some general conclusions as to the temperatures best fitted for the highest and most prolific developments of Crustacea.

Second.—To compare different geographical positions in similar regions with one another, in order to arrive at their resemblances and differences, and deduce the several distinct zoological provinces; and also to distinguish the more or less wide diffusion of species in longitudinal range.

1. DISTRIBUTION OF CRUSTACEA WITH REFERENCE TO THE TEMPERATURE.

We here present a series of tables, containing, for each genus, the number of species that occurs in each temperature region, with a column also giving the sum of the Torrid zone species, and another for the sum of the Temperate zone species. The several regions are lettered *a*, *b*, *c*, *d*, &c., to *h*, and where one or more species in a region occur in another nearer the equator, it is indicated by annexing the number with the letter of the column in which it occurs. Thus, 6 (2 *a*) in column *b*, means that there are six species in the *b* or Subtorrid Region, but two of them are found also in the *a* or Torrid Region.

We give first a table of the Brachyura, and following this, a recapitulation and summary, containing a summing up of the species for the subfamilies, families, tribes, &c. These tables afford some obvious deductions. Then follow similar tables for the Anomoura, Macroura, and remaining Podophthalmia, with a series of deductions; and then the same for the Tetrdecapoda.

The perfecting of the Temperature Chart, by changing the limits of some of the regions (which is to be expected as new facts are brought in), will undoubtedly cause some modifications of these tables; but nothing that will affect essentially the conclusions which will here be drawn from them.

TABLE I.
BRACHYURA.

1. MAIOIDEA.										
	a. Torrid.	b. Sub-torrid.	Total of Torrid zone.	c. Warm temp.	d. Temperate.	e. Sub-temperate.	f. Cold Temp.	g. Sub-frigid.	Total of Temperate zone.	h. Frigid.
I. MAIINEA.										
I. INACHIDÆ.										
1. MACROCHEIRINÆ.										
Macrocheira,							1	1(f)	1	
2. INACHINÆ.	1		1	1	3				6	
Inachus,				2	3		3(1c)		2	
Microrhynchus,										
3. SALACINÆ.						1			1	
Salacia,										
II. MAIIDÆ.										
1. LIBININÆ.										
Doclea,	4	1(a)	4		1				1	
Libidoclea,						1		1	2	
Libinia,		2	2	2(1b)	1	2(1b)	1(c)	1(c)	4	
2. MAIINÆ.										
Maia,	1	2(1a)	2	1	2(1c)		1(c)	1?	3	
3. PISINÆ.										
Paramithrax,	1	1(a)	1		1?	2(f)		1(c)	4	
Pisa,	3	3(1a)	5	5	4(2c)		2(1c)		7	
Pella,				1					1	
Lissa,					1				1	
Rhodia,				1					1	
Hyas,		1	1				2	2(1f)	3	1(f)
Pisoides,				1		1(c)			1	
Herbstia,				2	1(1c)	1			3	
Thoe,				1					1	
Dehaanius,			1?						1	
4. PRIONORHYNCHINÆ.										
Prionorhynchus,			1?							
5. MICIPPINÆ.										
Micippa,	4	2(1a)	5							
6. CHORININÆ.										
Chorinus, {	6	2(1a)	7				1		1	
Chortilia, }										
Lahaina,		1	1							
Naxia,		1	1	1?					1	
Scyra,							1		1	
Hyastenus,	1		1							
Pyria,	1		1							
7. OTHONINÆ.										
Othonia,				2					2	
III. MITHRACIDÆ.										
11. MITHRACINÆ.										
Mithrax,	8	5(4a)	9	2(1a)	2(2a)				4	
Mithraculus,	1		1	2					2	
12. CYCLACINÆ.										
Cyclax,	1		1							
IV. TYCHIDÆ.										
1. CRIOCARCININÆ.										
Criocarcinus,			1?							
2. TYCHINÆ.										
Tyche,	2		2							
3. CAMPOSCINÆ.										
Camposcia,	1	(1a)	1							

MAIOIDEA—Continued.

	a. Torrid.	b. Sub-torrid.	Total of Torrid zone.	c. Warm Temp.	d. Temperate.	e. Sub-temperate.	f. Cold Temp.	g. Sub-frigid.	Total of Temperate zone.	h. Frigid.
V. EURYPODIDÆ.										
1. EURYPODINÆ.										
Eurypodius,						2		4 (2e)	4 (+1f)	
Oregonia,								2	2	
2. AMATHINÆ.										
Amathia,					1				1	
VI. LEPTOPODIDÆ.										
1. ACHEINÆ.										
Acheus,				1?	1		1 (d)		2 (1)	
2. INACHOIDINÆ.										
Inachoides,						1			1	
3. LEPTOPODINÆ.										
Leptopodia,	1		1	3 (1a?)		1 (a?)			3	
4. STENORHYNCHINÆ.										
Stenorhynchus,					2		1 (d)	1 (d)	2	1
VII. PERICERIDÆ.										
1. PARAMICIPPINÆ.										
Paramicippa,		1	1		1				1	
2. PERICERINÆ.										
Pericera,	4	3 (2a)	5	1					1	
Tiarinia,	5	1	6							
Perinea,		1	1							
Hallnus,	2		2		1				1	
Pugettia,					1			1	2	
3. MENESTHINÆ.										
Menesthus,	5	6 (2a)	9							
Acanthonyx,	2	5 (1a)	6	1 (a)	2				3	
Antilibinia,		1	1							
Peltinia,	1	1	2							
4. STENOCLONOPINÆ.										
Stenoclonops,		1	1							
5. EPIALINÆ.										
Epialtus,		3	3	1 (b)		4 (1b)			5	
Huenia,	2	3 (1a)	4							
Xenocarcinus,		1	1							
Leucippa,		1	1			1	1		2	
II. PARTHENOPINEA.										
I. PARTHENOPIDÆ.										
Parthenope,	3	1 (a)	3							
Lambrus,	13	5 (1a)	17		3				3	
Eurynome,					1	1 (? d)	1		3	
II. EUMEDONIDÆ.										
Eumedonus,	1 (? b)		1							
Ceratocarcinus,			3							
?Gonatonotus,			1							
?Zebrida,			1							
?Harrovia,			1							
III. CRYPTOPODIDÆ.										
Cryptopodia,	2		2	1		1			1	
Eurytolambrus,									1	
III. ONCININEA.										
Oncinopus,	2		2							

GEOGRAPHICAL DISTRIBUTION OF CRUSTACEA. 1493

CANCROIDEA—Continued.

	a. Torrid.	b. Sub-torrid.	Total of Torrid zone.	c. Warm Temp.	d. Temperate.	e. Sub-temperate.	f. Cold Temp.	g. Sub-frigid.	Total of Temperate zone.	h. Frigid.
VI. PODOPTHALMIDÆ. Podophthalmus, . . .	2	1 (a)	2							
II. TELPHUSINEA.*										
III. CYCLINEA. Acanthocyclus, . . .						1			1	

3. GRAPSOIDEA.

	a. Torrid.	b. Sub-torrid.	Total of Torrid zone.	c. Warm Temp.	d. Temperate.	e. Sub-temperate.	f. Cold Temp.	g. Sub-frigid.	Total of Temperate zone.	h. Frigid.
I. GONOPLACIDÆ. Eucrate, Curtonotus, Gonoplax,	1	2 2 (1 a)	2 2	1	2 (1 c)	1	1 (d)	1	1 2	
II. MACROPTHALMIDÆ. 1. MACROPTHALMINÆ. Cleistostoma, Macrophthalmus,	2 7	5 (2 a) 5 (?+1)	5 12							
2. OCEPODINÆ. Gelasimus, Helocius, Oceypoda, Scopimera,	10 8	9 (3 a) 7 (2 a) 1	16 13 1	3 (b) 1 (b)		2 2 (1 a)	1 (b)	1 (b)	5 2 3	
3. DOTINÆ. Doto,	1	1 (a)	1							
III. GRAPSIDÆ. 1. GRAPSIDINÆ. Pseudograpsus, Heterograpsus, Brachyotus, *Eriochelr, *Platynotus, Trichopus, Grapsus, Goniograpsus, Planes, Hemigrapsus, Cyrtoagrapsus,	1? 1 1 1 5 2 2 4 (?+1)		1 1 1 1 7 8 2 4		1 1			2	2 1 1 1 5 3 2 5 1	
2. SESARMINÆ. Sesarma, Sarmatium, Cyclograpsus, Chasmagnathus, Helice,	9 1 2 1 1?	11 (3 a) 1 3 2 (1 a) 1?	17 1 5 2 1	3 (2 b)		1 (b)	1 (b)		3 1 1 2	
3. PLAGUSINÆ. Acanthopus, Plagusia,	2 3	1 (a) 3 (1 a)	2 5	1 (a) 1 (a)	1 (a) 1 (a)	1 (a) 2 (1 a)			1 3	
IV. GECARCINIDÆ. 1. UCALINÆ. Uca,	2	2 (2 a)	2							

* None marine.

GRAPSOIDEA—Continued.

	a. Torrid.	b. Sub-torrid.	Total of Torrid zone.	c. Warm Temp.	d. Temperate.	e. Sub-temperate.	f. Cold Temp.	g. Sub-frigid.	Total of Temperate zone.	h. Frigid.
Gecarcinus,	1		1							
Cardisoma,	4	2(2a)	4							
Gecarcoidea,		1(?)	1							
2. GECARCININÆ.										
Gecarcinus,	2	1(?)	2			2			2	
V. PINNOTHERIDÆ.										
1. PINNOTHERINÆ.										
Pinnothera,	2	3(1a)	4	3(1b)	2	1	4(4c, d)	2(1d)	7	
Fabia,			1			1		1	2	
Xenophthalmus,	1		1						2	
Xanthasia,	1		1						1	
Pinnixa,				1		1			1	
Pinnotherella,						1			1	
2. HYMENICINÆ.										
Hymenosoma,						1			1	
Halicarcinus,						2		2(1e)	3	
Hymenicus,						2			2	
Elamena,	1	2(a)	2							
VI. MYCTIRIDÆ.										
Myctiris,	1	(1a)	1			1			1	

4. LEUCOSOIDEA.

	a. Torrid.	b. Sub-torrid.	Total of Torrid zone.	c. Warm Temp.	d. Temperate.	e. Sub-temperate.	f. Cold Temp.	g. Sub-frigid.	Total of Temperate zone.	h. Frigid.
I. CALAPPIDÆ.										
1. CALAPPINÆ.										
Calappa,	6	7(6a)	7	2(1a)	1(c)				2	
Platymera,						1			1	
Mursia,	1	2(1a)	2	1					1	
Cycloes,		1	1							
2. ORITHYINÆ.										
Orithya,	1		1							
II. MATUTIDÆ.										
Hepatus,	1	2(1a)	2	1		1			2	
Thealia,	1		1							
Matuta,	2	2(2a)	2							
III. LEUCOSIDÆ.										
Leucosia,	3	4	7			1			1	
Philyra,	2	2	4	1					1	
Leucisca,		1?	1							
Ebalia,					3	1?	3	2(1f)	8	
Nucia,		1	1							
Nursia,	1	2(1a)	2						2	
Ilia,				1	2(1c)					
Myra,	1	2(1a)	2							
Guala,	1		1	1(a)		1(a)			1	
Ixa,	2	1(a)	2							
Iphis,	3		3							
Arcania,	2		2		1				1	
Oreophorus,	1	1	2							
Tlos,	1		1							
IV. DORIPPIDÆ.										
Dorippe,	4	4(4a)	4	4(2a)	2(1c)				4	
Ethusa,					1				1	

5. CORYSTOIDEA.

	a. Torrid.	b. Sub-torrid.	Total of Torrid zone.	c. Warm Temp.	d. Temperate.	e. Sub-temperate.	f. Cold Temp.	g. Sub-frigid.	Total of Temperate zone.	h. Frigid.
I. TRICHO CERIDÆ. Trichocera,	1	1(?) c)	1(?) +1)					1	1	
II. THINIDÆ. Thia, Kraussia,		2(?) +1)	2		1		1(d)		2	
III. CORYSTIDÆ. Telmessus, Atelecyclus, Peltarion, Pseudocorystes, Gomezia, Æidia, Corystes, Dicera,	1	1?	1 1?	1		1	1 3(1 c)	2(2, f) 1	1 4 1 1 1	
				1?	1 2?		1(d)	1(d)	3(?) +1) 2(?)	

In the following recapitulation, the figure in parenthesis following the *Total* for the Temperate zone of the larger groups, expresses the number of species common to the Temperate and Torrid zones.

6. RECAPITULATION.

	a. Torrid.	b. Sub-torrid.	Total of Torrid zone.	c. Warm Temp.	d. Temperate.	e. Sub-temperate.	f. Cold Temp.	g. Sub-frigid.	Total of Temperate zone.	h. Frigid.
I. MAINEA.	82	57	122	35	27	21	16	14	92(9)	
I. MAIOIDEA.	57	50	92	32	23	19	15	14	84(9)	
1. INACHIDÆ.	1		1	3	4	1	4		10	
Macrochelrinæ.								1(f)	1	
Inachinæ.	1		1	3	3		3(1c)		8	
Salacinæ.									1	
2. MAIDÆ.	21	16(5a)	32	18	10	7	8	6	38(2)	
Libinæ.	4	3(1a)	6	2(1b)	2	3(1b?)	1(c)	2(1c)	7	
Maidinæ.	1	2(1a)	2	1	1		1(c)	1?	3	
Pisina.	4	5(2a)	7	11(?)	7(3c)	4(1c)	4(2c, d)	3(2c, f)	23(2)	1
Prionorhynchinæ.			1?							
Micippinæ.	4	2(1a)	5							
Choriniinæ.	8	4(1a)	11	1?			2		3	
Othoninæ.				2					2	
3. MITHRACIDÆ.	10	5	11	4	1	1			6(3)	
Mithracinæ.	9	5(4a)	10	4(1a)	2(1a)				6	
Cyclacinæ.	1		1							
4. TYCHIDÆ.	3	1	4							
Criocarcinina.			1?							
Tychinæ.	2		2							
Camposcinæ.	1	1(a)	1							
5. EURYPODIDÆ.						3		6	7	
Eurypodinæ.						2		6(2e)	6(+1?)	
Amathinæ.						1			1	
6. LEPTOPODIDÆ.	1		1	4	3	2	2	1	8(1)	
Acheinæ.				1?	1		1(d)		2(7i)	
Inachoidinæ.						1			3	
Leptopodinæ.	1		1	3(1a?)		1(at)			2	
Stenorhynchinæ.							1(d)	1(d)	15(3)	1
7. PERICERIDÆ.	21	28	43	3	5	5	1	1	1	
Paramicippinæ.	1		1		1				1	
Pericerinæ.	11	5(2a)	14	1	2			1	4	
Menæthinæ.	8	13(3a)	18	1(a)	2				3	
Stenocionopinæ.			1							
Epialtinæ.	2	8(1a)	9	1(b)		5(1b)	1		7	
II. PARTHENOPINEA.	23	7	28	1	4	2	1		8	
1. PARTHENOPIDÆ.	16	6(2a)	20		4	1(d?)	1		6	
2. EUMEDONIDÆ.	5		5						0	
3. CRYPTOPODIDÆ.	2	1	3	1		1			2	
III. ONCININEA.	2		2						0	
II. CANCROIDEA.										
I. CANCRINEA.	157	112	229	22	25	23	25	8	69(12)	
1. CANCHIDÆ.				1	1	7	3(2c, d)	3(2c, f)	11	
2. XANTHIDÆ.	83	61	129	8	6	6	5(5b, d)		16	
Xanthinæ.	43	44(9a)	77	8(4b)	6(4a, b)	7(1c)	5(5b, c, d)		16(5)	
Chlorodinæ.	40	12(4a)	49							
Polydectinæ.		2(?)	3							
3. ERIPHIDÆ.	35	16	44	4	6	4	2	1	14	
Ethinæ.	1	1(a)	1							
Ozinæ.	16	8(?)	23(1+7)	3(?)	5	4(2d)	1(d)	1	12(2)	
Actumninæ.	1	1	2							
Eriphinæ.	17	5(4a)	18	1	1(c)		1		2	
4. PORTUNIDÆ.	36	32	52	8	10	2	13	3	21	
Lupinæ.	35	31(15a)	51	6(3a, b)	1(c)		1(b)	1(b)	6(3)	
Arenasinæ.	1	1(a)	1	1(a)					1(1)	
Portuninæ.				2(?)	5	2(1d)	12(8c, d, e)	2(d, f)	14	
5. PLATYNTCHIDÆ.	1	2(?)	2(?)	1	2	4	2(2b, d)	1(b)	7(1)	
6. PODOPTHALMIDÆ.	2	1(a)	2							
III. GRAPSOIDEA.	72	88	131	21	14	27	10	9	63(8)	
1. GONOPLACIDÆ.	1	4(1a)	4	1	2(1c)		1(d)	1	3	
2. MACROPTHALMIDÆ.	28	28	48	4		4	1	1	10	
Macrophthalminæ.	9	10(2a)	17							
Ocyropodinæ.	18	17(5a)	30	4(2b)		6	1(b)	1(b)	10	
Dotinæ.	1	1(a)	1							
3. GRAPSIDÆ.	28	44	60	12	10	10	4	2	30	
Grapsinæ.	10	23(6a)	27	7(6a, b)	8(2a, b)	4(1a)	3(1b)	2	20	
Sarfaminæ.	13	17(4a)	26	3(2b)		4(1b)	1(b)		6	
Plagusinæ.	5	4(2a)	7	2(2a)	2(2a)	3(1a)			4	

RECAPITULATION—Continued.

	a. Torrid.	b. Sub-torrid.	Total of Torrid zone.	c. Warm Temp.	d. Temperate.	e. Sub-temperate.	f. Cold Temp.	g. Sub-frigid.	Total of Temperate zone.	h. Frigid.
4. GECARCINIDÆ,	9	6	10			2			2	
Ucaïnae,	7	5 (4 a)	6						2	
Gecarcininae,	2	1 (?)	2			2			2	
5. PINNOTHERIDÆ,	5	5	3	4	2	2	4	5	17	
Pinnotherinae,	4	3 (1 a)	6	4 (1 b)	2	4	4 (4 c, d)	3 (1 d)	11	
Hymeniciinae,	2	1 (a)	2			5	2 (1 e)		6	
6. MICTRIDÆ,	1	1 (a)	1			1			1	
IV. LEUCOSOIDEA,	35	33	43	11	8	5	3	2	24 (5)	
1. CALAPPIDÆ,	8	10	11	3 (1 a)	1	1			4	
Calappinae,	7	10 (7 a)	10	3 (1 a)	1 (c)	1			4	
Orithyinae,	1	1	1							
2. MATUTIDÆ,	4	4 (3 a)	5	1		1			2	
3. LEUCOSIDÆ,	19	15 (3 a)	23	3	5	3 (1 a)	3	2 (1 f)	13	
4. DORIPPIDÆ,	4	4 (4 a)	4	4 (3 a)	2 (1 c)				5	
V. CORYSTOIDEA,	2	3 (?+1)	5	2	4	2	6	6	16	
1. TRIGOCERIDÆ,	1	1 (?)	1 (?+1)				1	1	1	
2. TRIDÆ,		2	2		1		1		2	
3. CORYSTIDÆ,	1	1	2	2	3	2	5 (2 c, d)	5 (3 d, f)	13	

SUMMARY.

	a. Torrid.	b. Sub-torrid.	Total of Torrid zone.	c. Warm Temp.	d. Temperate.	e. Sub-temperate.	f. Cold Temp.	g. Sub-frigid.	Total of Temperate zone.	h. Frigid.
Maiouidea,	82	57	122	35	27	21	16	14	92	3 (2)
Caucroidea,	157	112	229	22	25	23	25	8	69	3 (3)
Grapsouidea,	72	88	131	21	14	27	10	9	63	
Leucosouidea,	35	33	43	11	8	5	3	2	24	
Corystouidea,	2	3	5	2	4	2	6	6	16	1?
	348	296	535	91	78	78	60	39	64	

We here notice a few of the general facts or conclusions that may be deduced from the preceding tables.

I. The line of division, separating the Torrid and Temperate zones of ocean temperature, following the isocryme of 68° or the outer limit of coral reef seas, marks a grand boundary in organic life, well exemplified in Crustacean species. Out of the five hundred and thirty-four species of the Torrid and Subtorrid Regions (the Torrid zone), there are one hundred now known to be common to the two. But of the two hundred and fifty-four in the Temperate Regions, only thirty-four occur in the Torrid zone. A large number of genera, containing more than a single known species, are confined wholly to the Torrid zone:

such are *Micippa* (5 species), *Menæthius* (9), *Huenia* (4), *Parthenope* (3), *Atergatis* (17), *Carpilius* (13), all the *Chlorodinæ*, including forty-nine species, nearly all the *Eriphinæ*, including eighteen species, *Charybdis* (15). At the same time, the species of the Torrid and Subtorrid Regions are in many cases equally numerous. Of species of *Charybdis*, eleven species occur in each of these regions; of the *Carpilii*, eleven are reported from the Subtorrid and but five from the Torrid; of the *Menæthii*, five are found in the Torrid Region, and six in the Subtorrid, only two being common to both. These proportions may be much varied by future investigations. Still it cannot fail to be evident from a survey of the table, that the line between the Torrid and Temperate zones is a natural zoological limit. A further examination of the other subdivisions, will show, we believe, that all of them are important.

II. The Torrid species of *Brachyura* (Torrid and Subtorrid Regions) greatly preponderate over those of the Temperate zone, the proportion being above two to one. This fact is the subject of remarks by Edwards, but with different conclusions from those which we would deduce.

III. The Frigid zone, as far as known, includes *one* species peculiar to it, the *Chionocetes opilio*. And *Stenorhynchus phalangium*, *Hyas araneus*, *Portunus pusillus*, *Carcinus mænas*, and *Cancer pagurus*, are all that are known to extend into it from the Temperate zone. Perhaps the *Cancer chirogonus* from Kamtschatka (*Telmessus chirogonus* of White) should be added. This may be in part evidence of the little exploration hitherto made in the Frigid Seas. Yet, after the investigations of Beechey, Fabricius, Kröyer, Rathke, and others, we may be assured that the number of species is exceedingly small.

IV. Within the Temperate zone, the species are most numerous in the Warm Temperate, Temperate, and Subtemperate Regions; beyond this, the number diminishes, being a *quarter less* in the Cold Temperate than in the Subtemperate, and *half less* in the Subfrigid. Moreover, in the last-mentioned region, seventeen out of the thirty-seven species, or nearly one-half, occur in warmer temperate latitudes, only twenty species being confined to the Region.

V. In the Torrid zone, the species of the torrid region, amounting to three hundred and forty-eight, exceed in number those of the Subtorrid by only forty-two, although the Subtorrid region is not one-third as great, both as to surface and extent of coast line.

VI. Passing now from these general considerations respecting the Brachyura as a class to the several orders, we may look at their ratios among these orders and their subdivisions, for the several regions, in order to discover what is the relation of the species to temperature, and whether the cold or warm water species are the higher or lower in grade, or whether the torrid or temperate zone can claim species of the highest perfection or magnitude among the Brachyura.

The following table gives the ratio which the number of species of the several orders in the Temperate and Frigid zones, bears to that of the Torrid zone.

1. Maiioidea,	1 : 1.3
2. Cancroidea,	1 : 3.3
3. Grapsoidea,	1 : 2.1
4. Leucosoidea,	1 : 2.0
5. Corystoidea,	1 : 0.3

It hence appears that the Maiioidea and Corystoidea are proportionally much more abundant in the colder seas than the Cancroidea, Grapsoidea, or Leucosoidea.

If we examine into the subdivisions of the Maiioidea and Cancroidea, we shall find the differences between the two groups in distribution more strikingly brought out. We shall find, moreover, that both groups may be divided into a warm-water and cold-water section, as below.

I. MAIOIDEA.

1. TEMPERATE ZONE SECTION.

	Torrid species.	Temperate species.
1. Inachidæ,	1	10
2. Maiidæ, subfamilies <i>Libininæ</i> , <i>Maiinæ</i> , <i>Pisinæ</i> , <i>Otho-</i> <i>ninæ</i> ,	15	35
3. Eurypodidæ,	0	7
4. Leptopodidæ,	1	8
	<hr/>	<hr/>
	17	60

2. TORRID ZONE SECTION.

	Torrid.	Temperate.
1. Maiidæ, subfamilies <i>Micippinæ</i> , <i>Chorininæ</i> , <i>Pyrinæ</i> , .	16	3
2. Mithracidæ,	11	6
3. Tychidæ,	4	0
4. Periceridæ,	43	14
5. Parthenopinea,	28	8
6. Oncininea,	2	0
	<hr/>	<hr/>
	104	31

II. CANCROIDEA.

1. TEMPERATE ZONE SECTION.

	Torrid.	Temperate.
Cancridæ,	0	11
Platyonychidæ,	2	7
Portunidæ, subfamily <i>Portuninæ</i> ,	0	15
Cyclinea,	0	1
	<hr/>	<hr/>
	2	34

2. TORRID ZONE SECTION.

	Torrid.	Temperate.
Xanthidæ,	129	16
Eriphidæ,	44	12
Portunidæ, excluding the <i>Portuninæ</i> ,	52	7
Podophthalmidæ,	2	0
	<hr/>	<hr/>
	227	35

We have here two singular facts brought out.

First, that the cold-water section of the Cancroidea embraces those species that approach most nearly to the Corystoidea, and which we have elsewhere shown to be the *lowest* in grade of the Cancrinea. All have the lax character of the outer maxillipeds, which is a mark of degradation in the Corystoids; and the Cyclinea are still nearer that group. Many of the species moreover have the hind legs a swimming pair, another mark of degradation. The Corystoidea, as before shown, are two-thirds cold-water species.

Second, that the cold-water section of the Maiioidea contains the

species that are *highest* in grade, and largest in size. It is headed by the *Macrocheira* of Northern Japan, the king of all crabs, whose body is seventeen inches long and a foot broad, or, with extended legs, sometimes covers a breadth of eleven feet, and whose anterior legs or arms are *four feet* long!* The species of the other genera are mostly among the larger of the Maioids, and have no mark of inferiority. Such are the species of *Maia*, *Pisa*, *Libanii*, *Eurypodius*, etc.

But among the species of the warmer section, we find the *Oncininea* and *Parthenopinea*, both manifestly inferior in grade, the former approaching even the *Anomoura*, and the latter forming the passage of the Maioids to the Cancroids, as has been explained. We observe also the *Periceridæ* and *Tychidæ*, all very small species, excepting a few *Periceræ*: the *Menæthii*, *Tiariniæ*, and *Acanthonyces*, are examples of the group. In addition, there are the *Mithracidæ*, which although attaining a large size show their inferiority in their shorter epistome, shorter body, which is sometimes even transverse, and their spoon-shaped fingers. In the last character, the *Chlorodinæ* among the Cancroids, similarly show their inferiority to the *Xanthidæ*. That this kind of finger is such a mark of inferiority is apparent from its diminishing in many species as the adult size of the animal is attained, the tendency being towards producing the acuminate finger found in the highest grades.

We are hence sustained in the conclusion that the Maioids of the Temperate zone are generally those that are highest in grade. It also shows the congeniality of cold waters to the Maioids, that the only Brachyuran peculiar to the Frigid zone is of this group. We refer to the *Chionœcetes opilio*.

VII. The *Brachyura*, therefore, although most numerous in the Torrid zone, do not reach in this zone their highest perfection. On the contrary, the Temperate zone or colder waters are the habitat of the highest species. Hence, as the *Maioidæ* stand first among all Crustacea, the highest development of the class Crustacea takes place, not in the Torrid zone, the most profuse in life, but beyond the tropics and coral-reef seas, in the middle Temperate Regions.

VIII. The prevalence also of the inferior *Corystoids* in the colder waters does not invalidate this conclusion, as the fact respecting the Maioids is wholly an independent one; for these last, by attaining

* De Haan's *Fauna Japon.*, Crust. p. 101.

their highest perfection in these coldest waters, determine the principle as regards themselves, the highest grade of Crustacea. Lower grades occur also in the colder waters, and the laws governing their distribution demand separate study and consideration.

IX. Passing a step below the Maioids, we come to the Cancroids, and these, with the exception of the lower Corystoid species, and only *one-eighth* of the rest, are Torrid zone species.

X. If the Torrid zone is the proper region for the full development of the Cancroid type, and its heat is needed for this end, it is natural that species of Cancroids like the *Portuninæ*, *Platyonychidæ*, and *Cancridæ*, found in the less genial waters of the Temperate zone, should bear some mark of inferiority, and it is a fact that they have such marks in their structure. This inferiority is not seen in their smaller size, for a larger size, under certain conditions, may equally evince a lower grade, but in the inferior concentration of the life-system, exhibited either in the lax outer maxillipeds, the elongation of the antennæ and abdomen, or in the smaller size or swimming character of the posterior legs.

For a like reason also, the species of Corystoidea, a grade still lower, naturally occur in the cold and ungenial region they frequent.

We hence perceive, that the degradation among the Maioids takes place when the species become warm-water species, and the degradation among the Cancroids, in the reverse manner, when the species become cold-water species; for the reason that the colder waters are the proper habitat for the Maioid type, and the warmer for the Cancroid type.

XI. In the tables of the Maioidæ and Cancroidæ of the Temperate and Torrid zones, page 1499, the species are included by families and subfamilies, and consequently the peculiarities of some genera are not shown. In the families or subfamilies referred to the cold-water section, there is only one warm-water genus, viz., *Doclea*, of the subfamily *Libininæ*, in which there are four Torrid and one Temperate zone species.

Among those referred to the warm-water section, there are the following cold-water genera:—

		Species in Torrid zone.	Species in Temperate zone.
Parthenopinea, genus	Eurynome,	0	2
"	" Eurynolambrus,	0	1
Xanthidæ,	" Paraxanthus,	0	2
Ozinæ,	" Ozius,	2	3

The species of Cancrinea of the Torrid zone section, which reach farthest into the Temperate zone, are those of the following genera:— *Xantho*, which has eight Temperate zone species out of twenty-eight in all; *Panopeus*, which in the same way has four out of ten; *Pilumnus*, which has seven out of twenty-two; and *Lupa*, which has four out of ten. The Cold Temperate Region is the highest for each of these genera, excepting *Lupa* and *Pilumnus*, a species of each of these latter genera extending just within the limits of the Subfrigid Region, on the coast of Massachusetts.

XII. The Grapsoidea, if divided between the Torrid zone and Temperate zone, according to families or subfamilies, will fall within the Torrid zone, excepting a single family of the Pinnotheridæ, which contains eight species in the Torrid zone and fifteen in the Temperate. Considering the genera, however, we find that several among the Grapsidæ may be called cold-water genera, or are about equally divided between the Torrid and Temperate zones. They are as follows:

	Torrid species.	Temperate species.
Pseudograpsus,	1	2
Heterograpsus,	0	1
Brachynotus,	0	1
Planes,	2	2
Hemigrapsus,	4	5
Cyrtograpsus,	0	1
Chasmagnathus,	2	2

Five out of twelve species of *Grapsus* also reach into the colder seas. Further particulars will be gathered from the tables.

XIII. The Leucosoids include as cold-water genera the following:

	Torrid.	Temperate.
Genus <i>Ebalia</i> ,	0	8
“ <i>Ilia</i> ,	0	1

The remaining genera are mainly confined to the Torrid zone; out of the species they contain, sixty-seven in all, forty-eight are of this zone. *Hepatus*, however, contains as many cold-water as warm-water species, and the same is true of *Dorippe*, although but one of the species of the latter is exclusively Temperate.

XIV. The tropics afford not only a larger number of species of *Brachyura* than the Temperate zone, but also a much greater propor-

tion of individuals of the several species. Crustacean life, of this tribe, is far the most prolific in the warm waters of the globe. Crustacea are very abundant about coral islands, far exceeding what may be found in other regions.

XV. The actual mass of Brachyura appears also to be the largest in the tropics, although there are genera, as *Macrocheira* and *Cancer*, which have their largest species in the colder waters, and which exceed in size any other Brachyura. The genera *Atergatis*, *Carpilius*, *Xantho*, *Menippe*, *Zozymus*, *Eriphia*, *Thalamita*, *Charybdis*, *Calappa*, besides others of the Torrid zone, contain many large species, which are of very common occurrence; while the cold-water genera of Maioids appear to be much less prolific in species, and the other genera, though abounding in individuals, as *Cancer* and *Lupa*, are still but few in number. Any very exact comparison, however, of the two zones in this particular cannot be made without more data than have yet been collected.

GEOGRAPHICAL DISTRIBUTION OF CRUSTACEA. 1505

TABLE II.

ANOMOURA, MACROURA, AND ANOMOBRANCHIATA.

1. ANOMOURA.										
	a. Torrid.	b. Sub-torrid.	Total of Torrid zone.	c. Warm Temp.	d. Temperate.	e. Sub-temperate.	f. Cold Temp.	g. Sub-frigid.	Total of Temperate zone.	h. Frigid.
I. DROMIDEA.										
1. DROMIDÆ.										
Dynomene,		1	1							
Dromia,	5	6 (3 a)	8	1	2 (2 a, c)	2 (1 b)	1 (c)		3	
Latreillia,				1	2				3	
Homola,				1	2 (1 c)				2	
2. CYNOPOLIDÆ.										
Cynopolla,	1		1		1				1	
Caphyra,	2		2							
II. BELLIDEA.										
Corystoides,										
Bellia,						1			1	
III. RANINIDEA.										
Raninoides,										
Ranina,	1	1 (a)	1							
Ranilla,	1	1	1							
Notopus,					1				1	
Lyreidus,					1				1	
Cosmonotus,	1		1							
IV. HIPPIDEA.										
Albunæa,										
Albunhippa,	2	1	3	3 (2 a)	2 (2 a, c)				3	
Remipes,	5	1 (a)	5	1 (a)	2				2	
Hippa,	1	1	2	2 (b)		1 (c)	1 (c)	1 (c)	2	
V. PORCELLANIDEA.										
Porcellana,	17	13 (3 a)	27	5 (2 a, b)	7 (1 c)	11 (3 d)	3 (2 e, d)	1 (c)	20	
VI. LITHODEA.										
Lithodes,										
Lomis,						2?	2	7 (2 f)	7	2 (2 g)
Echinoccerus,							1		1	
VII. PAGURIDEA.										
1. PAGURINÆ.										
Paguristes,	2	1 (? a)	3		2	4			6	
Diogenes,	2	4 (1 a)	5		2 (2 a)				2	
Bernhardus,		3 (? + 3)	3 (? + 3)	2 (1 b)	8	8 (1 d)	7 (2 e)	6 (3 b, d, f)	25	4 (1 e)
Pagurus,	9	7 (2 a)	14	1	6 (2 b, c)		1?		7	
Calcinus,	6	3 (3 a)	6							
Aniculus,	1	1 (a)	1							
Clibanarius,	16	7 (4 a)	19		3	1	1 (e)		4	
2. CANCELLINÆ.										
Cancelus,			1?							
2. CENOBITIDÆ.										
Cenobita,	8	6 (5 a)	9		1				1	
Birgus,	1	1 (a)	1							
VIII. ÆGLEIDEA.										
Æglea,						2			2	
IX. GALATHEIDEA.										
Galathea,										
Munida,	4	1	5	1	2 (1 e)	1	3 (2 c, e)	1 (f)	4	
Grimothea,							1	2 (1, f)	2	
							1	1 (f)	1	
MEGALOPIDEA.										
Marestita,										
Monolepis,	2		2	1			1		2	
Megalopa,	1		1			1			1	
Cyllene,	1		1			1	2		2	
Tribola,	1		1	1					1	

2. MACROURA.										
	a. Torrid.	b. Sub-torrid.	Total of Torrid zone.	c. Warm Temp.	d. Temperate.	e. Sub-temperate.	f. Cold Temp.	g. Sub-frigid.	Total of Temperate zone.	h. Frigid.
I. THALASSINIDEA.										
I. GEBIDÆ.										
Gebia,				2	1	2(1c)	2	1	7	
Axius,							1		1	
Calocaris,								1	1	
Laomedea,				1?					1?	
Glaucothoe,	1?		1?							
II. CALLIANASSIDÆ.										
Callianassa,		1	1	1	2	1	1(c)	1	5	
Trypæa,						1			1	
III. THALASSINIDÆ.										
Thalassina,	2		2			1			1	
IV. CALLISEIDÆ.										
Callianidea,	1		1							
Callisea,	1		1							
II. ASTACIDEA.										
I. SCYLLARIDÆ.										
Scyllarus,	1	5(1a)	6	1(b)	1(b)				1	
Arctus,				1	1(c)				1	
Thenus,	1		1						1	
Parribacus,	2	1(a)	2	1(a)						
Ibacus,	1?	1	2							
II. PALINURIDÆ.										
Palinurus,	1	1	2		1	2	1(d)		3	
Panulirus,	8	8(4a)	12			1?			1?	
III. ASTACIDÆ.										
1. ASTACINÆ.										
Homarus,					1	1	2(1d)		3	
{ Astacus, &c.										
{ Freshwater.										
2. NEPHROPINÆ.										
Nephrops,					1		2	1(f)	2	
Paranephrops,						2			2	
III. CARIDEA.										
I. CRANGONIDÆ.										
1. CRANGONINÆ.										
Crangon,					5(?)3	1	7(3e)	4(2e,f)	12	3(1g)
Sabinea,									1	1
Argis,										1
Paracrangon,								1	1	
2. LYSMATINÆ.										
Nika,		2	2		2		2(1d)		3	
Lysmata,				1?	1				2	
Cyclorhynchus,				1?					1	
3. GNATHOPHYLLINÆ.										
Gnathophyllum,				1	1(c)				1	
II. ATYIDÆ.										
1. ATYINÆ.										
Atya,	4	2	6							
Atyoida,		1	1							
Caridina,		1	1		1				1	
2. EPHYRINÆ.										
Ephyra,					2				2	
III. PALÆMONIDÆ.										
1. ALPHEINÆ.										
Alpheus,	14	17	31	3(1b)	4(2b)	1	1(c)		7	
Betæus,	1		1			3		1	4	
Alope,						1(?)f)			1	
Athanas,					1				1	
Hippolyte,	5	4(2a)	7	2	3(1c)	6	1(d)	4	18	19
Rhynocinetes,						1	6(1c)		1	
2. PANDALINÆ.										
Pandalus,				1?	1(?)+1)			2	3(?)+1)	2(1g)
3. PALÆMONINÆ.										
Pontonia,	3	1	4	1	1					
Cædipus,	3		3						2	
Harpilius,	1		1							
Anchistia,	3		3							

GEOGRAPHICAL DISTRIBUTION OF CRUSTACEA. 1507

MACROURA—Continued.										
	a. Torrid.	b. Sub-torrid.	Total of Torrid zone.	c. Warm Temp.	d. Temperate.	e. Sub-temperate.	f. Cold Temp.	g. Sub-frigid.	Total of Temperature zone.	h. Frigid.
Palæmonella,	2		2							
Palæmon,	14	20 (2a)	32	5	6 (3 c)	7 (2 b, c)	6 (2 c, e)	1	18	1
Hymenocera,	1		1			1			1	
Cryphiops,										
4. OPHLOPHORINÆ.										
Oplophorus,	1		1	1					1	
Regulus,	2		2						1	
IV. PASIPHÆIDÆ.										
Pasiphaea,					1		1 (d)	1	2	1
IV. PENÆIDEA.										
I. PENÆIDÆ.										
Sicyonia,	3	1 (?+3)	1 (?+3)		2				2	
Penæus,	2	9 (3 a)	14	3	2		3		2	
Stenopus,	2	1 (a)	2						1	
Spongicola,		1	1						1	
II. SERGESTIDÆ.										
Sergestes,	1		1		1				1	
Acetes,										
Euphema,							1?		1	
III. EUCOPIIDÆ.										
Eucopia,										1
3. ANOMOBRANCHIATA.										
	a. Torrid.	b. Sub-torrid.	Total of Torrid zone.	c. Warm Temp.	d. Temperate.	e. Sub-temperate.	f. Cold Temp.	g. Sub-frigid.	Total of Temperature zone.	h. Frigid.
I. SQUILLOIDEA.										
I. SQUILLIDÆ.										
Lysiosquilla,	3	3 (2 a)	4	1 (a)					1	
Squilla,	6	8 (3 a)	11	5 (1 b)	5 (2 b, c)	2 (2 a, b)	2 (2 b, d)		10	
Pseudosquilla,	1	1 (a)	1	1		2 (1 d)			2	
Coronis,	1		1					1?	1	
Gonodactylus,	2	5 (1 a)	6	2 (2 a, b)	1 (a)	1			3	
II. ERICHTHIDÆ.										
Squillerichthus,	2		2							
Erichthus,	3	4	12						1	
Alima,	6		6					1	1	
II. MYSIDEA.										
I. EUPHAUSIDÆ.										
Thysanopoda,	1		1					3	3	
Euphausia,	2		2					1	1	
Cyrtopia,	2		2							
II. MYSIDÆ.										
1. CYNTHINÆ.										
Cynthia,				1				1	2	
2. MYSINÆ.										
Mysis,	1		1		2		2	2 (1 f)	7	2
Fromysia,		1	1					2	2	
Macromysis,										
Siriella,	3		3							
Loxopia,	1		1							
3. Sceletinidæ.										
Sceletina,	3		3							
Rachitia,		1	1							
Myto,										
III. LUCIFERIDÆ.										
Lucifer,	3	1	4							
III. AMPHIONIDEA.										
AMPHIONIDÆ.										
Phyllosoma,	15	1	16		2				2	
Amphion,	17		1							

4. RECAPITULATION.

	a. Torrid.	b. Sub-torrid.	Total of Torrid zone.	c. Warm Temp.	d. Temperate.	e. Sub-temperate.	f. Cold Temp.	g. Sub-frigid.	Total of Temperate zone.	h. Frigid.
ANOMOURA ,	90	59 (25 a)	125	20 (7 a, b)	43 (11 a-c)	34 (8 b-d)	25 (8 c-e)	19 (10 c-f)	110 (15)	6 (3 e-g)
DROMIDEA ,	8	7 (3 a)	12	3	7 (3 a-c)	2 (1 b)	1 (c)		8	
Dromidae,	5	7 (3 a)	9	3	6 (3 a-c)	2 (1 b)	1 (c)		7	
Cymopolidae,	3		3		1				1	
BELLIDEA ,									2	
RANINIDEA ,	3	2 (1 a)	4		2				2	
HIPPIDEA ,	8	3 (1 a)	10	6 (4 a, b)	4 (2 a-c)	1 (c)	1 (c)	1 (c)	8	
PORCELLANIDEA ,	17	13 (3 a)	27	5 (2 a, b)	7 (1 c)	11 (3 a)	3 (2 c, d)	1 (c)	20	
LITHODEA ,							3 (1 e)	7 (2 f)	10	2 (2 f, g)
PAGURIDEA ,	45	33 (17 a)	62	3 (1 b)	21 (4 a-c)	13 (3 b, c, d)	9 (3 e)	6 (3 b, d, f)	44	4 (1 e)
Paguridae,	36	26 (11 a)	52	3 (1 b)	21 (4 a-c)	13 (3 b, c, d)	9 (3 e)	6 (3 b, d, f)	44	
Cenobitidae,	9	7 (6 a)	10							
ZEGLEIDEA ,						2			2	
GALATHEIDEA ,	4	1	5	1	2 (1 c)	1	5 (2 c, e)	4 (3 f)	7	
MEGALOPEIDEA ,	5		5	2		2	3		7	
MACROURA ,	84	77 (14 a)	147	23 (2 a, b)	40 (8 b, c)	35 (4 b, c)	36 (12 d-e)	18 (3 e, f)	126 (16)	23 (2 g)
THALASSINIDEA ,	5	1	6	4	3	3	4 (1 e)	3	17	
Gebidae,	1?		1?	3	1	2 (1 c)	3	2	10	
Callianassidae,		1	1	1	2	2	1 (e)	1	6	
Thalassinidae,	2		2			1			1	
Calliseidae,	2		2							
ASTACIDEA ,	14	16 (6 a)	24	3 (2 a, b)	4 (2 b, c)	6	5 (2 d)	1 (f)	14	
Scyllaridae,	5	7 (2 a)	10	3 (2 a, b)	2 (2 b, c)				3	
Palinuridae,	9	9 (4 a)	14		1	3	1 (d)		4	
Astacidae (Marine),					1	3	4 (1 d)	1 (f)	7	
CARIDEA ,	54	48 (4 a)	98	13 (7 + 3)	28 (5 b, c)	24 (3 b, c)	24 (10 c, e)	14 (2 e, f)	84	23 (2 g)
CRANGONIDEA ,				3 (7 + 3)	8 (?)	4 (1 c)	9 (4 e)	5 (2 e, f)	21	5 (1 g)
Crangoninae,		2	2		5 (7 3)	1	7 (3 e)	5 (2 e, f)	14	5 (1 g)
Lysmatinae,		2	2	2?	3	2	2 (1 e)		6	
Gnathophyllinae,				1		1 (c)			1	
ATYIDEA ,	4	4	8		3				3	
Atyinae,	4	4	8		1				1	
Ephyrinae,					2				2	
PALEMONIDEA ,	51	42 (4 a)	89	13 (1 b)	16 (5 b, c)	20 (2 b, c)	14 (4 c, e)	8	58	22 (1 g)
Alpheinae,	20	21 (2 a)	39	5 (1 b)	8 (2 b, c)	12	8 (3 c-e)	5	33	19
Pandalinae,				1?	1 (7 + 1)			2	3 (7 1)	2 (1 g)
Palemoninae,	27	21 (2 a)	46	6	7 (3 c)		6 (2 c, e)	1	21	1
Ophlophorinae,	3		3	1					1	
PASIPHEIDEA ,					1		1 (d)	1	2	1
PENEIDEA ,	11	12 (4 a)	10*	3	5		3 (7 + 1)		11	1
PENAEIDEA ,	10	12 (4 a)	18	3	4		3		9	
SERGESTIDEA ,	1		1		1		1?		2 (?)	1
EUCOPEIDEA ,										
ANOMOB-RANCHIATA ,	62	26 (7 a)	82	9	10 (3 a-c)	5 (2 b, d)	4 (2 b, d)	10 (1 f)	33 (9 a, b)	
SQUILLOIDEA ,	30	22 (7 a)	45	3 (4 a, b)	6 (3 a-c)	4 (2 b, d)	2 (2 b, d)	1 (7 + 1)	16 (9)	2
SQUILLIDEA ,	13	15 (7 a)	24	3 (4 a, b)	6 (3 a-c)	5 (3 b, d)	2 (2 b, d)	1?	16 (9)	
ERICHTHIDEA ,	17	4	21					1	1	
MYSIDEA ,	17	3	20	1	2	1	2	9 (1 f)	15	2
EUPHAUSIDEA ,	6		6					4	4	
MYSIDEA ,	8	2	10	1	2		2	5 (1 f)	11	2
Cynthinae,				1				1	2	
Mysinae,	5	1	6		2		2	4 (1 f)	9	2
Sceletinae,	3		4							
LUCIFERIDEA ,	3	1	4							
AMPHIONIDEA ,	15 (7 + 1)	1	17		2				2	

The following deductions may be drawn from the preceding tables:

I. ANOMOURA.

XVI. The Anomoura are nearly equally divided between the torrid and temperate zones, there being hardly *one-tenth* more torrid than cold-water species. Only fifteen species out of two hundred and twenty-five are common to the torrid and temperate zones.

Yet it is seen from the table, that if we except the Galatheidea, Lithodea, and part of the Paguridea, the species hardly extend beyond the warmer half of the temperate zone. There are but six known frigid species, and these are of the two last-mentioned groups.

XVII. The torrid zone and temperate zone sections of the Anomoura, are as follows; the frigid zone species being here added to the temperate.

1. TEMPERATE ZONE SECTION.

	Torrid zone.	Temperate zone.
Dromidæ, G. <i>Latreillia</i> ,	0	3
<i>Homola</i> ,	0	2
Bellidea,	0	2
Raninidea, G. <i>Notopus</i> ,	0	1
<i>Lyreidus</i> ,	0	1
Hippidea, G. <i>Albunhippa</i> ,	0	2
Lithodea,	0	10
Porcellanidea,	27	20
Paguridæ, G. <i>Paguristes</i> ,	3	6
<i>Bernhardus</i> ,	3	29
<i>Ægleidea</i> ,	0	2
Galatheidea, G. <i>Munida</i> ,	0	2
<i>Grimothea</i> ,	0	1
<i>Galathea</i> ,	5	4

{ 1 torrid and
4 frigid.

2. TORRID ZONE SECTION.

	Torrid zone.	Temperate zone.
Dromidæ, G. <i>Dynomene</i> ,	1	0
<i>Dromia</i> ,	8	2 (1 torrid).
Cymopolidæ, G. <i>Cymopolia</i> ,	1	1
<i>Caphyra</i> ,	2	0

	Torrid zone.	Temperate zone.
Raninidea, G. <i>Raninoides</i> ,	1	0
<i>Ranina</i> ,	1	0
<i>Ranilia</i> ,	1	0
<i>Cosmonotus</i> ,	1	0
Hippidea, G. <i>Albuncea</i> ,	3	3 (2 torrid).
<i>Remipes</i> ,	5	1 (1 torrid).
<i>Hippa</i> ,	2	2 (1 torrid).
Paguridæ, G. <i>Diogenes</i> ,	5	2 (2 torrid).
<i>Pagurus</i> ,	14	7 (1 torrid).
<i>Calcinus</i> ,	6	0
<i>Aniculus</i> ,	1	0
<i>Clibanarius</i> ,	19	4
<i>Cancellus</i> ,	1?	0?
Cenobitidæ,	10	1

The Dromidea and Paguridea have *one-third* to *one-fourth* more torrid than cold-water species.

The Raninidea and Hippidea are mainly tropical. The two extra-tropical species of Raninidea occur only in the warmer of the temperate regions, and the species of Hippidea in the temperate zone (eight out of the whole number eighteen) have among them four that occur also in the tropics.

The Lithodea belong to the coldest temperate regions, abounding especially in the subfrigid region. The Galatheidea are mainly of the temperate zone; there are five known torrid species, and seven temperate, the latter pertaining to the colder seas.

The genus *Porcellana* has but two-thirds as many species in the temperate as in the torrid zone. Yet the subtemperate region contains but one less than the subtorrid, and some of the largest species of the genus occur here; while, on the contrary, the torrid zone species are quite small. Although, therefore, *Porcellana* may rank as a torrid zone genus, if we consider the relative number of species in the two zones, it is more properly a temperate zone genus.

The Paguridea range through both the tropics and temperate zone, even passing into the frigid zone. *Bernhardus* is mainly a cold-water genus, while *Pagurus*, *Calcinus*, and *Clibanarius* are mostly torrid genera. *Pagurus* has seven out of twenty-one species in the temperate zone. But it is in the torrid zone where the species of the largest size occur; the extra-torrid species belong almost exclusively to the Mediterranean. The species are exceedingly prolific in the tropics, far exceeding what occurs as regards any Paguridea in the temperate zone.

XVIII. It was found in the Brachyura, that the highest species among the Maioids, and the highest of Crustacea occur in the *extra-tropical* regions; and that as we descend to the Cancroids, the species become mainly *tropical*; moreover, as we descend among the Cancroids (the type of which is tropical), there is in general a return to the less genial colder waters, as exemplified in the true Cancers or Cancridæ and the Corystoidea, these last being mainly cold-water species. By these steps we find the more degraded forms among the Brachyura occurring in both the colder and warmer waters. We cannot therefore expect that the Anomoura, which are properly Brachyura of a still lower grade, should be arranged according to rank in one zone in preference to the other. And it is a fact that the genera of higher species occur about equally in the two zones. *Latreillia*, but a single step below the Inachidæ, is found in the warmer temperate regions; and *Dromia*, a little lower, has three-fourths of its species in the tropics. *Homola*, again, has been found only in the temperate zone.

Among the Paguridea, the Bernhardi or cold-water species are probably the superior in rank; and the Lithodea, which are a grade higher still, are from the neighbourhood of the frigid zone.

The Hippidea, which have been considered as in the Corystoid series (page 54), but below the Corystoidea, are mostly from *warmer* waters.

The most bulky forms among the Anomoura are found in the genera *Lithodes*, *Ranina*, and *Dromia*. The common *Ranina dentata* has a length of five inches in the Japan Seas, while in the warm East Indies (at the Moluccas), as De Haan states, four inches is the greatest length.

II. MACROURA.

XIX. The Macroura, according to the table, are nearly equally divided between the torrid and extra-torrid zones, the former including one hundred and forty-seven species, and the latter one hundred and fifty-three species.

In the above table we have not included the fresh-water Astacidæ, as we are treating only of marine species. Yet in a comparison of numbers between the zones, these should be brought in. They are about thirty-six in number, and all, excepting perhaps one, belong to

the temperate zone. With this addition, the numbers become one hundred and forty-seven for the torrid zone, and one hundred and eighty-nine for the extra-torrid. Sixteen of the cold-water species are common to both the torrid and temperate zones, and twenty-nine occur in the *frigid* zone, twenty-seven being peculiar to this zone. This is strikingly in contrast with the Brachyura, of which two-thirds are torrid species, and only five or six are known to extend into the cold zone, of which but *one* is confined to it.

XX. The Thalassinidea are mainly extra-torrid species.

The Astacidea are divided between the warm and cold seas; the Palinuridæ and Scyllaridæ being mostly of the former, and the Astacidæ almost exclusively of the latter.

The Caridea spread largely over both zones; but extensive groups are extra-torrid, and some genera contain many frigid species.

The Penæidea are mainly of the torrid zone.

The exact ratios will be gathered from the preceding tables.

XXI. The geographical relations of the subordinate groups are shown in the following table.

1. TEMPERATE AND FRIGID ZONE SECTION.

	Species in the Torrid zone.	Species in the Tempe- rate and Frigid zones.
Thalassinidea,	6	17
Astacidea,	24	50
Astacidæ,	1	46
Scyllaridæ, G. <i>Arctus</i> ,	0	1
Palinuridæ, G. <i>Palinurus</i> ,	2	3
Caridea.		
Crangonidæ,	2	25
Atyidæ, G. <i>Ephyra</i> ,	0	2
Palæmonidæ.		
Alpheinæ, G. <i>Betæus</i> ,	1	4
<i>Alope</i> ,	0	1
<i>Athanas</i> ,	0	1
<i>Hippolyte</i> ,	8	37 (19 frigid).
Pandalinæ, G. <i>Pandalus</i> ,	0	4 (2 frigid).
Palæmoninæ, G. <i>Cryphiops</i> ,	0	1
Pasiphæidæ, G. <i>Pasiphæa</i> ,	0	3 (1 frigid).
Penæidea, G. <i>Eucopia</i> ,	0	1 (1 frigid).

2. TORRID ZONE SECTION.

	Species in the Torrid zone.	Species in the Tempe- rate and Frigid zones.
Astacidea.		
Scyllaridæ, except <i>Arctus</i> ,	10	2
Palinuridæ, G. <i>Panulirus</i> ,	12	1
Caridea.		
Atyinaë,	8	1
Palæmonidæ.		
Alpheinaë, G. <i>Alpheus</i> ,	31	7
Palæmoninaë, G. <i>Pontonia</i> ,	4	2
<i>Edipus</i> ,	3	0
<i>Harpilius</i> ,	1	0
<i>Anchistia</i> ,	3	0
<i>Palæmonella</i> ,	2	0
<i>Palæmon</i> ,	32	19 (1 frigid).
<i>Hymenocera</i> ,	1	0
Oplophorinaë,	3	1
Penæidea,	19	12

XXII. Considering the Scyllaridæ and Palinuridæ as the Macroura highest in grade, this division of the Podophthalmia appears at first to have its superior developments in the tropics. But it may still be questioned whether this is altogether true. The Palinuridæ include two genera, one *Palinurus*, mainly a cold-water genus, the other *Panulirus*, a warm-water or Torrid zone genus: and is the Torrid zone genus the superior in rank, as should be the case, if the tropics are the most congenial to the highest Macroural developments? *Palinurus* has the outer antennæ nearly in contact at base, and the flagella of the inner antennæ are very short; *Panulirus*, the warm-water genus, has the outer antennæ remote at base, and the flagella of the inner antennæ very long. The genera are thus characterized by marks analogous to those that distinguish the higher and lower species among the Brachyura, or that exhibit the superiority of the Brachyura as a class over the Macroura; and if such evidence is here to be regarded, the cold-water genus, *Palinurus*, is the higher in rank. Moreover, the aspect of the Palinuri, the harder shell and more compact body, strike the eye at once as indicating their higher character. In size, they are not at all inferior; they even exceed the Panuliri in bulk if not in length. Among the Palinuri, one species is afforded by the warm seas of the West Indies; but it is not half the size lineally,

of the *Lalandii* of the Cape of Good Hope, or the *vulgaris* of the Mediterranean, both gigantic species, sometimes a foot and a half in length independent of the antennæ.

The Astacidæ, the remaining family in the tribe Astacoidea, is confined almost wholly to the colder waters, and the species are numerous.

Among the Caridea, the Crangonidæ certainly have the precedence. The fact that the first pair of legs have perfect hands, while the other legs are vergiform, shows a relation to the Brachyura, which is evidence of superiority. These Crangonidæ, thus the highest of the Caridea, are almost exclusively cold-water species.

In the family Palæmonidæ, some genera have the anterior legs furnished with stout hands, while in others the second is the stout chelate pair. The former, for the reason just alluded to while speaking of the Crangonidæ, and elsewhere farther explained, are superior in rank. It is among these genera of this superior grade, the Alpheinæ, that we find the cold-water and boreal species. The genus Hippolyte alone contains thirty-seven cold-water species, nineteen of which are of the Frigid zone; and there are only eight torrid species.

On the contrary, among the Palæmoninæ, the inferior group, there are forty-six torrid to twenty-two of extra-torrid; and only one of the latter is boreal. Species of Alpheus are common in the tropics about coral-reefs; but the largest species of the genus, two or three inches long, occur beyond the tropics.

The Penæidea, the lowest of the tribes of Macroura, are mainly tropical. Yet, the very lowest species (like the lowest Brachyura) occur partly in the colder waters, or even in the Frigid zone.

XXIII. Comparing the torrid and temperate species of Macroura, we are led to conclude, that the latter are probably most numerous in individuals, and the most bulky in mass. Excepting the Panuliri, Scyllari, and some Palæmons, the tropical species are small, and moreover, they are not particularly abundant about coral-reefs. The species of the torrid genera, Pontonia, Cædipus, Harpilius, Anchistia, Palæmonella, Hymenocera, and Atya, are all quite small, the greater part not exceeding an inch and a quarter in length, and moreover, the tropical Alpei are also small species, as stated above. The Penæidea are partly larger species. Contrast these particulars with the facts as to the genera of the Temperate zone. Palinurus, Astacus, Nephrops, Paranephrops, Homarus, Arctus, Crangon, and the related genera, Hippolyte, Pandalus, Cryphiops, contain species mostly of

large size, and the adult *Homari* and *Palinuri* are not exceeded in weight by any other *Macroura*.

The *Thalassinidea*, which belong almost exclusively to the temperate regions are smallest in the warmer part of the Temperate zone, and larger in the middle and colder part. A Puget Sound species (subfrigid region) of *Callinassa* (*C. gigas*) is at least four and a half inches long, the *C. uncinata* of Chili, five inches, and the *Thalassinia scorpionides* of Chili, six inches. The facts respecting this subtribe, added to those mentioned above, strengthen much the conclusion, that the cold-water genera have the largest species; for all the species are over an inch and a half in length.

III. ANOMOBRANCHIATA.

XXIV. The *Mysidea*, to which the *Penæidea* are related, are, to a considerable extent, cold-water species, although many are found also in the tropics. There are among them twenty torrid species and seventeen extra-torrid species.

In the *Squilloidea* we have an example of an inferior grade in a large lax body, with a small head and long abdomen; and they remind us of overgrown larval forms, or species vegetatively enlarged beyond the normal or most efficient size. In this particular they have some analogies with the earlier forms of life. They are found mostly within the tropics. Twenty-four of the *Squillidæ* are Torrid zone species, and only seven pertain exclusively to the Temperate zone. Of the *Erichthidæ*, twenty-one out of twenty-two species are reported from the Torrid zone. The *Amphionidea*, a related group, include seventeen Torrid zone species and two of the Temperate zone.

TABLE III.
TETRADECAPODA.

1. ISOPODA.										
	a. Torrid.	b. Sub-torrid.	Total of Torrid zone.	c. Warm Temperate.	d. Temperate.	e. Sub-temperate.	f. Cold Temperate.	g. Sub-frigid.	Total of Temperate zone.	h. Frigid.
IDOTEIDEA.										
IDOTEIDÆ.										
Idotea,	3	1	4	1 (a)	10	6	11 (3 d, c)	3 (1 e)	27	9
Edotia,		1	1					1	1	
Erichsonia,						1			1	
Cleantis,							1		1	
Epelys,										
CHÆTILIDÆ.										
Chætilia,							1		1	
ONISCOIDEA.										
ARMADILLIDÆ.										
TYLINÆ.										
Tylus,				1	1 (c)	2		1	4	
ARMADILLINÆ.										
Armadillo,	1	2	3	1		6 (1 d)			6	
Spherillo,	1	1	2			2			2	
Armadillidium,				5	5	1	8		19	
Diploexochus,										
ONISCIDÆ.										
ONISCINÆ.										
Oniscus,*		6	6	5	8	14	10	3 (1 f)	39	
Playarthrus,							1		1	
Deto,						1			1	
SCYPHACINÆ.										
Scyphax,						1			1	
Styloniscus,	1		1					1	1	
LYGINÆ.										
Lygia,	1	2	3	1	2 (1 e)	6	2	1 (f)	9	
Lygidium,							1		1	
ASELLIDÆ.										
Jæra,					2	1	2	2 (1 f)	6	2
Jæridina,									1	1
Asellus,				1	1		2		4	1
Janira,							1		1	1
Henopomus,									1	1
Munna,								1	1	2
CYMOTHOIDEA.										
CYMOTHOIDÆ.										
CYMOTHOINÆ.										
Cymothoa,	4	3 (1 a)	6			1			1	
Ceratothoa,	1		1	1	2	2			5	
Livoneca,	2	3	5			1			1	
Anilocra,	2		2		4	1			5	
Neroclia,	1	6	7		1	1	1		3	
Oleocira,										
OROZEUKTINÆ.										
Orozeuktes,	1		1							
ÆGATHOINÆ.										
Ægathoa,		2 (1 g)								

* Including Trichoniscus, Porcellio, and Philoscia.

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ISOPODA—Continued.										
	a. Torrid.	b. Sub-torrid.	Total of Torrid zone.	c. Warm Temperature.	d. Temperate.	e. Sub-temperate.	f. Cold Temperature.	g. Sub-frigid.	Total of Temperature zone.	h. Frigid.
ÆGIDÆ.										
ÆGINÆ.										
Æga,	1	1	2	1	1	1	1 (d)	2	5	3 (2 d, g)
Conilera,							1	1	1	
Rocinela,					2		2	1	5	
Acherusia,					1				1	
Pterelas,						1		1	2	
CROALINÆ.										
Cirolana,	4	1	5		1	1	3 (1 e)		4	
Corallana,	1		1							
Alitropus,	2		2							
SPHEROMIDÆ.										
SPHEROMINÆ.										
Spheroma,	1	3	4	1	4	13 (1 e)	10 (2 e)	6 (3 e, f)	28	
Cymodocea,						4		5	9	
Cerceis,							1		1	
Caridina,								1	1	
Amphoroidea,					1	1			2	
NESÆINÆ.										
Nesæa,				1	1		4		6	
Campecopea,							2	1 (f)	2	
ANCININÆ.										
Ancinus,										
2. ANISOPODA.										
	a. Torrid.	b. Sub-torrid.	Total of Torrid zone.	c. Warm Temperature.	d. Temperate.	e. Sub-temperate.	f. Cold Temperature.	g. Sub-frigid.	Total of Temperature zone.	h. Frigid.
I. SEROLIDEA.										
SEROLIDÆ.										
Serolis,						1	1	3 (1 f)	4	1
PRANIZIDÆ.										
Praniza,					2		3	1	6	1
Ancus,					2		2 (1 d)		3	1
II. ARCTURIDEA.										
ARCTURINÆ.										
Arcturus,					1				1	1
Leachia,	1		1				1	2	3	
ANTHURINÆ.										
Anthura,					2		2	1 (f)	4	
III. TANAIDEA.										
TANAIDÆ.										
Tanais,	1	2	3		3	2		1	6	6
Paratanais,	1		1		1				1	
Leptochella,	1		1		1				1	
Apsedes,							1		1	
Rhesa,					1		1 (d)		1	
LIRIOPINÆ.										
Liriope,										1
Cryptothir,	1		1							
CROSSURINÆ.										
Crossurus,										1
BOPYRIDÆ.										
BOPYRINÆ.										
Bopyrus,					1	1 (d)	1 (d)		1	2
Phryxus,										
Cepon,	1		1							1
Dajus,										
IONINÆ.										
Ione,							1		1	
Argela,								1	1	

AMPHIPODA—Continued.

	a. Torrid.	b. Sub-torrid.	Total of Torrid zone.	c. Warm Temperate.	d. Temperate.	e. Sub-temperate.	f. Cold Temperate.	g. Sub-frigid.	Total of Temperate zone.	h. Frigid.
ISEINÆ.										
Iseæ,							1		1	
Anisopus,										
HYPERIDEA.										
HYPERIDÆ.										
VIBILINÆ.										
Vibilia,	1		1		1				1	
HYPERINÆ.										
Lestrigonus,	4		4					1	1	
Tyro,		1	1						1	
Hyperia,				1		3	2		6	1
Metoecus,										1
Tauria,								1	1	1
Cyllopus,										
Dairilia,	4		4						1	
Cystisoma,						1?			1?	
SYNOPIINÆ.										
Synopia,	2		2							
PHRONIMIDÆ.										
PHRONIMINÆ.										
Phronima,	1		1		1			1 (d)	1	
Primno,						1			1	
PHROSININÆ.										
Anchylomera,	1	3	4	1	2				1	
Phrosina,									2	
Themisto,								1	1	3
PHORCINÆ.										
Phorcus,	1	1	2							
TYPHIDÆ.										
TYPHINÆ.										
Dithyrus,				1					1	
Typhis,					1				3	
Thyropus,	1		1	2			2?		2	
PRONOINÆ.										
Pronoe,	1		1			1			1	
Lycea,					1				1	
OXYCEPHALINÆ.										
Oxycephalus,		1?	1?			1			1	
Rhabdosoma,							1		1	

4. RECAPITULATION.

	a. Torrid.	b. Sub-torrid.	Total of Torrid zone.	c. Warm Temp.	d. Temperate.	e. Sub-temperate.	f. Cold Temp.	g. Sub-frigid.	Total of Temperate zone.	h. Frigid.
ISOPODA ,	26	31 (1 a)	56	19 (1 a)	48 (2 c)	67 (2 c, d)	65 (9 c, d, e)	30 (9 e, f)	208	21 (3 d, f, g)
IDOTEIDAE,	3	2	5	1 (a)	10	7	13 (3 d, c)	4 (1 e)	31	9
Idoteidae,	3	2	5	1 (a)	10	7	12 (3 d, c)	4 (1 e)	30	9
Chætilidae,							1		1	
ONISCOIDEA,	4	11	15	14	19 (2 c)	34 (1 d)	27	9 (4 f)	96	9 (1 f)
Armadillidae,	2	3	5	7	6 (1 c)	11 (1 d)	8	1	31	
Oniscidae,	2	8	10	6	10 (1 c)	22	14	5 (2 f)	53	
Oniscinae,		6	6	5	8	15	11	3 (1 f)	41	
Scyphacinae,	1		1			1		1	2	
Lyginae,	1	2	3	1	2 (1 c)	6	3	1 (f)	10	
Asellidae,				1	3	1	5	3 (1 f)	12	9 (1 f)
CYMOTHOIDEA,	19	18 (1 a)	36	4	18	26 (1 c)	25 (4 d, e)	17 (4 e, f)	81	3 (2 d, g)
Cymothoidae,	11	12 (1 a)	22	1	7	6	1		15	
Cymothoinae,	10	12 (1 a)	21	1	7	6	1		15	
Orozeuktinae,	1		1							
Ægathoinae,		2 †	2 †							
Ægidae,	8	2	10	1	5	3	7 (2 d, e)	4	18	3 (2 d, g)
Æginae,	1	1	2	1	4	2	4 (1 d)	4	14	3 (2 d, g)
Cirolaninae,	7	1	8		1		3 (1 e)		4	
Spheromidae,	1	3	4	2	6	18 (1 c)	17 (2 e)	13 (4 e, f)	49	
Spherominae,	1	3	4	1	5	18 (1 c)	11 (2 e)	12 (3 e, f)	40	
Nesæinae,				1	1		6	1 (f)	6	
Ancininae,									2	
ANISOPODA ,	5	3	8		14	4 (1 d)	13 (3 d)	9 (1 f)	34	15
SEROLIDEA,					4	1	6 (1 d)	4 (1 f)	13	3
Serolidae,						1	1	3 (1 f)	4	1
Pranizidae,					4		5 (1 d)	1	9	2
ARCTURIDEA,	1		1		3		3	3 (1 f)	8	1
TANAIDEA,	4	3	7		7	3 (1 d)	4 (2 d)	2	13	11
Tanaidae,	4	2	6		1	2	2 (1 d)	1	10	8
Bopyridae,		1	1		1	1 (d)	2 (1 d)	1	3	3
AMPHIPODA ,	48	34	82	11	22	42 (1 d)	61 (5 d, e)	30 (5 d, e, f)	157	83 (4 f, g)
CAPRELLIDEA,	3	6	9	2	2	6	8 (2 e)	7 (2 e, f)	21	9 (2 f, g)
Caprellidae,	3	6	9	2	1	3	5	6 (1 f)	16	9 (2 f, g)
Cyamidae,					1	3	3 (2 e)	1 (e)	5	
GAMMARIDEA,	29	22	51	4	1	30 (1 d)	48 (1 e)	19	112	68 (2 f, g)
Dulichidae,					14					1
Cheluridae,							7	1	8	5
Corophidae,	3	2	5				1	1	5	2
Orchestidae,	4	8	12	1	6	20 (1 d)	6 (2 d, e)	5	35	2
Gammaridae,	22	12	34	3	8	10	35 (1 d)	13	68	60
Stegocephalinae,										1
Lysianassinae,	2	2	4		2		2	2	6	14 (1 g)
Leucothoinae,	2		2				1	1	1	2
Gammarinae,	16	13	29	3	6	10	30 (1 d)	11 (1 f)	58	39 (1 f)
Pontoporeinae,						1	1		2	4
Isæinae,							1	1	1	1
HYPERIDEA,	16	6	22	5	6	6	5	4 (1 d)	24	6
Hyperidae,	11	1	12	1	1	3	2	2	8	3
Phronimidæ,	3	4	7	1	3	1		2 (1 d)	6	3
Typhidae,	2	1	3	3	2	2	3		10	
Total, TETRADECAPODA,	79	68 (1 a)	146	30 (1 a)	84 (2 c)	113 (4 c, d)	139 (17 c, d, e)	69 (15 d, e, f)	399	129 (7 d, f, g)

Before stating the conclusions from the above tables of the Tetradecapoda, it should be observed that this division of Crustacea has been less thoroughly explored than that of the Podophthalmia, and future investigations must vary much the proportions between the species of the different regions. The coasts of Europe and the northern seas, are within the reach of European zoologists, and have been carefully examined; while voyagers through the tropics have

usually contented themselves with collecting the larger Crustacea. In the genus *Gammarus*, not a tropical species had been reported, until our investigations, which brought ten or eleven to light, being one-third the whole number of those of ascertained localities reported to this genus.

Some general conclusions may, however, be safely drawn from the facts already known, although the exact ratios deduced from the tables may hereafter be much modified.

I. The Tetradecapoda are far more numerous in extra-tropical latitudes than in the tropical.

The proportion in the above table is 521 : 146; allowing for future discoveries, it may be set down at 2 : 1, without fear of exceeding the truth.

II. The *genera* of extra-tropical seas are far more numerous than those of the tropical.

Out of forty-nine genera of *Isopoda*, only nineteen are known to occur in the tropics, and but four of these are peculiar to the tropics.

Out of twenty genera of *Anisopoda*, six only are known to be tropical, and but two are exclusively so.

Among the *Amphipoda*, out of fifty genera of *Gammaridea*, only seventeen are known to contain tropical species; nine are exclusively tropical, and but ten, including these nine, have more tropical than extra-tropical species. The Caprellidea and Hyperidea embrace thirty genera, fifteen or sixteen of which include tropical species.

The variety of extra-tropical forms compared with the tropical, is hence very great.

III. From the tables, the ratio of extra-tropical and tropical species in the

Isopoda, is	4 : 1
Anisopoda,	6 : 1
Amphipoda,	3 : 1

Among the Isopoda, the Idotæidea are the most decidedly cold-water species, and the Cymothoidea, the least so. The ratio of species for the

Idotæidea, is	8 : 1
Oniscoidea,	7 : 1
Cymothoidea,	2½ : 1

Two-ninths of the extra-tropical Idotæidea (or nine species) belong

to the Frigid zone, and nearly one-tenth of the extra-tropical Oniscoidea (or nine species); while less than a twenty-fifth of the Cymothoidea occur in the Frigid zone, and but one of these has not also been found in lower latitudes.

Of the Amphipoda, the Gammaridea are most strongly extra-tropical, the proportion being for the extra-tropical and tropical species $3\frac{1}{2} : 1$; while the ratio in the Caprellidea, is $3 : 1$; and in the Hyperidea, $1\frac{1}{2} : 1$. Out of one hundred and seventy-eight extra-tropical species of Gammaridea, sixty-six are Frigid zone species, besides two which have been found both in the Frigid and Temperate zones.

IV. The genera which extend into the frigid region are the following. The names of those more especially frigid, according to present knowledge, are italicized; and the proportion of frigid species to the whole number of extra-tropical, is mentioned in decimals, where they are not exclusively frigid.

IDOTÆIDEA.—*Idotæa* (0.3), *Glyptonotus*.

ONISCOIDEA.—*Jæra* (0.25) *Jæridina*, *Asellus* (0.20), *Janira* (0.5), *Henopomus*, *Munna* (0.66).

CYMOTHOIDEA.—*Æga* (0.4).

SEROLIDEA.—*Serolis* (0.2), *Praniza* (0.15), *Anceus* (0.25).

ARCTURIDEA.—*Arcturus* (0.5).

TANAIDEA.—*Tanais* (0.5), *Liriope*, *Crossurus*, *Phryxus*, *Dajus*.

CAPRELLIDEA.—*Proto* (0.5), *Caprella* (0.24), *Ægina*, *Cercops*, *Podalirius*.

GAMMARIDEA.—*Dulichia*, *Siphonæctes*, *Unciola* (0.5), *Podocerus* (0.5), *Laphystius*, *Orchestia* (0.07), *Stegocephalus*, *Opis* (0.66), *Uristes*, *Anonyx* (0.9), *Leucothoe* (0.66), *Acanthonotus* (0.75), *Iphimedia* (0.6) *Ædicerus* (0.5), *Gammarus* (0.33), *Melita* (0.5), *Pardalisca*, *Ischyrocerus*, *Microcheles*, *Pontoporeia*, *Ampelisca*, *Protomedea*, *Phoxus*.

HYPERIDEA.—*Hyperia* (0.14), *Metæcus*, *Tauria*, *Themisto* (3.0).

The Spheromidæ are nearly all cold-water species, though not reaching into the Frigid zone. There are forty-nine known species of Spheromidæ in the Temperate zone, and but *four* in the Torrid. *Serolis* is a peculiar cold-water form, belonging mainly to the subfrigid and frigid regions. *Orchestia* is to a large extent of the Temperate zone, while *Allorchestes* is more equally distributed through the torrid and temperate. Amphithoe, as restricted by us, is alike common in the torrid and temperate regions; while *Iphimedia*, the other section of the old group, is mainly a cold-water genus.

The Hyperidea are mostly tropical genera.

V. The species and genera of Tetracapoda are not only most

abundant in the extra-tropical regions, but besides, the individuals of species appear to be more numerous, or at least not less so. At Fuegia, the quantity of Gammaridæ collected on bait dropped in the water was exceedingly large; and in no region visited by us, did we find evidence of as great profusion. The Spheromæ were also very abundant along the shores.

VI. Moreover, the species of extra-tropical waters are the largest of the tribe. In the Frigid zone, there are *Idotæidæ* three to four inches long, while the average size of the tropical species is less than three-fourths of an inch; there are *Spheromæ* an inch long, while those of the tropics seldom exceed a fourth of an inch; there is a *Lysianassa* three inches long, while the warmer seas afford only small species, half an inch in length; there is a *Pterelas* over an inch in length, while the *Ægidæ* of the tropics are less than half an inch. The *Gammari* of the tropics are small slender species, not half the size of those of the colder seas. The species of *Serolis* are an inch to two inches long. Thus, through the *Idotæidea*, the *Ægidæ*, *Serolidæ*, *Spheromidæ*, *Caprellidea*, and *Gammaridea*, the largest species belong to the colder seas, and the giants among *Tetradecapods*, are actually found in the Frigid zone.

Among the *Hyperidea* there is one gigantic species, belonging to the genus *Cystisoma*, which is over three inches long. It is reported from the Indian Ocean, but whether tropical or not is unascertained. Of the species of this group examined by the writer, the largest, a *Tauria*, was from the Frigid zone.

VII. Again, the *Tetradecapoda* of extra-tropical waters are the highest in rank. Among the *Isopoda* (which stand first), the *Idotæidea* appear to be of superior grade, and these, as observed, are especially developed in the colder seas, reaching their maximum size in the Frigid zone. Again the *Serolidæ*, the highest of the *Anisopoda*, are cold-water species. The *Orchestiæ* among the *Amphipoda*, although reaching through both the *Torrid* and *Temperate* zones, are largest and much the most numerous in the latter.

VIII. Those species of a genus that occur in the colder waters, are often more firmly put together, and bear marks of superiority in their habits. The *Amphithoe* and *Gammari* of the tropics are lax and slender species, of small size compared with those of the colder seas.

IX. There is a tendency in the colder waters to the development of spinous species. This fact is as true of the *Podophthalmia* as of the

Tetradecapoda. Among the former, there are the thorny *Lithodes*, the numerous *Maioids* armed with spines, the *Acanthodes*; while the Cancroids and Grapsoids of the tropics are usually very smooth and often polished species. There are the spinous boreal Crangons, the species of which genus in the warmer seas are without spines. Among the Tetradecapods, the *boreal* Iphimediæ are often spinous or crested; *Acanthonotus* and *Dulichia* are spinous genera. The same tendency is seen in the third pair of caudal stylets in some cold-water Gammari, which have the branches spinulous instead of furnished with a few minute hairs like those of the tropics.

There are also some spinous Crustacea in the tropics, as the Palinuridæ and species of *Stenopus*. Such facts, however, do not lead to any modification of the previous remark; for the tendency observed is still a fact as regards the several genera mentioned.

ENTOMOSTRACA.

The Entomostraca have been little studied out of the Temperate zone, if we except the results of the author's labours. The described species of most of the families are, therefore, almost exclusively from the temperate regions, and we know little of the corresponding species or groups in the warmer seas. The following table presents the number of known species of the torrid and extra-torrid zones, omitting the Lernæoids:—

TABLE IV.

	Torrid zone.	Extra-torrid zone.
LOPHYROPODA.		
Cyclopoidea,	120	76
Daphnioidea,	5	46
Cyproidea,	13	61
PHYLLOPODA.		
Artemioidea,	0	10
Apodoidea,	0	3
Limnadioidea,	2	2
PÆCILOPODA.		
Ergasiloidæ,	1	4
Caligoidea,	16	33

Were we to leave out of view the researches of the author, the number of species and the proportion for the Cyclopoidea, instead of 120 to 76, would be about 3 : 50, thus not only reversing the ratio,

but giving to the Temperate zone almost all the species of the group.* Moreover, no Daphnioids and few Caligoids have been yet reported from the Torrid zone, excepting those described in this Report. The author's time when on land in the tropics was devoted mainly to the department of Geology, and consequently the fresh-water Entomostracans were not as thoroughly collected as those of the oceans. He therefore attempts to draw no conclusions from the above ratios.

A few facts may, however, be deduced with respect to some genera, and especially those of the Cyclopoidea. The following table gives the number, as nearly as known, of the species of each genus of the Cyclopoidea, occurring in the torrid and extra-torrid zones. The number common to the extra-torrid and torrid zones is mentioned in brackets.

TABLE V.
CYCLOPOIDEA.

I. CALANIDÆ.		Torrid.	Extra-torrid.	II. CYCLOPIDÆ.	
1. <i>Calaninæ</i> .				1. <i>Cyclopinaæ</i> .	
Calanus, . . .	25	12	(3)	Cyclops, . . .	2 9
Rhincalanus, . .	2			? Psammathe, . .	1
Cetochilus, . .		1		? Idomene, . .	1
Euchæta, . . .	4	1		? Euryta, . .	1
Undina, . . .	3			2. <i>Harpacticinæ</i> .	
2. <i>Oithoninæ</i> .				Canthocamptus,	2 4
Oithona, . . .	2	1		Harpacticus, . .	15
3. <i>Pontellinæ</i> .				Westwoodia, . .	1
Diaptomus, . .		2		Alteutha, . .	1
Hemicalanus, . .	4			Metis, . . .	1
Candace, . . .	5	1		Clytemnestra, . .	1
Acartia, . . .	3	1		Setella, . . .	5 1 (1)
Pontella, . . .	22	9	(3)	Laophon, . .	1
Catopia, . . .	1			Oncæa, . . .	1
4. <i>Notodelphinæ</i> .				Ænippe, . . .	1
Notodelphys, . .		1		Idya, . . .	1
				3. <i>Steropinæ</i> .	
				Zaus, . . .	1
				Sterope, . . .	4

* The whole number of Cyclopoidea described previous to May, 1842, by which time the author's observations were completed, was less than *twenty-five*; and of the oceanic Cyclopoidea, one hundred and fifty species of which the author has described, not *ten* were then known. We may judge from these results of a single cruise, what still remains to be done in the department of Entomostraca.

III. CORYCÆIDÆ.		Torrid.	Extra-torrid.	2. Miracinæ.		Torrid.	Extra-torrid.
1. Corycæinæ.				Miracia, . . .			
Corycæus, . . .	18	1		1	1		
Antaria, . . .	3	1 (1)					
Copilia, . . .	2						
Sapphirina, . . .	15	5					
				Total CALANIDÆ, . . .	71	29 (6)	
				Total CYCLOPIDÆ, . . .	10	44 (1)	
				Total CORYCÆIDÆ, . . .	39	8 (1)	

The properly oceanic genera include all the *Calanidæ*, excepting *Diatomus* and *Notodelphys*; all the *Corycæidæ*; with only the single genus *Setella* among the *Cyclopida*.

Among the *Calanidæ*, the genera are mainly tropical, yet each affords some extra-tropical species; and those which are most abundant in the colder waters are *Calani* or closely allied. *Setella* occurs beyond the tropics; but all the species thus far examined are found in the Torrid zone. *Pontella* is more of a warm-water genus than *Calanus*. The *Corycæidæ* are to a large extent tropical. The genus *Corycæus* is almost exclusively so, while *Sapphirina* is common in the Temperate zone. The *Steropina* are Frigid species.

Although the *Calanidæ* are more varied in species within the tropics, they abound more in individuals in the colder seas. Vast areas of "bloody" waters were observed by us off the coast of Chili, south of Valparaiso (latitude 42° south, longitude 78° 45' west, and latitude 36° south, longitude 74° west), which were mainly due to a species of this group; and another species was equally abundant in the North Pacific, 32° north, 173° west.* They have been reported as swarming in other seas, constituting the food in part of certain species of whale. Such immense shoals we did not meet with, within the tropics.

Among the *Daphnioidea*, the genera *Daphnella*, *Penilia*, *Ceriodaphnia*, and *Lynceus* were observed by us in the Torrid zone. Of the *Cyprids*, *Cypridina*, *Conchoecia*, and *Halocypris* are oceanic forms, and mainly of the tropical oceans.

The *Caligoids* spread over both zones. *Caligus* and *Lepeophtheirus* reach from the equator to the frigid seas; *Nogagus*, *Pandarus*, and *Dinematura* are represented in both the Torrid and Temperate zones.

* The species in the former case was the *Pontella* (subgen. *Calanopia*) *brachiata*; and in the latter, *Calanus sanguineus*.

GENERAL REMARKS AND RECAPITULATION.

We continue with some general deductions from the tables, and a recapitulation of some principles.

A survey of all the great divisions of Crustacea, shows us that exclusive of the Entomostraca, they are distributed, according to present knowledge, as follows :—

	a. Torrid zone.	b. Temperate zone.	c. Frigid zone.
Brachyura,	535	257 (34 a)	5 (4 b)
Anomoura,	125	110 (15 a)	4 (1 b)
Macroura,	148	125 (16 a)	29 (2 b)
Anomobranchiata,	82	33 (9 a)	2
Isopoda,	56	208 (1 a)	21 (3 b)
Anisopoda,	8	34	15
Amphipoda,	82	157	83 (4 b)
Total,	1036	924 (75 a)	159 (14 b)

Taking the sum of the Frigid and Temperate zone species (subtracting the fourteen common to the two) we have 1036 species in the torrid regions to 1069 in the extra-torrid, seventy-five of which are common to the two. This shows a nearly equal distribution between the zones. But excluding the Brachyura, the numbers become 501 to 811, giving a preponderance of more than one-half to the Temperate zone.*

* Adding to the numbers above, the species which have been necessarily left out as of uncertain locality, amounting to one hundred and forty in all, and inserting also the Entomostraca, it makes the total of described living species, as follows :—

Brachyura,	830
Anomoura,	262
Macroura,	297
	1389
Anomobranchiata,	115
Isopoda,	295
Anisopoda,	57
Amphipoda,	341
	693
Entomostraca,	492
Total,	2689

The number of species collected in the course of the cruise of the Expedition (exclu-

The species of highest rank among the Brachyura, Macroura, Isopoda, and Amphipoda, the four principal types in the above, belong to the extra-torrid zones; and in subordinate groups or families, it is often true that the genera of superior grade are extra-torrid, in contrast with the others which are torrid genera. Higher groups, characteristic of the colder regions, sometimes show degradation among those species of the group that are tropical; and the tropical sections also may continue the line of degradation by an extension again into the colder seas.

As we descend in the scale of Crustacea, from the Podophthalmia to the Tetradecapoda, the number of cold-water species increases, becoming in the latter group, three times greater than the warm-water species. It is an important fact, nevertheless, that this increase of cold-water species is still no mark of degradation; the particular facts that have been discussed, leading to a very different conclusion. Other principles follow. These are—

First, that the two types, the Decapodan and Tetradecapodan, are distinct types, to be independently considered, and not parts of a series or chain of species, a fact illustrated in the preceding chapter on the classification of Crustacea.

Second, that the preponderance of cold-water species is the reverse of what must have been true in the earlier geological epochs, when the oceans had a somewhat higher temperature; or were to a large extent tropical.

Third, that the progress of creation as regards Crustacea, has ended

sive of those lost in the wreck of the Peacock, which included nearly all the collections of two seasons in the tropical regions of the Pacific) is nearly 900; and the number of new species described is 658, distributed among the groups as follows:—

Brachyura,	151
Anomoura,	50
Macroura,	57
Anomobranchiata,	28
	—286
Isopoda,	67
Anisopoda,	7
Amphipoda,	110
	—184
Entomostraca,	188
	—
Total,	658

not where it begun, in multiplying the species of warmer waters and giving them there their superior developments, but in carrying species to a higher perfection in the colder regions of the oceans. A preponderance of species in the warmer seas is perhaps to be expected, since warm waters have prevailed even more largely than now in earlier epochs. But it would seem, that the introduction of the higher grades of Crustacea required, not merely the cooler waters of the present tropics, but even the still colder temperature of the Temperate zone, and therefore the present condition of the globe.

The genera of Fossil species commence with the Entomostracans and Trilobites in the Palæozoic rocks. Next appear certain *Thalassinidea* and *Astacoid* species, in the Permian system; then *Mysidea*, *Penæidea*, many *Thalassinidea*, *Astacodea*, and *Anomoura*, in the Oolitic system; then a few *Canceroids* and *Leucosoids* in the Cretaceous, which become much more numerous in the *Tertiary* system, along with some *Grapsoids*. None of the *Maioids*, the highest of Crustacea, have yet been reported from either of the Geological epochs.

The *number* of individuals and the *size* are, for the Brachyura, greater in the Torrid zone than in the colder regions. But for the Macroura, the species of cold-water genera average nearly twice the lineal dimensions of those of warm waters; and the number of individuals also may possibly be greater.

In stating the conclusion respecting the Macroura, on a preceding page (p. 1515), we omitted to give in detail the mean sizes of the different groups. The following are the results, including the Galatheidea, which are closely related to the Macroura:—

	Mean length of Torrid zone species.	Mean length of Extra-torrid species.
Galatheidea,	0·3 inches.	3·0 inches.
Thalassinidea,	2·0 “	3·0 “
Scyllaridæ,	6·0 “	6·0 “
Palinuridæ,	12·0 “	15·0 “
Astacidæ.—Homarus,		14·0 “
Astacinæ,		3·0 “
Nephropinæ,		5·0 “
Crangonidæ,		2·0 “
Palæmonidæ.—Alpheinæ,	1·5 “	1·5 “
Pandalinæ,		3·0 “
Palæmoninæ,	2·3 “	2·4 “
Oplophorinæ,	1·0 “	
Penæidæ,	3·6 “	4·5 “

The table shows that the torrid species, in none of the groups, average larger than the extra-torrid. The cold-water Palinuridæ are as large as the largest warm-water species, and will outweigh them; the cold-water Galatheidea, are ten times the average length of the warm-water; the Alpheinæ, Palæmoninæ, and Penæidæ are at least as large in the temperate regions as in the torrid. There is hence nothing in the tropics to balance the Astacidæ, a group of large species, some of them gigantic; nor the Crangonidæ, nor Pandalinæ. The genus Palæmon, in the Torrid zone, averages larger than in the Temperate, the ratio being 3·5 to 2·40; the former amount being reduced to 2·3 for the Palæmoninæ, by the species of the other tropical genera, which are mostly quite small. Yet, taking the ratio of 3·5 to 2·40, it affects but little the balance against the Torrid zone.

As to *bulk*, also, the Temperate zone probably has the preponderance; yet our data are less definite. In the Galatheidea, the cold-water species are not only ten times larger lineally (which implies at least eight hundred times cubically), but they are far more prolific, swarming in vast numbers where they occur. The Thalassinidea are more numerous in extra-torrid species than torrid, as well as larger in size. The Scyllaridæ are mainly tropical; but the species are not of common occurrence, compared with the Astacidæ, which abound everywhere, and these, as well as the Crangonidæ and Pandalinæ, are all Temperate zone species. The Palæmoninæ and Penæidæ probably preponderate in the tropics, and this may be also true of the Alpheinæ. Taking a general view of the whole, and considering the fact, that the extra-torrid species rather outnumber the torrid, we believe that the deduction above stated is correct.

In the *Tetradecapoda*, the number of species, the number and diversity of genera, the number of individuals, and the bulk, are all greater in the extra-torrid seas than in the torrid, as has been explained on a preceding page; and this is especially true of the Amphipoda.

The tendency to spinose forms among the species of the colder temperate regions, or Frigid zone, has been remarked upon on page 1523, as exemplified among the Gammaridea, the Crangonidæ, Lithodes, and Maioids.

2. DISTRIBUTION OF CRUSTACEA ACCORDING TO GEOGRAPHICAL PROVINCES.

The following tables are presented, as embodying in a general way

the greater part of the information furnished us by the present state of science, with reference to the distribution of Crustacea in the different parts of the globe.

We divide the surface of the globe, for marine zoological geography, into three sections, the *Occidental*, the *Africo-European*, and the *Oriental*; the first, including the east and west coasts of America and adjoining islands; the second, the eastern side of the Atlantic Ocean, the coasts of Europe, and also of Africa as far as the Cape of Good Hope; the third, embracing the Indian Ocean and its coasts and islands, the East Indies, and the Pacific Ocean, with its coasts and islands, exclusive of the western coast of America and the neighbouring islands. The total number of species in each is given in a separate column.

In the *Occidental* section, under the head of *Western America*, there are two columns; one (N.) for the coast *north* of the equator; the other (S.) for the coast *south*, together with the Gallapagos.

Under the head of *Eastern America*, there are the same two divisions of *north* and *south*. *Fuegia* is included in Eastern instead of Western America.

In the *Africo-European* section, we make three columns; one (N.) for the coast of Europe and Africa, north of the equator; and the adjacent islands, the Cape Verdes, Canaries, and Azores; a second (Med.) for the Mediterranean Sea; a third, for the coast of Africa south of the equator to the Cape of Good Hope, with the islands, Ascension, St. Helena, and Tristan d'Acunha.

A separate column is devoted to species in the north frigid region of the Atlantic.

In the *Oriental* section, there are the divisions (1), *East Africa*, with the columns north (N.), and south (S.), the latter including Madagascar, Isle of France, and other islands near the African coast; (2), *Indian Ocean and the East Indies*, including the coast of Southern Asia, the islands of the oceans south, with Torres Straits and north-western Australia; (3), the *Western Pacific*, including Japan and other regions *north* of the equator, for one column, and for the other, the islands and shores in the Western Pacific *south* of the equator, embracing New Ireland, Eastern Australia, Van Diemens Land; (4), the *Middle Pacific*, divided into *north* and *south*, and embracing the various islands over this ocean exclusive of those just mentioned, with New Zealand, the Aucklands, &c., on the south.

Under each subdivision, we designate the particular temperature

region in which the species occur, by using the letters *a, b, c, d, e, f, g, h*, as in the preceding tables. Thus opposite *Libinia*, 1 *e* in the first column means that *one* species occurs on the west coast of North America, and this one in the *subtemperate* region (*e*), the position of which on the coast will be observed on the chart. So, opposite *Hyas*, 1 *g*, in the same column, implies that *one* species occurs in the *subfrigid* region. These letters *a, b, &c.*, in the columns in some cases have a more definite signification, than simply that of indicating the temperature region, for the reason, that species may have hitherto been obtained only at a single point in such a region. Thus in the column—

W. America, N.,	<i>g</i> ,	signifies Puget's Sound.
W. America, S.,	<i>c</i> ,	" the Gallapagos.
"	<i>d</i> ,	" Peruvian coast.
"	<i>e</i> ,	" the coast of Chili and mainly Valparaiso.
"	<i>f</i> ,	" the coast of Chiloe.
E. America, N.,	<i>b</i> ,	" Key West and the adjoining coast of Florida.
"	<i>c</i> ,	" the coast of Georgia, and the Carolinas, to Cape Hatteras, but mainly Charleston, South Carolina.
E. America, S.,	<i>b</i> ,	" Rio Janeiro.
"	<i>e</i> ,	" Rio Negro.
"	<i>g</i> ,	" Falklands and Fuegia.
E. Atlantic, S.,	<i>e</i> ,	" Table Bay, South Africa.
"	<i>f</i> ,	" Tristan d'Acunha.
E. Africa, N.,	<i>a</i> ,	" southern half of Red Sea.
"	<i>b</i> ,	" northern half of Red Sea.
E. Africa, S.,	<i>b</i> ,	" Port Natal.
"	<i>b'</i> ,	" Mauritius or Isle of France.
Indian O. and E. Indies,	<i>c</i> ,	" Swan River, West Australia.
W. Pacific, N.,	<i>b</i> ,	" Lochoo, Formosa, and part of South Japan.
W. Pacific, S.,	<i>e</i> ,	" Port Jackson, in East Australia, and Isle of King, north of Van Diemens Land.
"	<i>f</i> ,	" Van Diemens Land.
Mid. Pacific, N.,	<i>a</i> ,	" Kingsmills and Wakes Island.
"	<i>b</i> ,	" Hawaiian or Sandwich Islands.
Mid. Pacific, S.,	<i>e</i> ,	" northern part of New Zealand.
"	<i>f</i> ,	" middle part of New Zealand.
"	<i>g</i> ,	" southern extremity of New Zealand and the Aucklands.

Other information respecting the use of the letters will be gathered from the Chart.

The order of the genera is the same as in the preceding tables, and the subdivisions into families may there be ascertained.

TABLE VI.

I. BRACHYURA.

	W. America.		E. America.		Total.	E. Atlantic.			N. Frigid.	Total.	E. Africa.		Indian Ocean and E. Indies.	W. Pacific.		Mjd. Pacific.		Total.
	N.	S.	N.	S.		N.	Medit.	S.			N.	S.		N.	S.	N.	S.	
MAIOIDEA.																		
MAIINEA.																		
Macrocheira,						1c, 3f	3d.			6			1a	1e, g				1
Inachus,					2													1
Microrhynchus,		2c																
Salacia,		1e?			1													
Doclea,							1d.			1			4a, 1b					5
Libidocelea,		1e		1g	2													
Libinia,	1e	1d, e	1b, c, f, g	1b, 1c	5													
Maia,						1c, f	1d.			2				2c				2
Paramithrax,					4								1a	1c?	2e			3
Pisa,		2c	1b, 1c		4	2c, 2f	3d.			4	1b.		3a, 1b					4
Pella,		1c			1													
Lissa,							1d.			1								
Rhodia,		1c			1													
Hyas,	1g		1b, 1g		3	2f, 1g			1h.	2								
Pisoides,		1c, e			1													
Herbstia,	1	1c			2	1c.	1d.			1								
Thoe,		1c			1													
Dehaanius,												1						1
Micippa,												1b	4a, 1b					5
Chorinus,			1a, b		1								4a	1b			1a	6
Chorilla,					1													
Lahaina,																1b.		1
Naxia,													1a, 1	1b				3
Scyra,	1g				1													
Hyastenus,													1a				1a	1
Pyria,		2c			2													
Othonia,		1c, 1d	5a, 4b, 1c		9		1d.			1		1	2a					2(1)
Mithrax,	1a	2c	1a		3													
Mithraculus,																		
Cyclax,																	1a	1
Criocarcinus,																		

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2. ANOMOURA.

	W. America.		E. America.		Total.	E. Atlantic.			Arctic.	Total.	E. Africa.		Indian Ocean and E. Indies.	W. Pacific.		Mid. Pacific.		Total.	
	N.	S.	N.	S.		N.	Medit.	S.			N.	S.		N.	S.	N.	S.		
DROMIDEA.																			
Dynomene,	1	.	.	.	.	4	.	1 b'	.	.	.	.	.	1	
Dromia,	1 a, b	.	1	1 c, f	2 d	2 e	.	4	2 a, 1 b	2, 2 b'	2 a	2	1	1 b	.	9	
Latreillia,	1 d	.	.	2	.	.	.	.	.	.	.	2	
Homola,	1 c	2 d	.	.	2	.	.	.	.	.	.	.	2	
Cymopolia,	1 d	.	.	1	.	.	1 a	.	.	.	.	1	
Caphyra,	2 a	.	.	.	.	2	
BELLIDEA.																			
Bellia,	1 e	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	1	
Corystoides,	1 e	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	1	
RANINIDEA.																			
Raninoides,	1 a	.	.	.	.	1	
Ranina,	1 b'	1 a	1 b	.	1 b	.	1	
Ranilla,	1 b, c	.	1	.	.	.	.	.	.	.	.	1	.	.	.	1	
Notopus,	1 e	.	.	.	.	1	
Lyreidus,	1 a	.	.	.	.	1	
Cosmonotus,	1	
HIPPIDEA.																			
Albunea,	1 d?	1 a, 3 c	.	3	1 c	1 d	.	.	1	.	.	1 a	.	.	1 a	.	2	
Albunhippa,	1 d	1 d	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	2
Remipes,	1 b	.	1	.	.	3 a, 1 c	.	.	1 b	1 a	4	
Hippa,	1 d, 1 e	1 c, f	.	2	.	.	.	.	.	.	.	1 a	.	.	.	1	1	
PORCELLANIDEA.																			
Porcellana,	4 d, 12 e	3 a, 4 b, 4 c	3 b	24	1 c, 3 f, 1 g	3 d	.	.	4	2 b, 1 b'	11 a	1	.	1 a, 2 b	5 a, 1 e	19		
LITHODEA.																			
Lithodes,	1 f	1 g	3 g	4	1 g	.	.	1 h	1 (1)	.	.	.	1 h	.	.	.	1	
Lomis,	1	.	.	1 e	2	
Echinocerus,	1 (f?)	.	.	.	1	.	.	.	.	.	.	.	.	.	.	.	.	1
PAGURIDEA.																			
Paguristes,	1 d, e	.	.	2	.	1 d	1 e	.	2	.	.	3 a	2 e	.	.	.	5	
Diogenes,	1 b	2 a	3	2	.	.	5	
Bernhardus,	3 g	1 d, 8 e	1 b, 2 c, 1 f, 2 g	2 b, 1 g	18	2 f, 5	7 d	3 h	.	13 (1)	.	.	3, 2 h	.	.	2 e	6 (1)		
Pagurus,	1 b	1 b	1	1 c	6 d	.	.	5	1 b'	7 a	4	2, 1 f	2 b	7 a	16		
Calcinus,	1 a	.	1	.	.	.	.	.	.	4 a	.	.	3 a, 3 b	3 a	5		
Aniculus,	1	.	.	.	.	.	1 b'	.	1 b	.	1 a	1 a	1		
Clibanarius,	2 a	1 b	3	1 b, 1 f	5 d	.	.	6	2 b	6 a	3	.	1 a	7 a, 1 e	16		
Cancellus,	1	
Cenobita,	1 a	.	1	.	1 d	.	.	1 (1)	.	1 b	4 a	3 b	1 a	3 b	4 a	6	
Birgus,	1 (1)	.	1 b'	1 a	1 a, 1 b	.	1 a	1 a	1	
ÆGLEIDEA.																			
Æglea,	2 e	.	.	2	.	.	.	.	.	.	.	.	.	.	.	.	2	
GALATHEIDEA.																			
Galathea,	1 e	.	.	1	1 c, 3 f, 1 g	2 d	.	2 h	4	.	.	.	.	1 b	4 a	.	5	
Munda,	1 g	1	1 f, 1 g	.	.	.	1	.	.	.	.	.	.	.	1	
Grimothea,	1 e	.	.	1 e	1	.	.	.	.	1 (1)	.	.	.	.	.	.	.	1

4. ANOMOBANCHIATA.

	W. America.		E. America.		Total.	E. Atlantic.			E. Africa.	Indian Ocean and E. Indies.		W. Pacific.		Mid. Pacific.		Total.	
	N.	S.	N.	S.		N.	Medit.	S.		N.	S.	N.	S.	N.	S.		
																	Total.
SQUILLOIDEA																	
Lysiosquilla,		2a, 1c		2b	3												3 (1)
Scquilla,		3c, 1f, g		2b	5			3d									11 (1)
Pseudosquilla,		1d, 1e			1			1d									1
Coronis,		1e			1			1d									2
Gonodactylus,									5b'								6 (1)
Squillierichthys,									1a								1
Erichthus,								3a									4
Alima,								1a									5
								1a, 4b									4
								1a									5
MYSIDEA																	
Thysanopoda,																	
Euphausia,								1a									3
Cyrtopis,								1a									2
Cynthia,								1b (or c), 1g									1
Mysis,								2f, 2g									2
Promysis,																	1
Macronyasis,				1b	1			2g									3
Sirtella,																	1
Loxops,																	2
Secedins,																	1
Rochitla,				1b	1												3
Nyco,				1b	1												2
Lucifer,				1b	1												3
AMPHIONIDEA																	
Phylleconis,								6a, 1d, 1f									11
Amphion,								1									1

Mara			2b	2	4f, 1g	2d			7			1a					1
Dercothoe			1b	1								2a					2
Pyctilus			1	1								2a					
Pardalsea									1h								
Atylus									1								
Ischyrocerus									2h								
Microcheles									1h								
Lepidactylis									1h								
Pontiporeia									1h								
Amphelisea									1h								
Protomedea									1h								
Aora		1e		1													
Phoxus									2h								2
Isea																	1
Anisopus																	
HYPERIDEA.																	
Vibilia						1d			1			1a					1
Lestrigonus								2a	1h			1a				1a	2
Tyro					1				1								
Hyperia		2e	1g	3	1d, 2f		1e		1h	4							
Metoecus									1h	1							
Tauria														1h			1
Cylopus			1g	1													
Dairilia												2a				2a	4
Cyatisoma												1					1
Synopia								1a								1a	1
Phronima					1a, 1g	1d				2							
Primno		1e		1													
Anchlomera			1b, 1e	2							1b'	1a					2
Phrosina								2d		2							
Themisto								1g	2h	3							
Phoreus								1a		1				1h			1
Dithyrus					1c					1							1
Typhis					2f			1d		3							
Thyropus					2d			1a		3							
Proneo		1e		1				1a		1							
Lycea														1d			1
Oxycephalus		1e		1								1a					1
Rhabdosoma																	1

RECAPITULATION.

The three subdivisions adopted in the preceding table, are designated A, B, and C, in the following summary of the results. The division A, includes the Atlantic and Pacific coasts and islands of America; B, the European and West African coasts and islands, from Cape Horn to Greenland inclusive; and C, the coasts and islands of the Indian and Pacific Oceans (America excluded).*

I. BRACHYURA.

	A.	B.	C.
MAIOIDEA.			
Maiinea,	69	24 (1 a)	73 (1 b)
Parthenopinea,	1	5	29
Oncininea,	0	0	2
	<hr/>	<hr/>	<hr/>
Total Maiioidea,	70	29 (1)	104 (1)
 CANCROIDEA.			
Canceridæ,	10	3	0
Xanthidæ,	17	7 (1 a)	129 (1 b)
Eriphidæ,	7	5	52 (1 b)
Portunidæ, Platyonychidæ and Podophthalmidæ, }	13	19 (1 a)	54 (1 a)
Telphusinea,	6	1	7
Cyclinea,	1	0	0
	<hr/>	<hr/>	<hr/>
Total Cancroidea,	54	35 (2)	242 (3)
 GRAPSOIDEA,	 51	 18 (5)	 124 (5)
LEUCOSOIDEA,	9	12	48 (1)
CORYSTOIDEA,	6	5	8
	<hr/>	<hr/>	<hr/>
Total BRACHYURA,	190	99 (8)	526 (10)

II. ANOMOURA.

	A.	B.	C.
Dromidea,	1	9	15 (1 b)
Bellidea,	2	0	0
Raninidea,	1	0	5

* The discrepancies between the enumeration here and the summaries of the preceding tables, arise from species omitted in one or both, on account of the uncertainty of their localities.

GEOGRAPHICAL DISTRIBUTION OF CRUSTACEA. 1547

	A.	B.	C.
Hippidea,	7	2	7
Porcellanidea,	24	4	19
Lithodea,	5	1 (1 a)	3
Paguridea,	26	27 (1 a)	61 (1 b)
Ægleidea,	2	0	0
Galatheidea,	3	6 (1 a)	5
Total ANOMOURA,	71	49 (3)	115 (2)

III. MACROURA.

	A.	B.	C.
Thalassinidea,	7	8	9 (1 b)
Astacidea,	29	9	27
Caridea,	40	77 (3 a)	85 (3 b)
Penæidea,	4	8	22
Total MACROURA,	80	102 (3)	143 (4)

IV. ANOMOBRANCHIATA.

	A.	B.	C.
Squilloidea,	10	16	32 (3 b)
Mysidea,	3	18	15
Amphionidea,	0	9	11
Total ANOMOBRANCHIATA,	13	43	58 (3)

V. TETRADECAPODA.

	A.	B.	C.
ISOPODA.			
Idotæidea,	11	25	6 (1 b)
Oniscoidea,	30	72 (1 a)	11
Cymothoidea,	32	57 (1 a)	42 (2 b)
Total Isopoda,	73	154 (2)	59 (3)
ANISOPODA,	10	38	6
AMPHIPODA.			
Caprellidea,	13	24	6
Gammaridea,	55	114	51
Hyperidea,	9	27	17
Total Amphipoda,	77	165	74
Total TETRADECAPODA,	160	357 (2)	139 (3)

The preceding table affords the following lists of genera of the three grand divisions, according to the present state of the science.

1. GENERA EXCLUSIVELY AMERICAN OR OCCIDENTAL.

	Coast on which found.		Coast on which found.
1. <i>Maiioidea</i> .		3. <i>Grapsoidae</i> .	
Microrhynchus, . . .	west.	Cyrtograpsus, . . .	east.
Salacia, . . .	"	Uca, . . .	west and east.
Libidoclea, . . .	west and east.	Gecarcoidea, . . .	east.
Libinia, . . .	" "	Fabia, . . .	west.
Pelia, . . .	west.	Pinnixa, . . .	west and east.
Rhodia, . . .	"	Pinnotherelia, . . .	west.
Pisoides, . . .	"	Halicarcinus, . . .	west and east.
Thoe, . . .	west and east.	4. <i>Leucosoidea</i> .	
Chorilia, . . .	west.	Platymera, . . .	west.
Seyra, . . .	"	Hepatus, . . .	west and east.
Othonia, . . .	"	Guaia, . . .	" "
Mithraculus, . . .	west and east.	5. <i>Corystoidea</i> .	
Tyche, . . .	" "	Telmessus, . . .	west.
Eurypodius, . . .	" "	Peltarion, . . .	east.
Oregonia, . . .	west.	Pseudocorystes, . . .	west.
Inachoides, . . .	"	6. <i>Anomoura</i> .	
Pugettia, . . .	"	Corystoides, . . .	west.
Epialtus, . . .	west and east.	Bellia, . . .	"
Leucippa, . . .	" "	Ranilia, . . .	"
2. <i>Cancroidea</i> .		Albunhippa, . . .	west.
Pilumnoides, . . .	west.	Echidnocerus, . . .	"
Trichodaetylus, . . .	east.	7. <i>Macroura</i> .	
Arenæus, . . .	"	Cambarus, . . .	west and east.
Potamia, . . .	west and east.	Paracrangon, . . .	west.
Orthostoma, . . .	east.	Æglea, . . .	"
Acanthocyclus, . . .	west.	Cryphiops, . . .	"

2. GENERA EXCLUSIVELY OF THE AFRICO-EUROPEAN DIVISION.

1. <i>Maiioidea</i> .	3. <i>Grapsoidae</i> .
Lissa.	Gonoplax.
Stenorhynchus.	Heterograpsus.
Amathia.	Brachynotus.
Eurynome.	Hymenosoma.
2. <i>Cancroidea</i> .	4. <i>Leucosoidea</i> .
Perimela.	Ilia.
Portumnus.	5. <i>Corystoidea</i> .
Polybius.	Thia.

- Corystes.
- 6. *Anomoura*.
- Homola.
- 7. *Macroura*.
- Axius.

- Calocaris.
- Ephyra.
- Gnathophyllum.

3. GENERA EXCLUSIVELY ORIENTAL, OR OF THE THIRD DIVISION.

- 1. *Maioidae*.
- Macrocheira.
- Paramithrax.
- Micippa.
- Lahaina.
- Naxia.
- Hyastenus.
- Pyria.
- Cyclax.
- Camposcia.
- Paramicippa.
- Tiarinia.
- Perinea.
- Halimus.
- Menæthius.
- Stenocionops.
- Huenia.
- Xenocarcinus.
- Parthenope.
- Eumedonus.
- Ceratocarcinus.
- Gonatonotus.
- Euryrolambrus.
- 2. *Cancroidea*.
- Atergatis.
- Liomera.
- Liagora.
- Medæus.
- Halimede.
- Etisus.
- Carpilodes.
- Zozymus.
- Daira.
- Cymo.
- Polydectus.
- Æthra.
- Galene.
- Pseudozius.

- Melia.
- Acanthodes.
- Actumnus.
- Ruppellia.
- Domæcius.
- Trapezia.
- Tetralia.
- Quadrella.
- Scylla.
- Charybdis.
- Lissocarcinus.
- Podophthalmus.
- 3. *Grapsoidae*.
- Curtonotus.
- Cleistostoma.
- Macrophthalmus.
- Helœcius.
- Scopimera.
- Doto.
- Eriocheir.
- Platynotus.
- Trichopus.
- Sarmatium.
- Helice.
- Gecarcinicus.
- Xenophthalmus.
- Xanthasia.
- Hymenicus.
- Elamena.
- Myctiris.
- 4. *Leucosoidea*.
- Mursia.
- Orythia.
- Thealia.
- Matuta.
- Philyra.
- Leucisca.
- Nucia.

- | | |
|-------------------------|----------------------|
| Nursia. | 7. <i>Macroura</i> . |
| Myra. | Laomedea. |
| Ixa. | Glaucothoe. |
| Iphis. | Callianidea. |
| Arcania. | Callisea. |
| Oreophorus. | Thenus. |
| Tlos. | Ibacus. |
| Ethusa. | Astacoides. |
| 5. <i>Corystoidea</i> . | Paranephrops. |
| Kraussia. | Cyclorhynchus. |
| Æidia. | Atyoida. |
| Dicera. | Alope. |
| 6. <i>Anomoura</i> . | Ædipus. |
| Caphyra. | Harpilius. |
| Raninoides. | Anchistia. |
| Ranina. | Palæmonella. |
| Notopus. | Hymenocera. |
| Lyreidus. | Oplophorus. |
| Cosmonotus. | Regulus. |
| Lomis. | Stenopus. |
| Diogenes. | Spongicola. |
| Aniculus. | Acetes. |
| Birgus. | Eucopia. |

4. GENERA COMMON TO THE AMERICAN AND AFRICO-EUROPEAN DIVISIONS,
BUT NOT IN THE THIRD, OR ORIENTAL.

- | | |
|------------------------|----------------------|
| 1. <i>Maiioidea</i> . | Atelecyclus. |
| Hyas. | 3. <i>Anomoura</i> . |
| Herbstia. | Munida. |
| Leptopodia. | Grimothea. |
| Stenorhynchus. | 4. <i>Macroura</i> . |
| 2. <i>Cancroidea</i> . | Homarus. |

5. GENERA COMMON TO THE AFRICO-EUROPEAN AND ORIENTAL DIVISIONS,
NOT YET FOUND IN THE OCCIDENTAL.

- | | |
|------------------------|-------------------------|
| 1. <i>Maiioidea</i> . | 3. <i>Leucosoidea</i> . |
| Inachus. | Cycloes. |
| Doclea. | Ebalia. |
| Maia. | Dorippe. |
| Achæus. | 4. <i>Anomoura</i> . |
| Lambrus. | Latreillia. |
| 2. <i>Cancroidea</i> . | Cynopolia. |
| Actæa. | Remipes. |
| Actæodes. | 5. <i>Macroura</i> . |
| Thalamita. | Nika. |
| Portunus. | Lysmata. |
| Telphusa. | Caridina. |

6. GENERA COMMON TO THE THREE DIVISIONS.

1. <i>Maiioidea</i> .		Albunæa.
Pisa.		Porcellana.
Mithrax (mainly Occid.)		Lithodes.
Acanthonyx.		Paguristes.
2. <i>Cancroidea</i> .		Bernhardus.
Xantho.		Pagurus (mainly Orient.)
Panopæus (mainly Occid.)		Clibanarius.
Pilumnus.		Galathea.
Eriphia.	5. <i>Macrourea</i> .	Gebia.
Lupa.		Scyllarus.
Amphitrite.		Panulirus.
Carcinus.		Palinurus.
Platyonychus.		Astacus.
3. <i>Grapsoidæa</i> .		Crangon.
Grapsus.		Alpheus.
Goniograpsus.		Betæus.
Sesarma (sparingly European).		Hippolyte.
Acanthopus.		Pandalus.
Plagusia.		Palæmon.
Pinnothera.		Sicyonia.
Calappa.		Penæus.
4. <i>Anomoura</i> .		
Dromia (sparingly Occid.)		

The following are lists of *species* common to two or more of the three divisions. They may be much changed by further study, through the discovery that the specimens from distant localities are not conspecific. Should this happen, there is a relation indicated based on their close similarity, which is important.

1. SPECIES STATED TO BE COMMON TO DIVISIONS A. AND B., OR THE AMERICAN AND THE AFRICO-EUROPEAN WATERS.

Hyas coarctata; Massachusetts and Long Island, in United States; France; England; Shetlands.

Leptopodia sagittaria; Canaries; West Indies; Valparaiso.

Panopæus Herbstii; Mediterranean; Key West, South Carolina, and New York, in United States.

Carcinus mænas; Mediterranean at Nice; Crimea; England; Massachusetts, United States.

Grapsus pictus; Madeira; Peru and Chili; (also various Pacific islands.)

- Planes minutus*; Atlantic Ocean, and occasionally found on both the American and European coasts.
- Goniograpsus varius*; Canaries; Mediterranean at Algiers, Nice, Italy; Crimea; Brittany; and probably at Rio Janeiro, Brazil.
- Sesarma reticulata*; Key West and South Carolina, in United States; and in South Africa, according to M'Leay.
- Acanthopus planissimus*; West Indies; Canaries; Madeira; Cape Town and Port Natal, South Africa (also various tropical Pacific islands).
- Plagusia squamosa*; West Indies; Key West, South Carolina, in United States; Canaries; Madeira (also, Isle of France; Indian Ocean; Red Sea; Port Natal).
- Plagusia tomentosa*; Chili; Cape Town (also, New Zealand).
- Albunæa symnista*; Canaries; Mediterranean (also, Pondicherry); and if the *A. oxyphthalmus* is the same species, it occurs in the West Indies, and on the coast of South Carolina.
- Lithodes maia*; Great Britain; Shetlands; Norway; coast of Massachusetts (rare).
- Bernhardus streblonyx*; Great Britain; France; Mediterranean; Norway; Massachusetts, in United States; (also Kamtschatka).
- Cenobita diogenes*; West Indies; Mediterranean; (Hawaii?)
- Crangon vulgaris*; Great Britain; France; United States; San Francisco and Puget's Sound, Western America.
- Crangon boreas*; Norway; Iceland; Greenland; Massachusetts (in fish), (also, Kamtschatka).
- Pandalus annulicornis*; Scotland and Shetlands; Norway; Iceland; Massachusetts (rare).
- Gonodactylus chiragra*; Mediterranean; Key West; (also, Red Sea; Port Natal, South Africa; Isle of France; East Indies; Swan River, Australia; Pacific Ocean, at Feejees, Tongatabu, &c.)

2. SPECIES COMMON TO B. AND C., THE AFRICO-EUROPEAN AND ORIENTAL SEAS.

- Mithrax dichotomus*; Mediterranean; East Indies.
- Achæus Cranchii*; Mediterranean; *Japan* (probably same species).
- Actæa rufo-punctata*; Canaries and Mediterranean; Isle of France, Indian Ocean.
- Thalamita admete*; Canaries; Port Natal, South Africa; Red Sea; Indian Ocean and East Indies; Pacific Ocean, at the Feejees, Samoa, Hawaiian Islands, Wake's Island, &c.
- Pilumnus Forskalii*; Canaries; Red Sea.
- Grapsus pictus*; *see above*.
- Grapsus strigosus*; Canaries; South Africa; Red Sea; East Indies.
- Goniograpsus messor*; Canaries; Port Natal, South Africa; Red Sea; East Indies.
- Planes minutus*; Atlantic; *Japan*.
- Acanthopus planissimus*; *see above*.
- Plagusia tomentosa*; Chili; South Africa; New Zealand.
- Plagusia squamosa*; *see above*.

Cycloes granulosa; Canaries; *Japan* (probably same species).
Remipes scutellata; Ascension Island; Swan River, Australia; St. Christopher's.
Lysmata seticaudata; Mediterranean; *Japan*.
Alpheus Edwardsii; Mediterranean; Cape Verdes; Port Natal, South Africa.
Pandalus pristiis; Mediterranean; *Japan*.
Squilla mantis; Mediterranean; Canaries; *Tschusan*.
Pagurus striatus; Mediterranean; *Japan*.

3. COSMOPOLITES.

The above lists include the following species occurring in the Occidental, Africo-European, and Oriental seas.

<i>Grapsus pictus</i>.	|	<i>Bernhardus streblonyx</i> .
<i>Acanthopus planissimus</i>.	|	<i>Crangon boreas</i> .
<i>Plagusia squamosa</i>.	|	<i>Crangon vulgaris</i> .
<i>Plagusia tomentosa</i>.	|	<i>Gonodactylus chiragra</i> .

These are cosmopolite species.* The *Grapsus*, *Acanthopus*, *Plagusia squamosa*, and *Gonodactylus* pre-eminently deserve this name, being found both north and south of the equator. They thrive in the hottest equatorial waters, and have their extreme limit in the temperate region. The temperature they admit of is hence at least from 56° to 88° F.

The other species are cold-water species. *Plagusia tomentosa* belongs to the southern subtemperate region, being reported from Cape Town, New Zealand, and Chili, and the rest are found in high northern latitudes, and probably pass from the Atlantic to the Pacific Ocean through the Arctic Seas.

Besides the above species, a few are found in the West Indies, which occur also in the Oriental Seas, but are not yet known from the European or West African coasts. These, which also may be styled cosmopolites, are as follows:—

Mithrax asper; East Indies; probably the same on the Peruvian coasts.
Atergatis lobatus; Red Sea and Indian Ocean; West Indies.
Carpilius maculatus; East Indies; South France; *Japan*; various Pacific Islands from the Paumotus to the Feejees and Hawaiian Islands; West Indies.
Eriphia gonagra; East Indies; Port Natal; Key West.

* The *Platyonychus bipustulatus* may possibly be another cosmopolite, for it is reported from Table Bay, the East Indies, *Japan*, and Valparaiso. But we believe the Valparaiso species to be different from that of the East Indies, and have so named it.

Menippe Rumphii; East Indies; Rio Janeiro and the West Indies.

Chlorodius exaratus; Pacific Islands; East Indies; West Indies.

Lysiosquilla scabricaudis; Indian Ocean; West Indies; Brazil; South Carolina.

From the survey already made, it is apparent, that the three grand divisions of the seas and coasts adopted in the preceding table, have very few species in common, and they correspond to a natural geographical arrangement. They constitute three kingdoms, to which two should be added, one for the Arctic Seas, and the other for the Antarctic. These kingdoms are:—

I. The *Occidental* Kingdom, embracing the Atlantic and Pacific coasts of America to the frigid region, or some point in the subfrigid region.

II. The *European* Kingdom, extending from Cape Horn (or Cape Agulhas) to the Shetlands inclusive, and embracing the adjoining islands.

III. The *Oriental* Kingdom, including the east coast of Africa, the south and east of Asia, and the islands of the Indian and Pacific Ocean, exclusive of the American continent.

IV. The *Arctic* Kingdom, including Norway, Iceland, Greenland, the Alascha Archipelago, and adjoining parts of the coasts of America and Kamtschatka, with other Arctic lands.

V. The *Antarctic* Kingdom, embracing Fuegia, the Falklands, Southern New Zealand, and the lands or islands of the Antarctic Seas.

Each of the first three kingdoms are naturally divided into three subkingdoms: a *north*, a *middle*, and a *south*, corresponding severally to the North Temperate, Torrid, and South Temperate zones of sea-temperature. The importance of these divisions will be a subject of further remark beyond.

The summary of the results in the preceding table, presents some striking facts.

We observe, first, that there is a ratio of 1:1.5 between the Maioids of the A and C divisions (that is between those of the *Occidental* and *Oriental* seas, as just explained), while the ratio is about 1:4½ for the Cancroids. So also, while the ratio of the A and B divisions together (*Occidental* and *European*) to C (*Oriental*) is for the Maioids, nearly 1:1, it is for the Cancroids, 1:3. Here is a wide difference between the *Occidental* and *Oriental* seas as regards these groups. This last ratio is for the Corystoids nearly that for the Maioids, or more exactly, 1:0.75; and for the Grapsoids it is 1:2;

for the Leucosoids, 1 : 2½. (The Arctic and Antarctic Seas are here merged in the other kingdoms, with which they are most nearly associated.)

If we compare these ratios with those which the same groups sustain as regards temperature, as exhibited on a former page, we discover that there is a very close parallelism; showing plainly that the prevalence of Maioids in the Occidental Seas must be owing to the comparative prevalence of cold waters; and the prevalence of the warm-water groups, the Cancroids and Leucosoids, in the Oriental Seas, is owing conversely to the great extent of warm waters.

Again, the ratio between the A and B divisions together of the Macrourea, and the C division, is nearly as 1 : 0·8, which sustains the same conclusion.

The corresponding ratio for the Tetracapoda is as 1 : 0·26. But as this group, owing to the smallness of the species, has not been thoroughly investigated, except in European regions, directly under the eyes of European observers, we cannot use satisfactorily the facts they present for deducing general conclusions, or for characterizing zoological districts or provinces. Still, it should be observed that the facts conform to the same principle.

It is hence of the highest importance before comparing the zoological character of different coasts, that the temperature-regions of those coasts should be ascertained.

Comparative tables of the East Indies and Mediterranean, or of the Peruvian coast and the East Indies, or of the southeast and southwest coast of Africa (and so on), would lead us far astray, if this element were left out of view; for a difference of temperature region, implies a difference of genera and species, independent of other considerations. On these grounds, whole continents, or sides of continents, may have a common character and differ widely from other continents in the same latitudes.

If we look at the American continent in this point of view, we at once perceive a striking peculiarity. All the coasts of North and South America, with the Gallapagos on the west, belong to the Temperate zone, excepting a few degrees along by Panama, and a connected range of coast from Key West to Rio Janeiro. Chili and Peru are excluded even from the warm temperate region, and so also, the coast of the United States, north of Cape Hatteras.

Now contrast America with the Oriental Seas. The whole east

coast of Africa, north of the parallel of 30° south, the coasts of India and the East India Islands, and the northern half of Australia, together with the numerous islands of the Pacific, belong alike to the Torrid zone. In the American Seas, the torrid coasts make a single range, and have many species in common throughout. In the Oriental Seas, they reach with an uninterrupted surface over one-half of the circumference of the globe, and there is room for many distinct provinces within the same temperature region. The space for Torrid zone species along the American coasts in the Atlantic or Pacific, or that of the whole Atlantic Ocean, is small compared with the vast extent of the East Indies, Indian Ocean, and Middle Pacific, and this fact is more striking, if we consider that the Atlantic east of the West Indies contains no islands in the Torrid zone, besides St. Helena, Ascension, and the Cape Verdes, all of which are of small size.

Again, in order to compare the coasts of America and Europe, we must observe that the warm temperate region is represented along the former by a small district from Northern Florida to Cape Hatteras, while this region does not reach at all the latter, and only the Canaries in the eastern Atlantic are within it. Moreover, the temperate and subtemperate regions are mere points on the North American coast at Cape Hatteras; while on the European side, the former embraces the larger part of the Mediterranean, and a portion of Northwestern Africa, and the latter includes the Atlantic coast of Portugal. But north of Cape Hatteras, the coast of America is rightly compared with that of Europe, north of Portugal.

To compare the coast of Asia and Europe, we first observe in the same manner the temperature regions. There is in fact a striking similarity with the coast of the United States. Yet, the torrid and subtorrid regions are confined to limits much nearer the equator; and the warm temperate, although embracing as many degrees of latitude as the warm temperate on the United States, does not on the China coast extend farther north than the subtorrid region of the Florida coast. The temperate region hardly has a place on the coast of China, while the subtemperate occupies the Yellow Sea. North of this Gulf, the coast corresponds mostly with the coast of the United States, north of Cape Cod.

It is unnecessary to adduce other explanations, as the chart furnishes all that is needed for a ready comparison between the different coasts.

The propriety of uniting in one kingdom both coasts of America, the eastern and western, and thus shutting off the latter from the great Pacific Ocean, may at first appear unnatural. Yet it is supported by all facts bearing on the subject. There are no species known to be common to Western America and the Middle Pacific, excepting two or three cosmopolites. Moreover, the genera are to a great extent distinct, and where so, they often occur on both sides of the continent. The genera of *Podophthalmia* peculiar to America are mentioned on page 1548, and also the particular coast on which they occur.

A review of some of the facts will exhibit in a strong light the zoological resemblances of the two sides of the continent.

Of *Cancer*, there are *four* species found on the west coast of South America, *three* on the west coast of North America, and *two* on the east coast of North America.

Of *Hepatus*, there is *one* species common to the West Indies and Brazil, a *second*, found at Rio Janeiro; a *third*, at Valparaiso, Chili; a *fourth*, on the Carolina coast.

Libinia, in the same manner, has its species on the Atlantic and Pacific coasts of the United States, and the coasts of Western and Eastern South America. *Mithrax* is as widely distributed.

Epialtus occurs in the West Indies, California, Brazil, Gallapagos, and Valparaiso. *Potamia* has two West Indian and one Chilian species.

Eurypodius of Southern South America has its representative at Puget's Sound, in the genus *Oregonia*.

Again, the *Libinia dubia* of the West Indies, is hardly distinguishable, according to Prof. L. R. Gibbes, from the *L. affinis*, Rand., of the California coast. *L. spinosa* of Brazil is also found in Chili. *Leptopodia sagittaria* occurs in the West Indies, and also, according to Bell, at Valparaiso; *Acanthonyx Petiverii* (?), in the West Indies, Brazil, and Gallapagos; *Epialtus marginatus*, on the coast of Brazil and at the Gallapagos (Bell); *Epialtus bituberculatus*, in Chili, and at Key West; *Uca una*, Guayaquil and West Indies; *Albuncea scutellata*, West Indies and San Lorenzo, Peru; *Hippa emerita* and *talpoides*, both on East and West America, North and South.

It is obvious, therefore, that the east and west sides of America are very closely related, and differ widely in a zoological sense, from either of the other kingdoms.

We observe further, that nearly all the genera peculiar to America are *cold-water* genera. They are mostly Maioids; the large group of

the Cancroids, which belong mainly to warm waters, does not include a single genus exclusively American, and of the family Leucosidæ, of the Leucosoids, there are only three known species.

We also perceive why the western coast of America has no zoological affinity with the Pacific Islands. The temperature of their waters is widely different; and, moreover, the oceanic currents of the tropics run *from* the American coast to the westward, and are a barrier to migration eastward.

The relations of the American or Occidental to the Africo-European kingdom are of much interest. The two kingdoms are widely different in most respects.

In the first place, the genera *Lupa*, *Gelasimus*, *Ocypoda*, *Libinia*, *Epialtus*, *Hepatus*, well represented on the American coasts, are not known on the European, besides others (Table 1, page 1548) of less prominence.

Again, there are several genera common in Europe, not known in America, as *Inachus*, *Maia*, *Achæus*, *Portunus*, *Ebalia*, *Latreillia*, *Athanas*, in addition to those included in Table 2, on page 1548.

Still, the American and Africo-European kingdoms have a common character separating them from the Oriental. For example: the great genus *Cancer* occurs in both of these kingdoms, and is not known in Oriental seas, except in New Zealand and Tasmania. So also the important genus *Homarus*; besides *Hyas*, *Herbstia*, *Leptopodia*, *Atelecyclus*, *Munida*, and *Grimothea*. The genus *Homarus* has one species on the coast of the United States, one on the coast of Europe, and one at Table Bay, South Africa, thus ranging over the whole Atlantic.

We may now treat separately of the several Kingdoms, and their subdivision into *Provinces*, pointing out the naturalness of their limits, and the characteristics of these Provinces. Each temperature region along a coast makes a distinct Province, which facts, where ascertained, show to be well characterized. In some cases, a farther subdivision may be desirable, and when so, the subordinate divisions may be called *Districts*. The Provinces of each zone together may constitute a *Subkingdom*, as the *Torrid* Subkingdom, *Temperate* Subkingdom, &c.

I. OCCIDENTAL KINGDOM.

In the Occidental kingdom, there are in the first place, two SECTIONS, the *Eastern* and the *Western*; and both these sections are subdivided into—

1. The *Torrid* Subkingdom; 2. The *South Temperate* Subkingdom; 3. The *North Temperate* Subkingdom. The last two subkingdoms include the whole of the Temperate zone, excepting perhaps the extreme portions, which on zoological grounds may be separated, and united to the Frigid zone, forming the Arctic or Antarctic kingdoms.

In the following mention of the provinces, we give their lengths along the coast; and it will be seen, that although they may appear to be numerous, they still have a wide extent, the length being seldom under five hundred miles, and sometimes full four thousand miles.

A. WESTERN SECTION.

I. TORRID SUBKINGDOM.

1. The PANAMA Province (torrid), extending from the equator or a degree south to a degree beyond Acapulco. Length, sixteen hundred miles.

2. The MEXICAN Province (north subtorrid), reaching from the termination of the Panama province to the Peninsula of California. Length to the California Peninsula, exclusive of the Gulf, six hundred miles.

3. The GUAYAQUIL Province (south subtorrid) occupying from Cape Blanco, the west cape of South America, nearly to the equator, and including the Bay of Guayaquil. Length, nearly two hundred miles.

II. SOUTH TEMPERATE SUBKINGDOM.

1. The GALLAPAGOS Province (warm temperate) includes the Gallapagos Islands, but does not reach the continent. The genera peculiar to it are *Microrhynchus*, *Pelia*, *Rhodia*, *Thoe*, and *Othonia*. There are also two species of *Mithraculus*, one of *Mithrax*, one of *Pisoides* (also

Chilian), one of *Herbstia*, one of *Pisa*, one of *Epialtus*. The variety of Maioid forms is remarkably large. The Cancroids have not been described. *Epialtus marginatus* is also reported from Brazil.

2. The PERUVIAN Province (temperate), from just north of Payta nearly to Copiapo. Length, fifteen hundred miles. The most characteristic species appear to be the *Panopæus crenatus*, *Xantho crenatus*, and *Albunhippa spinosa* (another species of which genus occurs in California). There also exists here, the cosmopolite *Grapsus pictus*, of very large size, which is rare farther south; also *Libinia rostrata*, *Mithrax asper*, *Acanthonyx emarginatus*, *Porcellana mitra*, *Paguristes Weddellii*; besides several Chilian species of *Porcellana*, and *Xantho Orbignii*, *X. Gaudichaudii*, *Bernhardus Edwardsii*, and *Pseudosquilla monoceros*, which are common to Chili and Peru. The *Pilumnoides perlatus* is reported from Peru by D'Orbigny; but we observed it only at Valparaiso, where it was originally found by Pöppig.*

3. The CHILIAN Province (subtemperate). Length, seven hundred miles. This province is distinguished from the Peruvian by the rare occurrence of *Grapsus pictus*, and the unusual number and size of the species of *Cancer* and *Porcellana*, three of the former and ten of the latter existing at Valparaiso. Both of these genera have been shown to reach their highest developments in the middle Temperate zone. Other characteristic genera are the following:—*Inachoides*, *Acanthocyclus*, *Platymera*, *Pseudocorystes*, *Bellia*, *Æglea*, *Cryphiops*, *Pinnothelia*, and *Rhyncocinetes*. *Epialtus dentatus*, *Ocypoda Gaudichaudii*, *Grapsus planifrons*, *Hepatus chilensis*, and *Platyonychus purpureus* are large and common species. The genera *Ocypoda* and *Grapsus* are not found south of the subtemperate region. *Pilumnoides* we suspect to be peculiar to Chili. The following are other genera represented in the Chilian seas:—*Libinia*, *Libidoclea*, *Pisoides*, *Leptopodia*, *Leucippa*, *Xantho* (four large species), *Panopæus*, *Ozius* (also an Australian genus), *Pilumnus*, *Gelasimus*, *Cyclograpsus*, *Uca*, *Pinnixa*, *Leucosia*, *Atelecyclus*, *Paguristes*, *Bernhardus*, *Galathea*, *Callianassa*, *Thalassina*, *Alpheus*, *Betæus*, *Palæmon*, *Pseudosquilla*, *Gonodactylus*.

The Chilian province is allied to the Gallapagos through *Pisoides tuberculatus* and perhaps, *Acanthonyx Petiverii*; with Brazil, through *Libinia spinosa*; with the West Indies and Canaries, through *Leptopodia sagittaria*. The *Hepati* of Chili and Rio Janeiro are closely related; and we suspect that the *H. chilensis* is found also at

* Gay, in his *Historia de Chile*, mentions its occurrence only on the Chilian coast.

Callao, Peru. The Eurypodii of the Patagonian seas sometimes reach as far north as Valparaiso.

Among the Tetradecapoda, *Amphoroidea typica* is a peculiar species, yet it closely resembles a species from Australia. Other genera of Tetradecapoda represented in Chili, are the following:—*Epelys*, *Porcellio*, *Lygia*, *Spheroma*, *Desmarestia* (Nicolet), *Orchestia*, *Allorchestes*, *Iphimedia*, *Amphithoe*, *Aora*, *Hyperia*, *Primno*, *Pronoe*, *Oxycephalus*.

4. The ARAUCANIAN Province (cold temperate), extending from Valdivia nearly to the parallel of 50°. Length, nine hundred miles. The genera *Eurypodius* and *Lithodes* occur on this coast, and probably also *Platyonychus* and *Pseudocorystes*; but the Araucanian species have not yet been studied.

South of the Araucanian province lies the *South Patagonian* and *Fuegian*, the latter of which properly falls into the Antarctic kingdom.

III. NORTH TEMPERATE SUBKINGDOM.

1. The SONORA Province (warm temperate) along the California Peninsula. Length, five hundred and fifty miles.

2. The DIEGO Province (temperate), extending from just below the entrance of the Peninsula, in latitude 28½° to latitude 34½°, and including the port of San Diego. Length, four hundred and fifty miles. A species of the genus *Pugettia* and an *Albunhippa* (a Peruvian genus) occur on this coast.

3. The CALIFORNIAN Province (subtemperate) extending beyond the Bay of San Francisco to Cape Mendocino. Length, four hundred and eighty miles. This region has a close resemblance to the Chilian, in some of its genera, which is also subtemperate. Thus there are three species of *Cancer*, two of *Epialtus*, and one of *Libinia*. The *Libinia* is closely like the *L. dubia* of the United States, if not identical with it.

4. The OREGON Province (cold temperate), extending probably to Puget's Sound. Length, about four hundred and eighty miles. The *Crangon vulgaris*, common in Northern Europe, occurs on this coast, and the *Echidnocerus* of White (near *Lithodes*) is reported from the mouth of the Columbia.

5. The PUGETTIAN Province (subfrigid). Length, about twelve hundred miles. This province has some distinctive genera, as *Oregonia* (related to *Eurypodius*), *Chorilia*, *Scyra*, and *Telmessus*; also,

species of *Pugettia*, *Hyas*, *Pseudograpsus*, *Pinnothera*, *Fabia*, *Trichocera*, with others of *Bernhardus*, *Gebia*, *Callianassa*, *Nephrops*, *Crangon*, *Paracrangon*, *Pandalus*; and among the Tetradecapoda, there are the genera *Oniscus*, *Spheroma*, *Argeia*, *Orchestia*, *Allorchestes*, *Iphimedia*, and *Gammarus*.

The northern part of the North American coast, including the Alaschka Archipelago, belongs to the Arctic kingdom.

B. EASTERN SECTION.

I. TORRID SUBKINGDOM.

1. The CARIBBEAN Province (torrid), including the West India Islands, and the northern and northeastern coast of South America, from the north of Yucatan to beyond Bahia. Length, along the South American coast alone, about four thousand miles. There are as yet no known Caribbean genera of Podophthalmia, that do not occur in other Provinces in this or the other kingdoms. *Mithrax* and *Uca* are the more characteristic genera, and the latter is reported elsewhere only from Guayaquil, Brazil. The following are prominent forms:—*Chorinus heros*, *Pericera cornuta*, and *P. 3-spinosa*, *Amphitrite forceps* and *A. 3-spinosa*, *Ocypoda rhombea*, *Calappa marmorata*, *Atya occidentalis*, *Palinnurus longimanus*, *Palæmon Jamaicensis*. The Torrid zone genus *Carpilius* contains two West Indian species, one of which (*C. maculatus*) is a cosmopolite, and allies the West Indies to the Oriental seas. *Dromia*, although a warm-water genus, has but a single representative, *D. latior*; and of *Chlorodius*, so common in the Orient, in like manner, only one species has been observed, and that occurs also in the Pacific. There is but a single species of Leucosidæ known; but the Caribbean species of Crustacea, it must be acknowledged, are not very thoroughly known. Through *Leptopodia sagittaria* the province is related to the Canaries.

2. The FLORIDAN Province (subtorrid), Key West and a part of Florida are here embraced, together with the Bermudas. Length on the United States coast, two hundred miles. The species are mostly those of the Caribbean Sea. A *Libinia*, *Hyas*, *Epialtus*, and *Menippe*, have been reported from Key West and Florida, that are not mentioned as occurring about the West India Islands; also, several *Sesarmas*, a *Ranilia*, and a *Callianassa*; these genera are none of them

eminently Torrid zone genera. The northern species, *Bernhardus pollicaris*, *Platyonychus ocellatus*, *Lupa dicantha*, *Panopæus limosus* and *Herbstii*, reach as far south as Key West.

3. The BRAZILIAN Province (subtorrid), including the harbour of Rio Janeiro, and extending north nearly to Bahia. Length, six hundred miles. The species of Crustacea are numerous, and have close relations to those of Key West. Among the species peculiar to the province are the following:—*Leucippa levis*, *Pilumnus Quoyi*, *Lupa spinimana*, *Eucrate crassimanus*, *Chasmagnathus granulatus*, *Hemigrapsus granulatus*, *Hepatus fasciatus*, *H. angustatus*, *Sicyonia carinata*, etc. The number of species of Caprellids and Cymothoids is large. The following species are common to Rio Janeiro and Key West, or the West Indies:—*Acanthonyx Petiverii*, *Gelasimus maracoani*, and *G. vocans*, *Uca levis?*, *Xuntho parvulus*, *Lupa dicantha*, *Arenæus cribraria*, *Ocypoda arenaria*, *O. rhombea*, *Goniograpsus ruricola*, *Cardisoma guanhumi*, *Scyllarus equinoctialis*, *Pencæus brasiliensis*, *Pagurus granulatus*, etc. *Epialtus marginatus* occurs also at the Gallapagos, and *Menippe Rumphii*, reported as Brazilian, belongs to the East Indies.

II. NORTH TEMPERATE SUBKINGDOM.

1. The CAROLINIAN Province (warm temperate), extending along by Northern Florida, Georgia, and the Carolinas to Cape Hatteras. Length, six hundred miles. Several Key West species occur also in this province; for example, *Libinia dubia*, *Mithrax hispidus*, *Menippe mercenarius*, *Arenæus cribraria*, *Ocypoda arenaria*, *Sesarma reticulata*, and *S. cinerea*, *Plagusia squamosa*. Still, the general character of the species is different. Among the peculiar species mentioned by L. R. Gibbes, are *Leptopodia calcarata*, *Pisa mutica*, *Cryptopodia granulata*, *Pilumnus aculeatus*, *Hepatus decorus*, *Guaiia punctata*, *Porcellana macrocheles*, *Albuncea scutellata*, *Callianassa major*, *Gebia affinis*, *Alpheus heterochelis*, *A. formosus*, and *Pontonia domestica*. The following northern species have Charleston as their southern limit:—*Libinia canaliculata*, *Cancer Sayi*, *Bernhardus longicarpus*; *Squilla empusa* also reaches from Florida to New York. The warm-water genera of Cancroids are all absent; the species of *Hepatus* indicates a relation to the Chilian and Brazilian provinces.

2. The VIRGINIAN Province (cold temperate). It extends from Cape Hatteras to Cape Cod, including the shores of Virginia, New Jersey,

Delaware Bay, New York, Connecticut, Rhode Island. Length, six hundred and fifty miles. It corresponds essentially to the Pennsylvanian Province of Milne Edwards; a name not here adopted, since the state of Pennsylvania has no part in the coasts, it being entirely inland. The giant *Homarus*, *Lupa dicantha*, *Pilumnus Harrisii*, *Cancer Sayi*, and *C. irroratus*, *Libinia canaliculata*, *Panopæus Herbstii*, and *P. limosus*, *Platyonychus ocellatus*, *Gelasimus vocans*, *Bernhardus pollicaris*, and *B. longicarpus*, *Palæmon vulgaris*, with *Sesarma reticulata* (a southern species), occur in this province.

The province strongly contrasts with the same province across the Atlantic in the fewness of its species. Only two Maioids (exclusive of the subfrigid *Hyas coarctata*, and one of the two *Mithrax hispidus*, is properly a southern species) have been reported from these shores, with seven Cancroids, two Grapsoids (one a Pinnothera), three Anomoura (a Hippa and two Bernhardi), and three or four Macroura (besides Astaci). There is still one point of resemblance between the two regions, in that *Carcinus mænas* is common to both; also, the genus *Homarus* has a species in each, and so also the genus *Cancer*. But America has no *Xantho* north of Florida, while this genus on the other side of the Atlantic reaches to the shores of Britain. Again, we have species of *Panopæi*, extending even to the subfrigid region, none of which group occur in the British Seas.

3. The NOVA-SCOTIA Province (subfrigid) extends from Cape Cod to the eastern cape of Newfoundland. Length, nine hundred miles. *Cancer irroratus*, *Pilumnus Harrisii*, *Carcinus mænas*, and occasionally *Pundulus annulicornis*, *Hippolyte aculeatus*, *Crangon vulgaris*, and *C. boreas*, *Lithodes maia*, *Hyas coarctata*, *Bernhardus streblonyx*, occur on this coast, besides other species mentioned above as belonging to the Virginian province. We begin to find a resemblance to the Northern European and British shores.

III. SOUTH TEMPERATE SUBKINGDOM.

We know little of the Crustacea of this coast of South America. According to the temperate regions, there are four provinces. Two are north of the La Plata, and may be called the Provinces of ST. PAUL (four hundred and eighty miles long), and URAGUAY (three hundred and sixty miles). The mouth of the La Plata from Maldonado, around by Montevideo, Buenos Ayres, to the south Cape, C. Antonio, consti-

tutes a third province, the PLATENSIAN; a fourth, from C. Antonio to the south cape of the bay of Rio Negro, the NORTHERN PATAGONIAN, five hundred miles long. A peculiar Grapsoid form of Rio Negro is the *Cyrtograpsus angulatus*. The *Hemigrapsus affinis* is another species, and this locality is the extreme outer limit of the genus *Hemigrapsus*, as far as now known. Two peculiar Idotæid forms occur in this vicinity, having been taken by us from a fish: they are *Cleantis linearis*, and *Chaetilia ovata*. The genus *Serolis* occurs farther south, and does not appear to extend to Rio Negro.

The subfrigid region, in its southern part at least, along Fuegia, belongs properly to the Antarctic kingdom; but the rest of the coast may belong to another province, called the *Southern Patagonian*, which may include also the coast of Western Patagonia south of the Araucanian Province.

II. AFRICO-EUROPEAN KINGDOM.

The prominent differences in temperature between this kingdom and the Occidental have been briefly pointed out. The most influential is the existence of a large temperate region, covering a considerable part of the Mediterranean coasts, as well as a portion of the western coast of Africa, with the Azores and Madeira; and also a subtemperate on the coast of Portugal; both of which regions are unrepresented on the coast of the United States. There are many species peculiar to the Mediterranean; and by their extension north, they give a greater variety to the British seas than they probably would otherwise have.

On the African coast, we make Cape Agulhas the southern limit. Table Bay, however, as is natural from its situation near the borders between two great kingdoms, partakes of a middle character, yet belongs more properly to the Atlantic Ocean. It affords the Oriental species *Platyonychus trimaculatus* and *Dromia hirsutissima*; but produces also a species of the Atlantic genus *Homarus*, and according to M'Leay, the *Sesarma reticulata* of Say, besides four other species of this genus.

The genera peculiar to the Africo-European kingdom, and those common to it and the other kingdoms, are already mentioned on pages 1548, 1550.

The following are the provinces belonging to the three subkingdoms, the torrid, the north temperate, and south temperate:—

I. TORRID SUBKINGDOM.

1. The GUINEAN Province (torrid), including the coast of Guinea to 9° north or Sierra Leone. Length, twelve hundred miles.

2. The VERDENSIAN Province (north subtorrid), including the coast from 9° north nearly to Cape Verde, and also the Cape Verde Islands. Length on the African coast, three hundred and fifty miles. A species of *Actæodes* (*A. faba*) occurs here, the only one of this warm-water genus yet known in the Atlantic.

3. The BIAFRIAN Province (south subtorrid), including part of the African coast near the equator, about the Bight of Biafra, and reaching to 7° or 8° south; and also the islands Ascension and St. Helena. Length on the African coast, nine hundred miles.

II. NORTH TEMPERATE SUBKINGDOM.

1. The CANARIAN Province (warm temperate), including the west coast of Africa to the latitude of the Canaries, and embracing these islands. Length on the African coast, one thousand miles. In this province there are several species from more tropical regions, which here reach their northern limit, such as *Pilumnus Forskalii*, also from the Red Sea; *Thalamita admete*, East Indies, Natal, &c.; *Grapsus strigosus*, East Indies, &c.; *Goniograpsus messor*, East Indies, Red Sea, &c. *Oplophorus spinosa* (= *Palæmon spinosa*, *Brullé*), *Leptopodia lanceolata*, *Cycloes cristata*, *Squilla oculata*, are reported only from the Canaries; though the *Cycloes* resembles closely a Japan species, if it be not identical with it. Many of the species of the British Channel here reach their southern limit; for example, *Inachus dorhynchus*, *Maia squinado*, *Pisa tetraodon*, *Xantho rivulosus*, *Portunus corrugatus*, *Gonoplax angulata*, *Goniograpsus varius*, *Atelecyclus cruentatus*, *Dromia vulgaris*, *Porcellana platycheles*, *Galathea strigosa*; these are found also in the Mediterranean. There are besides many other Canarian species that are found in the Mediterranean, which do not extend to the north, e. g., *Herbstia condyliata*, *Actæa rufo-punctata*, *Eriphia spinifrons*, *Lupa hastata*, *Amphitrite hastata*, *Portunus holsatus*,

Calappa granulata, *Dorippe lanata*, *Homola spinifrons*, *Albuncea symnista*, *Scyllarus latus*, *Arctus ursus*, *Gnathophyllum elegans*, *Palæmon Treillianus*, *Pagurus callidus*. The cosmopolites, *Plagusia squamosa* and *Acanthopus planissimus* are also found at the Canaries. The *Leptopodia sagittaria* occurs here, at the West Indies, and at Valparaiso.

2. The MEDITERRANEAN Province. The Azores and Madeira belong to this province. The characteristic species, distinguishing it from the more northern provinces are, *Lissa chiragra*, *Doclea ovis*, *Acanthonyx lunulatus*, *Panopæus Herbstii* (also, N. American), *Platyonychus nasutus*, *Goniograpsus maurus*, *Heterograpsus 6-dentatus*, *Brachynotus 6-dentatus*, *Ilia nuclea* and *I. rugulosa*, *Latreillia elegans*; and at Madeira, *Acanthopus planissimus* and *Grapsus pictus* are very common species. Above we have mentioned some of the species that are found at the Canaries also; and beyond we give a list of those found in the seas of Britain.

The relations of the Mediterranean region to Japan are mentioned by De Haan. The genera strikingly Mediterranean which occur in Japan, are *Latreillia*, *Nika*, *Curidina*, *Ephyra*, *Sicyonia*, *Achæus*, *Pandalus*, *Lyismata*; and the species of the last three, together with *Squilla mantis*, are probably identical, viz., *Pandalus pristis*, *Lyismata seticaudata*, and the *Achæus Cranchii*, which last is at least hardly distinguishable, according to De Haan, from the *A. japonicus*. *Portunus corrugatus* is also closely like a Japan species, according to De Haan. The *Cycloes* of the Canaries is another of the Atlantic species, allying the Atlantic region to Japan, as above mentioned. *Doclea* is also an Oriental genus, represented in the Occidental kingdom by *Libinia*. It has but one described species out of the Oriental kingdom.

3. The LUSITANIAN Province (temperate), along the western coast of Portugal. Length, three hundred miles.

4. The CELTIC Province (cold temperate) so named by Milne Edwards, including the Atlantic coast of Spain and France, the British Channel, and Southern Britain and Ireland. The more characteristic genera are *Inachus*, *Hyas*, *Pisa*, *Eurynome*, *Perimela*, *Cancer* (*C. pagurus*), *Portumnus*, *Portunus*, *Polybius*, *Ebalia*, *Atelecyclus*, *Bernhardus*, *Galathea*, *Munida*, *Axius*, *Calocaris*, *Homarus*, *Crangon*, *Nika*, *Hyppolyte*, *Pandalus*. Several of the species of the Celtic province, which reach to the Canaries, and occur also in the Mediterranean, are mentioned above. The following is a list of the Decapods common to the Celtic province and the Mediterranean:—

DECAPODA COMMON TO THE CELTIC PROVINCE AND THE MEDITERRANEAN.*

1. *Brachyura*.

Maia squinado, A.
 Pisa tetraodon, A.
 " lanata (Gibbsii), A.
 Achæus Cranchii, A.
 Stenorhynchus phalangium, A.
 Eurynome aspera.
 Pèrimela denticulata, A.
 Xantho floridus, A.
 " rivulosus, A.
 Pilumnus hirtellus.
 Portunus pusillus.
 " Rondeletii, A.
 " depurator (plicatus), A.
 " marmoreus.
 " corrugatus, A.
 " holsatus.
 Carcinus mænas, A.
 Portumnus latipes, A.
 Gonoplax angulata, A.
 Goniograpsus varius, A.
 Pinnothera pisum.
 Thia polita.
 Corystes dentatus.

2. *Anomoura*.

Dromia vulgaris, A.

Porcellana platycheles, A.
 " longicornis, A.
 Bernhardus Prideauxii, A.
 " Forbesii.
 " streblonyx.
 Clibanarius oculatus.
 Galathea strigosa, A.
 " squamifera.

3. *Macroura*.

Callianassa subterranea.
 Arctus ursus, A.
 Palinurus vulgaris, A.
 Homarus vulgaris, A.
 Nephrops norvegicus.
 Crangon fasciatus, A.
 " vulgaris.
 " cataphractus, A.
 Nika edulis, A.
 Alpheus ruber, A.
 Athanas nitescens, A.
 Hippolyte varians, A.
 " viridis, A.
 Palæmon serratus, A.
 Pasiphæa sivado.
 Penæus sulcatus (caramote), A.

The genus *Xantho*, in *X. rivulosus* and *X. floridus* here reaches its extreme cold limit. *Nephrops norvegicus*, although more properly pertaining to the next province north, occurs also within the limits of this; and it has even been taken in the Mediterranean. *Stenorhynchus phalangium* and *Portunus pusillus*, reach south into the Mediterranean and north to the Frigid zone; *Portunus holsatus*, *Galathea strigosa*, and *Porcellana platycheles*, south to the Canaries and north into the subfrigid.

5. The CALEDONIAN Province (subfrigid), including Northern Scotland, the Shetlands, Orkneys, and the Ferroe Islands. *Hyas coarctatus*, *Portunus arcuatus*, *Galathea nexa*, *Munida Rondeletii*, *Calocaris Macandreae*, *Nephrops norvegicus*, *Hippolyte spinus*, *Pandalus annuli-*

* Those species that are reported by Lucas from Algiers, are followed by the letter A.

cornis, and *Pasiphaea Savignii*, appear to belong especially to this province, besides some species of *Bernhardus* and *Crangon*. *Lithodes maia* also occurs here.

III. SOUTH TEMPERATE SUBKINGDOM.

The provinces of the South Temperate zone, along the west coast of Africa, are, the ANGOLA (warm temperate, three hundred and sixty miles long), BENGUELA (temperate, nine hundred miles long), and CAPENSIAN (subtemperate, four hundred and fifty miles long). Nothing is known of the Crustacea of the coasts, excepting in the last mentioned province, upon which we have already remarked. *Hymenosoma orbiculare* is one of the Table Bay species; and it belongs to a group that is represented only about the southern extremity of South America and in New Zealand. *Palinurus Lalandii*, another species, is one of the largest of known Macrourans.

South of the subtemperate region, in the *cold temperate*, stands in the Atlantic, the island of Tristan D'Acunha, which may be another province, the TRISTENSIAN. As mentioned by Krauss, the *Spheroma tristense*, Edw., is common to this island and Table Bay.

III. ORIENTAL KINGDOM.

Turning Cape Agulhas, we soon come into a different Zoological world. The coast immediately east to longitude 30°, belongs still to the Temperate zone, and must constitute a distinct province, which we call the ALGOA province (from Algoa Bay), the length of which, measured from Cape Agulhas, is full five hundred and fifty miles.

Passing beyond this, we reach the Natal province, and here we recognise at once the seas of India and the Pacific Ocean. Krauss mentions eighty-one Natal species of Podophthalmia, not thirty of which are peculiar to this region. *Twenty* are found in the Indian Ocean, *eighteen* in the Red Sea, *thirteen* in Japan, *eight* in Australia, *five* in the Isle of France, besides *three* European species, and *three* American. We observe further that, twenty-two of the species of Podophthalmia occur in the Pacific Islands, among which are four species supposed by Krauss to be peculiar to Natal, viz., *Pagurus* (*Clibanarius*, D.) *virescens*, Kr., *Pagurus* (*Calcinus*, D.) *elegans*, *Galene*

natalensis, Kr., *Platyonychus* (*Kraussia*, D.) *rugulosus*, Kr., all of which occur at the Hawaiian Islands.*

Of the *European* species, one is the cosmopolite *Gonodactylus chiragra*, Latr. The others are *Alpheus Edwardsii*, and *Gammarus pulex*, Fabr. *Megalopa mutica* and *Hippolyte ensiferus*, also reported from South Africa, do not occur at Port Natal. The *American* are the cosmopolites *Goniograpsus pictus*, and *Gonodactylus chiragra*, together with *Eriphia gonagra*, Edw. The *Sesarma reticulata*, Say, and *Plagusia tomentosa*, Lk., also South African, are not from Port Natal.

It is obvious, therefore, that the great ocean, from the east coast of Africa to the Hawaiian and Paumotu Islands, covering two-thirds of the surface of the globe, makes one great kingdom, closely related in its species, although including several zoological provinces and subordinate districts. This fact respecting the oceans is strikingly in contrast with those relating to the continents adjoining. A list of the genera of Decapods peculiar to this kingdom, and others of the genera and species common to this and the other two kingdoms, are given on pages 1549, 1550.

This kingdom may be viewed as consisting of three SECTIONS.

First, the *African*, including the African coast to the head of the Red Sea and Persian Gulf, with the adjoining islands, Madagascar, Mauritius, etc.

Second, the *Asiatic*, from Van Diemens Land and New Holland, by the East Indies to North Japan.

Third, the *Pacific*, including the Pacific Islands west of New Guinea, from New Zealand to the Hawaiian Islands.†

The principal provinces of these three sections are as follows:—

A. AFRICAN SECTION.

1. The NATAL Province (south subtorrid), including also South Madagascar, and the Isle of France and Bourbon. This region is

* The *Galene hawaiiensis*, D., is so closely like the *G. natalensis*, that we believe there is not sufficient reason for considering them distinct.

† The species of these three sections are separately presented in Table VI. The two columns *N.* and *S.*, under *East Africa*, include the AFRICAN species; the column *E. Indies and Indian Ocean*, and the two columns *N.* and *S.*, under *West Pacific*, the ASIATIC species; the two columns *N.* and *S.*, under *Middle Pacific*, the PACIFIC species.

called the "Madecasse" by Edwards, a name here not accepted, as the larger part of Madagascar is in the torrid and not subtorrid region.

2. The **ABYSSINIAN** Province (torrid), including the east coast of Africa and the Red Sea, excepting its northern third, and also the larger part of Madagascar and the islands of that part of the Indian Ocean.

3. The **ERYTHREAN** Province (subtorrid), including the northern subtorrid part of the Red Sea, and probably also the Persian Gulf.

B. ASIATIC SECTION.

I. ASIATIC TORRID SUBKINGDOM.

1. The **INDIAN** Province (torrid), including the East Indian Islands, Northern Australia, from its most western to its most eastern cape, and the coast of Asia to latitude $12\frac{1}{2}^{\circ}$ on the coast of Cochin China.

2. The **LIUKIU** Province (subtorrid), including the islands of Liukiu and Formosa, the Meicoshimah Islands, and the southeastern coast of Nippon, along by Jeddo, with the eastern side of Kiusiu; the province has but little space on the coast of Asia, along a part of Cochin China.

A third province exists on the west coast of Australia.

II. ASIATIC NORTH TEMPERATE SUBKINGDOM.

1. The **TONQUIN** Province (warm temperate), including the Gulf of Tonquin and coast of China, south of 25° .

2. The **CHUSAN** Province (subtemperate), including the coast of China north of 25° and the Yellow Sea, together with the western part of Kiusiu, along by Nagasaki.

The *temperate* region is nearly or quite absent from the China coast.

3. The **SAGHALIAN** Province (subfrigid), including the Asiatic coast within the Japan Sea, and part of the western and the northern shores of Nippon, with the islands Saghalian, Yeso, and others.

The cold temperate region does not appear to be represented on the Asiatic coast, but is found on the east coast of Nippon, where it forms along with the subtemperate region, what may be called the **NIPPON** Province.

III. ASIATIC SOUTH TEMPERATE SUBKINGDOM.

1. The SWAN RIVER Province (warm temperate), on the *west* coast of Australia.
2. The FLINDERS Province (temperate), along the southern coast of Australia.
3. The MORETON Province (warm temperate and temperate), on the *east* coast of Australia.
4. The BASS Province (subtemperate), from north of Port Jackson to Van Diemens Land.
5. The TASMANIAN Province (cold temperate), including Van Diemens Land.

C. PACIFIC SECTION.

I. PACIFIC TORRID SUBKINGDOM.

1. The POLYNESIAN Province (torrid). To this province belong the Pacific Islands east of the East Indies, within the torrid region, including all the groups between 20° south, and the Hawaiian Islands on the north, embracing also the New Hebrides and nearly all of New Caledonia. There are probably several subordinate districts, but as they are imperfectly indicated by the Crustacea, we do not attempt to lay them down. Tongatabu and Tahiti lie on the borders of the sub-torrid region, in somewhat cooler waters than the Feejee or Samoan Islands.
2. The HAWAIIAN Province (north subtorrid), Hawaiian Islands and others in the same range, to the north of west.
3. The RARATONGAN Province (south subtorrid), including nearly all the Hervey Islands south of west from Tahiti, with Pitcairn's and the Gambier Islands, Ducie's, and some other islands in that vicinity.

II. PACIFIC SOUTH TEMPERATE SUBKINGDOM.

1. The KERMADEC Province (warm temperate and temperate). A few islands north of New Zealand lie in this province, and probably also Norfolk Island, a little farther to the west.

2. The WANGAROA Province (subtemperate). Includes the north part of New Zealand, of which the Bay of Islands is the prominent port.

3. The CHATHAM Province (cold temperate), embracing the Chatham Islands and Middle New Zealand, nearly to its southern extremity.

In the above, the Torrid zone of the Oriental kingdom embraces in each of its regions three provinces, as follows:—

	African Section I.	Indian Section II.	Pacific Section III.
I. TORRID REGION.	1. Abyssinian.	2. Indian.	3. Polynesian.
II. NORTH SUBTORRID REGION.	1. Erythrean.	2. Liukiuan.	3. Hawaiian.
III. SOUTH SUBTORRID REGION.	1. Natalensian.	2. West Australian.	3. Raratongan.

1. SPECIES COMMON TO THE THREE SECTIONS, THE AFRICAN, THE INDIAN, AND THE PACIFIC.

1. <i>Brachyura</i> .	
Parthenope horrida.—I. Fr., Red Sea; E. I.; Haw.	Podophthalmus vigil.—I. Fr.; E. I., Jap.; Haw.
Atergatis limbatus.—R. Sea; E. I.; Feej.	Ocypoda brevicornis.—I. Fr.; E. I.; Tonga.
Atergatis floridus.—Natal; E. I.; Tonga, Paumotus; Tahiti.	Acanthopus planissimus.—Nat.; E. I. ?; Samoa, Tahiti, Paumotu, Haw. [also Madeira].
Carpilius maculatus.—I. Fr.; E. I.; Jap.; Samoa, &c., to Paumotus.	Calappa tuberculata.—Nat.; I. Fr., R. Sea; E. I.; Feej., Tonga, Haw.
Carpilius convexus.—R. Sea; E. I., Jap.; Feej., Haw.	Calappa fornicata.—I. Fr.; E. I.; Feej.
Actæa hirsutissima.—R. Sea; Samoa.	2. <i>Anomoura</i> .
Chlorodius niger.—R. Sea (N.); E. I.; Feej., Tonga, Samoa.	Pagurus difformis.—I. Fr.; E. I.; Feej.
Trapezia ferruginea.—R. Sea; E. I.; Pacific.	Pagurus punctulatus.—E. I. ?; E. I.; Haw.
Cymo Andreossi.—R. Sea; E. I. ?; Samoa, Tahiti.	Calcinus tibicen.—Nat.; E. I.; Samoa, Wake's, Tahiti, Paumotus, Haw.
Scylla serrata.—Natal; R. Sea; E. I., Jap.; Samoa.	Calcinus elegans.—Nat.; E. I. ?; Wake's, Paumotus, Haw.
Lupa sanguinolenta.—Nat.; I. Fr., R. Sea; E. I.; Haw.	Aniculus typicus.—I. Fr.; Jap.; Wake's, Paumotus.
Thalamita admete.—Nat.; R. Sea; E. I.; Samoa, Wake's, Haw.	Clibanarius virescens.—Nat.; E. I.; Feej.
Thalamita crenata.—Nat.; R. Sea (S.); E. I., Jap., Feej.	Cenobita rugosa.—Nat.; E. I., Jap.; Feej.; Samoa, Tonga, Paumotus.
Cleistostoma Boscii.—Nat.; R. Sea; [E. I. ?]; Feej.	Birgus latro.—I. Fr.; E. I., Jap.; Samoa, Swain's, Paumotus.
	3. <i>Macroura</i> .
	Parribacus antarcticus.—I. Fr.; E. I.; Samoa, Paumotus.

Panulirus penecillatus.—R. Sea; E. I.; Pacific.	4. <i>Anomobranchiata</i> .
Hippolyte marmoratus.—?; E. I.; Pacific; Haw.	Pseudosquilla stylifera.—I. Fr.; ?; Feej., Haw.
Stenopus hispidus.—I. Fr.; E. I.; Paumotu.	Gonodactylus chiragra.—Nat.; I. Fr., R. Sea; E. I.; Feej., Tonga.

Of the above species, a few occur in both the torrid and subtorrid regions of these three sections of the Oriental kingdom, that is, in the Erythrean, Natalensian, Indian, Liukiuan, Polynesian, and Hawaiian Provinces. These are:—*Lupa sanguinolenta*, *Podophthalmus vigil*, *Calappa tuberculata*, *Acanthopus planissimus*, *Calcinus tibicen*, *C. elegans*, and *Gonodactylus chiragra*. *Grapsus pictus* is not included; it has not yet been reported from the eastern coast of Africa. The above list must be much increased as the species of the different regions are better understood. Some of the species have a range of over twelve thousand miles. Many species common to Natal and Japan or the Hawaiian Islands, are given in the above list. We add below a list of—

2. SPECIES COMMON TO THE NATAL AND THE LIUKIUAN (SOUTH JAPAN) OR HAWAIIAN PROVINCES OF THE SUBTORRID REGIONS, AND NOT YET OBSERVED IN THE TORRID REGION INTERMEDIATE.

Micippa thalia.—Nat. and Jap.	Ocypoda cordimana.—Nat. and Jap.
Xantho affinis, De H.—Nat. and Jap.	Sesarma picta.—Nat. and Jap.
Xantho obtusus, De H.—Nat. and Jap.	Sesarma affinis.—Nat. and Jap.
Carpilius petræus, De H.—Nat. (I. Fr.) and Jap.	Kraussia rugulosa.—Nat. and Haw.
Charybdis granulatus.—Nat. and Jap.	Galene natalensis.—Nat. and Haw.
Thalamita prymna.—Nat. and Jap.	Dromia hirsutissima.—S. Afr. and Haw.
Gelasimus arcuatus.—Nat. and Jap.	Calappa spinosissima.—I. Fr. and Haw.
Gelasimus lacteus, De H.—Nat. and Jap.	Doto sulcatus, Nat., Jap., and R. Sea.

The Natal province, includes properly two districts, the *Natal* and the *Mauritius*, the latter distinguished by its more torrid character and its larger number of East Indian species, among which are the following:—*Doclea ovis*, *Camposcia retusa*, *Carpilius maculatus*, *Æthra scruposa*, *Melia tessellata*, *Eriphia levimana*, *Calappa fornicata*, *Aniculus typicus*, *Birgus latro*, *Parribacus antarcticus*, etc. Among the species common to the two, not also East Indian, are the following:—*Elamena Mathœi* (a species found also in the northern or subtorrid part of the Red Sea), *Ocypoda cordimana* and *Orchestia Bottœ*.

The following are some of the species peculiar to Port Natal:—*Pisa fascicularis*, *Antilibinia Smithii*, *Acanthonyx Mac Leaii*, *A. scutellatus*, *A. 4-dentatus*, *Eriphia Smithii*, *Menippe Martensii*, *Pilumnus xanthoides* and *P. granulatus*, *Actæodes Ruppelii*. Among those of the Isle of France or Mauritius are, *Stenocionops cervicornis*, *Dynomene hispida*, *Hemigrapsus Latreilli* (the genus *Hemigrapsus* is not yet known to occur in the Torrid region), *Atergatis sinuatifrons*, A. and W., *Carpilius signatus*, A. and W., *Dromia fallax* and *D. hispida*, etc.; also *Caprella scaura*, and *C. nodosa*.

The *Erythrean* province, or the subtorrid portion of the Red Sea, includes several species not reported from more southern parts of the sea, as *Elamena Matthæi*, *Mencæthius monoceros* (a Natal species), *Paramicippa platipes*, *Myru fugax*, Rüpp., *Oreophorus horridus*, Rüpp., *Nursia granulata*, Rüpp., *Macrophthalmus depressus*, Rüpp.

The *Abyssinian* province in its Red Sea portion contains seven species of *Atergatis*, of which *A. sculptus*, *A. exsculptus*, and *A. Savignii* are not elsewhere reported. *Lambrus pelagicus*, *Actæa asper*, *Ruppellia tenax?*, *Thalamita chaptalis*, are other species, besides many that are common in the East Indies. *Dromia unidentata* is found in both the northern and southern parts.

The *Indian* province is characterized more particularly by the following genera:—*Egeria*, *Doclea*, *Micippa*, *Tiarinia*, *Mencæthius*, *Lambrus*, *Parthenope*, *Ceratocarcinus*, *Cryptopodia*, *Tlos*, *Atergatis*, *Carpilius*, *Actæa*, *Xantho*, *Zozymus*, *Panopæus*, *Actæodes*, *Etisus*, *Chlorodius*, *Pilumnus*, *Eriphia*, *Lupa*, *Amphitrite*, *Thalamita*, *Charybdis*, *Lissocarcinus*, *Podophthalmus*, *Ocypoda*, *Sesarma*, *Xenophthalmus*, *Xanthasia*, *Calappa*, *Matuta*, *Leucosia*, *Ixa*, *Iphis*, *Arcania*, *Platyonychus*, *Paguristes*, *Pagurus*, *Calcinus*, *Clibanarius*, *Cenobita*, *Birgus*, *Remipes*, *Thalassina*, *Thenus*, *Panulirus*, *Atya*, *Alpheus*, *Palæmon*, *Pencæus*, *Acetes*, *Squilla*, *Gonodactylus*, etc., and by the comparatively few species, if any, of the following Torrid zone genera, viz.—*Pericera*, *Acanthonyx*, *Mithrax*, *Ruppellia*, and *Hymenocera*, besides others that have been mentioned as peculiarly Occidental or Africo-European.

The relation of the Japan Seas to the Mediterranean, and also to the Natalensian have been remarked upon. The warm-water genera of *Xanthidæ* and *Lupinæ* are abundantly represented in the Liukian province, so also the *Calappinæ*, *Scyllaridæ*, *Sesarminæ*, *Pulinuridæ*, and *Squillidæ*. *Eriocheir penicillatus*, *Curtonotus longimanus*, *Trichia*

dromiiformis, and *Oncinopus arenaria* are peculiar species. The *Ranina dentata* occurs here of a larger size than in the East Indies.

The *Tonquin* province is characterized by species of *Dorippe*, and by *Liagora rubro-maculata*, with some Leucosidæ. The *Acanthodes armatus* of De Haan from the east coast of Nippon appears to belong to the Nippon province; and the giant *Macrocheira Kæmpferi* of De Haan to the Saghalian.

The Japan Seas are allied to the Hawaiian through certain species, as mentioned beyond. Through species of *Sicyonia* they are related to Rio Janeiro as well as the Mediterranean. The species occurring both in the Japan Seas and at Port Natal, are given on page 1574.

The *Swan River* province on Western Australia, although of the warm temperate region, contains the following species identical with species of the Natal province, viz., *Penæus canaliculatus* and *Gonodactylus 3-spinosus*; also the cosmopolite, *Gonodactylus chiragrus*, and the East India species, *Thenus orientalis*. The following species found in this province, have not been mentioned from other localities, viz., *Gelasimus forceps* and *Philyra porcellana*.

The Crustacea of the eastern coast of Australia have been little studied, excepting those of Port Jackson and the vicinity. This province is characterized by the presence of *Halimus tumidus*, D., *Myctiris longicarpus*, *Ozium truncatus*, Edw., *Helæcius cordiformis*, *H. inornatus*, D., *Chasmagnathus levis*, D., and *C. subquadratus* (possibly N. Zealand), *Helice crassa*, *Plagusia glabra*, D., *Paguristes frontalis* (?), *Callianassa (Trypæa) australiensis*, D., *Hippolyte spinicaudis*.

The absence of the Xanthidæ is one of the prominent characters here observed, a group of species that occur but sparingly in any subtemperate region. Among the Tetracapods there is the Chilian genus *Amphoroidea*, affording a species closely like that of Valparaiso. The other genera of Tetracapoda observed, are *Idotea*, *Spheroma*, *Orchestia*, *Allorchestes*, *Hyperia*.

In the great Pacific section of the Oriental kingdom, the *Polynesian* kingdom is of great extent, covering twenty degrees either side of the equator through the ocean to 130° west. Nearly the same genera are represented as in the East Indies, mentioned on page 1575. Among the exceptions, according to present knowledge, are *Egeria*, *Doclea*, *Tiarinia*, *Parthenope*, *Cryptopodia*, *Tlos*, *Panopæus*, *Lupa*, *Podophthalmus*, *Leucosia*, *Ixa*, *Arcania*, *Platyonychus*, *Thalassina*, *Acetes*, *Thenus*, etc., while there are present, species of *Pericera*, *Rup-*

pellia, *Cymo*, *Domæcius*, *Galathea*, *Ædipus*, *Harpilius*, *Hymenocera*, *Regulus*. *Dromia* and *Ranina* have not been observed in the Pacific except in the Hawaiian province. No species of *Penæus* has yet been reported from the Torrid region in this ocean. The *Maiioidea* are few and small, the *Xanthidæ* and *Eriphidæ* numerous, and often large. Some of the species common to the Pacific and East Indies have already been mentioned.*

The Hawaiian province contains the following species, not elsewhere observed:—*Lahaina ovata*, D., *Perinea tumida*, D., *Huenia simplex* and *H. brevirostris*, *Xantho intonsus*, D., *Medæus ornatus*, *Chlorodius nodosus*, *Pseudozius inornatus*, some *Trapeziæ*, *Thalamita pulchra*, *Lupa pubescens*, *Macrophthalmus telescopicus*, *Gelasimus minor*, *Ocypoda levis*, D., *O. Urvillii*, *Hemigrapsus crassimanus*, *Sesarma trapezium*, and *S. obtusifrons*, *Cyclograpsus granulatus*, *C. cinereus*, *Nucia speciosa*, D., *Albuncea speciosa*, *Porcellana cinctipes*, *Galathea spinirostris*, *Scyllarus latus*, Randall, *Nika hawaiiensis*, *Atyoida bisulcata*, Rand., *Alpheus levis*, *A. pacificus*, *A. pugnax*, *A. diadema*, *Pulæmon debilis*, D., *P. acutifrons*, D., *P. grandimanus*, Rand., *P. gracillimanus*, Rand., *Penæus velutinus*.

It is most closely related to the southern part of the Japan Seas, containing the following Japan species:—*Penæus canaliculatus*, *Podophthalmus vigil*, *Ranina dentata*, *Pagurus carinatus*, Rand. (= *P. asper*, *De H.*); and the following genera that are represented in Japan and not in the Torrid region, viz. :—*Galene*, *Kraussia* (D.), *Nika*, *Scyllarus*, *Hemigrapsus*. Several Polynesian species occur here, as *Amphitrite vigilans* (Feejees), *Thalamita integra*, *Goniograpsus thukujar* (Feejees), *Grapsus rudis* (Ladrones), *Porcellana coccinea* (Paumotus), *Hippolyte marmoratus* (Paumotus), *Calcinus tibicen*, *C. elegans*, *C. latens*, *Pagurus punctulatus*, *Chlorodius cytherea*, besides *Grapsus pictus*, *Acanthopus planissimus*, and *Calappa tuberculata*, which have a wide range. *Lupa sanguinolenta* occurs here and also in the East Indies and at the Isle

* The following oceanic Entomostraca occur in the Pacific, or East Indies, and Atlantic:—*Pontella (Pontellina) turgida*, Atlantic, 0° to 8½° N., and 4½° S., 17°–31° W.; Pacific, near Hall's and Pitts' Islands, 1°–3° N., 173° E.—*Pontella (Pontellina) crispata*, Atlantic, 8½° N., 23° 45' W.; 5°–7° N., 174½°–177° E.—*Undina vulgaris*, Straits of Banca; Atlantic, 9° S., 17½° W., and 4½° S., 25° W. *Oithona plumifera*, Atlantic, 4½°–7° N., 20°–22° W.; also 1° S., 30½° W.; Pacific, near Kingsmill Islands.—*Corycæus varius*, Atlantic, 1°–7° N., 18°–22° W., and 1°–7° S., 20°–30° W.; Pacific, 15½° S., 138½° W.; 33° S., 153½° E.; Ladrones.—*Candace pachydactyla*, Atlantic, 11° S., 14° W.; 4½° S., 25° W.; 8½° S., 150° W.; 1° S., 30° W.; China Sea, 300 miles northeast of Singapore.

of France. The relations to the Natal province are similar to those with Japan, as before observed (p. 1574). *Goniograpsus plicatus*, a Hawaiian species, according to Krauss, is also South African.

Little is known respecting the species of the *Raratongan*, or *Kermadec* provinces.

The *Wangaroa* province (Northern New Zealand) is distinguished by an absence of Cancroid forms, as in Southeastern Australia, and rather a prevalence of Grapsoid species. No *Squillidæ* have yet been observed. Among the species peculiar to the province are the following:—*Paramithrax Gaimardii*, *Eurynolambrus australis*, Edw., *Portunus integrifrons*, *P. cantharus*, *Goniograpsus strigilatus*, *Hemigrapsus crenulatus*, *H. Gaimardii*, *Halicarcinus varius*, *H. pubescens*, *Lomis hirta* (possibly from Middle or Southern New Zealand), several *Porcellanæ*, *Paguristes pilosus*, *Bernhardus cristatus*, *B. novi-zealandicæ*, *Clibanarius cruentatus*, *Gebia hirtifrons*, *Paranephrops planifrons*, *P. tenuicornis*, *B. æquimanus*, *Alope palpalis*, *Hippolyte spinifrons*, *Palæmon affinis*, with species of the Tetradecapodan genera, *Idotea*, *Armadillo*, *Spherillo*, *Oniscus*, *Scyphæx*, D., *Lygia*, *Cymothoa*, *Nerocila*, *Æga*, *Spheroma* (several species), *Orchestia*, *Allorchestes*, *Iphimedia*, *Melita*, *Ædicerus*, *Hyperia*.

The genus *Hymenicus*, which is near *Hymenosoma*, and the *Plagusia tomentosa* found also at Table Bay, show a relation to the Capensian province (South Africa). *Palæmon Quoyanus* is also stated by Krauss to be a South African species, found at Port Natal.

The genera *Ozius*, *Hemigrapsus*, and *Chasmagnathus*, and some of their species, are common to the Bass province (Australia) and North New Zealand, showing a relation between the two. Yet the difference in species is still so great, that they are properly distinct provinces. New Zealand is over twelve hundred miles from New Holland, and its Crustacea are hardly as much like those of New Holland as those of Valparaiso. The following genera characterize both Chili and North New Zealand:—*Cancer*, *Ozius*, *Cyclograpsus*, *Paguristes*, and *Betæus*; and the *Cancer Edwardsii* and *Plagusia tomentosa* appear to be common to the two provinces, while the genus *Cancer* is not elsewhere known out of America and Northern Europe. *Palæmon affinis* of the Bay of Islands, as Edwards observes, is hardly distinguishable from *P. squilla* of the coasts of France and Britain. The species of *Portunus* in these southern seas are representatives of the most characteristic of European genera, and they belong rather to the

cold temperate than subtemperate regions of the Australian and New Zealand Seas. *Portunus integrifrons* is reported from Tasmania (Van Diemens Land). *Ozius* represents *Xantho* of the British Channel.

ARCTIC AND ANTARCTIC KINGDOMS.

With our existing knowledge of species, the Arctic and Antarctic kingdoms widely differ; but much of this difference may be owing to the greater extent of land in the northern kingdom, and not a little to our limited knowledge of the latter. In the Arctic Frigid zone, there are the following genera of Podophthalmia:—*Hyas* 1 species, *Stenorhynchus* 1, *Cancer* 1, *Portunus* 1, *Carcinus* 1, *Lithodes* 2, *Bernhardus* 3, *Galathœa* 2, *Crangon* 2, *Sabinea* 1, *Argis* 1, *Hippolyte* 18, *Pandalus* 3, *Palæmon* 1, *Thysanopoda* 3, *Mysis* 3, *Myto* 1. Out of these, only *Lithodes* and *Galathea* are at present known to occur in the Antarctic kingdom, and as yet we are not certain that either reaches beyond Fuegia, near the limits of the subfrigid and frigid regions: further researches are required. The *Thysanopoda* of the north are represented in the south by a species of *Euphausia*.

Among the Tetracapoda, the following exist in the Arctic kingdom:—IDOTÆIDEA, *Idotea*, 9 species, *Glyptonotus* 1; ONISCOIDEA, *Lygia*, 1, *Jæra* 2, *Jæridina* 1, *Asellus* 1, *Janira* 1, *Henopomus* 1, *Munna* 1; of CYMOTHOIDEA, *Æga* 3; SEROLIDEA, *Praniza* 1, *Anceus* 1; TANAIDEA, *Tanais* 6, *Crossurus* 1, *Bopyrus* 1, *Phryxus* 2, *Dajus* 1; of CAPRELLIDEA, *Proto* 2, *Caprella* 6, *Ægina* 2, *Cercops* 1, *Podalirius* 1; GAMMARIDEA, *Dulichia* 1, *Siphonœcetes* 1, *Unciola* 1, *Laphystius* 1, *Orchestia* 2, *Stegocephalus* 1, *Anonyx* 2, *Leucothoe* 2, *Acanthonotus* 3, *Iphimedia* 14, *Ædicerus* 1, *Gammarus* 13, *Photis* 1, *Melita* 2, *Pardalisca* 1, *Ischyrocerus* 2, *Microcheles* 1, *Lepidactylis* 1, *Pontiporeia* 1, *Ampelisca* 1, *Protomedeia* 1, *Phoxus* 1; HYPERIDEA, *Lestrignonus* 1, *Hyperia* 1, *Metæcus* 1, *Themisto* 2.

From the Antarctic kingdom, there are at present known, *Glyptonotus* 1, *Idotea* 1, *Cirolana* 1, *Serolis* 1, *Uristes* (related to *Anonyx*) 1; of HYPERIDEA, *Cyllopus* 1, *Tauria* 1, *Themisto* 1; and if we add Southern Fuegia, *Eurypodii* 2 or 3, *Halicarcinus* 1, *Munida* 1, *Grimothea* 1, *Lithodes* 3, *Tylus* 1, *Oniscus* 1, *Styloniscus* 1, *Jæra* 1, *Pterelas* 1, *Spheroma* 3, *Serolis* 3, *Anonyx* 1, *Amphithoe* 1, *Gammarus* 1, etc. The contrast is again very striking. *Serolis* and some allied forms, with *Glyptonotus* are the most characteristic of southern Isopoda, and the

first of these genera is not known in the north. *Halicarcinus* characterizes the south but not the north. *Hippolyte* and *Crangon* are common in the north, and have not yet been detected in the south. *Lithodes* is common to both. *Eurypodius* is wholly southern, but has its analogue in *Oregonia* of Northwest America. If then we were to characterize the kingdoms by any of the species, we should call the Arctic, the *Hippolyte* kingdom, about half of the known species of the genus *Hippolyte* being Arctic; and the southern, the *Serolis* kingdom. The names imply a higher zoological rank for the Arctic than the Antarctic Seas.

The *Arctic* kingdom is naturally divided into three provinces. One occupying the North Atlantic Ocean; one corresponding, north of the Pacific; and the third, a Polar province. The limits of the Polar province we cannot exactly lay down. But the more Frigid seas which afford only Tetracapods (and perhaps a species or so of Decapods) should be considered as constituting a distinct province from that in which species of *Hippolyte* and *Crangon* are common. These provinces are the *Norwegian*, the *Camtschatican*, and the *North Polar*.

The *Norwegian* includes the coast of Norway and Iceland, with a part probably of Greenland; characterized by *Lithodes maia*, *Hyas araneus*, *Bernhardus pubescens*, *Galathea rugosa*, *Crangon lar*, *C. 7-carinatus*, and many species of *Hippolyte*, etc. The *Camtschatican* comprises Kamtschatka, the Aleutian Islands, and the neighbouring part of the North American coast, and extending it may be some distance beyond Behring's Straits, and is characterized by the *Lithodes camtschatica*, *Telmessus chirogonus*, *Bernhardus splendescens*, *Crangon salebrosus*, *Hippolyte armata*, *H. cornuta*.

In these Polar seas, the species have often a wide range, and probably pass from one ocean to the other through the Polar oceans. Thus *Crangon boreas*, *Carcinas mœnas*, *Pagurus streblonyx*, *Hippolyte aculeatus*, are not only found on opposite sides of the Atlantic, but also in the North Pacific.

The *Antarctic* kingdom may also consist of three provinces:—

1. The **FUEGIAN** Province, including Fuegia, the Falklands, South Georgia; and characterized by *Lithodes antarctica*, *L. verrucosa*, *L. granulata*, species of *Eurypodius*,* *Halicarcinus*, *Galathea*, *Spheroma*, and *Serolis*.

* The species of *Eurypodius* probably belong more especially to the South Patagonian or the Araucanian province, although occurring also in the Fuegian.

2. The AUCKLANDIAN Province, embracing the Aucklands and perhaps the south extremity of New Zealand.

3. The SOUTH POLAR province, including the South Shetlands (whence comes the huge *Glyptonotus* of Eights), and also the Antarctic lands of Wilkes and Ross.

The group Hymenicinæ, including the genera *Hymenosoma*, *Halicarcinus*, and *Hymenicus*, is peculiarly a southern type, and through these genera the extremities of the continents have a common character. The first characterizes the Cape of Good Hope, the second Patagonia and Fuegia, and the third New Zealand. The Patagonian genus reaches north to Valparaiso, into the same temperature region (the subtemperate) that affords the *Hymenosoma* of South Africa and *Hymenicus* of New Zealand, and this subtemperate region is the highest northern limit of the group. *Halicarcinus* is developed in its greatest perfection in Fuegia.

ORIGIN OF THE GEOGRAPHICAL DISTRIBUTION OF CRUSTACEA.

The origin of the existing distribution of species in this department of zoology deserves attentive consideration. Two great causes are admitted by all, and the important question is, how far the influence of each has extended. The first, is *original local creations*; the second, *migration*.

Under the first head, we may refer much that we have already said on the influence of temperature, and the restriction of species to particular temperature regions. It is not doubted that the species have been created in regions for which they are especially fitted; that their fitness for these regions involves an adaptation of structure thereto, and upon this adaptation, their characteristics as species depend. These characteristics are of no climatal origin. They are the impress of the Creator's hand, when the species had their first existence in those regions calculated to respond to their necessities.

The following questions come up under this general head:—

1. Have there been local centres of creation, from which groups of species have gone forth by migration?

2. Have genera only and not species, or have species, been repeated by creation in distinct and distant regions?

3. How closely may we recognise in climatal and other physical

conditions, the predisposing cause of the existence of specific genera or species?

With regard to the *second* head, migration, we should remember, that Crustacea are almost wholly maritime or marine; that marine waters are continuous the globe around; and that no seashore species in zoology are better fitted than crabs for migration. They may cling to any floating log and range the seas wherever the currents drift the rude craft, while the fish of the sea-shores will only wander over their accustomed haunts. Hence it is, that among the Pacific Islands the fishes are often to a considerable extent peculiar to particular groups of islands, while the Crustacea are much more generally diffused.

A direction and also a limit to this migration exist, (1) in the currents of the ocean, and (2) in the temperature of its different regions. Through the Torrid zone, the currents flow mainly *from the east* towards the west; yet they are reversed in some parts during a certain portion of the year. But this reversed current in the Pacific never reaches the American continent, and hence it could never promote migration to its shores. Again, beyond 30° or 35° of north or south latitude, the general course of the waters is *from the west*, and the currents are nearly uniform and constant. Here is a means of eastward migration in the middle and higher temperate regions. But the temperature regions in these latitudes are more numerous than in the tropics, and species might readily be wafted to uncongenial climates, which would be their destruction; in fact they could hardly escape this. Moreover, such seas are more boisterous than those nearer the equator. Again, these waters are almost entirely bare for very long distances, and not dotted closely with islands like the equatorial Pacific.

In the northern hemisphere, on the eastern coasts especially, there are warm currents from the south and cold currents from the north. The former overlie the latter to a great extent in the summer and may aid southern species in northward migrations. Cape Hatteras is nearly the termination of the summer line of 70° (see Maury's Chart), a temperature which belongs to the subtorrid region in winter. On the China coast, at Macao there is a temperature of 83° in July, and in the Yellow Sea, of 78° to 80° . But such northward migrations as are thus favoured, are only for the season; the cold currents of the winter months destroy all such adventurers, except the individuals of

some hardier species that belong to the seas or have a wide range in distribution. Sea-shore Crustacea are not in themselves migratory, and are thus unlike many species of fish. Even the swimming Por-tunidæ are not known voluntarily to change their latitudes with the season.

The following is a brief recapitulation of the more prominent facts bearing on these points.

1. The distribution of individuals of many species through twelve thousand miles in the Torrid zone of the Oriental seas.

2. The very sparing distribution of Oriental species in Occidental seas.

3. The almost total absence of Oriental species from the west coast of America.

4. The world-wide distribution within certain latitudes of the species we have called cosmopolites.

5. The occurrence of closely allied genera at the Hawaiian Islands and in the Japan seas.

6. The occurrence of the same subtorrid species at the Hawaiian Islands and at Port Natal, South Africa, and not in the Torrid zone intermediate, as *Kraussia rugulosa* and *Galene natalensis*.

7. The occurrence of identical species in the Japan seas and at Port Natal.

8. The occurrence of the same species (*Plagusia tomentosa*) in South Africa, New Zealand, and Valparaiso; and the occurrence of a second species (*Cancer Edwardsii* (?)) at New Zealand and Valparaiso.

9. The occurrence of closely allied species (as species of *Amphoroidea* and *Ozius*) in New South Wales and Chili.

10. The occurrence of the same species in the Japan seas and the Mediterranean, and of several identical genera.

11. The occurrence of a large number of identical species in the British seas and the Mediterranean; and also in these seas and about the Canary Islands.

12. The occurrence of closely allied, if not identical, species (as of *Palæmon*) in New Zealand and the British seas; and also of certain genera that are elsewhere peculiarly British, or common only to Britain and America.

13. An identity in certain species of Eastern and Western America.

The following are the conclusions to which we are led by the facts:

I. The migration of species from island to island through the tropical Pacific and East Indies may be a possibility; and the same species may thus reach even to Port Natal in South Africa. The currents of the oceans favour it, the temperature of the waters is congenial through all this range, and the habits of many Crustacea, although they are not voluntarily migratory, seem to admit of it. The species which actually have so wide a range are not Maioids (which are to a considerable extent deep-water species), but those of the shores; and some, as *Thalamita admete*, are swimming species.

II. The fact, that very few of the Oriental species occur in the Occidental seas, may be explained on the same ground, by the barrier which the cold waters of Cape Horn and the South Atlantic present to the passage of tropical species around the Cape westward, or to their migration along the coasts.

Moreover, the diffusion of Pacific tropical species to the Western American coast is prevented, as already observed, by the westward direction of the tropical currents, and the cold waters that bathe the greater part of this coast.

III. When we compare the seas of Southern Japan and Port Natal and find species common to the two that are not now existing in the Indian Ocean or East Indies, we hesitate as to migration being a sufficient cause of the distribution. It may, however, be said that driftings of such species westward through the Indian Ocean may have occasionally taken place; but that only those individuals that were carried during the season quite through to the *subtorrid* region of the South Indian Ocean (Port Natal, etc.), survived and reproduced, the others, if continuing to live, soon running out under the excessive heat of the intermediate equatorial regions. That they would thus run out in many instances is beyond question; but whether this view will actually account for the resemblance in species pointed out is open to doubt.

IV. When further, we find an identity of species between the Hawaiian Islands and Port Natal—half the circumference of the globe, or twelve thousand miles, apart—and the species, as *Galene natalensis*, not a species found in any part of the torrid region, and represented by another species only in Japan, we may well question whether we can meet the difficulty by appealing to migration. It may however be said, that we are not as yet thoroughly acquainted

with the species of the tropics, and that facts may hereafter be discovered that will favour this view. The identical species are of so peculiar a character that we deem this improbable.

V. The existence of the *Plagusia tomentosa* at the southern extremity of Africa, in New Zealand, and on the Chilian coasts, may perhaps be due to migration, and especially as it is a southern species, and each of these localities is within the subtemperate region. We are not ready however to assert, that such journeys as this range of migration implies are possible. The oceanic currents of this region are in the right direction to carry the species eastward, except that there is no passage into this western current from Cape Horn, through the Lagulhas current, which flows the other way. It appears to be rather a violent assumption that an individual or more of this species could reach the western current from the coast on which it might have lived; or could have survived the boisterous passage, and finally have had a safe landing on the foreign shore. The distance from New Zealand to South America is five thousand miles, and there is at present not an island between.

VI. Part of the difficulty in the way of a transfer of species between distant meridians might be overcome, if we could assume that the intermediate seas had been occupied by land or islands during any part of the recent epoch. In the case just alluded to, it is possible that such a chain of interrupted communication once had place; and this bare possibility weakens the force of the argument used above against migration. Yet as it is wholly an assumption, we cannot rely upon it for evidence that migration has actually taken place.

VII. The existence of the same species on the east and west coasts of America, affords another problem, which migration cannot meet, without sinking the isthmus of Darien or Central America, to afford a passage across. As yet we know of no evidence that this portion of the continent has been beneath the ocean during the recent epoch. An argument against such a supposition might be drawn from the very small number of species that are identical on the two sides, and the character of these species. *Libinia spinosa* occurs at Brazil and Chili, and has not been found in the West Indies. *Leptopodia sagittaria*, another Maioid, occurs at Valparaiso, the West Indies, and the Canaries.

VIII. The large number of similar species common to the Mediterranean and British seas may be due to migration, as there is a con-

tinuous line of coast and no intermediate temperature rendering such a transfer impossible; and the passage farther south to the Canaries of several of the species is not beyond what this cause might accomplish. Still, it cannot be asserted that in all instances the distribution here is owing to migration; nor will it be admitted unless other facts throw the weight of probability on that side.

IX. But when we find the same Temperate zone species occurring in distant provinces, these provinces having between them no water communication except through the Torrid or Frigid zone, and offering no ground for the supposition that such a communication has existed during the recent epoch, we are led to deny the agency of voluntary or involuntary migration in producing this dissemination. An example of this, beyond all dispute, is that of the Mediterranean Sea and Japan. No water communication for the passage of species can be imagined. An opening into the Red Sea is the only possible point of intercommunication between the two kingdoms; but this opens into the Torrid zone, in no part of which are the species found. The two regions have their peculiarities and their striking resemblances; and we are forced to attribute them to original creation and not intercommunication.

X. The resemblances found are not merely in the existence of a few identical species. There are genera common to the two seas that occur nowhere else in the Oriental kingdom, as *Latreillia*, *Ephyra*, *Sicyonia*, &c.; and species where not identical have an exceedingly close resemblance.

Now this resemblance in genera and species (without exact identity in the latter) is not explained by supposing a possible intercommunication. But we may reasonably account for it on the ground of a similarity in the temperature and other physical conditions of the seas; and the well-known principle of "like causes, like effects" forces itself upon the mind as fully meeting the case. Mere intercommunication could not produce the resemblance; for just this similarity of physical condition would still be necessary. And where such a similarity exists, creative power may multiply analogous species; we should almost say, *must*, for, as species are made for the circumstances in which they are to live, identical circumstances will necessarily imply identity of genera in a given class, and even of specific structure or of subgenera.

If, then, the similarity in the characters of these regions is the

occasion of the identity of genera, and of the very close likeness in certain species (so close that an identity is sometimes strongly suspected where not admitted), we must conclude that there is a possibility of actual identity of species, through original creation. This, in fact, becomes the only admissible view, and the actually identical species between Japan and the Mediterranean are examples.

XI. When we find a like resemblance of genera and species between Temperate zone provinces in opposite hemispheres that are almost exact antipodes, as in the case of Great Britain and New Zealand, we have no choice of hypotheses left. We must appeal directly to creative agency for the peopling of the New Zealand seas as well as the British, and see in both, like wisdom, and a like adaptedness of life to physical nature. The *Palæmon affinis* of the New Zealand seas is hardly distinguishable from the common *P. squilla* of Europe, and is one example of this resemblance. It may not be an identity; and on this account it is a still better proof of our principle, because there is no occasion to suspect migration or any other kind of transfer. It is a creation of species in these distant provinces, which are almost identical, owing to the physical resemblances of the seas; and it shows at least, that a very close approximation to identity may be consistent with Divine Wisdom.

The resemblance of the New Zealand and British seas has been remarked upon as extending also to the occurrence in both of the genera *Portunus* and *Cancer*. It is certainly a wonderful fact that New Zealand should have a closer resemblance in its Crustacea to Great Britain, its antipode, than to any other part of the world—a resemblance running parallel, as we cannot fail to observe, with its geographical form, its insular position, and its situation among the temperate regions of the ocean. Under such circumstances, there must be many other more intimate resemblances, among which we may yet distinguish the special cause which led to the planting of peculiar British forms in this antipodal land.

The close resemblance in species and genera from Britain and New Zealand, and from Japan and the Mediterranean, and the actual identity in some species among the latter, proves therefore that, as regards the species of two distant regions, identity as well as resemblance may be attributable to independent creations, these resemblances being in direct accordance with the physical resemblances of the regions. As this conclusion cannot be avoided, we are compelled in all cases to try

the hypothesis of migration by considering something beside the mere possibility of its having taken place under certain assumed conditions. The possibility of independent creations is as important a consideration. After all the means of communication between distant provinces have been devised or suggested, the principle still comes up, that it is in accordance with Divine Wisdom, to create similar and identical species in different regions, where the physical circumstances are alike; and we must determine by special and thorough investigation, whether one or the other cause was the actual origin of the distribution in each particular case. Thus it must be with reference to the wide distribution of species in the Oriental tropics, as well as in the European temperate regions, and the Temperate zone of the South Pacific and Indian Oceans.

XII. With respect to the creation of identical species in distant regions, we would again point to its direct dependence on a near identity of physical condition. Although we cannot admit that circumstances or physical forces have ever created a species (as like can only beget like, and physical force must result simply in physical force), and while we see in all nature the free act of the Divine Being, we may still believe the connexion between the calling into existence of a species and the physical circumstances surrounding it to be as intimate nearly as cause and effect. The Creator has in infinite skill, adapted each species to its place, and the whole into a system of admirable harmony and perfection. In his wisdom, any difference of physical condition and kind of food at hand, is sufficient to require some modification of the intimate structure of species, and this difference is expressed in the form of the body or members, so as to produce an exactness of adaptation, which we are far from fully perceiving or comprehending with our present knowledge of the relations of species to their habitats.

When therefore we find the same species in regions of unlike physical character, as, for example, in the seas of the Canaries and Great Britain—regions physically so unlike—we have strong reason for attributing the diffusion of the species to migration. The difference between the Mediterranean and Great Britain may require the same conclusion for the species common to these seas. They are so far different, that we may doubt whether species *created* independently in the two could have been identical, or even have had that resemblance that exists between varieties; for this resemblance is usually of the

most trivial kind, and effects only the least essential of the parts of a species.

The continental species of Crustacea from the interior of different continents, are not in any case known to be identical; and it is well understood that the zoological provinces and districts of the land are of far more limited extent than those of the ocean. The physical differences of the former are far more striking than those of the latter. As we have observed elsewhere, the varieties of climate are greater; the elevation above the sea may vary widely; and numberless are the diversities of soil and its conditions, and the circumstances above and within it. Hence as the creation of each species has reference most intimately to each and all of these conditions, as well as to other prospective ends, an identity between distant regions is seldom to be found, and the characteristic groups of genera are very widely diverse. Comparatively few genera of Insects have as wide a range as those of Crustacea; and species with rare exceptions, have very narrow limits. Where the range of a species in this class is great, we should in general look to migration as the cause rather than original creation; but the considerations bearing on both should be attentively studied before either is admitted as the true explanation.

Throughout the warmer tropical oceans, a resemblance in the physical conditions of distant provinces is far more common and more exact than in the Temperate zone. And hence it would seem that we could not safely appeal to actual differences as an argument against the creation of a species in more than one place. The species spread over the Oriental Torrid zone may hence be supposed to owe their distribution to independent creations of the same species in different places, as well as to migration. Yet we may in this underrate the exactness of physical identity required for independent creations of the same species. We know that for some chemical compounds, the condition of physical forces for their formation is exceedingly delicate; and much more should we infer that when the creation of a living germ was concerned, a close exactness in the conditions would be required in order that the creation should be repeated in another place. Infinite power, it is true, may create in any place; but the creation will have reference to the forces of matter, the material employed in the creation. The few species common to the Oriental and Occidental torrid seas seem to be evidence on this point; the fact that the Oriental species have so rarely been repeated in the Occidental

seas, when the conditions seem to be the same, favours the view that migration has been the main source of the diffusion in the Oriental tropics.

As we descend in the order of Invertebrates, the species are less detailed in structure, with fewer specific parts and greater simplicity of functions, and they therefore admit of a wider range of physical condition; the same argument against multiplication by independent creations in regions for the most part different, does not, therefore, so strongly hold. As we pass, on the contrary, to the highest groups in Zoology, the argument receives far greater weight; and at the same time there are capabilities of migration increasing generally in direct ratio as we ascend, which are calculated to promote the diffusion of species, and remove the necessity of independent creations.

Migration cannot therefore be set aside. It is an actual fact in nature, interfering much with the simplicity which zoological life in its diffusion would otherwise present to us. Where it ends, and where independent creations have taken place, is the great problem for our study. This question has its bearings on all departments of Zoology; but in few has migration had the same extended influence as in that of Crustacea. Molluscs, if we except oceanic species, are no travellers, and keep mostly to narrow limits.

XIII. There is evidence in the exceedingly small number of Torrid zone species identical in the Atlantic and Indian Oceans, that there has been no water communication across from one to the other in the Torrid zone, during the period since existing species of Crustacea were first on the globe.

XIV. As to zoological centres of diffusion for groups of species, we can point out none. Each species of Crustacea may have had its place of origin and single centre of diffusion in many and perhaps the majority of cases. But we have no reason to say that certain regions were without life, and were peopled by migration from specific centres specially selected for this end. If such centres had an existence, there is at present no means by which they may be ascertained. The particular temperature region in which a species originated may be ascertained by observing which is most favourable to its development: we should thus conclude that the *Ranina dentata*, for example, was created in the subtorrid region and not the torrid, as it attains its largest size in the latter. By pursuing this course with reference to each species, we may find some that are especially fitted for almost

every different locality. Hence, we might show, as far as reason and observation can do it, that all regions have had their own special creations.

The world throughout all its epochs in past history, has been furnished with life in accordance with the times and seasons, each species being adapted to its age, its place, and its fellow species of life.

In the elaboration of the tables given in the preceding chapter, the following works and memoirs have been consulted:—

- A. G. DESMAREST's *Considérations Générales sur les Crustacés*, 8vo., Paris, 1825.
 MILNE EDWARDS's *Histoire Naturelle des Crustacés*, 3 vols., 8vo., Paris, 1834-1840.
 MILNE EDWARDS, in Victor Jacquemont's *Voy. dans L'Inde*, 4to., 1844; and other papers in the *Archives du Mus. d'Hist. Nat.*, and the *Annales des Sci. Naturelles*.
 MILNE EDWARDS and H. LUCAS, on the Crustacea of D'Orbigny's *Voy. dans L'Amérique Méridionale*, 4to., Paris, 1843.
 W. E. LEACH's *Malacostraca Podophthalmata Britanniaë*, 4to., 1815-1817.
 SAVIGNY, *Crustacea of Napoleon's Egypt*, folio.
 DE HAAN's *Crustacea of the Fauna Japonica*, fol., 1833-1850.
 M'LEAY, in Smith's *Illustrations of the Zoology of South Africa*, 1838.
 E. RÜPPELL's *Beschreibung und Abbildung von 24 Arten kurzschwänzigen Krabben als Beitrag zur Naturgeschichte des rothen Meeres*, 4to., Frankfurt, 1830.
 THOS. BELL's papers on the genus *Cancer* and on some Crustacea of the coasts of South America, *Zool. Trans.*, i. 335, and ii. 39.
 THOS. BELL's *British Crustacea*, Parts 1 to 6, 8vo., London, 1844-1847.
 R. OWEN, on the Crustacea of the *Voyage of the Blossom*; and also, *Appendix to Sir John Ross's Second Voyage in search of a Northwest Passage*.
 H. RATHKE, *Fauna der Krym*, *Mem. Imp. Acad. Sci. St. Petersburg*, iii. 1837, and *Beit. zur Fauna Norwegens Kais. Leop. Car. Acad. der Nat. Bonn.*, vol. xx., 4to., 1840.
 DR. F. KRAUSS's *Südafrikanischen Crustaceen*, 4to., Stuttgart, 1843.
 O. S. COSTA's *Fauna del Regno di Napoli*, 4to., *Crustacei* in 1836.
 WEBB and BERTHELOT, on the *Canaries*.
 KRÖYER's *Conspectus Crustaceorum Greenlandiaë*, Copenhagen, and also various papers in his *Tidskrift*, published at Copenhagen; and also the Crustacea of the *Spitzbergen Expedition*, in folio.
 NICOLET, in Gay's *Historia de Chile, Zoologia, Tome III.* (including the Crustacea), 1849.
 H. LUCAS, *Crustacea of Expl. de l'Algiers*, 4to., Paris.
 List of the Specimens of Crustacea in the Collection of the British Museum, 16mo., London, 1847.
 List of the Specimens of British Crustacea in the British Museum, 16mo., London, 1850.

A. ADAMS and A. WHITE, *Crustacea of the Voyage of the Samarang*, 4to., London, 1848.

A. A. GOULD's *Invertebrata of Massachusetts*, 374 pp., 8vo., with plates. Boston, 1841.

LEWIS R. GIBBES, on the Carcinological collections of the Cabinets of Natural History in the United States, with an enumeration of the species contained therein, and Descriptions of New Species. From *Proceedings of the Amer. Assoc.*, vol. iii., 1850.

W. BAIRD's *Natural History of British Entomostraca*, 8vo., London, 1850.

EYDOUX and SOULEYET, *Voyage of the Bonite*.

HOMBRON and JACQUINOT, *Voy. au Pole Sud. et dans l'Océanie*.

Besides various other Memoirs by Say, J. W. Randall, Pöppig, Erichson, Philippi, Müller, Wiegmann, Guérin, S. Loven, H. D. S. Goodsir, A. White, W. Thompson, etc., in the *Journal Acad. Nat. Sci. Philádelphia*; *Wiegmann's Archiv. f. Naturg.*, Berlin; *Guérin's Magasin de Zool.*, Paris, and also *Revue Zoologique*, Paris; *Annales des Sci. Nat.*, Paris; *Vet. Acad. Förhandl.*, Stockholm; *Annals and Mag. Nat. Hist.*, London; *Reports of Brit. Assoc.*; *Proceedings of the Zool. Soc.*, London; *Jameson's New Edinburgh Journal*, etc., etc.

ADDENDA ET CORRIGENDA.

- Page 19.—*Homologies of Crustacea*.—This subject, in its bearing on different groups of Crustacea, is treated of on pages 429, 503, 849, 1024, 1028, 1307, 1383.
- “ 92.—Under *Chorilia longipes*, add the locality, Oregon.
- “ 284.—Under *Thalamita crassimana*, add the locality, Feejee Islands.
- “ 292.—Under *Platyonychus purpureus*, add the locality, Valparaiso.
- “ 304.—The title, Family III. Corystidæ, should precede the genus *Telmessus*, on page 303.
- “ 320.—Under *Helæcius cordiformis*, add reference, *Gelasimus cordiformis*, Latr., Edwards, ii. 53.
- “ 347.—Under *Planes cyaneus*, longitude 105° is west.
- “ 379.—*Liriopea* of Nicolet (in Gay's *Historia de Chile*, iii.) is identical with *Halicarcinus* of A. White, and of more recent date. It is also an objection to the name that it is so near *Liriope*.
- “ 394.—Under *Calappa fornicata*, add the locality, Feejee Islands.
- “ 426.—The name *Porcellana armata* has been employed by L. R. Gibbes for a Florida species, and the author therefore would change the name of the Balabac species to *Porcellana spinuligera*.
- “ 444.—The name *Pagurus pubescens* is applied by Kröyer to a northern species; and as it is probably a Bernhardus, the author has changed the name of his species to *B. scabriculus* (see Proc. Acad. Nat. Sci. Philad., Jan. 1852, p. 6).
- “ 517.—*Ibacus antarcticus*, should be *Parribacus antarcticus*.
- “ 534.—*Periclímenes* of Costa (*Fauna del Regno di Napoli*, 1836) has the general form and habit of *Anchistia*, and the two may be identical; but the description contains no information as to whether the mandibles are palpigerous or not, and in other points it is defective.
- “ 534.—*Cryptophthalmus* of Rafinesque is retained by Costa (loc. cit.),

although hardly differing from *Alpheus*. The anterior hands are stout and very nearly equal.

Page 535.—*Typton*, Costa (loc. cit.) is also near *Anchistia* in habit. But the author states that there is no basal scale to the outer antennæ, and in this respect it is abnormal among the Caridea.

“ 593.—Add under *Hymenocera picta*, references to Latreille, Règne Anim., iv. 95, and Edwards, ii. 348.

“ 600.—*Cerataspis* of Gray (Cryptopus of Latreille) has not been inserted among the Mysidea, as Edwards has observed that there are regular branchiæ as in the Caridea, and remarks that the animal is probably the larve of some Penæidean; see Gray's Spicilegia Zoolog., p. 8, Pl. 6, f. 5, and Edwards, Crust., ii. 439, and Règne An. Illustr., Pl. 54 bis, f. 4, and note to this plate. If a distinct genus of the Penæidea, as is altogether probable, it should be arranged with the Sergestidæ.

“ 600.—*Solenocera* is a name given by Lucas, in his work on Algiers, to a genus of Penæidæ.

“ 615.—*Phyllamphion* of Reinhardt (Vid. Med. af den nat. Forening, 1849, ii.) is a genus between Phyllosoma and Amphion.

“ 622.—Under *Pseudosquilla stylifera*, add reference, *Squilla stylifera*, Lamk., Hist. des An. sans Vert., v. 189; Edw., Crust., ii. 526, &c.

“ 697.—*Glyptonotus*. This genus is instituted by Dr. Eights for a gigantic *Idotæa* from the South Shetlands, related to *I. entomon*, which it would also include. The species is called *G. antarctica*. Trans. Albany Institute, ii. 331, 1838–1852.

“ 697.—The genus *Anthura* has been referred by us with hesitation to the Anisopoda. In the figure given by Edwards, on Plate 31, of his Crustacés, the four anterior pairs of legs are thrown forward and the three posterior backward. But in Costa's figure of a Naples species in his Crustacea of the *Fauna del Regno di Napoli*, which he calls the *A. gracilis*, the three anterior pairs are alike and are thrown forward, and differ in form as well as position from the four posterior pairs. Taking this species as the type of the genus, it is a true Isopod, and the family Anthuridæ should follow *Idotæidæ* in the system.

“ 701.—The *Idotæa annulata* was taken in latitude 66° 16' south, longitude 106° 15' east.

“ 716.—In the characteristic of *Philoscia*, *7-articulatis* should read *7–8-articulatis*. We intended to make the genus rest on the fact, that the antennæ are not at all concealed at base, and not on the number of joints. We doubt the value of either generic distinction.

“ 716.—*Titanethes* is a name given by Schiödte (Danske Vid. Selsk. Skr. anden Række, ii.) to the *Pherusa alba* of Koch (Deutschlands Crust.

taceen, etc., Heft. xxxiv. 24), a species of *Lyginæ*, without eyes, and having a narrow head but slightly transverse, with the anterior angles projecting.

Page 717.—Insert the heading, *Pedes posteriores valde elongati*, after the characteristic of Genus 5, directly before that of Genus 6.

- “ 738.—Under *Lygia Ehrenbergii*, add reference to Brandt's *Conspectus*, and to Edwards's *Crustacés*, iii. 157.
- “ 741.—Under *Lygia Gaudichaudii*, add the reference, Edwards's *Crustacés*, iii. 157.
- “ 746.—The genus *Desmarestia* of Nicolet (loc. cit.) is near *Cymothoe* in its ancoral legs, but the abdomen is only two-jointed. The thorax is broad elliptical, the abdomen hardly half as wide as its greatest breadth; the four antennæ nearly equal. It is near *Orozeuktes*.
- “ 851.—The genus *Nicea* of Nicolet (loc. cit.) may possibly be the same with *Allorchestes*; but the essential characteristics are not given, excepting the non-palpigerous character of the mandible. Even if identical, the genus does not antedate the author's, as the description of *Allorchestes* was first published on July 1st of 1849. The maxillipeds are peculiar in having the surface tuberculate, and the inner lamella is dentate only at apex, and there sparingly.
- “ 855.—*Orchestoidea tuberculata* of Nicolet (loc. cit., Pl. 2, f. 4) is the author's *Talitronus insculptus*, and the genus *Talitronus* was instituted and published by the author, on July 1, 1849. The name has been since rejected by him for *Orchestia insculpta*; and as Gay's specific name is the older, it will become *Orchestia tuberculata*. We suspect that his *Talitrus chilensis* is what we have considered the *female* of the *O. insculpta*.
- “ 882.—The locality of the *Orchestia Pickeringi*, was Kauai or Oahu, Sandwich Islands.
- “ 908.—*Callisoma*, Costa (loc. cit.), appears to be identical with *Lysianassa*. The four anterior feet are not cheliform, and the second pair is longer than the first.
- “ 910.—*Niphargus* is the name of a new genus near *Gammarus*, proposed by Schiödte, in *Danske Vid. Selsk. Skr. anden Række*, ii. The author has not seen a description of it.
- “ 913.—The genus *Lalaria* (*L. longitarsis*) of Nicolet (loc. cit., Pl. 2, f. 8), is between the *Gammaridæ* and *Corophidæ*, and appears to be identical with *Aora* of Kröyer, which was also from Valparaiso.
- “ 917.—The specimen of *Uristes gigas* was taken from the stomach of a Penguin, in latitude 62° 28' south, longitude 101° 35' east.
- “ 989.—The *Tauria macrocephala* was found in latitude 67° 5' south, 147° 42' east. The colour when alive was deep orange.
- “ 991.—The name *Daira* of Edwards, is of more recent date than *Daira* of

De Haan; and we, therefore, propose to change it to *Dairilia*, and have so employed this name in the latter part of this volume.

Page 1046.—*Labidocera* of J. Lubbock (Ann. and Mag. Nat. Hist., Jan., 1853 [2], xi. 25), does not differ from *Pontella*. The figure represents the inferior eye, with the same form and position as in this genus (that is, projecting from the under side of the head); and in other respects it is identical with *Pontella*. The species *Labidocera Darwinii* is from the Atlantic, 38° south, in the open sea off the coast of Patagonia.

In the March number of the same Journal (1853), Mr. Lubbock proposes two subgenera under *Labidocera*, which do not appear to be based on important characters. The form of the posterior prehensile legs of the male, on which he rests for one characteristic, is exceedingly various, and if adopted as subgeneric, the subdivisions will become very numerous, and altogether at variance with correct natural affinities. Mr. Lubbock's three species of *Labidocera* are referred to three distinct subgenera.

- “ 1046.—*Iphionyx*, *Centropages*, *Agetus*, *Thaumaleus*, and *Thaumatoessa*, are names given by Kröyer to oceanic genera of Cyclopoidea, in a recent number of his *Tidskrift*, not seen by the author (vol. ii. 2d series, 582–595).
- “ 1203.—The genus *Edwardsia* of Costa (loc. cit.) is a true Sapphirina, and his figure represents well the general structure of the species.
- “ 1308.—The genus *Nesidea* of Costa (loc. cit.) is like *Cythere* in its structure and legs, except that it is said to have a sucker-mouth, and it is thus figured with some details by Costa. This Cyproid form of sucking Crustacea adds a new type to this section of the Entomostraca.
- “ 1393.—The statement that the Cirripedia of the Exploring Expedition are described by Dr. A. A. Gould in his Exp. Exp. Report on Mollusca, is incorrect.

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* In the following pages, the accepted names of species have the generic name in small capitals, and precede those which are only synonyms.

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