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*q*, 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 conspicilla 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 $\frac{1}{7000}$ to $\frac{1}{8000}$ of an inch apart. In some muscles, among which we may mention those elevating the buccal mass, we found them as coarse as $\frac{1}{5000}$ 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 diminished 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 œsophagus, 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 œsophagus. 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 œsophagus, the stomach, and the intestine.

The œsophagus 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 œsophagus.

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 œsophagus 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 stomach, is invariably torn off, not far from the base of the œsophagus, as in the figure.

The stomach has a broad cordate form, and is a little shorter than the œsophagus, 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 œsophagus, 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. *k*. 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 œsophagus, and about one-fifth the diameter of the stomach. It is slightly enlarged below the second pair of natatories, 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 œsophagus. 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 œsophagus, 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 œsophagus 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 œsophagus 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 $\frac{1}{150}$ 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-corpuscles.

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 spermatic 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 exserted, 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. *q*). The peculiarity we refer to, is an appendage to this lappet, arising from the termination of the internal duct (fig. 1 *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 Nicothoe, 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 suctatoriis 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 percrassi, 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 perbrevibus 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 elytroideo. 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 subcheliformes, 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 suctorial 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 uncinate 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 uncinate 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 (Thymnus 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 uncinate 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. Feminæ:—*Abdominis segmentum primum valde oblongum, posticè truncatum, anticè angustius, latèribus 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, subnatatorii, setis plumosis instructi.*

Near *Caligus*. *Cephalothorax* two-jointed, without disks for attachment, posterior segment not alate. *Posterior feet* two-branched, subnatatory, 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 obsolete 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 breviore 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 alatè 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 styliformes, 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, margine 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 *concinnus*.

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 Pandarinæ. 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 perbrevibus.

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 ådhesion. 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* 1*mas 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 conspicilla, 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. 1. 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;* TRACHELIASTES, *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.

† *Lerneocériens,* 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 Conchœcia, 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 Arachnoid 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 Goodsir,¶ 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 *Pephredo 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 Caligus).
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 character 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.	PYCNOGONOIDEA.
1. Mandibles. 2. Maxillæ.	Trunk corresponding to 1, mandibles, and 2, maxillæ.
3. Labium or second maxillæ.	3. Ovigerous legs.
4, 5, 6, 7. Legs.	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-rameæ.

G. 1. Nymphum, *Fabr.**—Antennæ birameæ, 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 birameæ, ramis gracilibus. Truncus ad basin multo angustior. Abdomen 2-articulatum.

G. 4. Pallene, *Johnston.*—Antennæ unirameæ, 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 unirameæ, 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.

* *Pephredo*, 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 breviore.

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.

CIRRIPEDIA.

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 Tetradecapods, 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 Tetradecapods. 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 Tetradecapods, than from the lowest Decapods, and is properly a distinct group. Unlike the Decapods and Tetradecapods, 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 Tetradecapods. 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 Tetradecapods. 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 cephalothoracic 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 àre 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 Callidina, 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 annuli.	Mean normal length, in twelfths of inches or lines.
Type I. Podophthalmia or Decapoda,	Subtype I. Brachyura,	9	24 (and breadth, 24).
	II. Macroura,		36 (and breadth, 6).
Type II. Tetradecapoda,		7	6
Type III. Entomostraca,		6–5	1
Type IV. Cirripedia,		6–5	1
Type V. Rotatoria,		5–4	$\frac{1}{9}$

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 signification 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 laxe 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 annulum 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. PŒCILOPODA.

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 SYNOPSIS

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. MAIINEA vel MAIOIDEA TYPICA.—Corpus sæpissime oblongum, sæpius antice angustum et rostratum. Articulus antennarum externarum 1mus sub oculo insitis, anteriusque 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. Digiti 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. Digiti 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. *Maia*, 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 *Siphonœcetes*, Kr.]

Fam. III. MITHRACIDÆ.—Oculi et maxillipedes externi ac in *Maiidis*. Digiti 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 Maioidea. 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 obsoleto, 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 perbrevi, 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. *Etisus*, Lh., *Carpilodes*, D., *Zozymus*, Lh., *Actæodes*, D., *Daïra*, De H., *Chlorodius*, Lh. (subgenera *Chlorodius*, *Pilodius*, D., *Cyclodius*, D.), *Cymo*, De H.
3. POLYDECTINÆ.—Antennæ internæ transversæ. Antennæ externæ basi solutæ et liberæ.—[Añ *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. ŒTHRINÆ.—Carapax transversus, lateribus valde dilatatis et rotundatis. Antennæ internæ fere longitudinales.—G. *Œthra*, 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, hiatu interno carens, articulo antennæ basali ex orbitâ omnino excluso. Carapax sive paulo transversus sive subquadratus. G. *Ruppellia*, E., *Eriphia*, Lat., *Domœcius*, 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., *Gomeza*, Gray, *Œidia*, 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., *Helœcius*, 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. GRAPSINÆ.—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 pliferâ 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. LEUCOSOIDEA.

1. *Appendices* maris *genitales basi pedum* 5*torum 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 Maioideis.

Fam. I. DROMIDÆ.

G. *Dynomene*, Lat., *Dromia*, Fab., *Latreillia*, Roux, *Homola*, Lh.

Fam. II. CYMOPOLIDÆ.—[An hujus sedis?]

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.

G. *Corystoides*, Lucas, *Bellia*, E.

Subtribus III. RANINIDEA, vel Anomoura Leucosidica.

Carapax oblongus. Via efferens osque uti in *Leucosoideis*.

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 Leucosoideis.

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. *Albunœa*, 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*, Lamarck.

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 Maioideis. 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 1mis anteriores. Antennæ 2dæ oculis posteriores et exteriores. Abdomen elongatum, vix inflexum, appendicibus caudalibus instructum, sæpe appendicibus quoque ventralibus.

SUBTRIBUS VII. PAGURIDEA, vel ANOMOURA MAIIDICA 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, *feminæ* 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 feminœ*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 thoracicis instructæ tantum.

Fam. I. GEBIDÆ.—Maxillipedes externi pediformes. Appendices caudales et aliæ abdominales latæ.

G. *Gebia*, Lh., *Axius*, Lh., *Calocaris*, Bell, *Laomedia*, De H., *Glaucothoe*, E.

Fam. II. CALLIANASSIDÆ.—Maxillipedes externi operculiformes. Appendices caudales latæ.

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 longitudinalibus 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 cephalothoracis utrinque tenui, carapace lateraliter subito inflexo. Antennæ 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 dilatatâ. 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 antici chelati, 2di 1mis crassiores, carpis nullis annulatis. Pedes nulli palpigeri.—G. *Pontonia*, Lat., D., *Œdipus*, D., *Harpilius*, D., *Anchistia*, D. (An *Periclimeni* Costæ similis?) *Palæmonella*, D., *Palæmon*, Fab., *Hymenocera*, Lat., *Cryphiops*, D. [Hîc *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. =

[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 antici 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 3tiique 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 3tiique non chelati, 1mi maxillipedesque externi monodactyli et subprehensiles.

G. *Eucopia*, D.

Ordo II. ANOMOBRANCHIATA.

Tribus I. MYSIDEA.

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., *Loxopis*, 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., *Calyptopis*, D., *Zoea*. Bosc.

Tribus II. AMPHIONIDEA.

Fam. I. AMPHIONIDÆ.

G. *Phyllosoma*, Leach, *Amphion*, Edw.

Tribus III. SQUILLOIDEA.

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.

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 laxe 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., *Olencira*, 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. CIROLANINÆ.—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. *Nesœa*, 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 styliformes, subterminales, interdum obsoletæ.

Fam. I. TANAIDÆ.—Pedes 1mi 2dive subchelati, sequentes non ancorales. Abdomen paribus 5 appendicum subnatatoriis unoque postico stylorum instructum.

1. TANAINÆ.—Corpus lineare, segmento thoracis 1mo sæpe oblongo capiteque parvulo. Styli caudales longi. G. *Tanais*, E., *Paratanais*, D., *Leptochelia*, D., *Apseudes*, Lh., *Rhœa*, E.
2. LIRIOPINÆ.—Corpus antice latius, postice sensim angustans, segmento thoracis 1mo 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 1mo 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 *feminæ* appendicibus branchialibus carens. G. *Bopyrus*, Lat., *Phryxus*, Rathke, *Cepon*, Duv., *Dajus*, Kr.
2. Ioninæ.—Pedes thoracis *feminæ* 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 parisiticæ.]

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., *Siphonœcetes*, 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 basique sat brevi instructæ. Styli caudales ac in *Corophinis*.—G. *Icilius*, D., *Pterygocera*, 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 subdepressum, 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 permagnæ.—G. *Stegocephalus*, Kr.
2. Lysianassinæ.—Antennæ breves, superiores basi crassæ. Mandibulæ apice parce dentatæ et acuminatæ, acie vix instructæ, palpo 2–3-articulato. Maxillipedes 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 perbrevibus*. Mandibulæ sive palpigeræ sive non palpigeræ, processu molari carentes (An semper?). Epimeræ magnæ.—G. *Stenothoe*, D., *Leucothoe*, Lh.

[An hujus sedis, genus *Michrocheles*, Kr., et *Amphithoe marionis*, Edw.?]

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.—G. *Acanthonotus*, Owen, *Alibrotus*, E., *Leptochirus*, Zad., *Iphimedia*, Rath., D., *Œdicerus*, 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., *Metœcus*, 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 1mo operculiformi, interdum longitudine mediocres.

1. Typhinæ.—Abdomen in ventrem se flectens.—G. *Dithyrus*, D., *Typhis*, R. *Thyropus*, D.
2. Pronoinæ.—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 1mis 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 palpigeræ. Pedes 1mi nunquam prehensiles.

1. Calaninæ.—Oculi inferiores nulli. Antennæ 1mæ 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 1mæ 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 1mi plus minusve subprehensiles.

1. Cyclopinæ.—Sacculi ovigeri externi duo.—G. *Cyclops*.
2. Harpacticinæ.—Sacculus oviger unicus.—G. *Harpacticus*, Edw., *Clytemnestra*, D., *Canthocamptus*, 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 1mi sæpius subprehensiles.

1. Corycæinæ.—Sacculi ovigeri duo.—G. *Corycœus*, D., *Antaria*, D., *Sapphirina*, Thompson.
2. Miracinæ.—Sacculus ovigerus 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 biramеæ, 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., *Conchœcia*, 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. PŒCILOPODA.

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. *Nicothoe*, 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 ore 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, *Lerneonema*, Edw.
2. Lerneocerinæ.—Pedes omnino obsoleti.—G. *Lerneocera*, Bl., *Lernea*.

Subordo II. ARACHNOPODA vel PYCNOGONOIDEA.

Fam. I. NYMPHIDÆ.—Antennis munitæ.

G. *Nymphum*, Fabr., *Ammothea*, Lh., *Pallene*, J., *Phoxichilidium*, J.

Fam. II. PYCNOGONIDÆ.—Antennis carentes.

G. *Pycnogonum*, Brunnich, *Phoxichilus*, Lat.

Subclassis IV. CIRRIPEDIA.

Subclassis V. ROTATORIA.

APPENDIX.

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.

Etyœa, 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 acuminated; 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, Cancrinos, 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, *Halicyne*, 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 *isotheral* 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 κρυμος, *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 overlie 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 Fakaafo, 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°

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, 49½° 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 55½° to 60¼° 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 49½° 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 temperature increases two to four degrees. In July, Fitzroy carried a temperature above 68° as far south as 33° 16′ south, longitude 50° 10′ west, the water giving at this time 68½° to 69½° 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 68½° 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 54½° 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° 36′ west. But on July 10 and 13, 1833, at Montevideo, the sea-temperature was 46½° to 47½°, 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° 5′ south, 49° 23′ west, on April 14, it was 66·2° F., and farther south, in 37° 42′ south, 53° 28′ west, April 30, it was 64·4° F.; and in 39° 19′ south, 54° 32′ west, on May 1, it was 57¾° F.; but a little to the westward, on May 2, in 40° 30′ south, 56° 54′ west, the temperature was 48° F., an abrupt transition to the colder shore waters. Beechey, in 39° 31′ south, 45° 13′ west, on August 28 (last of winter), found the temperature 57·25° F., and on the 29th, in 40° 27′ south, 45° 46′ west, it was 54·20°; while on the next day, in 42° 27′ south, and 45° 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° 43′ south, 15° 51′ east, found the temperature 56° F.; while on the 22d, in the same latitude, and 14° 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° 4′ south, and 15° 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) 48½° to 50° F. But during the voyage from the La Plata to Rio Negro, a few days before, a temperature of 44½° 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 47½° 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° 31′ south, and longitude 8° 8′ east, the temperature was down to 34·3° F., and in 50° 18′ south, 7° 15′ east, it was 37° F.; March 20, in 54° 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 7½° 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 (83½°) 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 Fakaafo, 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 83½° F.; on May 2d, at 5° north, longitude 174° east, 83½° 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° 4′ to 16° 15′ north, 132° 40′ to 135° west; and farther west, in the same latitude, longitude 141° 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° 16′ north, 109° 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° 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 22½°, in longitude 115° west. In 23° 56′ north, 128° 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 68½° F.; in 16° 22′

north, 108° 11′ east, on January 24, it was 67°; in 12° 16′ north, 109° 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 Niphon, 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° 42′ north, 126° 37′ west, the temperature 62·75° F.; while on the preceding day, 32° 42′ north, 125° 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 Niphon, in 41° north and 142½° east, was 44° F., in March, showing the influence of the cold Polar current; and in 42° north, and 149½° 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° 50′ north, 151° east, the sea-temperature was 41° F.; in 44° 50′ north, 152° 10′ east, 39° F.; in 46° 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° 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 70½° to 73½° F., and at the Puna anchorage, August 5 to 12, 74·7° to 75·2° F. But off the coast, August 15, in 2° 22′ south, 81° 42′ west, the temperature was 69·8° F.; and the next day, in 1° 25′ south, 84° 12′ west, it was 70° F.; on the 17th, 1° south, 87° 42′ west, it was 71·28° F.; and on the 14th, nearer the shore of Guayaquil, in 3° 18′ south, 80° 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 60·8° to 61½° 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 58½° 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° 58′ north, and 79° 42′ west, and on the 15th, found 68½° 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 83·58° 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°, 70·5°, 72·5°, 73·5°, 74°; and beyond this, 75½°, 76½°, 77½° F., the last on November 8, in 14° 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.	$78\frac{1}{2}$	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.	$77\frac{3}{4}$	71	Clear and fine.
19	19 57	170 47	S.	76	75	Cloudy.
20	20 21	169 11	S. by E.	$76\frac{1}{4}$	74	"
21	20 16	167 21	S. by E.	$76\frac{1}{2}$	72	"
22	20 18	167 03	Var.	76	74	Clear.
23	21 09	166 37	S.	$74\frac{3}{4}$	76	Dark.
24	20 46	164 29	S.	75	75	Cloudy.
25	26 30	163 33	S.	76	$74\frac{1}{2}$	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	$71\frac{1}{2}$	"
16	22 37	159 05	Var.	71	71	At Mangaia.
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.

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.

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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 27	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 28	84 55	N.W.	56	56	"
9	34 14	82 08	N.W.	54	56	"
10	34 06	74 25	Var.	57	57	"
11	34 03	73 06	S.W.	57	56	Fine.
12	34 48	72 10	N.N.E.	57	57	"
13	33 39	72 40	N.	56	57	"
14	33 33	72 50	N.W.	56	57	"
15	33 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° 33′ south, 47° 17′ east, on August 4th, Vaillant found the temperature 69·26° F.; and in 29° 34′ south, 46° 46′ east, the temperature of 67·84° F.; off South Africa, August 12, in 34° 42′ south, 27° 25′ east, the temperature 63·5° F.; on August 14, in 35° 41′ south, 22° 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 Berghaus. 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° 39′ north, 91° 58′ west (of Greenwich), to 81·9° F., in August 31, 11° 15′ north, 107° 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), 82½° 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 26½° (?) south.

B. Indian Ocean.—6. Coast of Persia, India, Malacca, Siam, and Cochin China, to 12½° 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 17½° 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 14½° 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 26½° 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 26½° (?) south.

D. North Pacific Ocean.—11. Coast of Cochin China, between 12½° 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 17½° north.

E. South Pacific.—14. A small part of the coast of Eastern Australia, between 25° south and 26½° 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 Niphon, 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 Niphon 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 Niphon, 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 2½ 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 2½°, the second, from 2½ degrees to 5 degrees, and so on.

2½° . .	809,824	32½° . .	692,424
5° . .	808,200	35° . .	673,440
7½° . .	805,124	37½° . .	653,172
10° . .	800,512	40° . .	631,656
12½° . .	794,368	42½° . .	608,944
15° . .	786,728	45° . .	585,064
17½° . .	777,580	47½° . .	560,320
20° . .	766,952	50° . .	534,032
22½° . .	754,868	52½° . .	506,960
25° . .	740,544	55° . .	478,924
27½° . .	726,408	57½° . .	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 Niphon, 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 Niphon, 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°–64½°.
Rio Negro, 46°–60°.
Fuegia, 36°–56°.
Falklands, 37°–50°.
Chiloe, 48°–56½°
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 Cocoanut Palm as well as for coral-reefs, and the Torrid zone of oceanic temperature, might hence be called the *Cocoanut-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.
Corbula nucleus, . .	3–80	5–50	5–25	8–20	7–80	6–50	8–35
Neæra cuspidata, . .	10–80	50	20	45*	12–185	. . .	. . .
Thracia phaseolina, .	0–80?	3–30	. . . .	. . . .	7–30	. . .	. . .
Solen pellucidus, . .	7–100	5–50	. . . .	40	. . .	. . .	35
Psammobia ferroensis,	3–90	5–50	. . . .	8*	20–40	. . .	10
Tellina donacina, . .	1–80	5–40	. . . .	. . . .	7–45	. . .	10
Mactra subtruncata, .	0–12	0–20?	5–10	. . . .	. . .	. . .	6
Lutraria elliptica, . .	0–10	0–20	Low water.	. . .	. . .	. . .	. . .
Cytherea chione, . .	. . . .	10–20?	. . . .	8	7–10	6–15	. . .
Venus ovata, ...	5–100	7–50	8	6–40	29–135	6–40	6–35
Venus fasciata, . . .	5–90	7–50	8	8	27–40	6–50	6–35
Venus verrucosa, . .	. . . .	0–10	5	6	2–40	6–15	6
Artemis lincta, . . .	0–80	5–50	Low water.	6	. . .	6–15	6–8
Cardium echinatum, .	5–100	5–50	Littoral.	. . . .	7–50	. . .	. . .
Lucina flexuosa, . .	3–100	5–50	4	. . . .	7–11	. . .	. . .
Lucina spinifera, . .	10–100	15–30?	10–12	15–25	4–30	6–40	35
Kellia suborbicularis,	0–90	10–40	8	. . . .	29–45	35–50	. . .
Modiola tulipa, . . .	10–50	5–25	12	10–25	2–50	. . .	35
Modiola barbata, . .	. . . .	2–15	. . . .	. . . .	7–95	6–15	6–8
Arca tetragona, . . .	10–60	20–30	8*	30	20–80	35–50	35
Arca lactea, ...	. . . .	10–50	. . .	12–20	0–150	. . .	6–35
Pectunculus glycerimis,	5–80	5–50	8–12	30	6–24	. . .	35
Nucula nitida, . . .	5–60	5–30	20–25	12–40	. . .	6–15	6–8
Nucula nucleus, . .	5–100	5–50	5–25	6–20	2–10	6–40	6–35
Lima subauriculata, .	4–100	15–30	. . . .	35	15–30	. . .	35
Pecten similis, . . .	2–80	20–50	20*	. . . .	27–185	. . .	35
Pecten maximus, . .	2–40	10–30	8	4–25	. . .	35–50	6–8
Pecten opercularis, .	2–100	5–50	8–20	20–40	10–70	. . .	35
Pecten varius, . . .	3–20	3–30	8	8	7–55	6–15	35
Anomia ephippium, .	0–80	0–50	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 Tetradecapoda.

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.					3					
Inachus, ...	1		1	1	3		3 (1 *c*)		6	
Microrhynchus, . .				2					2	
3. SALACINÆ.										
Salacia, ...						1			1	
II. MAIIDÆ.										
1. LIBININÆ.										
Doclea, ...	4	1(*a*)	4		1				1	
Libidoclea, ...						1		1	2	
Libinia, ...		2	2	2 (1 *b*)	1	2 (1 *b*)	1 (*c*)	1 (*c*)	4	
2. MAIINÆ.										
Maia, ...	1	2 (1 *a*)	2	1	2 (1 *c*)		1 (*c*)	1?	3	
3. PISINÆ.										
Paramithrax, . . .	1	1(*a*)	1		1?	2 (?*f*)		1 (*e*)	4	
Pisa, ...	3	3 (1 *a*)	5	5	4 (2 *c*)		2 (1 *c*)		7	
Pelia, ...				1					1	
Lissa, ...					1				1	
Rhodia, ...				1					1	
Hyas, ...		1	1				2	2 (1 *f*)	3	1 (*f*)
Pisoides, ...				1		1 (*c*)			1	
Herbstia, ...				2	1 (1 *c*)	1			3	
Thoe, ...				1					1	
Dehaanius, ...			1?						1	
4. PRIONORHYNCHINÆ.										
Prionorhynchus, . .			1?							
5. MICIPPINÆ.										
Micippa, ...	4	2 (1 *a*)	5							
6. CHORININÆ.										
Chorinus, } Chorilia, }	6	2 (1 *a*)	7				1		1	
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 (4 *a*)	9	2 (1 *a*)	2 (2 *a*)				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	(1 *a*)	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 (2 *e*)	4 (+1?)	
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 (1 *a*?)		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 (2 *a*)	5	1						
Tiarinia,	5	1	6							
Perinea,		1	1							
Halimus,	2		2		1				1	
Pugettia,					1			1	2	
3. MENÆTHINÆ.										
Menæthius,	5	6 (2 *a*)	9							
Acanthonyx,	2	5 (1 *a*)	6	1 (*a*)	2				3	
Antilibinia,		1	1							
Peltinia,	1	1	2							
4. STENOCIONOPINÆ.										
Stenocionops,		1	1							
5. EPIALTINÆ.										
Epialtus,		3	3	1 (*b*)		4 (1 *b*)			5	
Huenia,	2	3 (1 *a*)	4							
Xenocarcinus,		1	1							
Leucippa,		1	1			1	1		2	
II. PARTHENOPINEA.										
I. PARTHENOPIDÆ.										
Parthenope,	3	1 (*a*)	3							
Lambrus,	13	5 (1 *a*)	17		3				3	
Eurynome,					1	1 (? *d*)	1		3	
II. EUMEDONIDÆ.										
Eumedonus,	1 (? *b*)		1							
Ceratocarcinus,	3		3							
? Gonatonotus,	1		1							
? Zebrida,	1		1							
? Harrovia,	1		1							
III. CRYPTOPODIDÆ.										
Cryptopodia,	2		2	1					1	
Eurynolambrus,						1			1	
III. ONCININEA.										
Oncinopus,	2		2							

2. CANCROIDEA.

	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. CANCRINEA.										
I. CANCRIDÆ.										
Cancer, ...				1		7	2 (1 *c*)	3 (1 *c*, 1 *f*)	10	1
Perimela, ...					1		1 (*d*)		1	
II. XANTHIDÆ.										
1. Xanthinæ.										
Atergatis, ...	14	7 (4 *a*)	17							
Carpilius, ...	5	11 (3 *a*)	13							
Liomera, ...	1		1							
Liagora, ...		1 (? *c*)								
Actæa, ...	6	7 (? 3 *a*)	12 (? 2)	1 (*b*)	1 (*b*)				1	
Xantho, ...	12	10 (2 *a*)	20	2	4 (2 *a*, *c*)	3	2 (3 *c*, *d*)		8	
Paraxanthus, . . .						2			2	
Menippe, ...	2	4 (1 *a*)	5	2 (1 *b*)					2	
Panopeus, ...	3	3	6	3 (2 *b*)	1 (*b*)	1	2 (2 *b*)		4	
Medæus, ...		1	1							
Halimede, ...		2	2							
2. Chlorodinæ.										
Etisus, ...	2 (+1 ?)	1	4 (? 1)							
Etisodes, ...	2		2							
Carpilodes, ...	1		1							
Zozymus.	3	1 (? +1)	4 (? 1)							
Actæodes, ...	8	2	10							
Daïra, ...	1	1 (*a*)	1							
Chlorodius, ...	13	10 (4 *a*)	19							
Pilodius, ...	4		4							
Cyclodius, ...	2		2							
Cymo, ...	2		2							
3. Polydectinæ.										
Polydectus, ...	2 (? +1)		3 (? 1)							
III. ERIPHIDÆ.										
1. Œthrinæ.										
Œthra, ...	1	1 (*a*)	1							
2. Ozinæ.										
Galene, ...		2 (? —1)	2 (? —1)							
Ozius, ...	2		2		2	2 (1 *d*)			3	
Pseudozius, ...	2	1	3							
Pilumnus, ...	11	4 (? +7)	15 (? +7)	2	3		1 (*d*)	1	7	
Pilumnoides, . . .						1			1	
Melia, ...	1	1 (*a*)	1							
? Acanthodes, ...				1 (? *d*)					1	
3. Actumninæ.										
Actumnus, ...	1	1	2							
4. Eriphinæ.										
Ruppellia, ...	1	1	2							
Eriphia, ...	2		2	1	1 (*c*)		1		2	
Domæcius, ...	1		1							
Trapezia, ...	9	5 (4 *a*)	10							
Tetralia, ...	3		3							
Quadrella, ...	1		1							
IV. PORTUNIDÆ.										
1. Lupinæ.										
Scylla, ...	1 (+1 ?)	1 (*a*)	1 (? +1)							
Lupa, ...	5	5 (2 *a*)	8	4 (2 *b*)			1 (*b*)	1 (*b*)	4	
Amphitrite, ...	8	7 (2 *a*)	13	1	1 (*c*)				1	
Carupa, ...	1		1							
Thalamita, ...	7	7 (3 *a*)	11	1 (*a*)					1	
Charybdis, ...	11	11 (7 *a*)	15							
Lissocarcinus, . . .	2		2							
2. Arenæinæ.										
Arenæus, ...	1	1 (*a*)	1	1 (*a*)					1	
3. Portuninæ.		?		2 (? +5)	9 (2 *c*)	2 (1 *d*)	12 (8 *c*, *d*)	2 (*d*, *f*)	14	1
V. PLATYONYCHIDÆ										
Carcinus, ...				1		1			2	1
Portumnus, ...					1		1 (*d*)			
Platyonychus, . . .	1 ?	2 (? —1)	2 (? —1)		1	2	1 (*b*)	1 (*b*)	5	
Polybius, ...										

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. PODOPHTHALMIDÆ.										
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, ...		2	2					1	1	
Curtonotus, ...	1	2 (1 *a*)	2							
Gonoplax, ...				1	2 (1 *c*)	1	1 (*d*)		2	
II. MACROPHTHALMIDÆ.										
1. MACROPHTHALMINÆ.										
Cleistostoma, . . .	2	5 (2 *a*)	5							
Macrophthalmus, . .	7	5 (?+1)	12							
2. OCYPODINÆ.										
Gelasimus, ...	10	9 (3 *a*)	16	3 (*b*)		2	1 (*b*)	1 (*b*)	5	
Helœcius, ...						2			2	
Ocypoda, ...	8	7 (2 *a*)	13	1 (*b*)		2 (1 *a*)			3	
Scopimera, ...		1	1							
3. DOTINÆ.										
Doto, ...	1	1 (*a*)	1							
III. GRAPSIDÆ.										
1. GRAPSINÆ.										
Pseudograpsus, . .	1?		1					2	2	
Heterograpsus, . .					1				1	
Brachynotus, . . .					1				1	
*Eriocheir, ...	1	2	3							
*Platynotus, ...		1	1							
Trichopus, ...	1	1 (*a*)	1							
Grapsus, ...	5	5 (3 *a*)	7	3 (3 *a*, *b*)	1 (*a*)	2 (1 *a*)			5	
Goniograpsus, . . .	2	8 (2 *a*)	8	2 (2 *a*, *b*)	2 (1 *b*)		1 (*b*)		3	
Planes, ...		2	2	2 (1 *b*)	1 (*b*)				2	
Hemigrapsus, . . .		4 (?+1)	4		2 (? *e*)	2	1		5	
Cyrtograpsus, . . .							1		1	
2. SESARMINÆ.										
Sesarma, ...	9	11 (3 *a*)	17	3 (2 *b*)		1 (*b*)	1 (*b*)		3	
Sarmatium, ...	1		1							
Cyclograpsus, . . .	2	3	5			1 (?+1 *a*)			1	
Chasmagnathus, . .	1	2 (1 *a*)	2			2			2	
Helice, ...		1?	1							
3. PLAGUSINÆ.										
Acanthopus, . . .	2	1 (*a*)	2	1 (*a*)	1 (*a*)	1 (*a*)			1	
Plagusia, ...	3	3 (1 *a*)	5	1 (*a*)	1 (*a*)	2 (1 *a*)			3	
IV. GECARCINIDÆ.										
1. UCAINÆ.										
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.
Gecarcinicus, . .	1		1							
Cardisoma, ...	4	2 (2 *a*)	4							
Gecarcoidea, ...		1 (? *a*)	1							
2. GECARCININÆ.										
Gecarcinus, ...	2	1 (?)	2			2			2	
V. PINNOTHERIDÆ.										
1. PINNOTHERINÆ.										
Pinnothera, ...	2	3 (1 *a*)	4	3 (1 *b*)	2	1	4 (4 *c*, *d*)	2 (1 *d*)	7	
Fabia, ...						1		1	2	
Xenophthalmus, . .	1		1							
Xanthasia, ...	1		1							
Pinnixa, ...				1		1			2	
Pinnotherelia, . . .						1			1	
2. HYMENICINÆ.										
Hymenosoma, . . .						1			1	
Halicarcinus, . . .						2		2 (1 *e*)	3	
Hymenicus, ...						2			2	
Elamena, ...	1	2 (*a*)	2							
VI. MYCTIRIDÆ.										
Myctiris, ...	1	(1 *a*)	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 (6 *a*)	7	2 (1 *a*)	1 (*c*)				2	
Platymera, ...						1			1	
Mursia, ...	1	2 (1 *a*)	2							
Cycloes, ...		1	1	1					1	
2. ORITHYINÆ.										
Orithyia, ...	1		1							
II. MATUTIDÆ.										
Hepatus, ...	1	2 (1 *a*)	2	1		1			2	
Thealia, ...	1		1							
Matuta, ...	2	2 (2 *a*)	2							
III. LEUCOSIDÆ.										
Leucosia, ...	3	4	7			1			1	
Philyra, ...	2	2	4	1					1	
Leucisca, ...		1?	1							
Ebalia, ...					3	1?	3	2 (1 *f*)	8	
Nucia, ...		1	1							
Nursia, ...	1	2 (1 *a*)	2							
Ilia, ...				1	2 (1 *c*)				2	
Myra, ...	1	2 (1 *a*)	2							
Guaia, ...	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 (4 *a*)	4	4 (2 *a*)	2 (1 *c*)				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. TRICHOCERIDÆ.										
Trichocera,	1	1 (? *c*)	1 (?+1)					1	1	
II. THIIDÆ.										
Thia,					1		1 (*d*)		2	
Kraussia,		2 (?+1)	2							
III. CORYSTIDÆ.										
Telmessus,							1		1	
Atelecyclus,				1		1	3 (1 *c*)	2 (2 *f*)	4	
Peltarion,								1	1	
Pseudocorystes,						1			1	
Gomeza,	1		1					1	1	
Œidia,		1?	1?							
Corystes,				1?	1		1 (*d*)	1 (*d*)	3 (?+1)	
Dicera,					2?				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. MAIINEA, . . .	82	57	122	35	27	21	16	14	92 (9)	
I. MAIOIDEA, . .	57	50	92	22	23	19	15	14	84 (9)	
1. INACHIDÆ, ...	1		1	3	4	1	4		10	
Macrocheirinæ, . .							1	1 (*f*)	1	
Inachinæ, ...	1		1	3	3		3 (1 *c*)		8	
Salacinæ, ...						1			1	
2. MAIIDÆ, ...	21	16 (5 *a*)	32	18	10	7	8	6	38 (2)	
Libininæ, ...	4	3 (1 *a*)	6	2 (1 *b*)	2	3 (1 *b*?)	1 (*c*)	2 (1 *c*)	7	
Maiinæ, ...	1	2 (1 *a*)	2	1	1		1 (*c*)	1?	3	
Pisinæ, ...	4	5 (2 *a*)	7	11 (?+1)	7 (3 *c*)	4 (1 *c*)	4 (2 *c*, *d*)	3 (2 *e*, *f*)	23 (2)	1
Prionorhynchinæ, . .			1?							
Micippinæ, ...	4	2 (1 *a*)	5							
Chorininæ, ...	8	4 (1 *a*)	11	1?			2		3	
Othoninæ, ...				2					2	
3. MITHRACIDÆ, ...	10	5	11	4	1	1			6 (3)	
Mithracinæ, ...	9	5 (4 *a*)	10	4 (1 *a*)	2 (1 *a*)				6	
Cyclacinæ, ...	1		1							
4. TYCHIDÆ, ...	3	1	4							
Criocarcininæ, . . .			1?							
Tychinæ, ...	2		2							
Camposcinæ, ...	1	1 (*a*)	1							
5. EURYPODIDÆ, ...						3		6	7	
Eurypodinæ, . . .						2		6 (2 *e*)	6 (+1?)	
Amathinæ, ...						1			1	
6. LEPTOPODIDÆ, ...	1		1	4	3	2	2	1	8 (1)	
Acheinæ, ...				1?	1		1 (*d*)		2 (?1)	
Inachoidinæ, . . .						1				
Leptopodinæ, . . .	1		1	3 (1 *a*?)		1 (*a*?)			3	
Stenorhynchinæ, . .					2		1 (*d*)	1 (*d*)	2	
7. PERICERIDÆ, ...	21	28	43	3	5	5	1	1	15 (3)	1
Paramicippinæ, . .	1		1		1				1	
Pericerinæ, ...	11	5 (2 *a*)	14	1	2			1	4	
Menæthinæ, ...	8	13 (3 *a*)	18	1 (*a*)	2				3	
Stenocionopinæ, . .		1	1							
Epialtinæ, ...	2	8 (1 *a*)	9	1 (*b*)		5 (1 *b*)	1		7	
II. PARTHENOPINEA,	23	7	28	1	4	2	1		8	
1. PARTHENOPIDÆ, ...	16	6 (2 *a*)	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. CANCRIDÆ, ...				1	1	7	3 (2 *c*, *d*)	3 (2 *c*, *f*)	11	
2. XANTHIDÆ, ...	83	61	129	8	6	6	5 (5 *b*, *d*)		16	
Xanthinæ, ...	43	44 (9 *a*)	77	8 (4 *b*)	6 (4 *a*, *b*)	7 (1 *c*)	5 (5 *b*, *c*, *d*)		16 (5)	
Chlorodinæ, ...	40	12 (4 *a*)	49							
Polydectinæ, ...	2 (? +1)		3							
3. ERIPHIDÆ, ...	35	16	44	4	6	4	2	1	14	
Œthrinæ, ...	1	1 (*a*)	1							
Ozinæ, ...	16	8 (?+7, 1 *a*)	23 (?+7)	3 (?—1)	5	4 (2 *d*)	1 (*d*)	1	12 (2)	
Actumninæ, ...	1	1	2							
Eriphinæ, ...	17	5 (4 *a*)	18	1	1 (*c*)		1		2	
4. PORTUNIDÆ, ...	36	32	52	8	10	2	13	3	21	
Lupinæ, ...	35	31 (15 *a*)	51	6 (3 *a*, *b*)	1 (*c*)		1 (*b*)	1 (*b*)	6 (3)	
Arenæinæ, ...	1	1 (*a*)	1	1 (*a*)					1 (1)	
Portuninæ, ...				2 (?+5)	9 (2 *c*)	2 (1 *d*)	12 (8 *c*, *d*, *e*)	2 (*d*, *f*)	14	
5. PLATYONYCHIDÆ, . . .	1	2 (?—1)	2 (?—1)	1	2	4	2 (2 *b*, *d*)	1 (*b*)	7 (1)	
6. PODOPHTHALMIDÆ, . . .	2	1 (*a*)	2							
III. GRAPSOIDEA, .	72	88	131	21	14	27	10	9	63 (8)	
1. GONOPLACIDÆ, ...	1	4 (1 *a*)	4	1	2 (1 *c*)		1 (*d*)	1	3	
2. MACROPHTHALMIDÆ, . .	28	28	48	4		4	1	1	10	
Macrophthalminæ, .	9	10 (2 *a*)	17							
Ocypodinæ, ...	18	17 (5 *a*)	30	4 (2 *b*)		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 (6 *a*)	27	7 (6 *a*, *b*)	8 (2 *a*, *b*)	4 (1 *a*)	3 (1 *b*)	2	20	
Sesarminæ, ...	13	17 (4 *a*)	26	3 (2 *b*)		4 (1 *b*)	1 (*b*)		6	
Plagusinæ, ...	5	4 (2 *a*)	7	2 (2 *a*)	2 (2 *a*)	3 (1 *a*)			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	
Ucainæ, ...	7	5 (4 *a*)	8							
Gecarcininæ, . . .	2	1 (?)	2			2			2	
5. PINNOTHERIDÆ, . . .	5	5	8	4	2	9	4	5	17	
Pinnotherinæ, . . .	4	3 (1 *a*)	6	4 (1 *b*)	2	4	4 (4 *c*, *d*)	3 (1 *d*)	11	
Hymenicinæ, . . .	2	1 (*a*)	2			5		2 (1 *e*)	6	
6. MYCTIRIDÆ, ...	1	1 (*a*)	1			1			1	
IV. LEUCOSOIDEA, .	35	33	48	11	8	5	3	2	24 (5)	
1. CALAPPIDÆ, ...	8	10	11	3 (1 *a*)	1	1			4	
Calappinæ, ...	7	10 (7 *a*)	10	3 (1 *a*)	1 (*c*)	1			4	
Orithyinæ, ...	1		1							
2. MATUTIDÆ, ...	4	4 (3 *a*)	5	1		1			2	
3. LEUCOSIDÆ, ...	19	15 (3 *a*)	28	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. TRICHOCERIDÆ, . . .	1	1 (? *c*)	1 (?+1)					1	1	
2. THIIDÆ, ...		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.
Maioidea, ...	82	57	122	35	27	21	16	14	92	3 (2)
Cancroidea, ...	157	112	229	22	25	23	25	8	69	3 (3)
Grapsoidea, ...	72	88	131	21	14	27	10	9	63	
Leucosoidea, ...	35	33	48	11	8	5	3	2	24	
Corystoidea, ...	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 *Chionœcetes opilio*. And *Stenorhynchus phalangium*, *Hyas araneus*, *Portunus pusillus*, *Carcinus mœnas*, 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. Maioidea,	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 Maioidea 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 Maioidea 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 *Libininæ, Maiinæ, Pisinæ, Othoninæ,*	15	35
3. Eurypodidæ,	0	7
4. Leptopodidæ,	1	8
	17	60

2. TORRID ZONE SECTION.

	Torrid.	Temperate.
1. Maiidæ, subfamilies *Micippinæ, Chorininæ, Pyrinæ*, .	16	3
2. Mithracidæ, ...	11	6
3. Tychidæ, ...	4	0
4. Periceridæ, ...	43	14
5. Parthenopinea, ...	28	8
6. Oncininea, ...	2	0
	104	31

II. CANCROIDEA.

1. TEMPERATE ZONE SECTION.

	Torrid.	Temperate.
Cancridæ, ...	0	11
Platyonychidæ, ...	2	7
Portunidæ, subfamily *Portuninæ*, ...	0	15
Cyclinea, ...	0	1
	2	34

2. TORRID ZONE SECTION.

	Torrid.	Temperate.
Xanthidæ, ...	129	16
Eriphidæ, ...	44	12
Portunidæ, excluding the *Portuninæ*, ...	52	7
Podophthalmidæ, ...	2	0
	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 Maioidea 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 Pericerae: 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 acuminated 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 Maioidea 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 Maioidea and Cancroidea 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 Ebalia,	0	8
" Ilia,	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 proportion 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.

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*)		2	
Latreillia,				1	2				3	
Homola,				1	2 (1 *c*)				2	
2. CYMOPOLIDÆ.										
Cymopolia,	1		1		1				1	
Caphyra,	2		2							
II. BELLIDEA.										
Corystoides,						1			1	
Bellia,						1			1	
III. RANINIDEA.										
Raninoides,	1		1							
Ranina,	1	1 (*a*)	1							
Ranilia,		1	1							
Notopus,					1				1	
Lyreidus,					1				1	
Cosmonotus,	1		1							
IV. HIPPIDEA.										
Albunæa,	2	1	3	3 (2 *a*)	2 (2 *a*,*c*)				3	
Albunhippa,					2				2	
Remipes,	5	1 (*a*)	5	1 (*a*)					1	
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 *c*,*d*)	1 (*c*)	20	
VI. LITHODEA.										
Lithodes,							2	7 (2 *f*)	7	2 (2 *g*)
Lomis,						2 ?			2	
Echidnocerus,							1		1	
VII. PAGURIDEA.										
1. PAGURIDÆ.										
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.										
Cancellus,			1 ?							
2. CENOBITIDÆ.										
Cenobita,	8	6 (5 *a*)	9		1				1	
Birgus,	1	1 (*a*)	1							
VIII. ÆGLEIDEA.										
Æglea,						2			2	
IX. GALATHEIDEA.										
Galathea,	4	1	5	1	2 (1 *c*)	1	3 (2 *c*,*e*)	1 (*f*)	4	
Munida,							1	2 (1 *f*)	2	
Grimothea,							1	1 (*f*)	1	
MEGALOPIDEA.										
Marestia,	2		2	1			1		2	
Monolepis,	1		1			1			1	
Megalopa,							2		2	
Cyllene,	1		1			1			1	
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 (1 c)	2	1	7	
Axius,							1		1	
Calocaris,								1	1	
Laomedia,				1?					1?	
Glaucothoe,	1?		1?							
II. CALLIANASSIDÆ.										
Callianassa,		1	1	1	2	1	1 (e)	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 (1 a)	5	1 (b)	1 (b)				1	
Arctus,				1	1 (c)				1	
Thenus,	1		1	1 (a)					1	
Parribacus,	2	1 (a)	2							
Ibacus,	1?	1	2							
II. PALINURIDÆ.										
Palinurus,	1	1	2		1	2	1 (d)		3	
Panulirus,	8	8 (4 a)	12			1?			1?	
III. ASTACIDÆ.										
1. Astacinæ.										
Homarus,					1	1	2 (1 d)		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 (3 e)	4 (2 e, f)	12	3 (1 g)
Sabinea,										1
Argis,										1
Paracrangon,								1	1	
2. Lysmatinæ.										
Nika,		2	2		2		2 (1 d)		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 (1 b)	4 (2 b)	1	1 (e)		7	
Betæus,	1		1			3		1	4	
Alope,						1 (? f)			1	
Athanas,					1		1 (d)		1	
Hippolyte,	5	4 (2 a)	7	2	3 (1 c)	6	6 (1 c)	4	18	19
Rhyncocinetes,						1			1	
2. Pandalinæ.										
Pandalus,				1?	1 (? + 1)			2	3 (? + 1)	2 (1 g)
3. Palæmoninæ.										
Pontonia,	3	1	4	1	1				2	
Œdipus,	3		3							
Harpilius,	1		1							
Anchistia,	3		3							

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 Temperate zone.	*h.* Frigid.
Palæmonella, . . .	2		2							
Palæmon, ...	14	20 (2 *a*)	32	5	6 (3 *c*)	7 (2 *b*, *c*)	6 (2 *c*, *e*)	1	18	1
Hymenocera, . . .	1		1							
Cryphiops, ...						1			1	
4. OPHLOPHORINÆ.										
Oplophorus, ...	1		1	1						
Regulus, ...	2		2						1	
IV. PASIPHÆIDÆ.										
Pasiphæa, ...					1		1 (*d*)	1	2	1
IV. PENÆIDEA.										
I. PENÆIDÆ.										
Sicyonia, ...		1 (?+3)	1 (?+3)		2				2	
Penæus, ...	8	9 (3 *a*)	14	3	4		3		9	
Stenopus, ...	2	1 (*a*)	2							
Spongicola, ...		1	1							
II. SERGESTIDÆ.										
Sergestes, ...					1				1	
Acetes, ...	1		1							
? Euphema, ...							1?		1	
III. EUCOPIDÆ.										
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 Temperate 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, ...	8	4	12					1	1	
Alima, ...	6		6							
II. MYSIDEA.								3	3	
I. EUPHAUSIDÆ.								1	1	
Thysanopoda, . . .	1		1							
Euphausia, ...	3		3							
Cyrtopia, ...	2		2							
II. MYSIDÆ.										
1. CYNTHINÆ.										
Cynthia, ...				1				1	2	
2. MYSINÆ.										
Mysis, ...					2		2	2 (1 *f*)	7	2
Promysis, ...	1		1					2	2	
Macromysis, ...		1	1							
Siriella, ...	3		3							
Loxopis, ...	1		1							
3. SCELETININÆ.										
Sceletina, ...	3		3							
Rachitia, ...		1	1							
Myto.										
III. LUCIFERIDÆ.										
Lucifer, ...	3	1	4							
III. AMPHIONIDEA.										
AMPHIONIDÆ.										
Phyllosoma, ...	15	1	16		2				2	
Amphion, ...	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.
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	
Dromidæ, ...	5	7 (3 *a*)	9	3	6 (3 *a–c*)	2 (1 *b*)	1 (*c*)		7	
Cymopolidæ, . . .	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 *d*)	3 (2 *c, d*)	1 (*c*)	20	
Lithodea, ...						1	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*)
Paguridæ, ...	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	
Cenobitidæ, ...	9	7 (6 *a*)	10							
Ægleidea, ...						2			2	
Galatheidea, ...	4	1	5	1	2 (1 *c*)	1	5 (2 *c,e*)	4 (3 *f*)	7	
Megalopidea, ...	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)	29 (2 *g*)
THALASSINIDEA, .	5	1	6	4	3	5 (1 *c*)	4 (1 *e*)	3	17	
Gebidæ, ...	1?		1?	3	1	2 (1 *c*)	3	2	10	
Callianassidæ, . . .		1	1	1	2	2	1 (*e*)	1	6	
Thalassinidæ, . . .	2		2			1			1	
Calliseidæ, ...	2		2							
ASTACIDEA, . .	14	16 (6 *a*)	24	3 (2 *a,b*)	4 (2 *b,c*)	6	5 (2 *d*)	1 (*f*)	14	
Scyllaridæ, ...	5	7 (2 *a*)	10	3 (2 *a,b*)	2 (2 *b,c*)				3	
Palinuridæ, ...	9	9 (4 *a*)	14		1	3	1 (*d*)		4	
Astacidæ (Marine), .					1	3	4 (1 *d*)	1 (*f*)	7	
CARIDEA, . . .	54	48 (4 *a*)	98	13 (?+3)	28 (5 *b,c*)	24 (3 *b,c*)	24 (10 *c,e*)	14 (2 *e,f*)	84	28 (2 *g*)
Crangonidæ, ...		2	2	3 (?+3)	8 (?)	4 (1 *c*)	9 (4 *e*)	5 (2 *e,f*)	21	5 (1 *g*)
Crangoninæ, ...					5 (? 3)	1	7 (3 *e*)	5 (2 *e,f*)	14	5 (1 *g*)
Lysmatinæ, ...		2	2	2?	3	2	2 (1 *e*)		6	
Gnathophyllinæ, . .				1		1 (*c*)			1	
Atyidæ, ...	4	4	8		3				3	
Atyinæ, ...	4	4	8		1				1	
Ephyrinæ, ...					2				2	
Palæmonidæ, ...	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*)
Alpheinæ, ...	20	21 (2 *a*)	39	5 (1 *b*)	8 (2 *b.c*)	12	8 (3 *c–e*)	5	33	19
Pandalinæ, ...				1?	1(?+1)			2	3 (? 1)	2 (1 *g*)
Palæmoninæ, . . .	27	21 (2 *a*)	46	6	7 (3 *c*)		6 (2 *c,e*)	1	21	1
Ophlophorinæ, . . .	3		3	1					1	
Pasiphæidæ, ...					1		1 (*d*)	1	2	1
PENÆIDEA, . .	11	12 (4 *a*)	19	3	5		3 (?+1)		11	1
Penæidæ, ...	10	12 (4 *a*)	18	3	4		3		9	
Sergestidæ, ...	1		1		1		1?		2 (?)	
Eucopidæ, ...										1
ANOMOBRANCHIATA,	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	8 (4 *a,b*)	6 (3 *a–c*)	4 (2 *b,d*)	2 (2 *b,d*)	1(?+1)	16 (9)	2
Squillidæ, ...	13	18 (7 *a*)	24	8 (4 *a,b*)	6 (3 *a–c*)	5 (3 *b,d*)	2 (2 *b,d*)	1?	16 (9)	
Erichthidæ, ...	17	4	21					1	1	
MYSIDEA, . . .	17	3	20	1	2	1	2	9 (1 *f*)	15	2
Euphausidæ, ...	6		6					4	4	
Mysidæ, ...	8	2	10	1	2		2	5 (1 *f*)	11	2
Cynthinæ, ...				1				1	2	
Mysinæ, ...	5	1	6		2		2	4 (1 *f*)	9	2
Sceletininæ, ...	3	1	4							
Luciferidæ, ...	3	1	4							
AMPHIONIDÆ, .	15 (?+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. *Latreillia*,	0	3
Homola,	0	2
Bellidea,	0	2
Raninidea, G. *Notopus*,	0	1
Lyreidus,	0	1
Hippidea, G. *Albunhippa*,	0	2
Lithodea,	0	10
Porcellanidea,	27	20
Paguridæ, G. *Paguristes*,	3	6
Bernhardus,	3	29 {1 torrid and 4 frigid.
Ægleidea,	0	2
Galatheidea, G. *Munida*,	0	2
Grimothea,	0	1
Galathea,	5	4

2. TORRID ZONE SECTION.

	Torrid zone.	Temperate zone.
Dromidæ, G. *Dynomene*,	1	0
Dromia,	8	2 (1 torrid).
Cymopolidæ, G. *Cymopolia*,	1	1
Caphyra,	2	0

		Torrid zone.	Temperate zone.
Raninidea, G.	*Raninoides,*	1	0
	Ranina,	1	0
	Ranilia,	1	0
	Cosmonotus,	1	0
Hippidea, G.	*Albunœa,*	3	3 (2 torrid).
	Remipes,	5	1 (1 torrid).
	Hippa,	2	2 (1 torrid).
Paguridæ, G.	*Diogenes,*	5	2 (2 torrid).
	Pagurus,	14	7 (1 torrid).
	Calcinus,	6	0
	Aniculus,	1	0
	Clibanarius,	19	4
	Cancellus,	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 Temperate and Frigid zones.
Thalassinidea,	6	17
Astacidea,	24	50
Astacidæ,	1	46
Scyllaridæ, G. *Arctus*,	0	1
Palinuridæ, G. *Palinurus*,	2	3
Caridea.		
Crangonidæ,	2	25
Atyidæ, G. *Ephyra*,	0	2
Palæmonidæ.		
Alpheinæ, G. *Betæus*,	1	4
Alope,	0	1
Athanas,	0	1
Hippolyte,	8	37 (19 frigid).
Pandalinæ, G. *Pandalus*,	0	4 (2 frigid).
Palæmoninæ, G. *Cryphiops*,	0	1
Pasiphæidæ, G. *Pasiphæa*,	0	3 (1 frigid).
Penæidea, G. *Eucopia*,	0	1 (1 frigid).

2. TORRID ZONE SECTION.

	Species in the Torrid zone.	Species in the Temperate and Frigid zones.
Astacidea.		
Scyllaridæ, except *Arctus*,	10	2
Palinuridæ, G. *Panulirus*,	12	1
Caridea.		
Atyinæ,	8	1
Palæmonidæ.		
Alpheinæ, G. *Alpheus*,	31	7
Palæmoninæ, G. *Pontonia*,	4	2
Œdipus,	3	0
Harpilius,	1	0
Anchistia,	3	0
Palæmonella,	2	0
Palæmon,	32	19 (1 frigid).
Hymenocera,	1	0
Oplophorinæ,	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, Œdipus, 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 Alphei 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 Callianassa (C. gigas) is at least four and a half inches long, the *C. uncinata* of Chili, five inches, and the *Thalassina 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.
IDOTÆIDEA.										
IDOTÆIDÆ.										
Idotæa, ...	3	1	4	1 (*a*)	10	6	11 (3 *d*, *c*)	3 (1 *e*)	27	9
Edotia, ...								1	1	
Erichsonia, ...		1	1							
Cleantis, ...							1		1	
Epelys, ...						1			1	
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 *c*)	6	2	1 (*f*)	9	
Lygidium, ...							1		1	
Asellidæ.										
Jæra, ...					2	1	2	2 (1 *f*)	6	2
Jæridina, ...										1
Asellus, ...				1	1		2		4	1
Janira, ...							1		1	1 (*f*)
Henopomus, ...										2
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	
Nerocila, ...	1	6	7		1	1	1		3	
Olencira.										
Orozeuktinæ.										
Orozeuktes, ...	1		1							
Ægathoinæ.										
Ægathoa, ...		2 (? *g*)								

* Including Trichoniscus, Porcellio, and Philoscia.

ISOPODA—*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.
ÆGIDÆ.										
ÆGINÆ.										
Æga,	1	1	2	1	1	1	1 (*d*)	2	5	3 (2 *d*, *g*)
Conilera,							1		1	
Rocinela,					2		2	1	5	
Acherusia,					1				1	
Pterelas,						1		1	2	
CIROLANINÆ.										
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 *c*)	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 Temperate.	*d.* Temperate.	*e.* Sub-temperate.	*f.* Cold Temperate.	*g.* Sub-frigid.	Total of Temperate zone.	*h.* Frigid.
I. SEROLIDEA.										
SEROLIDÆ.										
Serolis,						1	1	3 (1 *f*)	4	1
PRANIZIDÆ.										
Praniza,					2		3	1	6	1
Anceus,					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.										
TANAINÆ.										
Tanais,	1	2	3		3	2		1	6	6
Paratanais,	1		1		1				1	
Leptochelia,	1		1		1				1	
Apseudes,							1		1	
Rhœa,					1		1 (*d*)		1	
LIRIOPINÆ.										
Liriope,										
Cryptothir,	1		1							1
CROSSURINÆ.										
Crossurus,										1
BOPYRIDÆ.										
BOPYRINÆ.										
Bopyrus,					1	1 (*d*)	1 (*d*)		1	2
Phryxus,										
Cepon,		1	1							
Dajus,										1
IONINÆ.										
Ione,							1		1	
Argeia,								1	1	

3. AMPHIPODA.

	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.
CAPRELLIDEA.										
CAPRELLIDÆ.										
Proto, ...		1	1				1		1	1
Protella, ...	1		1							
Caprella, ...		5	5	2	1	3	4	6 (1 *f*)	15	4 (2 *f*, *g*)
Ægina, ...	(?) 2		2							2
Cercops, ...										1
Podalirius, . . .										1
CYAMIDÆ.										
Cyamus, ...					1	3	3 (2 *e*)	1 (*e*)	5	
GAMMARIDEA.										
DULICHIDÆ.										
Dulichia, ...										1
CHELURIDÆ.										
Chelura, ...							1		1	
COROPHIDÆ.										
COROPHINÆ.										
Corophium, . . .		(?) 1					1		1	
Siphonœcetes, . .										1
Platophium, . . .		1	1							
Cyrtophium, . .	1		1							
Unciola, ...							1		1	1
Podocerus, . . .							2		2	2
Cratophium, . .	1	1	2							
Cerapus, ...							2	1	3	
Cerapodina, . . .										
Erichthonius, . .							1		1	
Laphystius, . . .										1
ICILINÆ, ...										
Icilius, ...	1		1							
Pterygocera, . . .										
ORCHESTIDÆ.										
Orchestia, ...	2	5	7		4	14	6 (2 *d*, *e*)	4	26	2
Allorchestes, . .	2	3	5	1	2	6 (1 *d*)		1	9	
GAMMARIDÆ.										
STEGOCEPHALINÆ.										
Stegocephalus, . .										1
LYSIANASSINÆ.										
Lysianassa, . . .		2	2		2				2	
Phlias, ...							1 (?)		1	
Opis, ...								1	1	2 (1 *g*)
Uristes, ...										1
Anonyx, ...							1	1	2	11
Urothoe, ...	2		2							
LEUCOTHOINÆ.										
Stenothoe, . . .	1		1							
Leucothoe, . . .	1		1				1		1	2
GAMMARINÆ.										
Acanthonotus, . .							1		1	3
Alibrotus, . . .							2		2	
Leptochirus, . . .							1		1	
Iphimedia, . . .		1	1			3	2	3	8	14
Œdicerus, . . .						1			1	1
Amphithoe, . . .	3	7	10	1	2	2	6	2 (1 *f*)	12	
Gammarus, . . .	8	1	9	2	2	3	12 (1 *d*)	5	23	14 (2 *f*)
Photis, ...										1
Melita, ...						1	1		2	2
Mæra, ...	1	2	3		2		4	1	7	
Dercothoe, . . .	2	1	3							
Pyctilus, ...	2	1	3							
? Pardalisca, . . .										1
Atylus, ...										
Ischyrocerus, . .										2
Microcheles, . . .										1
PONTOPOREINÆ.										
Lepidactylis, . .							1		1	
Pontoporeia, . . .										1
Ampelisca, . . .										1
Protomedia, . . .										1
Aora, ...						1			1	
Phoxus, ...										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.
ISÆINÆ.										
Isæa, ...							1		1	
Anisopus, ...										
HYPERIDEA.										
HYPERIDÆ.										
VIBILINÆ.										
Vibilia, ...	1		1		1				1	
HYPERINÆ.										
Lestrigonus, ...	4		4					1	1	
Tyro, ...		1	1							
Hyperia, ...				1		3	2		6	1
Metœcus, ...										1
Tauria, ...										1
Cyllopus, ...								1	1	
Dairilia, ...	4		4							
Cystisoma, ...						1?			1?	
SYNOPINÆ.										
Synopia, ...	2		2							
PHRONIMIDÆ.										
PHRONIMINÆ.										
Phronima, ...	1		1		1			1 (*d*)	1	
Primno, ...						1			1	
PHROSININÆ.										
Anchylomera, . . .	1	3	4	1					1	
Phrosina, ...					2				2	
Themisto, ...								1	1	3
PHORCINÆ.										
Phorcus, ...	1	1	2							
TYPHIDÆ.										
TYPHINÆ.										
Dithyrus, ...				1					1	
Typhis, ...					1		2?		3	
Thyropus, ...	1		1	2					2	
PRONOINÆ.										
Pronoe, ...	1		1			1			1	
Lycæa, ...					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*)
IDOTÆIDEA, ...	3	2	5	1 (*a*)	10	7	13 (3 *d,c*)	4 (1 *e*)	31	9
Idotæidæ, ...	3	2	5	1 (*a*)	10	7	12 (3 *d,c*)	4 (1 *e*)	30	9
Chætilidæ, ...							1		1	
ONISCOIDEA, ...	4	11	15	14	19 (2 *c*)	34 (1 *d*)	27	9 (4 *f*)	96	9 (1 *f*)
Armadillidæ, . . .	2	3	5	7	6 (1 *c*)	11 (1 *d*)	8	1	31	
Oniscidæ, ...	2	8	10	6	10 (1 *c*)	22	14	5 (2 *f*)	53	
Oniscinæ, ...		6	6	5	8	15	11	3 (1 *f*)	41	
Scyphacinæ, . . .	1		1			1		1	2	
Lyginæ, ...	1	2	3	1	2 (1 *c*)	6	3	1 (*f*)	10	
Asellidæ, ...				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*)
Cymothoidæ, . . .	11	12 (1 *a*)	22	1	7	6	1		15	
Cymothoinæ, . .	10	12 (1 *a*)	21	1	7	6	1		15	
Orozeuktinæ, . . .	1		1							
Ægathoinæ, . . .		2 ?	2 ?							
Ægidæ, ...	8	2	10	1	5	3	7 (2 *d,e*)	4	18	3 (2 *d,g*)
Æginæ, ...	1	1	2	1	4	2	4 (1 *d*)	4	14	3 (2 *d,g*)
Cirolaninæ, . . .	7	1	8		1	1	3 (1 *e*)		4	
Spheromidæ, . . .	1	3	4	2	6	18 (1 *c*)	17 (2 *e*)	13 (4 *e,f*)	49	
Spherominæ, . . .	1	3	4	1	5	18 (1 *c*)	11 (2 *e*)	12 (3 *e,f*)	40	
Nesæinæ, ...				1	1		6	1 (*f*)	6	
Ancininæ, ...									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
Serolidæ, ...						1	1	3 (1 *f*)	4	1
Pranizidæ, ...					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
Tanaidæ, ...	4	2	6		1	2	2 (1 *d*)	1	10	8
Bopyridæ, ...		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*)
Caprellidæ, ...	3	6	9	2	1	3	5	6 (1 *f*)	16	9 (2 *f,g*)
Cyamidæ, ...					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*)
Dulichidæ, ...					14					1
Cheluridæ, ...							1		1	
Corophidæ, ...	3	2	5				7	1	8	5
Orchestidæ, ...	4	8	12	1	6	20 (1 *d*)	6 (2 *d, e*)	5	35	2
Gammaridæ, . . .	22	12	34	3	8	10	35 (1 *d*)	13	68	60
Stegocephalinæ, . .										1
Lysianassinæ, . .	2	2	4		2		2	2	6	14 (1 *g*)
Leucothoinæ, . . .	2		2				1		1	2
Gammarinæ, . . .	16	13	29	3	6	10	30 (1 *d*)	11 (1 *f*)	58	39 (1 *f*)
Pontoporeinæ, . .						1	1		2	4
Isæinæ, ...							1		1	
HYPERIDEA, ...	16	6	22	5	6	6	5	4 (1 *d*)	24	6
Hyperidæ, ...	11	1	12	1	1	3	2	2	8	3
Phronimidæ, . . .	3	4	7	1	3	1		2 (1 *d*)	6	3
Typhidæ, ...	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 3½ : 1; while the ratio in the Caprellidea, is 3 : 1; and in the Hyperidea, 1¼ : 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*, *Siphonœcetes*, 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) Œdicerus (0·5), Gammarus (0·33), Melita (0·5), *Pardalisca*, *Ischyrocerus*, *Michrocheles*, *Pontoporeia*, *Ampelisca*, *Protomedeia*, *Phoxus*.

HYPERIDEA.—Hyperia (0·14), *Metœcus*, *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 Tetradecapoda 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
PŒCILOPODA.		
Ergasiloidea,	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.

	Torrid.	Extra-torrid.
I. Calanidæ.		
1. *Calaninæ.*		
Calanus, . . .	25	12 (3)
Rhincalanus, .	2	
Cetochilus, . .		1
Euchæta, . .	4	1
Undina, . . .	3	
2. *Oithoninæ.*		
Oithona, . . .	2	1
3. *Pontellinæ.*		
Diaptomus, . .		2
Hemicalanus, .	4	
Candace, . . .	5	1
Acartia, . . .	3	1
Pontella, . . .	22	9 (3)
Catopia, . . .	1	
4. *Notodelphinæ.*		
Notodelphys, .		1

	Torrid.	Extra-torrid.
II. Cyclopidæ.		
1. *Cyclopinæ.*		
Cyclops, . . .	2	9
? Psammathe, .		1
? Idomene, . .		1
? Euryta, . .		1
2. *Harpacticinæ.*		
Canthocamptus,	2	4
Harpacticus, .		15
Westwoodia, .		1
Alteutha, . .		1
Metis, . . .		1
Clytemnestra, .	1	
Setella, . . .	5	1 (1)
Laophon, . .		1
Oncæa, . . .		1
Ænippe, . . .		1
Idya, ...		1
3. *Steropinæ.*		
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 Cyclopoids, 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.

	Torrid.	Extra-torrid.
III. CORYCÆIDÆ.		
1. *Corycæinæ.*		
Corycæus,	18	1
Antaria,	3	1 (1)
Copilia,	2	
Sapphirina,	15	5
2. *Miracinæ.*		
Miracia,	1	1
Total CALANIDÆ,	71	29 (6)
Total CYCLOPIDÆ,	10	44 (1)
Total CORYCÆIDÆ,	39	8 (1)

The properly oceanic genera include all the *Calanidæ*, excepting *Diaptomus* and *Notodelphys;* all the *Corycæidæ;* with only the single genus *Setella* among the Cyclopidæ.

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 Steropinæ 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 *Cyproids,* Cypridina, Conchœcia, 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, Penœidea*, many *Thalassinidea, Astacoidea*, and *Anomoura*, in the Oolitic system; then a few *Cancroids* 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.,	*g*,	signifies	Puget's Sound.
W. America, S.,	*c*,	"	the Gallapagos.
"	*d*,	"	Peruvian coast.
"	*e*,	"	the coast of Chili and mainly Valparaiso.
"	*f*,	"	the coast of Chiloe.
E. America, N.,	*b*,	"	Key West and the adjoining coast of Florida.
"	*c*,	"	the coast of Georgia, and the Carolinas, to Cape Hatteras, but mainly Charleston, South Carolina.
E. America, S.,	*b*,	"	Rio Janeiro.
"	*e*,	"	Rio Negro.
"	*g*,	"	Falklands and Fuegia.
E. Atlantic, S.,	*e*,	"	Table Bay, South Africa.
"	*f*,	"	Tristan d'Acunha.
E. Africa, N.,	*a*,	"	southern half of Red Sea.
"	*b*,	"	northern half of Red Sea.
E. Africa, S.,	*b*,	"	Port Natal.
"	*b'*,	"	Mauritius or Isle of France.
Indian O. and E. Indies,	*c*,	"	Swan River, West Australia.
W. Pacific, N.,	*b*,	"	Loochoo, Formosa, and part of South Japan.
W. Pacific, S.,	*e*,	"	Port Jackson, in East Australia, and Isle of King, north of Van Diemens Land.
"	*f*,	"	Van Diemens Land.
Mid. Pacific, N.,	*a*,	"	Kingsmills and Wakes Island.
"	*b*,	"	Hawaiian or Sandwich Islands.
Mid. Pacific, S.,	*e*,	"	northern part of New Zealand.
"	*f*,	"	middle part of New Zealand.
"	*g*,	"	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.		Mid. Pacific.		Total.
	N.	S.	N.	S.		N.	Medit.	S.			N.	S.		N.	S.	N.	S.	
MAIOIDEA.																		
MAIINEA.																		
Macrocheira,														1*e*, *g*				1
Inachus,						1*c*, 3*f*	3*d*			6			1*a*					1
Microrhynchus,		2*c*			2													
Salacia,		1*e*?			1													
Doclea,							1*d*			1			4*a*, 1*b*					5
Libidoclea,		1*e*		1*g*	2													
Libinia,	1*e*	1*d*, *e*	1*b*, *c*, *f*, *g*	1*b*, 1*c*	5													
Maia,						1*c*, *f*	1*d*			2				2*c*				2
Paramithrax,													1*a*	1*c*?	2*e*			3
Pisa,		2*c*	1*b*, 1*c*		4	2*c*, 2*f*	3*d*			4	1*b*		3*a*, 1*b*					4
Pelia,		1*c*			1													
Lissa,							1*d*			1								
Rhodia,		1*c*			1													
Hyas,	1*g*		1*b*, 1*g*		3	2*f*, 1*g*			1*h*	2								
Pisoides,		1*c*, *e*			1													
Herbstia,	1	1*c*			2	1*c*	1*d*			1								
Thoe,		1*c*			1													
Dehaanius,												1						1
Micippa,												1*b*	4*a*, 1*b*					5
Chorinus,			1*a*, *b*		1								4*a*	1*b*			1*a*	6
Chorilia,					1													
Lahaina,																1*b*		1
Naxia,													1*a*, 1	1*b*				3
Scyra,	1*g*				1													
Hyastenus,													1*a*					1
Pyria,																	1*a*	1
Othonia,		2*c*			2													
Mithrax,	1*a*	1*c*, 1*d*	5*a*, 4*b*, 1*c*		9		1*d*			1		1	2*a*					2 (1)
Mithraculus,		2*c*	1*a*		3													
Cyclax,																	1*a*	1
Criocarcinus,																		

BRACHYURA.—*Continued.*

	W. America.		S. America.		Total.	E. Atlantic.			N. Frigid.	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.	
Tyche	1 *a*		1 *a*		2													
Camposcia												1 *b′*	1 *a*					1
Eurypodius		2 *d*		4 *g*	4													
Oregonia	2 *g*				2													
Amathia							1			1								
Achæus						1 *f*	1			1				1 *d* or *e*?				1
Inachoides		1 *d*			1													
Leptopodia		1 *d*	1 *a*, 1 *c*		2	2 *c*				2 (1)								
Stenorhynchus						1*f*, *g*	2 *d*		1 *h*	2								
Paramicippa											1 *b*			1 *c*				2
Pericera		1 *b*, 1 *c*	2 *a*, *b*	1 *a*	5												1 *a*	1
Tiarinia												1 *b′*	5 *a*					6
Perinea																1 *b*		1
Halimus													2 *a*, 1?					3
Pugettia	1 *d*, 1 *g*				2													
Menæthius											1 *b*	2 *b′*	3 *a*	2		1 *b*	3 *a*	9
Acanthonyx		1 *c*, 1 *d*	1 *a*	1 *b*	2		1			1	1	3 *b*						4
Antilibinia												1 *b*						1
Peltinia				1 *b*	1												1 *a*	1
Stenocionops												1 *b′*						1
Epialtus	2 *e*	1 *c*, 2 *d*	1 *b*	2	6													
Huenia													2 *a*	1 *b*		2 *b*		4
Xenocarcinus															1 *b*			1
Leucippa		1 *d*, 1		1 *b*	3													
PARTHENOPINEA.																		
Parthenope											1 *a*	1 *b′*	2 *a*					3
Lambrus							3			3	1	2 *b′*	10 *a*	3			2 *a*	17
Eurynome						1 *f*	2			2								
Eumedonus													1					1
Ceratocarcinus													2 *a*				1 *a*	3
Gonatonotus													1 *a*					1
Cryptopodia			1 *c*		1								2 *a*					2
Eurynolambus																	1 *e*	1
Trichia														1				1
ONCININEA.																		
Oncinopus													2					2
CANCROIDEA. CANCRINEA.																		
Cancer	3 *e*	4 *d*	1 *c*, 1 *f*, 2 *g*		10	2 *f*, *g*			1 *h*	2					1 *f*		1 *e*	1
Perimela						1 *f*	1			1								
Atergatis											7*a*, 2 *b*	2 *b*, 1 *b′*	9 *a*	3 *b*			2 *a*	17
Carpilius			2 *a*		2						1 *a*	3 *b′*, 1	3 *a*	5 *b*	2	2 *b*	2 *a*	13
Liomera																	1 *a*	1

Liagora,													1					1
Actæa,						1 *c*	1			1	1 *a*, 1 *b*	3 *b′*	3 *a*	1	1		2 *a*	13
Xantho,		2 *d*, 3 *e*	1 *a*	2 *b*	6	1*b*, 1*c*, 2*d*	2 *d*, 2 *f*			4	2 *a*	2 *b*, 5 *b′*	2 *a*	3	1	1 *b*	6 *a*	22
Paraxanthus,		2 *e*			2													
Menippe,		1 *b*, *c*		1 *b*?	1							2 *b*, 1 *b′*	3 *a*		1			5
Panopeus,		1 *d*, 1 *e*	1 *a*, 1 *b*	1 *a*	5		1			1 (1)			3 *a*					3
Medæus,																1 *b*		1
Halimede,														1 *b*				1
Etisus,													1 *a*		1	1 *b*	2 *a*	4
Etisodes,													1 *a*			1 *a*		2
Carpilodes,																	1 *a*	1
Zozymus,												1 *b′*	3 *a*	1			1 *a*	5
Actæodes,						1 *b*				1		1 *b*	3 *a*				6 *a*	9
Daira,														1 *b*			1 *a*	1
Chlorodius,			1 *a*		1						1 *b*	3 *b′*	9 *a*	3		3 *b*	8 *a*	20 (1)
Pilodius,													3 *a*				2 *a*	4
Cyclodius,													1 *a*				1 *a*	2
Cymo,											1						1 *a*	2
Polydectus,													1 *a*				1 *a*	2
Œthra,												1 *b′*	1 *a*					1
Galene,												1 *b*				1 *b*		1 (? 2)
Ozius,		1 *e*			1								2 *a*		2 *d*, *e*			4
Pseudozius,													1 *a*			1 *b*	1 *a*	3
Pilumnus,		2 *e*	1 *c*, 1 *g*	1 *b*	4	1*c*, 1*d*, 1 *f*	2			4	1 *a*	2 *b*	8 *a*	3	4		2 *a*	19 (1)
Pilumnoides,		1 *e*?			1													
Melia,												1 *b′*					1 *a*	1
Acanthodes,														1				1
Actumnus,																1 *b*	1 *a*	2
Ruppellia,											1						1 *a*	2
Eriphia,				1 *f*	1	1 *c*	1			1		2 *b*, 1 *b′*	2 *a*				2 *a*	4
Domæcius,																	1 *a*	1
Trapezia,											3	3 *b*				2 *b*	7 *a*	9
Tetralia,																	3 *a*	3
Quadrella,													1 *a*					1
Scylla,											1		1 *a*	1			1 *a*	1
Lupa,			1 *a*, 1 *b*, *c* 1 *f*, *g*	2 *b*	} 4			1 *e*		1	2 *a*	2 *b*, 1 *c*	4 *a*	1		2 *b*		7
Amphitrite,			2 *a*	2 *b*	4	1 *c*	1			1		1 *b′*	3 *a*	3		1 *b*	3 *a*	9
Carupa,																	1 *a*	1
Thalamita,						1				1	3 *a*	3 *b*	3 *a*	4 *b*		2 *b*	4 *a*	11
Charybdis,											2 *a*	1, 2*b*, 1*b′*	10 *a*	7 *b*	1		1 *a*	15
Lissocarcinus,													1 *a*				1 *a*	2
Arenæus,			1 *a*, *c*	1 *a*, *b*	1													
Portunus,						2 *c*, 8 *f*	9*d*, 1*f*, 3*g*		1 *h*	11				1	2 *f*		2 *f*	4
Carcinus,			1 *g*		1	1 *f*, *g*	1		1 *h*	1 (1)				1				1
Portumnus,						1 *f*	1 *d*			1								
Platyonychus,		2 *e*	1 *b*, *f*, *g*		2		1 *a*	1 *e*		2			1 *a*					1
Polybius,						1 *f*				1								
Podophthalmus,												1 *b′*	2 *a*	1		1 *b*		2
TELPHUSINEA.																		
Telphusa,						1				1	3	3	2	1				7
Trichodactylus,				2 *b*	2													
Valdivia.																		

BRACHYURA.—*Continued.*

	W. America.		E. America.		Total.	E. Atlantic.			N. Frigid.	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.	
Potamia,		1 *e*	2 *a*	1 *a*	3													
Orthostoma,			1		1													
CYCLINEA.																		
Acanthyoclus,		1 *e*			1													
GRAPSOIDEA.																		
Eucrate,				1 *b*	1									1				1
Curtonotus,												1 *b*	1 *a*	2 *b*				2
Gonoplax,						1 *c*, *f*	2			2								
Cleistostoma,											2	3 *b*	1 *a*	2 *b*?				5
Macrophthalmus,											1 *b*	1 *b′*	6 *a*	2 *b*	1	1 *b*	1 *a*	12
Gelasimus,		2 *e*	1 *a*, 1 *c–g*	1 *a*, 2 *b*	5						1	3 *b*, 2 *b′*	7 *a*, 2 *c*	1 *b*		1 *b*	1 *a*	16
Helœcius,															2 *e*			2
Ocypoda,		1 *e*	1 *a*, 1 *b*, *c*	1 *b*	3						3 *a*	2 *b*, 2 *b′*	4 *a*			2 *b*	3 *a*	10
Scopimera,														1 *b*				1
Doto,											1	1 *b*		1				1
Pseudograpsus.	2 *g*				2								1		1			2
Heterograpsus,							1			1								
Brachynotus,							1			1								
Eriocheir,														2 *b*, 1 *g*				3
Platynotus,														1				1
Trichopus,												1 *b′*	1 *a*					1
Grapsus,		1 *d*, 2 *e*	1 *a*, *b*		3	1 *c*, 1 *d*				2 (1)	1 *a*	1 *b*, 1 *b′*	1 *a*	1		1 *a*, 3 *b*	3 *a*	7 (2)
Goniograpsus,			2 *b*	3 *b*,	4	2 *c*, 1 *f*	2 *d*, 1 *f*			3 (1)	1	2 *b*	1 *a*			3 *b*	1 *a*	4 (1)
Planes,						1 *c*	1			1				1		1·*c*	1 *b*	2
Hemigrapsus,				1 *b*, 1 *f*	2							1 *b′*		1		1 *b*	3 *e*	8
Cyrtograpsus,				1 *f*	1													
Sesarma,			3 *b*, 2 *c*, 1 *e*	1 *a*	4	2 *c*		1 *e*		3 (1)		4*b*, 1*b′*	5 *a*	6, 1 *e*.		2 *b*	1 *a*	13 (1)
Sarmatium,																	1 *a*	1
Cyclograpsus,		1 *e*		1 *b*	2								2 *a*			2 *b*	1 *e*	4
Chasmagnathus,				1 *b*	1								1 *a*	1 *b*	2 *e*		1 *e*?	3
Helice,														1				1
Acanthopus,			1 *a*, *b*		1	1 *c*, *d*.		1 *e*		1 (1)		1 *b*				1 *a*, *b*	2 *a*	2 (1)
Plagusia,		1 *e*	1 *a*, *b*		2	1 *c*, *d*.				1 (1)	1 *a*, *b*	2 *b′*	2 *a*	2	1 *d*		1 *a*, 1 *e*	6 (1)
Uca,		1 *b*	2 *a*	1 *a*, 1 *b*	2													
Gecarcinicus,													1 *a*					1
Cardisoma,			1 *a*, *b*	1 *b*	1							1 *b′*	1 *a*				2 *a*	3
Gecarcoidea,				1	1													
Gecarcinus,		2 *e*	2 *a*		4										1			1
Pinnothera,	1 *g*	1 *e*	1 *b*, *c*, *f*. 1 *c*, *f*		4	2 *f*, 2 *g*	2 *d*			2	1 *a*	1 *b*	1 *b*	1			1 *a*	3
Fabia,	1 *g*	1 *e*			2													
Xenophthalmus,													1 *a*					1
Xanthasia,													1 *a*					1
Pinnixa,		1 *e*	1 *c*		2													

Pinnotherelia,		1 e			1													
Hymenosoma,								1 e		1								
Halicarcinus,		2 e		2 g	3													
Hymenicus,																	2 e	2
Elamena,											1 b	1 b, 1 b′	1 a					2
Myctiris,													1 a	1 b	1 e			2
LEUCOSOIDEA.																		
Calappa,			1 a, b, c		1	1 c	1 d			1	2 a	1 b, 4 b′	4 a	1		2 b	2 a	5
Platymera,		1 e			1													
Mursia,												1	1 a	1				3
Cycloes,						1 c				1				1				1
Orithyia,													1 a					1
Hepatus,		1 e	1 a, 1 c	2 b	4													
Thealia,													1					1
Matuta,											1 b	2 b, 1 b′	2 a					2
Leucosia,		1 e			1								3 a	4				7
Philyra,													2 a, 1 c	2				5
Leucisca,												1						1
Ebalia,						3 f, 2 g	3			6				1				1
Nucia,																1 b		1
Nursia,											1 b	1 b	1 a					2
Ilia,							2			2								
Myra,											1 b	1 b′	1 a	1 b				2
Guaia,	1 e		1 a, c		2													
Ixia,												1 b′	2 a					2
Iphis,													2 a				1 a	3
Arcania,													2 a	1 d				3
Oreophorus,											1 b		1 a					2
Tlos,													1 a					1
Dorippe,						1 c	2			2			4 a	4				5
Ethusa.																		
CORYSTOIDEA.																		
Trichocera,	1 g				1								1 a	1				2
Thia,						1 f	1 d			1								
Kraussia,												1 b′		2		1 b		3
Telmessus,	1 g				1													
Atelecyclus,		1 e			1	1 c, 2 f, 2 g				} 3								
Peltarion,				1 g	1													
Pseudocorystes,		1 e			1													
Gomeza,				1 g	1								1 a					1
Œidia,														1				1
Corystes,						1 f, g	1 d			1								
Dicera,												1		1				1

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 *b′*						1
Dromia,			1 *a, b*		1	1 *c,f*	2 *d*	2 *e*		4	2 *a*, 1 *b*	2, 2 *b′*	2 *a*		1	1 *b*		9 (1)
Latreillia,							1 *d*			2				2				2
Homola,						1 *c*	2 *d*			2								
Cymopolia,							1 *d*			1			1 *a*					1
Caphyra,													2 *a*					2
BELLIDEA.																		
Bellia,		1 *e*			1													
Corystoides,		1 *e*			1													
RANINIDEA.																		
Raninoides,													1 *a*					1
Ranina,												1 *b′*	1 *a*	1 *b*		1 *b*		1
Ranilia,			1 *b,c*		1													
Notopus,														1				1
Lyreidus,														1 *e*				1
Cosmonotus,													1 *a*					1
HIPPIDEA.																		
Albunæa,		1 *d?*	1 *a*, 3 *c*		3	1 *c*	1 *d*			1			1 *a*			1 *a*		2
Albunhippa,	1 *d*	1 *d*			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
Echidnocerus,	1 (*f?*)				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*			2 *a*, 3 *b*	3 *a*	5
Aniculus,												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.																		
Cenobita,			1 *a*		1		1 *d*			1 (1)		1 *b*	4 *a*	3 *b*	1 *a*	3 *b*	4 *a*	6
Birgus,												1 *b′*	1 *a*	1 *a*, 1 *b*		1 *a*	1 *a*	1
ÆGLEIDEA.																		
Æglea,		2 *e*			2													
GALATHEIDEA.																		
Galathea,		1 *e*			1	1*c*, 3*f*, 1*g*	2 *d*		2 *h*	4						1 *b*	4 *a*	5
Munida,				1 *g*	1	1 *f*, 1 *g*				1								
Grimothea,	1 *e*			1 *e*	1					1 (1)								

3. MACROURA.

	W. America. N.	W. America. S.	E. America. N.	E. America. S.	Total.	E. Atlantic. N.	E. Atlantic. Medit.	E. Atlantic. S.	Arctic.	Total.	E. Africa. N.	E. Africa. S.	Indian Ocean and E. Indies.	W. Pacific. N.	W. Pacific. S.	Mid Pacific. N.	Mid Pacific. S.	Total.
THALASSINIDEA.																		
Gebia,	1 *g*		1 *c*		2	2 *f*	1 *d*	1 *e*		4				1			1 *e*	2 (1)
Axius,						1 *f*				1								
Calocaris,						1 *g*				1								
Laomedia,														1				1
Glaucothoe,													1					1
Callianassa,	1 *g*	1 *e*	1 *b*, 1 *c*		4	1 *f*	2 *d*			2								
Trypæa,															1 *e*			1
Thalassina,		1 *e*			1								2 *a*					2
Callianidea,													1 *a*					1
Callisea,														1 *a*				1
ASTACIDEA.																		
Scyllarus,			1 *a*, *b*	1 *b*	1	1 *c*	1 *d*			1		1 *b′*		2		1 *b*		4
Arctus,						1 *c*, *f*.	1 *d*			1								
Thenus,													1 *a*, 1 *c*					1
Parribacus,			1 *a*		1							1 *b′*	1 *a*					1
Ibacus,														1	1			2
Palinurus,		1 *e*	1 *a*		2	1 *d*, *f*	1	1 *e*		2				1				1
Panulirus,			2 *a*. 1 *b*		2						1 *a*	3 *b′*	4 *a*	3			2 *a*	10
Homarus,			1 *f*, *g*		1	1 *f*	1 *d*	1 *e*		1								
Astacoides,															1 *e*, 1 *f*			1
Cheraps,													1 *b* (*c*?) 1 *e*					2
Astacus,	1 *g*				1		3			3				1	3 *f*			4
Cambarus,			(20)		20													
Nephrops,	1 *f*				1	1 *f*, *g*	1			1								
Paranephrops,																	2 *e*	2
CARIDEA.																		
Crangon,	1 *e*, 2 *g*		1 *f*, 2 *g*		2	5 *f*, 3 *g*	2 *d*, 1 *f*		2 *h*	8 (1)				3, 1 *h*				4
Sabinea,									1 *h*	1								
Argis,									1 *h*	1								
Paracrangon,	1 *g*				1													
Nika,						2 *f*	2 *d*			3				1		1 *b*		2
Lysmata,							1 *d*			1				1				1
Cyclorhynchus,														1				1
Gnathophyllum,						1 *c*	1 *d*			1								
Atya,	2 *b*		1 *a*		3								2 *a*				1 *a*	3
Atyoida,																1 *b*		1
Caridina,							1 *d*			1				1				1
Ephyra,							2 *d*			2								
Alpheus,		1 *e*	1 *a*, 1 *b*, 3 *c*	2 *b*	7	1 *b*, 1 *f*	4 *d*			4		1 *b*, 1 *b′*	10 *a*	6	2	1 *a*, 4 *b*	3 *a*	19 (2)
Betæus,		2 *e*		1 *g*	3								1 *a*				2 *e*	3
Alope,																	1 *e*	1

MACROURA.—*Continued.*

	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.	
Athanas,						1 *f*	1 *d*			1								
Hippolyte,	3 *e*		1 *c*, 1 *g*	2 *b*	7	1*c*, 6 *f*, 2	3 *d*	1 *e*	18 *h*	29			5 *a*	2 *h*	1 *b*, 1 *e*	2 *b*	1 *a*, 1 *e*	10
Rhyncocinetes,		1 *e*			1													
Pandalus,	1 *g*		1 *g*		2	1 *g*	2 *d*		3 *h*	4				1				1 (1)
Pontonia,	1 *b*		1 *c*		2		1 *d*			1			1 *a*				3 *a*	3
Œdipus,													1 *a*				2 *a*	3
Harpilius,																	1 *a*	1
Anchistia,													2 *a*				1 *a*	3
Palæmonella,													2 *a*					2
Palæmon,	4 *b*	2 *e*	4 *a*, 1 *b*, 1 *c*, 1 *f*, 1 *g*	1 *b*	13	2 *c*, 1 *d*, 3 *f*	5 *d*, 2 *e*, 2 *f*		1 *h*	16		1 *b*, 2 *b′*	7 *a*	7		4 *b*	2 *a*, 2 *e*	22
Hymenocera,																	1 *a*	1
Cryphiops,		1 *e*			1													
Oplophorus,						1 *c*				1			1 *a*					1
Regulus,													2 *a*					2
Pasiphæa,						1 *f*, 1 *g*	1 *d*		1 *h*	3								
PENÆIDEA.																		
Sicyonia,				1 *b*	1		1 *d*			1				3				3
Penæus,			2 *c*	1 *b*, 1 *f*	3	2 *f*	3 *d*			5		1 *b*, 1 *b′*	8 *a*, 1 *c*	6		2 *b*		14
Stenopus,												1 *b*	1 *a*				2 *a*	2
Spongicola,														1				1
Sergestes,						1 *d*				1								
Acetes,													1 *a*					1
Euphema,									1 ?	1								
Eucopia,															1 *h*			1

4. ANOMOBRANCHIATA.

	W. America.		E. America.		Total.	E. Atlantic.			Frigid.	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.	
SQUILLOIDEA.																		
Lysiosquilla,			2 *a*, 1 *c*	2 *b*	3								2 *a*			1 *b*		3 (1)
Squilla,			3 *c*, 1 *f*, *g*	2 *b*	5	2 *c*, 1 *f*	3 *d*			4			6 *a*	7		1 *b*		11 (1)
Pseudosquilla,		1 *d*, 1 *e*			1		1 *d*			1			1 *b*			1 *b*	1 *a*	1
Coronis,													1 *a*				1 *g*	2
Gonodactylus,		1 *e*			1		1 *d*			1	1 *a*	5 *b′*	2 *a*, 2 *c*				1 *a*	6 (1)
Squillerichthus,													2 *a*					
Erichthus,						3 *a*		1 *a*, 4 *b*		8			4 *a*					4
Alima,						1 *a*		1 *a*		2			4 *a*				1 *g*	5
MYSIDEA.																		
Thysanopoda,						1 *a*			3 *h*	4								
Euphausia,						1 *a*				1						1 *a*	1 *a*, 1 *h*	3
Cyrtopia,																	2 *a*	2
Cynthia,						1 *b* (or *c*), 1 *g*				2								
Mysis,						2 *f*, 2 *g*	2 *d*		3 *h*	7								
Promysis,													1 *a*					1
Macromysis,				1 *b*	1	2 *g*				2								
Siriella,																	3 *a*	3
Loxopis,													1 *a*				1	1
Sceletina,								1 *a*		1			2 *a*					2
Rachitia,				1 *b*	1													
Myto,									1 *h*	1								
Lucifer,				1 *b*	1								1 *a*				2 *a*	3
AMPHIONIDEA.																		
Phyllosoma,						6 *a*, 1 *d*, 1 *f*	1 *d*			8			10 *a*	1				11
Amphion,						1				1								

5. ISOPODA.

	W. America.		E. America.		Total.	E. Atlantic.			Frigid.	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.	
IDOTÆIDEA.																		
Idotæa,	1 *g*	1 *e*	1 *c*, 4 *f*, 1 *g*	1 *b*	6	4 *f*	9 *d*, 1 *f*	4 *e*	9 *h*	24			3 *a*		3, 1 *g*	1 *h*		6 (1)
Glyptonotus,				1 *h*	1				1 *h*	1								
Edotea,				1 *g*	1													
Erichsonia,				1 *b*	1													
Cleantis,				1 *f*	1													
Chætilia,				1 *f*	1													
ONISCOIDEA.																		
Tylus,				1 *g*	1		1 *c*, *d*	2 *e*		3								
Armadillo,				1 *a*, 1 *b*	2		2 *d*	2 *e*		4							1 *e*	1
Spherillo,																1 *b*	1 *a*, 2 *e*	4
Armadillidium,			1 *f*		1	8 *f*	5 *c*, 6 *a*			18								
Diplœxochus.																		
Oniscus,	1 *f*, *g*	10 *e*	1 *f*, 1 *c*	3 *b*, 1 *g*	16	3*e*, 7*f*, 1*g*	12 *d*	1 *e*		25 (1)						2 *b*		2
Platyarthus,				1 *f*	1													
Deto,								1 *e*		1								
Scyphax,																	1 *e*	1
Styloniscus,				1 *g*	1												1 *a*	1
Lygia,	1 *b*, 1 *e*	2 *e*			4	1 *f*	1*c*, 2*d*, 1*e*	2 *e*	1 *h*	6					1 *e*	1 *b*	1 *e*	2
Lygidium.																		
Limnoria,						1 *f*, *g*				1								
Jæra,		1 *e*		1 *g*	2	2 *f*, 1 *g*	2		2 *h*	6								
Jæridina,									1 *h*	1								
Asellus,			1 *c*, 1 *f*		2	1 *f*	1 *d*		1 *h*	2								
Janira,						1 *f*			1 *h*	1								
Henopomus,									2 *h*	2								
Munna,						1 *g*			1 *h*	2								
CYMOTHOIDEA.																		
Cymothoa,			2 *a*	1 *b*	3								2 *a*	1 *d*		2 *b*		4
Ceratothoa,		1			1	1 *c*	2 *d*			3			1				1	2
Livoneca,			1 *a*	2 *b*	3			1 *e*		1			1 *a*			1 *b*		2
Anilocra,			1 *a*		1		4 *d*	1 *e*		5								
Nerocila,				6 *b*	6	1 *f*	1 *d*			2			1 *a*				1 *e*	2
Desmarestia,		1 *e*			1													
Orozeuktes,													1 *a*					1
Ægathoa,				2	2													
Æga,			1 *g*	1 *b*	2	1 *f*, 1 *g*	1 *d*		3 *h*	5 (1)			1 *a*, 1 *c*				1 *e*	3
Conilera,						1 *f*				1								
Rocinela,						3 *f*	2 *d*			5								
Acherusia,							1 *d*			1								
Pterelas,				1 *g*	1	1 *e*				1								
Cirolana,						3 *f*	1 *d*	2 *e*		5			3 *a*		1 *h*		1 *a*	5 (1)