Charles Darwin Esqr
With the Kind regards of
James D. Dana

ON THE

CLASSIFICATION

AND

GEOGRAPHICAL DISTRIBUTION

OF

CRUSTACEA:

FROM

THE "REPORT ON CRUSTACEA"

OF THE

"UNITED STATES EXPLORING EXPEDITION," UNDER CAPTAIN CHARLES WILKES, U. S. N.,

DURING THE YEARS 1838–1842.

BY

JAMES D. DANA, A.M.,

MEMBER OF THE SOC. CÆS. NAT. CUR. OF MOSCOW; THE SOC. PHILOMATHIQUE OF PARIS; THE GEOLOGICAL SOCIETY OF LONDON; THE AMERICAN ACADEMY OF ARTS AND SCIENCES AT BOSTON; THE ACADEMY OF NATURAL SCIENCES OF PHILADELPHIA, ETC.

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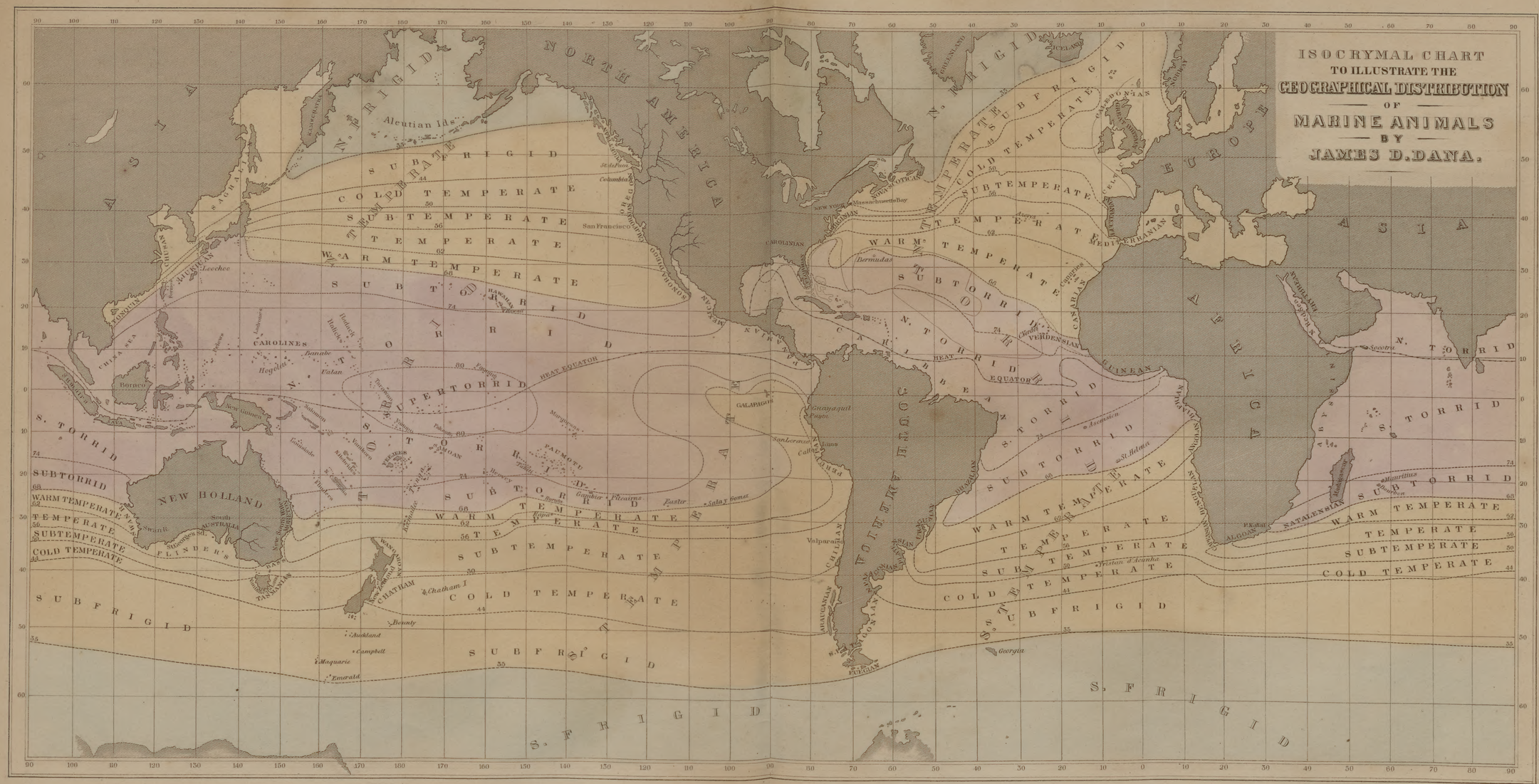
BY
JAMES D. DANA.



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 cephalotho-

racic annuli. In the Daphnioids and the Caligoids, they include only *five*. In Limulus, only the first *four* can properly be counted as of the cephalic series. In many other Entomostraca, the mouth organs are nearly as perfect legs as in Limulus, and the species, although evidently of a low grade, cannot properly be removed from the group Limulus has its nearest ally in Apus, although this genus has the mouth organs of a Daphnia.

The lowest species of the type are the Lernæoids.

A *fourth primary type* includes the Cirripeds. It is of the same rank as regards cephalization as the Entomostraca; yet, it has so many peculiarities of structure, that it should be regarded as a distinct type, rather than a subordinate division of the *third* type.

The mean size of the species of this group is much greater than the same among the higher Entomostraca. But if we regard the young in its active Cypris state, and compare it with the corresponding condition of species of Cyproids, we shall discover that the species have, in fact, an abnormal growth; a growth which takes place at the expense of the powers of motion or action in the individuals. The body, when it commences a sedentary life, increases in magnitude far beyond the Cypris or Daphnia size; and there is a corresponding loss of *power*. The same force will not move a heavy structure, that is sufficient for the tiny model; and when the model is enlarged without a corresponding increase in the seat of power, sluggish motion is the necessary consequence. Thus it is with the Medusæ. Individuals of the minuter species, or the larger species, when in the young state, are gifted with active powers of motion; the structure conforms to the forces within: but as the species enlarge, they become slow in movement, or lose almost every attribute of life. The same principle is illustrated again in the Bopyri. The male is a small active animal, related to Jæra and Tanais. The female, of sedentary habits, becomes grossly enlarged and corpulent, so as to exceed by twenty-fold lineally the length of the male, and nearly ten thousand times its bulk. It is manifest, that the nervous system, or motive power of the female, is absolutely no greater than that of the male; and consequently, the capabilities of locomotion will be ten thousand times less, or the female will move but a ten-thousandth of an inch at the most, while the male is moving one inch, a fact with regard to them, as any one is aware of who has seen the incapability of the female to make any

progress by locomotion. This then, is an example beyond dispute, of a system overgrown through the vegetative process, so as to be too much for the motive energies within. The Lernæoids afford a similar illustration of this principle.

For the same reason, therefore, as in the Bopyri, the Medusæ, the Lernæoids, and the Limuli, we cannot compare the actual mean size of the adult Cirripeds with those of the other primary types. We should rather infer the mean normal size for such a comparison, from the size of the young before it becomes sedentary, or from that of free males, if such exist. Such males are announced by Darwin, as actually occurring in some species. Moreover, they are very minute, varying from a line to half a line or less in length. This, therefore, is some reason for taking as the mean normal size, the same as given for the Entomostraca.

A *fifth primary type* includes the ROTATORIA. In these animalcular species, the mouth includes a pair of mandibles and often a rudimentary pair of maxillæ; and consequently, the cephalic portion may contain the same number of annuli as in the Daphnia group, with which group many of them have near relations. They have usually an articulated abdomen, furcate at extremity, like the Cyclopoids. The grand point of inferiority to the Entomostraca, evincing the more infinitesimal character of the system of life within, is the absence of all thoracic appendages or legs. The organs of locomotion are simply ciliæ arranged about the head; and it is quite probable that two sets (or more) of them correspond to the second pair of antennæ, as these are organs of prehension and motion in many Entomostraca. In 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, II. Macroura,	9	24 (and breadth, 24). 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.—[An *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 sivè 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 5torum ortæ.* [*Via afferens pone regionem pterygostomianam ingrediens.*]

Fam. I. CALAPPIDÆ.—Articuli maxillipedis externi terminales non celati.

1. CALAPPINÆ.—Pedes nulli natatorii.—G. *Calappa*, Fab., *Platymera*, E., *Mursia*, E., *Cycloes*, De H.
2. ORITHYINÆ.—Pedes 8 postici natatorii.—G. *Orithyia*.

Fam. II. MATUTIDÆ.—Articuli maxillipedis externi terminales celati, 3tio triangulato, palpo vix longiore quam articulus 2dus.

G. *Hepatus*, Lat., *Thealia*, Lucas, *Matuta*, Fab.

2. *Appendices* maris *genitales sterno ortæ.*

Fam. III. LEUCOSIDÆ.—Via afferens apud angulum palati anterolateralem 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. elongato et lato. Maxillipedes externi operculiformes, articulo 3tio Pedes 2di 3tii 4tique natatorii, 5ti debiles inflexi.

Fam. HIPPIDÆ.

G. *Albunæa*, Fab., *Albunhippa*, E., *Remipes*, Lat., *Hippa*, Fab.

Subtribus V. PORCELLANIDEA, vel Anomoura Grapsidica.

Carapax suborbiculatus. Maxillipedes externi male operculiformes, articulo 3tio paulo minore quam 2dus. Pedes 2di 3tii 4tique gressorii, 5ti debiles, inflexi.

Fam. PORCELLANIDÆ.

G. *Porcellana*, 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. Paguriné.—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 feminæ*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. *Nesæa*, Lh., E., *Campecopea*, Lh.
3. ANCININÆ.—Pedes 4 antici ancorales.—G. *Ancinus*, E.

TRIBUS II. ANISOPODA.

SUBTRIBUS I. SEROLIDEA, vel ANISOPODA CYMOTHOICA.

Appendices duæ posticæ abdominales lamellatæ, apud abdominis latera dispositæ.

Fam. I. SEROLIDÆ.—Appendices abdominales sex anticæ liberæ, subnatatoriæ, quatuor sequentes branchiales, bene lamellatæ, ultimæ ac in Cymothoidis. Antennæ 1mæ sub capite insitæ.

G. *Serolis*, Lh.

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

1. Pranizinæ.—Caput parvum. Mandibulæ vix salientes.—G. *Praniza*, Lh.
2. Anceinæ.—Caput grande. Mandibulæ ultra caput longè exsertæ.—G. *Anceus*, Risso.

Subtribus II. ARCTURIDEA, vel Anisopoda Idotæica.

Appendices duæ posticæ abdominales lamellatæ et bene operculiformes, appendices branchiales tegentes.

Fam. I. ARCTURIDÆ.

1. Arcturinæ.—Opercula abdominis ad ventrem strictè appressa.—G. *Arcturus*, Lat., *Leachia*, Johnston.
2. Anthurinæ.—(An Idotæideorum?) Opercula abdominis ad ventrem non bene appressa, sed libera et latera abdominis partim tegentia.—G. *Anthura*, Lh.

Subtribus III. TANAIDEA, vel Anisopoda Oniscica.

Appendices duæ posticæ abdominales plus minusve 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. *Corycæus,* 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 birameæ, 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.

Etycea, Leach (Mantell's Geol. of Sussex, Pl. 29, f. 11, 12), has the transverse form of Xantho.

2. ERIPHIDÆ (?)—*Zanthopsis*, M'Coy (Ann. Mag. N. H. [2], iv. 162), approaches Actumnus in nearly orbicular outline and convexity of carapax, but has the fingers 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 tem-

perature 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.	78½	78	Showery.
13	16 04	"	E. by S.	78·1	78	" heavy rains.
14	17 27	174 43	S.E.	78	78	Dark.
15	17 58	174 16	E.	78	77	Fine, but cloudy.
16	18 50	173 41	S.E.	78	76	" "
17	19 47	173 28	S.E.	78	76	Clear.
18	19 37	172 41	S.	77¾	71	Clear and fine.
19	19 57	170 47	S.	76	75	Cloudy.
20	20 21	169 11	S. by E.	76½	74	"
21	20 16	167 21	S. by E.	76¼	72	"
22	20 18	167 03	Var.	76	74	Clear.
23	21 09	166 37	S.	74¾	76	Dark.
24	20 46	164 29	S.	75	75	Cloudy.
25	26 30	163 33	S.	76	74½	Fine.
26	19 52	163 01	S.	77	75	Dark.
27	19 23	161 53	S.E.	73	75	"
28	20 07	162 22	S.E.	73	76	Fine.
29	21 04	162 54	S.S.E.	72	76	Cloudy.
30	21 16	162 46	E.S.E.	71	76	"
31	23 00	162 45	N.N.E.	72	76	Clear.
June 1	22 06	160 48	Var.	74	76	Fine.
2	22 46	161 19	S.S.W.	74	74	Clear.
3	21 00	160 00	E.	74	75	Fine; at Raratonga.
11	22 21	160 20	E.	73	72	Fine.
12	22 24	160 25	E.	73	72	"
13	22 49	159 33	Var.	73	72	"
14	22 29	158 54	E. by S.	72	72	"
15	22 25	159 37	N.N.E.	71	71½	"
16	22 37	159 05	Var.	71	71	At 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 4¼° 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

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.

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C. INDIAN OCEAN.—5. Prince Edward's Island, Crozet, Kerguelen's Land.

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2. South Shetlands, South Georgia, Sandwich Land, and other Antarctic Lands. The line runs quite 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 ocean-temperature, either side of the equator, considering 27° as the normal limit between the first two of these zones, and 56° the limit between the Frigid and Temperate, are as follows:—

Torrid zone,	. .	33,711,200	square miles (geographical).
Temperate zone,	.	27,849,500	" " "
Frigid zone,	. .	12,694,700	" " "

It is hence seen that the Temperate zone, although two 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 one-fifth more numerous in the Torrid zone than in the Temperate, unless the extent of ocean and of 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 deduced 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°	. .	3,239,296	32½° . . 2,769,696
5°	. .	3,232,800	35° . . 2,693,760
7½°	. .	3,220,496	37½° . . 2,612,688
10°	. .	3,202,048	40° . . 2,526,624
12½°	. .	3,177,472	42½° . . 2,435,776
15°	. .	3,146,912	45° . . 2,340,256
17½°	. .	3,110,320	47½° . . 2,241,280
20°	. .	3,067,808	50° . . 2,136,128
22½°	. .	3,019,472	52½° . . 2,027,840
25°	. .	2,962,176	55° . . 1,915,696
27½°	. .	2,905,632	57½° . . 1,767,168
30°	. .	2,840,368	60° . . 1,680,704

The zone from 60° to 70° has the area,	. . .	5,466,992
" 70° to 80° " "	. . .	3,350,064
" 80° to 90° " "	. . .	1,128,144

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 northeastward. 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
Nexera 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, }	6	2(1 *a*)	7				1		1	
Chorilia, }										
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		3	1?	3	2 (1 *f*)	8	
Ebalia, ...										
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)	
Achæinæ, ...				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 Periceræ: the Menæthii, Tiariniæ, and Acanthonyces, are examples of the group. In addition, there are the Mithracidæ, which although attaining a large size show their inferiority in their shorter epistome, shorter body, which is sometimes even transverse, and their spoon-shaped fingers. In the last character, the Chlorodinæ among the Cancroids, similarly show their inferiority to the Xanthidæ. That this kind of finger is such a mark of inferiority is apparent from its diminishing in many species as the adult size of the animal is attained, the tendency being towards producing the 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 propor-

tion of individuals of the several species. Crustacean life, of this tribe, is far the most prolific in the warm waters of the globe. Crustacea are very abundant about coral islands, far exceeding what may be found in other regions.

XV. The actual mass of Brachyura appears also to be the largest in the tropics, although there are genera, as Macrocheira and Cancer, which have their largest species in the colder waters, and which exceed in size any other Brachyura. The genera Atergatis, Carpilius, Xantho, Menippe, Zozymus, Eriphia, Thalamita, Charybdis, Calappa, besides others of the Torrid zone, contain many large species, which are of very common occurrence; while the cold-water genera of Maioids appear to be much less prolific in species, and the other genera, though abounding in individuals, as Cancer and Lupa, are still but few in number. Any very exact comparison, however, of the two zones in this particular cannot be made without more data than have yet been collected.

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	5 (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							
Alima,	6		6					1	1	
II. MYSIDEA.										
I. EUPHAUSIDÆ.								3	3	
Thysanopoda,	1		1					1	1	
Euphausia,	3		3							
Cyrtopia,	2		2							
II. MYSIDÆ.										
1. CYNTHINÆ.										
Cynthia,				1				1	2	
2. MYSINÆ.					2		2	2 (1 *f*)	7	2
Mysis,										
Promysis,	1		1							
Macromysis,		1	1					2	2	
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
	378	

	Torrid zone.	Temperate zone.
Raninidea, G. *Raninoides*,	1	0
Ranina,	1	0
Ranilia,	1	0
Cosmonotus,	1	0
Hippidea, G. *Albuncæa*,	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. *Pasiphœa*,	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, Diploexochus.				5	5	1	8		19	
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.										
Ægа,	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,										1
Cryptothir,	1		1							
CROSSURINÆ.										
Crossurus,										1
BOPYRIDÆ.										
BOPYRINÆ.										
Bopyrus,					1	1 (*d*)	1 (*d*)		1	2
Phryxus,		1	1							
Cepon,										1
Dajus,										
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,										2
Ischyrocerus,										1
Microcheles,										
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	
Anciniæ, ...									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,	$2\frac{1}{3}$: 1

Two-ninths of the extra-tropical Idotæidea (or nine species) belong

to the Frigid zone, and nearly one-tenth of the extra-tropical Oniscoidea (or nine species); while less than a twenty-fifth of the Cymothoidea occur in the Frigid zone, and but one of these has not also been found in lower latitudes.

Of the Amphipoda, the Gammaridea are most strongly extra-tropical, the proportion being for the extra-tropical and tropical species $3\frac{1}{2} : 1$; while the ratio in the Caprellidea, is $3 : 1$; and in the Hyperidea, $1\frac{1}{4} : 1$. 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 *Corycœidæ;* 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 northwestern 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*			2													
Libinia,	1*e*	1*d*, *e*	1*b*, *c*, *f*, *g*	1*b*, 1*c*	5													
Maia,						1*c*, *f*	1*d*			2			1*a*	2*c*				2
Paramithrax,														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												1*a*	1
Cyclax,																		
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							1 *b'*	1 *a*					1
Camposcia,																		
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 *b'*	5 *a*				1 *a*	1
Tiarinia,																1 *b*		1
Perinea,													2 *a*, 1?					3
Halimus,																		
Pugettia,	1 *d*, 1 *g*				2						1 *b*	2 *b'*	3 *a*	2		1 *b*	3 *a*	9
Menæthius,											1	3 *b*						4
Acanthonyx,		1 *c*, 1 *d*	1 *a*	1 *b*	2		1			1		1 *b*						1
Antilibinia,																	1 *a*	1
Peltinia,				1 *b*	1							1 *b'*						1
Stenocionops,																		
Epialtus,	2 *e*	1 *c*, 2 *d*	1 *b*	2	6								2 *a*	1 *b*		2 *b*		4
Huenia,															1 *b*			1
Xenocarcinus,		1 *d*, 1		1 *b*	3													
Leucippa,																		
PARTHENOPINEA.																		
Parthenope,							3			3	1 *a*	1 *b'*	2 *a*					3
Lambrus,						1 *f*	2			2	1	2 *b'*	10 *a*	3			2 *a*	17
Eurynome,													1					1
Eumedonus,													2 *a*				1 *a*	3
Ceratocarcinus,													1 *a*					1
Gonatonotus,													2 *a*					2
Cryptopodia,			1 *c*		1												1 *e*	1
Eurynolambus,														1				1
Trichia,																		
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.													1 *a*					1
Raninoides,												1 *b'*	1 *a*	1 *b*		1 *b*		1
Ranina,			1 *b,c*		1													1
Ranilia,													1					1
Notopus,													1 *e*					1
Lyreidus,																		
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.		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.	
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 *b*, 1 *c*		4	1 *f*	2 *d*			2					1 *e*			1
Trypæa,													2 *a*					2
Thalassina,		1 *e*			1								1 *a*					1
Callianidea,														1 *a*				1
Callisea,																		
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					1 *e*, 1 *f*			1
Astacoides,													1 *b* (*c*?) 1 *e*					2
Cheraps,														1	3 *f*			4
Astacus,	1 *g*				1		3			3								
Cambarus,			(20)		20													
Nephrops,	1 *f*				1	1 *f*, *g*	1			1							2 *e*	2
Paranephrops,																		
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 *b*	1 *a*	3
Atyoida,																		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.		E. Atlantic.			Arctic.	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 *c*, 1 *g*	. .	1 *f*	1 *d*	. .	. .	. .	. .	. .	. .	. .	. .	. .	10
Hippolyte,	. 3 *e*	. .	. .	2 *b*	1 *c*, 6 *f*, 2	3 *d*	. 1 *e*	. 18 *h*	. .	. .	5 *a*	. 2 *h*	1 *c*, 1 *g*	. .	. .	1 (1)
Rhynocinetes,	. .	. 1 *e*	. .	. .	. .	. .	. .	. 3 *h*	. .	. .	. .	. .	. .	. .	. .	3
Pandalus,	. 1 *g*	. .	. .	. .	1 *g*	2 *d*	. .	. .	. .	. .	. .	. 1	. .	. 1	. .	3
Pontonia,	. 1 *b*	. .	. .	2	. .	1 *d*	. .	. .	. .	. .	1 *a*	. .	1 *g*	. .	. .	1
Œdipus,	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .	1 *a*	. .	1 *e*	. .	. .	3
Harpilius,	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .	2
Anchistia,	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .	2 *a*	. .	. .	. .	. .	22
Palæmonella,	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .	2 *a*	. .	. .	. .	. .	1
Palæmon,	. 4 *b*	. 2 *e*	4 *a*, 1 *b*, 1 *c*, 1 *f*, 1 *g*	1 *b*	2 *c*, 1 *d*, 3 *f*	5 *d*, 2 *e*, 2 *f*	. .	. 1 *h*	. .	1 *b*, 2 *b'*	7 *a*	. 7	. .	. .	. .	1
Hymenocera,	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .	1
Cryphiops,	. .	. 1 *e*	. .	. .	1 *c*	. .	. .	. .	. .	. .	1 *a*	. .	. .	. .	. .	2
Ophiophorus,	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .	2 *a*	. .	. .	. .	. .	1
Regulus,	. .	. .	. .	. .	1 *f*, 1 *g*	1 *d*	. .	. 1 *h*	. .	. .	. .	. .	. .	. .	. .	3
Pasiphæa,	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .	3
PENÆIDEA.																
Sicyonia,	. .	. .	. .	1 *b*	. .	1 *d*	. .	. .	. .	. .	. .	. .	. .	. .	. .	14
Penæus,	. .	. .	. .	1 *b*, 1 *f*	. 2 *f*	. 3 *d*	. .	. .	. .	1 *b*, 1 *b'*	. 8 *a*, 1 *c*	. 3	. .	. 2	. .	2
Stenopus,	. .	. .	. .	. .	. .	. .	. .	. .	. .	1 *b*	. 1 *a*	. 6	. .	. .	. .	1
Spongicola,	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .	. 1	. .	. .	. .	1
Sergestes,	. .	. .	. .	. .	1 *d*	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .	1
Acetes,	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .	1 *a*	. .	. .	. .	. .	1
Euphema,	. .	. .	. .	. .	. .	. .	. .	. 1 *i*	. .	. .	. .	. .	. .	. .	. .	1
Eucopia,	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .	. .	

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							3 *a*	3
Siriella,																	1	1
Loxopis,													1 *a*					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			1 *e*		1							1 *e*	1
Deto,																	1 *a*	1
Scyphax,																		
Styloniscus,				1 *g*	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													
Ægа,			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)

Corallana,																			1 *a*		1
Alitropus,															2 *a*						2
Spheroma,	1 *e*, *g*	3 *e*	1 *c*	1 *b*, 3 *g*	9	6 *f*, 2 *g*	4 *d*	3 *e*, 1 *f*	3 *e*	13	2 *b*	2 *b*	1 *a*, 1 *f*			3, 2 *e*, 1 *f*		7 *e*		14 (1)
Cymodocea,						4 *f*, 1 *g*	4 *d*, 1 *f*			9						1				1
Cerceis,																1 *e*, 1				2
Cassidina,								1 *g*		1						1 *e*				1
Amphoroidea,		1 *e*			1											1 *e*				1
Nesæa,			2 *f*		2	1 *f*	1 *d*, 1 *f*			3			1 *c*							1
Campecopea,						2 *f*, 1 *g*				2										
Ancinus,																				

6. ANISOPODA.

	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.	
SEROLIDEA.																		
Serolis,		2 *e*		1 *f*, 3 *g*, 1 *h*	5													
Praniza,						3 *f*, 1 *g*	2 *d*		1 *h*	7								
Anceus,						2 *f*	2 *d*		1 *h*	4								
ARCTURIDEA.																		
Arcturus,							1 *d*			1								
Leachia,						1 *f*, 2 *g*				3			1 *a*					1
? Anthura,							1 *d*			1								
TANAIDEA.																		
Tanais,		2 *e*		1 *a*	3	1 *d*, 1 *f*	2 *d*		6 *h*	9	1 *b*							1 (1?)
Paratanais,				1 *b*?	1	1 *d*				1			1 *a*					1
Leptochelia,																	1 *a*	1
Apseudes,						1 *f*				1								
Rhœa,						1 *f*	1 *d*			1								
Liriope,									1 *h*	1								
Cryptothir,																	1 *a*	1
Crossurus,									1 *h*	1								
Bopyrus,						1 *f*	1 *d*, 1 *e*		2 *h*	4								
Phryxus,									2 *h*	2								
Cepon,												1 *b*?						1
Dajus,									1 *h*	1								
Ione,						1 *f*				1								
Argeia,	1 *g*				1													

7. AMPHIPODA.

	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.	
CAPRELLIDEA.																		
Proto,				1 *b*	1	1 *f*			2 *h*	2								
Protella,													1 *a*					1
Caprella,		3 *e*	1 *c*	6 *b*	10	4 *f*, 5 *g*	1 *d*		6 *h*	13		2 *b'*		1 *c*				3
Ægina,									2 *h*	2			2 *a*?					2
Cercops,									1 *h*	1								
Podalirius,									1 *h*	1								
Cyamus,		1 *c*	1 *g*		2	3 *f*	1 *d*	3		5 (1)								
GAMMARIDEA.																		
Dulichia,									1 *h*	1								
Chelura,						1 *f*				1								
Clydonia,						1 *a*				1								
Corophium,				1 *b*	1	1 *f*				1								
Siphonœcetes,									1 *h*	1								
Platophium,				1 *b*	1													
Cyrtophium,													1 *a*					1
Unciola,			1 *f*		1				1 *h*	1								
Podocerus,			2 *f*		2								1 *a*					1
Cratophium,				1 *b*	1													
Cerapus,			1 *f*		1	1 *f*, 1 *g*				2								
Erichthonius,						1 *f*				1								
Laphystius,									1 *h*	1								
Icilius,													1 *a*					1
Pterygocera.																		
Orchestia,	2 *g*	5 *e*	2 *f*	1 *b*, 1 *e*, 2 *g*	13	4 *f*	4 *d*, 1 *f*, 1 *e*	2 *e*	2 *h*	10	3 *b*	1 *b*			2 *e*	1 *b*	2 *a*, 6 *e*	14
Allorchestes,	1 *g*	1 *d*, 2 *e*		2 *b*	5	1 *c*, 1 *d*	1 *d*			2			1 *a*		2 *e*	1 *b*	1 *a*, 2 *e*	7
Stegocephalus,									1 *h*	1								
Lysianassa,				2 *b*	2		2 *d*			2								
Opis,						1 *g*				1								
Uristes,																	1 *h*	1
Anonyx,				1 *g*	1	1 *g*			2 *h*	3								
Urothoe,													2 *a*					2
Stenothoe,				1 *b*	1													
Leucothoe,						1 *f*			2 *h*	3								
Acanthonotus,						1 *f*	1 *f*		3 *h*	5								
Alibrotus,						1 *f*				1								
Leptochirus,						1 *f*				1								
Iphimedia,	1 *g*	1 *e*	1 *f*	2 *g*	5	1 *f*		1 *e*	14 *h*	16		1 *b*					1 *e*	2
Œdicerus,									1 *h*	1							1 *e*	1
Amphithoe,		2 *e*	1 *c*, 1 *f*	3 *b*, 1 *g*	8	4 *f*, 1 *g*	2 *d*, 1 *f*	1 *e*		9	2 *b*		3 *a*				1 *a*	6
Gammarus,	1 *g*	1 *d*, 2 *e*	2 *c*, 1 *f*	1 *b*, 1 *g*	8	1 *f*, 2 *g*	2		13 *h*	26			5 *a*		1 *e*		3 *a*	9
Photis,									1 *h*	1								
Melita,						1 *g*			2 *h*	3							1 *e*	1

Mæra,				2 *b*	2	4 *f*, 1 *g*	2 *d*			7			1 *a*					1
Dercothoe,				1 *b*	1								2 *a*					2
Pyctilus,				1	1								2 *a*					2
Pardalisca,									1 *h*	1								
Atylus,						1				1								
Ischyrocerus,									2 *h*	2								
Microcheles,									1 *h*	1								
Lepidactylis,									1 *h*	1								
Pontiporeia,									1 *h*	1								
Amphelisca,									1 *h*	1								
Protomedeia,									1 *h*	1								
Aora,		1 *e*			1													
Phoxus,									2 *h*	2								
Isæa,						1 *f*				1								
Anisopus,																		
HYPERIDEA.																		
Vibilia,							1 *d*			1			1 *a*					1
Lestrigonus,								2 *a*	1 *h*	3			1 *a*				1 *a*	2
Tyro,						1				1								
Hyperia,		2 *e*	1 *g*		3	1 *d*, 2 *f*		1 *e*	1 *h*	4								
Metœcus,									1 *h*	1								
Tauria,															1 *h*			1
Cyllopus,				1 *g*	1													
Dairilia,													2 *a*				2 *a*	4
Cystisoma,													1					1
Synopia,								1 *a*		1							1 *a*	1
Phronima,						1 *a*, 1 *g*	1 *d*			2								
Primno,		1 *e*			1													
Anchlomera,				1 *b*, 1 *e*	2							1 *b′*	1 *a*					2
Phrosina,								2 *d*		2								
Themisto,								1 *g*	2 *h*	3					1 *h*			1
Phorcus,								1 *a*		1			1					1
Dithyrus,						1 *c*				1								
Typhis,						2 *f*		1 *d*		3								
Thyropus,						2 *d*		1 *a*		3								
Pronoe,		1 *e*			1			1 *a*		1								
Lycæa,															1 *d*			1
Oxycephalus,		1 *e*			1								1 *a*					1
Rhabdosoma,																	1	1

RECAPITULATION.

The three subdivisions adopted in the preceding table, are designated A, B, and C, in the following summary of the results. The division A, includes the Atlantic and Pacific coasts and islands of America; B, the European and West African coasts and islands, from Cape Horn to Greenland inclusive; and C, the coasts and islands of the Indian and Pacific Oceans (America excluded).*

I. BRACHYURA.

	A.	B.	C.
MAIOIDEA.			
Maiinea,	69	24 (1 *a*)	73 (1 *b*)
Parthenopinea,	1	5	29
Oncininea,	0	0	2
Total Maioidea,	70	29 (1)	104 (1)
CANCROIDEA.			
Cancridæ,	10	3	0
Xanthidæ,	17	7 (1 *a*)	129 (1 *b*)
Eriphidæ,	7	5	52 (1 *b*)
Portunidæ, Platyonychidæ and Podophthalmidæ,	13	19 (1 *a*)	54 (1 *a*)
Telphusinea,	6	1	7
Cyclinea,	1	0	0
Total Cancroidea,	54	35 (2)	242 (3)
GRAPSOIDEA,	51	18 (5)	124 (5)
LEUCOSOIDEA,	9	12	48 (1)
CORYSTOIDEA,	6	5	8
Total BRACHYURA,	190	99 (8)	526 (10)

II. ANOMOURA.

	A.	B.	C.
Dromidea,	1	9	15 (1 *b*)
Bellidea,	2	0	0
Raninidea,	1	0	5

* The discrepancies between the enumeration here and the summaries of the preceding tables, arise from species omitted in one or both, on account of the uncertainty of their localities.

	A.	B.	C.
Hippidea,	7	2	7
Porcellanidea,	24	4	19
Lithodea,	5	1 (1 *a*)	3
Paguridea,	26	27 (1 *a*)	61 (1 *b*)
Ægleidea,	2	0	0
Galatheidea,	3	6 (1 *a*)	5
Total ANOMOURA,	71	49 (3)	115 (2)

III. MACROURA.

	A.	B.	C.
Thalassinidea,	7	8	9 (1 *b*)
Astacidea,	29	9	27
Caridea,	40	77 (3 *a*)	85 (3 *b*)
Penæidea,	4	8	22
Total MACROURA,	80	102 (3)	143 (4)

IV. ANOMOBRANCHIATA.

	A.	B.	C.
Squilloidea,	10	16	32 (3 *b*)
Mysidea,	3	18	15
Amphionidea,	0	9	11
Total ANOMOBRANCHIATA,	13	43	58 (3)

V. TETRADECAPODA.

	A.	B.	C.
ISOPODA.			
Idotæidea,	11	25	6 (1 *b*)
Oniscoidea,	30	72 (1 *a*)	11
Cymothoidea,	32	57 (1 *a*)	42 (2 *b*)
Total Isopoda,	73	154 (2)	59 (3)
ANISOPODA,	10	38	6
AMPHIPODA.			
Caprellidea,	13	24	6
Gammaridea,	55	114	51
Hyperidea,	9	27	17
Total Amphipoda,	77	165	74
Total TETRADECAPODA,	160	357 (2)	139 (3)

The preceding table affords the following lists of genera of the three grand divisions, according to the present state of the science.

1. GENERA EXCLUSIVELY AMERICAN OR OCCIDENTAL.

	Coast on which found.
1. *Maioidea.*	
Microrhynchus,	west.
Salacia,	"
Libidoclea,	west and east.
Libinia,	" "
Pelia,	west.
Rhodia,	"
Pisoides,	"
Thoe,	west and east.
Chorilia,	west.
Scyra,	"
Othonia,	"
Mithraculus,	west and east.
Tyche,	" "
Eurypodius,	" "
Oregonia,	west.
Inachoides,	"
Pugettia,	"
Epialtus,	west and east.
Leucippa,	" "
2. *Cancroidea.*	
Pilumnoides,	west.
Trichodactylus,	east.
Arenæus,	"
Potamia,	west and east.
Orthostoma,	east.
Acanthocyclus,	west.

	Coast on which found.
3. *Grapsoidea.*	
Cyrtograpsus,	east.
Uca,	west and east.
Gecarcoidea,	east.
Fabia,	west.
Pinnixa,	west and east.
Pinnotherelia,	west.
Halicarcinus,	west and east.
4. *Leucosoidea.*	
Platymera,	west.
Hepatus,	west and east.
Guaia,	" "
5. *Corystoidea.*	
Telmessus,	west.
Peltarion,	east.
Pseudocorystes,	west.
6. *Anomoura.*	
Corystoides,	west.
Bellia,	"
Ranilia,	"
Albunhippa,	west.
Echidnocerus,	"
7. *Macroura.*	
Cambarus,	west and east.
Paracrangon,	west.
Æglea,	"
Cryphiops,	"

2. GENERA EXCLUSIVELY OF THE AFRICO-EUROPEAN DIVISION.

1. *Maioidea.*
   - Lissa.
   - Stenorhynchus.
   - Amathia.
   - Eurynome.
2. *Cancroidea.*
   - Perimela.
   - Portumnus.
   - Polybius.
3. *Grapsoidea.*
   - Gonoplax.
   - Heterograpsus.
   - Brachynotus.
   - Hymenosoma.
4. *Leucosoidea.*
   - Ilia.
5. *Corystoidea.*
   - Thia.

Corystes.
6. *Anomoura.*
Homola.
7. *Macroura.*
Axius.
Calocaris.
Ephyra.
Gnathophyllum.

3. GENERA EXCLUSIVELY ORIENTAL, OR OF THE THIRD DIVISION.

1. *Maioidea.*
Macrocheira.
Paramithrax.
Micippa.
Lahaina.
Naxia.
Hyastenus.
Pyria.
Cyclax.
Camposcia.
Paramicippa.
Tiarinia.
Perinea.
Halimus.
Menæthius.
Stenocionops.
Huenia.
Xenocarcinus.
Parthenope.
Eumedonus.
Ceratocarcinus.
Gonatonotus.
Eurynolambrus.
2. *Cancroidea.*
Atergatis.
Liomera.
Liagora.
Medæus.
Halimede.
Etisus.
Carpilodes.
Zozymus.
Daïra.
Cymo.
Polydectus.
Œthra.
Galene.
Pseudozius.
Melia.
Acanthodes.
Actumnus.
Ruppellia.
Domæcius.
Trapezia.
Tetralia.
Quadrella.
Scylla.
Charybdis.
Lissocarcinus.
Podophthalmus.
3. *Grapsoidea.*
Curtonotus.
Cleistostoma.
Macrophthalmus.
Helœcius.
Scopimera.
Doto.
Eriocheir.
Platynotus.
Trichopus.
Sarmatium.
Helice.
Gecarcinicus.
Xenophthalmus.
Xanthasia.
Hymenicus.
Elamena.
Myctiris.
4. *Leucosoidea.*
Mursia.
Orythia.
Thealia.
Matuta.
Philyra.
Leucisca.
Nucia.

Nursia.
Myra.
Ixa.
Iphis.
Arcania.
Oreophorus.
Tlos.
Ethusa.

5. *Corystoidea.*
Kraussia.
Œidia.
Dicera.

6. *Anomoura.*
Caphyra.
Raninoides.
Ranina.
Notopus.
Lyreidus.
Cosmonotus.
Lomis.
Diogenes.
Aniculus.
Birgus.

7. *Macroura.*
Laomedia.
Glaucothoe.
Callianidea.
Callisea.
Thenus.
Ibacus.
Astacoides.
Paranephrops.
Cyclorhynchus.
Atyoida.
Alope.
Œdipus.
Harpilius.
Anchistia.
Palæmonella.
Hymenocera.
Oplophorus.
Regulus.
Stenopus.
Spongicola.
Acetes.
Eucopia.

4. GENERA COMMON TO THE AMERICAN AND AFRICO-EUROPEAN DIVISIONS, BUT NOT IN THE THIRD, OR ORIENTAL.

1. *Maioidea.*
Hyas.
Herbstia.
Leptopodia.
Stenorhynchus.

2. *Cancroidea.*
Atelecyclus.

3. *Anomoura.*
Munida.
Grimothea.

4. *Macroura.*
Homarus.

5. GENERA COMMON TO THE AFRICO-EUROPEAN AND ORIENTAL DIVISIONS, NOT YET FOUND IN THE OCCIDENTAL.

1. *Maioidea.*
Inachus.
Doclea.
Maia.
Achæus.
Lambrus.

2. *Cancroidea.*
Actæa.
Actæodes.
Thalamita.
Portunus.
Telphusa.

3. *Leucosoidea.*
Cycloes.
Ebalia.
Dorippe.

4. *Anomoura.*
Latreillia.
Cymopolia.
Remipes.

5. *Macroura.*
Nika.
Lysmata.
Caridina.

6. GENERA COMMON TO THE THREE DIVISIONS.

1. *Maioidea.*
   - Pisa.
   - Mithrax (mainly Occid.)
   - Acanthonyx.
2. *Cancroidea.*
   - Xantho.
   - Panopæus (mainly Occid.)
   - Pilumnus.
   - Eriphia.
   - Lupa.
   - Amphitrite.
   - Carcinus.
   - Platyonychus.
3. *Grapsoidea.*
   - Grapsus.
   - Goniograpsus.
   - Sesarma (sparingly European).
   - Acanthopus.
   - Plagusia.
   - Pinnothera.
   - Calappa.
4. *Anomoura.*
   - Dromia (sparingly Occid.)
   - Albunæa.
   - Porcellana.
   - Lithodes.
   - Paguristes.
   - Bernhardus.
   - Pagurus (mainly Orient.)
   - Clibanarius.
   - Galathea.
5. *Macroura.*
   - Gebia.
   - Scyllarus.
   - Panulirus.
   - Palinurus.
   - Astacus.
   - Crangon.
   - Alpheus.
   - Betæus.
   - Hippolyte.
   - Pandalus.
   - Palæmon.
   - Sicyonia.
   - Penæus.

The following are lists of *species* common to two or more of the three divisions. They may be much changed by further study, through the discovery that the specimens from distant localities are not conspecific. Should this happen, there is a relation indicated based on their close similarity, which is important.

1. SPECIES STATED TO BE COMMON TO DIVISIONS A. AND B., OR THE AMERICAN AND THE AFRICO-EUROPEAN WATERS.

Hyas coarctata; Massachusetts and Long Island, in United States; France; England; Shetlands.

Leptopodia sagittaria; Canaries; West Indies; Valparaiso.

Panopæus Herbstii; Mediterranean; Key West, South Carolina, and New York, in United States.

Carcinus mænas; Mediterranean at Nice; Crimea; England; Massachusetts, United States.

Grapsus pictus; Madeira; Peru and Chili; (also various Pacific islands.)

Planes minutus; Atlantic Ocean, and occasionally found on both the American and European coasts.

Goniograpsus varius; Canaries; Mediterranean at Algiers, Nice, Italy; Crimea; Brittany; and probably at Rio Janeiro, Brazil.

Sesarma reticulata; Key West and South Carolina, in United States; and in South Africa, according to M'Leay.

Acanthopus planissimus; West Indies; Canaries; Madeira; Cape Town and Port Natal, South Africa (also various tropical Pacific islands).

Plagusia squamosa; West Indies; Key West, South Carolina, in United States; Canaries; Madeira (also, Isle of France; Indian Ocean; Red Sea; Port Natal).

Plagusia tomentosa; Chili; Cape Town (also, New Zealand).

Albunæa symnista; Canaries; Mediterranean (also, Pondicherry); and if the *A. oxyophthalmus* is the same species, it occurs in the West Indies, and on the coast of South Carolina.

Lithodes maia; Great Britain; Shetlands; Norway; coast of Massachusetts (rare).

Bernhardus streblonyx; Great Britain; France; Mediterranean; Norway; Massachusetts, in United States; (also Kamtschatka).

Cenobita diogenes; West Indies; Mediterranean; (Hawaii?)

Crangon vulgaris; Great Britain; France; United States; San Francisco and Puget's Sound, Western America.

Crangon boreas; Norway; Iceland; Greenland; Massachusetts (in fish), (also, Kamtschatka).

Pandalus annulicornis; Scotland and Shetlands; Norway; Iceland; Massachusetts (rare).

Gonodactylus chiragrus; Mediterranean; Key West; (also, Red Sea; Port Natal, South Africa; Isle of France; East Indies; Swan River, Australia; Pacific Ocean, at Feejees, Tongatabu, &c.)

2. SPECIES COMMON TO B. AND C., THE AFRICO-EUROPEAN AND ORIENTAL SEAS.

Mithrax dichotomus; Mediterranean; East Indies.

Achæus Cranchii; Mediterranean; *Japan* (probably same species).

Actæa rufo-punctata; Canaries and Mediterranean; Isle of France, Indian Ocean.

Thalamita admete; Canaries; Port Natal, South Africa; Red Sea; Indian Ocean and East Indies; Pacific Ocean, at the Feejees, Samoa, Hawaiian Islands, Wake's Island, &c.

Pilumnus Forskalii; Canaries; Red Sea.

Grapsus pictus; *see above.*

Grapsus strigosus; Canaries; South Africa; Red Sea; East Indies.

Goniograpsus messor; Canaries; Port Natal, South Africa; Red Sea; East Indies.

Planes minutus; Atlantic; *Japan.*

Acanthopus planissimus; *see above.*

Plagusia tomentosa; Chili; South Africa; New Zealand.

Plagusia squamosa; *see above.*

Cycloes granulosa; Canaries; *Japan* (probably same species).
Remipes scutellata; Ascension Island; Swan River, Australia; St. Christopher's.
Lysmata seticaudata; Mediterranean; *Japan*.
Alpheus Edwardsii; Mediterranean; Cape Verdes; Port Natal, South Africa.
Pandalus pristis; Mediterranean; *Japan*.
Squilla mantis; Mediterranean; Canaries; *Tschusan*.
Pagurus striatus; Mediterranean; Japan.

3. COSMOPOLITES.

The above lists include the following species occurring in the Occidental, Africo-European, and Oriental seas.

Grapsus pictus.	Bernhardus streblonyx.
Acanthopus planissimus.	Crangon boreas.
Plagusia squamosa.	Crangon vulgaris.
Plagusia tomentosa.	Gonodactylus chiragrus.

These are cosmopolite species.* The *Grapsus*, *Acanthopus*, *Plagusia squamosa*, and *Gonodactylus* pre-eminently deserve this name, being found both north and south of the equator. They thrive in the hottest equatorial waters, and have their extreme limit in the temperate region. The temperature they admit of is hence at least from 56° to 88° F.

The other species are cold-water species. *Plagusia tomentosa* belongs to the southern subtemperate region, being reported from Cape Town, New Zealand, and Chili, and the rest are found in high northern latitudes, and probably pass from the Atlantic to the Pacific Ocean through the Arctic Seas.

Besides the above species, a few are found in the West Indies, which occur also in the Oriental Seas, but are not yet known from the European or West African coasts. These, which also may be styled cosmopolites, are as follows:—

Mithrax asper; East Indies; probably the same on the Peruvian coasts.
Atergatis lobatus; Red Sea and Indian Ocean; West Indies.
Carpilius maculatus; East Indies; South France; Japan; various Pacific Islands from the Paumotus to the Feejees and Hawaiian Islands; West Indies.
Eriphia gonagra; East Indies; Port Natal; Key West.

* The *Platyonychus bipustulatus* may possibly be another cosmopolite, for it is reported from Table Bay, the East Indies, Japan, and Valparaiso. But we believe the Valparaiso species to be different from that of the East Indies, and have so named it.

Menippe Rumphii; East Indies; Rio Janeiro and the West Indies.
Chlorodius exaratus; Pacific Islands; East Indies; West Indies.
Lysiosquilla scabricaudis; Indian Ocean; West Indies; Brazil; South Carolina.

From the survey already made, it is apparent, that the three grand divisions of the seas and coasts adopted in the preceding table, have very few species in common, and they correspond to a natural geographical arrangement. They constitute three kingdoms, to which two should be added, one for the Arctic Seas, and the other for the Antarctic. These kingdoms are:—

I. The *Occidental* Kingdom, embracing the Atlantic and Pacific coasts of America to the frigid region, or some point in the subfrigid region.

II. The *European* Kingdom, extending from Cape Horn (or Cape Agulhas) to the Shetlands inclusive, and embracing the adjoining islands.

III. The *Oriental* Kingdom, including the east coast of Africa, the south and east of Asia, and the islands of the Indian and Pacific Ocean, exclusive of the American continent.

IV. The *Arctic* Kingdom, including Norway, Iceland, Greenland, the Alascha Archipelago, and adjoining parts of the coasts of America and Kamtschatka, with other Arctic lands.

V. The *Antarctic* Kingdom, embracing Fuegia, the Falklands, Southern New Zealand, and the lands or islands of the Antarctic Seas.

Each of the first three kingdoms are naturally divided into three subkingdoms: a *north*, a *middle*, and a *south*, corresponding severally to the North Temperate, Torrid, and South Temperate zones of sea-temperature. The importance of these divisions will be a subject of further remark beyond.

The summary of the results in the preceding table, presents some striking facts.

We observe, first, that there is a ratio of 1 : 1·5 between the Maioids of the A and C divisions (that is between those of the *Occidental* and *Oriental* seas, as just explained), while the ratio is about 1 : 4½ for the Cancroids. So also, while the ratio of the A and B divisions together (Occidental and European) to C (Oriental) is for the Maioids, nearly 1 : 1, it is for the Cancroids, 1 : 3. Here is a wide difference between the Occidental and Oriental seas as regards these groups. This last ratio is for the Corystoids nearly that for the Maioids, or more exactly, 1 : 0·75; and for the Grapsoids it is 1 : 2;

for the Leucosoids, 1 : 2½. (The Arctic and Antarctic Seas are here merged in the other kingdoms, with which they are most nearly associated.)

If we compare these ratios with those which the same groups sustain as regards temperature, as exhibited on a former page, we discover that there is a very close parallelism; showing plainly that the prevalence of Maioids in the Occidental Seas must be owing to the comparative prevalence of cold waters; and the prevalence of the warm-water groups, the Cancroids and Leucosoids, in the Oriental Seas, is owing conversely to the great extent of warm waters.

Again, the ratio between the A and B divisions together of the Macroura, and the C division, is nearly as 1 : 0·8, which sustains the same conclusion.

The corresponding ratio for the Tetradecapoda is as 1 : 0·26. But as this group, owing to the smallness of the species, has not been thoroughly investigated, except in European regions, directly under the eyes of European observers, we cannot use satisfactorily the facts they present for deducing general conclusions, or for characterizing zoological districts or provinces. Still, it should be observed that the facts conform to the same principle.

It is hence of the highest importance before comparing the zoological character of different coasts, that the temperature-regions of those coasts should be ascertained.

Comparative tables of the East Indies and Mediterranean, or of the Peruvian coast and the East Indies, or of the southeast and southwest coast of Africa (and so on), would lead us far astray, if this element were left out of view; for a difference of temperature region, implies a difference of genera and species, independent of other considerations. On these grounds, whole continents, or sides of continents, may have a common character and differ widely from other continents in the same latitudes.

If we look at the American continent in this point of view, we at once perceive a striking peculiarity. All the coasts of North and South America, with the Gallapagos on the west, belong to the Temperate zone, excepting a few degrees along by Panama, and a connected range of coast from Key West to Rio Janeiro. Chili and Peru are excluded even from the warm temperate region, and so also, the coast of the United States, north of Cape Hatteras.

Now contrast America with the Oriental Seas. The whole east

coast of Africa, north of the parallel of 30° south, the coasts of India and the East India Islands, and the northern half of Australia, together with the numerous islands of the Pacific, belong alike to the Torrid zone. In the American Seas, the torrid coasts make a single range, and have many species in common throughout. In the Oriental Seas, they reach with an uninterrupted surface over one-half of the circumference of the globe, and there is room for many distinct provinces within the same temperature region. The space for Torrid zone species along the American coasts in the Atlantic or Pacific, or that of the whole Atlantic Ocean, is small compared with the vast extent of the East Indies, Indian Ocean, and Middle Pacific, and this fact is more striking, if we consider that the Atlantic east of the West Indies contains no islands in the Torrid zone, besides St. Helena, Ascension, and the Cape Verdes, all of which are of small size.

Again, in order to compare the coasts of America and Europe, we must observe that the warm temperate region is represented along the former by a small district from Northern Florida to Cape Hatteras, while this region does not reach at all the latter, and only the Canaries in the eastern Atlantic are within it. Moreover, the temperate and subtemperate regions are mere points on the North American coast at Cape Hatteras; while on the European side, the former embraces the larger part of the Mediterranean, and a portion of Northwestern Africa, and the latter includes the Atlantic coast of Portugal. But north of Cape Hatteras, the coast of America is rightly compared with that of Europe, north of Portugal.

To compare the coast of Asia and Europe, we first observe in the same manner the temperature regions. There is in fact a striking similarity with the coast of the United States. Yet, the torrid and subtorrid regions are confined to limits much nearer the equator; and the warm temperate, although embracing as many degrees of latitude as the warm temperate on the United States, does not on the China coast extend farther north than the subtorrid region of the Florida coast. The temperate region hardly has a place on the coast of China, while the subtemperate occupies the Yellow Sea. North of this Gulf, the coast corresponds mostly with the coast of the United States, north of Cape Cod.

It is unnecessary to adduce other explanations, as the chart furnishes all that is needed for a ready comparison between the different coasts.

The propriety of uniting in one kingdom both coasts of America, the eastern and western, and thus shutting off the latter from the great Pacific Ocean, may at first appear unnatural. Yet it is supported by all facts bearing on the subject. There are no species known to be common to Western America and the Middle Pacific, excepting two or three cosmopolites. Moreover, the genera are to a great extent distinct, and where so, they often occur on both sides of the continent. The genera of Podophthalmia peculiar to America are mentioned on page 1548, and also the particular coast on which they occur.

A review of some of the facts will exhibit in a strong light the zoological resemblances of the two sides of the continent.

Of *Cancer*, there are *four* species found on the west coast of South America, *three* on the west coast of North America, and *two* on the east coast of North America.

Of *Hepatus*, there is *one* species common to the West Indies and Brazil, a *second*, found at Rio Janeiro; a *third*, at Valparaiso, Chili; a *fourth*, on the Carolina coast.

Libinia, in the same manner, has its species on the Atlantic and Pacific coasts of the United States, and the coasts of Western and Eastern South America. *Mithrax* is as widely distributed.

Epialtus occurs in the West Indies, California, Brazil, Gallapagos, and Valparaiso. *Potamia* has two West Indian and one Chilian species.

Eurypodius of Southern South America has its representative at Puget's Sound, in the genus *Oregonia*.

Again, the *Libinia dubia* of the West Indies, is hardly distinguishable, according to Prof. L. R. Gibbes, from the *L. affinis*, Rand., of the California coast. *L. spinosa* of Brazil is also found in Chili. *Leptopodia sagittaria* occurs in the West Indies, and also, according to Bell, at Valparaiso; *Acanthonyx Petiverii* (?), in the West Indies, Brazil, and Gallapagos; *Epialtus marginatus*, on the coast of Brazil and at the Gallapagos (Bell); *Epialtus bituberculatus*, in Chili, and at Key West; *Uca una*, Guayaquil and West Indies; *Albunœa scutellata*, West Indies and San Lorenzo, Peru; *Hippa emerita* and *talpoides*, both on East and West America, North and South.

It is obvious, therefore, that the east and west sides of America are very closely related, and differ widely in a zoological sense, from either of the other kingdoms.

We observe further, that nearly all the genera peculiar to America are *cold-water* genera. They are mostly Maioids; the large group of

the Cancroids, which belong mainly to warm waters, does not include a single genus exclusively American, and of the family Leucosidæ, of the Leucosoids, there are only three known species.

We also perceive why the western coast of America has no zoological affinity with the Pacific Islands. The temperature of their waters is widely different; and, moreover, the oceanic currents of the tropics run *from* the American coast to the westward, and are a barrier to migration eastward.

The relations of the American or Occidental to the Africo-European kingdom are of much interest. The two kingdoms are widely different in most respects.

In the first place, the genera *Lupa*, *Gelasimus*, *Ocypoda*, *Libinia*, *Epialtus*, *Hepatus*, well represented on the American coasts, are not known on the European, besides others (Table 1, page 1548) of less prominence.

Again, there are several genera common in Europe, not known in America, as *Inachus*, *Maia*, *Achæus*, *Portunus*, *Ebalia*, *Latreillia*, *Athanas*, in addition to those included in Table 2, on page 1548.

Still, the American and Africo-European kingdoms have a common character separating them from the Oriental. For example: the great genus *Cancer* occurs in both of these kingdoms, and is not known in Oriental seas, except in New Zealand and Tasmania. So also the important genus *Homarus;* besides *Hyas*, *Herbstia*, *Leptopodia*, *Atelecyclus*, *Munida*, and *Grimothea*. The genus *Homarus* has one species on the coast of the United States, one on the coast of Europe, and one at Table Bay, South Africa, thus ranging over the whole Atlantic.

We may now treat separately of the several Kingdoms, and their subdivision into *Provinces*, pointing out the naturalness of their limits, and the characteristics of these Provinces. Each temperature region along a coast makes a distinct Province, which facts, where ascertained, show to be well characterized. In some cases, a farther subdivision may be desirable, and when so, the subordinate divisions may be called *Districts*. The Provinces of each zone together may constitute a *Subkingdom*, as the *Torrid* Subkingdom, *Temperate* Subkingdom, &c.

I. OCCIDENTAL KINGDOM.

In the Occidental kingdom, there are in the first place, two SECTIONS, the *Eastern* and the *Western;* and both these sections are subdivided into—

1. The *Torrid* Subkingdom; 2. The *South Temperate* Subkingdom; 3. The *North Temperate* Subkingdom. The last two subkingdoms include the whole of the Temperate zone, excepting perhaps the extreme portions, which on zoological grounds may be separated, and united to the Frigid zone, forming the Arctic or Antarctic kingdoms.

In the following mention of the provinces, we give their lengths along the coast; and it will be seen, that although they may appear to be numerous, they still have a wide extent, the length being seldom under five hundred miles, and sometimes full four thousand miles.

A. WESTERN SECTION.

I. TORRID SUBKINGDOM.

1. The PANAMA Province (torrid), extending from the equator or a degree south to a degree beyond Acapulco. Length, sixteen hundred miles.

2. The MEXICAN Province (north subtorrid), reaching from the termination of the Panama province to the Peninsula of California. Length to the California Peninsula, exclusive of the Gulf, six hundred miles.

3. The GUAYAQUIL Province (south subtorrid) occupying from Cape Blanco, the west cape of South America, nearly to the equator, and including the Bay of Guayaquil. Length, nearly two hundred miles.

II. SOUTH TEMPERATE SUBKINGDOM.

1. The GALLAPAGOS Province (warm temperate) includes the Gallapagos Islands, but does not reach the continent. The genera peculiar to it are *Microrhynchus*, *Pelia*, *Rhodia*, *Thoe*, and *Othonia*. There are also two species of *Mithraculus*, one of *Mithrax*, one of *Pisoides* (also

Chilian), one of *Herbstia*, one of *Pisa*, one of *Epialtus*. The variety of Maioid forms is remarkably large. The Cancroids have not been described. *Epialtus marginatus* is also reported from Brazil.

2. The PERUVIAN Province (temperate), from just north of Payta nearly to Copiapo. Length, fifteen hundred miles. The most characteristic species appear to be the *Panopœus crenatus*, *Xantho crenatus*, and *Albunhippa spinosa* (another species of which genus occurs in California). There also exists here, the cosmopolite *Grapsus pictus*, of very large size, which is rare farther south; also *Libinia rostrata*, *Mithrax asper*, *Acanthonyx emarginatus*, *Porcellana mitra*, *Paguristes Weddelii;* besides several Chilian species of Porcellana, and *Xantho Orbignii*, *X. Gaudichaudii*, *Bernhardus Edwardsii*, and *Pseudosquilla monoceros*, which are common to Chili and Peru. The *Pilumnoides perlatus* is reported from Peru by D'Orbigny; but we observed it only at Valparaiso, where it was originally found by Pœppig.*

3. The CHILIAN Province (subtemperate). Length, seven hundred miles. This province is distinguished from the Peruvian by the rare occurrence of *Grapsus pictus*, and the unusual number and size of the species of *Cancer* and *Porcellana*, *three* of the former and *ten* of the latter existing at Valparaiso. Both of these genera have been shown to reach their highest developments in the middle Temperate zone. Other characteristic genera are the following:—*Inachoides*, *Acanthocyclus*, *Platymera*, *Pseudocorystes*, *Bellia*, *Æglea*, *Cryphiops*, *Pinnotherelia*, and *Rhyncocinetes*. *Epialtus dentatus*, *Ocypoda Gaudichaudii*, *Grapsus planifrons*, *Hepatus chilensis*, and *Platyonychus purpureus* are large and common species. The genera *Ocypoda* and *Grapsus* are not found south of the subtemperate region. *Pilumnoides* we suspect to be peculiar to Chili. The following are other genera represented in the Chilian seas:—*Libinia*, *Libidoclea*, *Pisoides*, *Leptopodia*, *Leucippa*, *Xantho* (four large species), *Panopœus*, *Ozius* (also an Australian genus), *Pilumnus*, *Gelasimus*, *Cyclograpsus*, *Uca*, *Pinnixa*, *Leucosia*, *Atelecyclus*, *Paguristes*, *Bernhardus*, *Galathea*, *Callianassa*, *Thalassina*, *Alpheus*, *Betœus*, *Palœmon*, *Pseudosquilla*, *Gonodactylus*.

The Chilian province is allied to the Gallapagos through *Pisoides tuberculosus* and perhaps, *Acanthonyx Petiverii;* with Brazil, through *Libinia spinosa;* with the West Indies and Canaries, through *Leptopodia sagittaria*. The *Hepati* of Chili and Rio Janeiro are closely related; and we suspect that the *H. chilensis* is found also at

* Gay, in his Historia de Chile, mentions its occurrence only on the Chilian coast.

Callao, Peru. The Eurypodii of the Patagonian seas sometimes reach as far north as Valparaiso.

Among the Tetradecapoda, *Amphoroidea typica* is a peculiar species, yet it closely resembles a species from Australia. Other genera of Tetradecapoda represented in Chili, are the following:—*Epelys*, *Porcellio*, *Lygia*, *Spheroma*, *Desmarestia* (Nicolet), *Orchestia*, *Allorchestes*, *Iphimedia*, *Amphithoe*, *Aora*, *Hyperia*, *Primno*, *Pronoe*, *Oxycephalus*.

4. The ARAUCANIAN Province (cold temperate), extending from Valdivia nearly to the parallel of 50°. Length, nine hundred miles. The genera *Eurypodius* and *Lithodes* occur on this coast, and probably also *Platyonychus* and *Pseudocorystes;* but the Araucanian species have not yet been studied.

South of the Araucanian province lies the *South Patagonian* and *Fuegian*, the latter of which properly falls into the Antarctic kingdom.

III. NORTH TEMPERATE SUBKINGDOM.

1. The SONORA Province (warm temperate) along the California Peninsula. Length, five hundred and fifty miles.

2. The DIEGO Province (temperate), extending from just below the entrance of the Peninsula, in latitude 28½° to latitude 34½°, and including the port of San Diego. Length, four hundred and fifty miles. A species of the genus *Pugettia* and an *Albunhippa* (a Peruvian genus) occur on this coast.

3. The CALIFORNIAN Province (subtemperate) extending beyond the Bay of San Francisco to Cape Mendocino. Length, four hundred and eighty miles. This region has a close resemblance to the Chilian, in some of its genera, which is also subtemperate. Thus there are three species of *Cancer*, two of *Epialtus*, and one of *Libinia*. The Libinia is closely like the *L. dubia* of the United States, if not identical with it.

4. The OREGON Province (cold temperate), extending probably to Puget's Sound. Length, about four hundred and eighty miles. The *Crangon vulgaris*, common in Northern Europe, occurs on this coast, and the *Echidnocerus* of White (near Lithodes) is reported from the mouth of the Columbia.

5. The PUGETTIAN Province (subfrigid). Length, about twelve hundred miles. This province has some distinctive genera, as *Oregonia* (related to Eurypodius), *Chorilia*, *Scyra*, and *Telmessus;* also,

species of *Pugettia*, *Hyas*, *Pseudograpsus*, *Pinnothera*, *Fabia*, *Trichocera*, with others of *Bernhardus*, *Gebia*, *Callianassa*, *Nephrops*, *Crangon*, *Paracrangon*, *Pandalus*; and among the Tetradecapoda, there are the genera *Oniscus*, *Spheroma*, *Argeia*, *Orchestia*, *Allorchestes*, *Iphimedia*, and *Gammarus*.

The northern part of the North American coast, including the Alaschka Archipelago, belongs to the Arctic kingdom.

B. EASTERN SECTION.

I. TORRID SUBKINGDOM.

1. The Caribbean Province (torrid), including the West India Islands, and the northern and northeastern coast of South America, from the north of Yucatan to beyond Bahia. Length, along the South American coast alone, about four thousand miles. There are as yet no known Caribbean genera of Podophthalmia, that do not occur in other Provinces in this or the other kingdoms. *Mithrax* and *Uca* are the more characteristic genera, and the latter is reported elsewhere only from Guayaquil, Brazil. The following are prominent forms:—*Chorinus heros*, *Pericera cornuta*, and *P. 3-spinosa*, *Amphitrite forceps* and *A. 3-spinosa*, *Ocypoda rhombea*, *Calappa marmorata*, *Atya occidentalis*, *Palinurus longimanus*, *Palæmon Jamaicensis*. The Torrid zone genus *Carpilius* contains two West Indian species, one of which (C. maculatus) is a cosmopolite, and allies the West Indies to the Oriental seas. *Dromia*, although a warm-water genus, has but a single representative, *D. latior*; and of *Chlorodius*, so common in the Orient, in like manner, only one species has been observed, and that occurs also in the Pacific. There is but a single species of Leucosidæ known; but the Caribbean species of Crustacea, it must be acknowledged, are not very thoroughly known. Through *Leptopodia sagittaria* the province is related to the Canaries.

2. The Floridan Province (subtorrid), Key West and a part of Florida are here embraced, together with the Bermudas. Length on the United States coast, two hundred miles. The species are mostly those of the Caribbean Sea. A *Libinia*, *Hyas*, *Epialtus*, and *Menippe*, have been reported from Key West and Florida, that are not mentioned as occurring about the West India Islands; also, several *Sesarmas*, a *Ranilia*, and a *Callianassa*; these genera are none of them

eminently Torrid zone genera. The northern species, *Bernhardus pollicaris, Platyonychus ocellatus, Lupa dicantha, Panopœus limosus* and *Herbstii*, reach as far south as Key West.

3. The Brazilian Province (subtorrid), including the harbour of Rio Janeiro, and extending north nearly to Bahia. Length, six hundred miles. The species of Crustacea are numerous, and have close relations to those of Key West. Among the species peculiar to the province are the following:—*Leucippa levis, Pilumnus Quoyi, Lupa spinimana, Eucrate crassimanus, Chasmagnathus granulatus, Hemigrapsus granulatus, Hepatus fasciatus, H. angustatus, Sicyonia carinata*, etc. The number of species of Caprellids and Cymothoids is large. The following species are common to Rio Janeiro and Key West, or the West Indies:—*Acanthonyx Petiverii, Gelasimus maracoani*, and *G. vocans, Uca levis?, Xantho parvulus, Lupa dicantha, Arenœus cribraria, Ocypoda arenaria, O. rhombea, Goniograpsus ruricola, Cardisoma guanhumi, Scyllarus equinoctialis, Penœus brasiliensis, Pagurus granulatus*, etc. *Epialtus marginatus* occurs also at the Gallapagos, and *Menippe Rumphii*, reported as Brazilian, belongs to the East Indies.

II. NORTH TEMPERATE SUBKINGDOM.

1. The Carolinian Province (warm temperate), extending along by Northern Florida, Georgia, and the Carolinas to Cape Hatteras. Length, six hundred miles. Several Key West species occur also in this province; for example, *Libinia dubia, Mithrax hispidus, Menippe mercenarius, Arenœus cribraria, Ocypoda arenaria, Sesarma reticulata*, and *S. cinerea, Plagusia squamosa*. Still, the general character of the species is different. Among the peculiar species mentioned by L. R. Gibbes, are *Leptopodia calcarata, Pisa mutica, Cryptopodia granulata, Pilumnus aculeatus, Hepatus decorus, Guaia punctata, Porcellana macrocheles, Albunœa scutellata, Callianassa major, Gebia affinis, Alpheus heterochelis, A. formosus*, and *Pontonia domestica*. The following northern species have Charleston as their southern limit:—*Libinia canaliculata, Cancer Sayi, Bernhardus longicarpus; Squilla empusa* also reaches from Florida to New York. The warm-water genera of Cancroids are all absent; the species of Hepatus indicates a relation to the Chilian and Brazilian provinces.

2. The Virginian Province (cold temperate). It extends from Cape Hatteras to Cape Cod, including the shores of Virginia, New Jersey,

Delaware Bay, New York, Connecticut, Rhode Island. Length, six hundred and fifty miles. It corresponds essentially to the Pennsylvanian Province of Milne Edwards; a name not here adopted, since the state of Pennsylvania has no part in the coasts, it being entirely inland. The giant *Homarus, Lupa dicantha, Pilumnus Harrisii, Cancer Sayi,* and *C. irroratus, Libinia canaliculata, Panopæus Herbstii,* and *P. limosus, Platyonychus ocellatus, Gelasimus vocans, Bernhardus pollicaris,* and *B. longicarpus, Palæmon vulgaris,* with *Sesarma reticulata* (a southern species), occur in this province.

The province strongly contrasts with the same province across the Atlantic in the fewness of its species. Only *two* Maioids (exclusive of the subfrigid *Hyas coarctata,* and one of the two *Mithrax hispidus,* is properly a southern species) have been reported from these shores, with seven Cancroids, two Grapsoids (one a Pinnothera), three Anomoura (a Hippa and two Bernhardi), and three or four Macroura (besides Astaci). There is still one point of resemblance between the two regions, in that *Carcinus mœnas* is common to both; also, the genus *Homarus* has a species in each, and so also the genus *Cancer.* But America has no *Xantho* north of Florida, while this genus on the other side of the Atlantic reaches to the shores of Britain. Again, we have species of *Panopæi,* extending even to the subfrigid region, none of which group occur in the British Seas.

3. The NOVA-SCOTIA Province (subfrigid) extends from Cape Cod to the eastern cape of Newfoundland. Length, nine hundred miles. *Cancer irroratus, Pilumnus Harrisii, Carcinus mœnas,* and occasionally *Pandalus annulicornis, Hippolyte aculeatus, Crangon vulgaris,* and *C. boreas, Lithodes maia, Hyas coarctata, Bernhardus streblonyx,* occur on this coast, besides other species mentioned above as belonging to the Virginian province. We begin to find a resemblance to the Northern European and British shores.

III. SOUTH TEMPERATE SUBKINGDOM.

We know little of the Crustacea of this coast of South America. According to the temperate regions, there are four provinces. Two are north of the La Plata, and may be called the Provinces of ST. PAUL (four hundred and eighty miles long), and URAGUAY (three hundred and sixty miles). The mouth of the La Plata from Maldonado, around by Montevideo, Buenos Ayres, to the south Cape, C. Antonio, consti-

tutes a third province, the PLATENSIAN; a fourth, from C. Antonio to the south cape of the bay of Rio Negro, the NORTHERN PATAGONIAN, five hundred miles long. A peculiar Grapsoid form of Rio Negro is the *Cyrtograpsus angulatus*. The *Hemigrapsus affinis* is another species, and this locality is the extreme outer limit of the genus *Hemigrapsus*, as far as now known. Two peculiar Idotæid forms occur in this vicinity, having been taken by us from a fish: they are *Cleantis linearis*, and *Chœtilia ovata*. The genus *Serolis* occurs farther south, and does not appear to extend to Rio Negro.

The subfrigid region, in its southern part at least, along Fuegia, belongs properly to the Antarctic kingdom; but the rest of the coast may belong to another province, called the *Southern Patagonian*, which may include also the coast of Western Patagonia south of the Araucanian Province.

II. AFRICO-EUROPEAN KINGDOM.

The prominent differences in temperature between this kingdom and the Occidental have been briefly pointed out. The most influential is the existence of a large temperate region, covering a considerable part of the Mediterranean coasts, as well as a portion of the western coast of Africa, with the Azores and Madeira; and also a subtemperate on the coast of Portugal; both of which regions are unrepresented on the coast of the United States. There are many species peculiar to the Mediterranean; and by their extension north, they give a greater variety to the British seas than they probably would otherwise have.

On the African coast, we make Cape Agulhas the southern limit. Table Bay, however, as is natural from its situation near the borders between two great kingdoms, partakes of a middle character, yet belongs more properly to the Atlantic Ocean. It affords the Oriental species *Platyonychus trimaculatus* and *Dromia hirsutissima;* but produces also a species of the Atlantic genus *Homarus*, and according to M'Leay, the *Sesarma reticulata* of Say, besides four other species of this genus.

The genera peculiar to the Africo-European kingdom, and those common to it and the other kingdoms, are already mentioned on pages 1548, 1550.

The following are the provinces belonging to the three subkingdoms, the torrid, the north temperate, and south temperate :—

I. TORRID SUBKINGDOM.

1. The GUINEAN Province (torrid), including the coast of Guinea to 9° north or Sierra Leone. Length, twelve hundred miles.

2. The VERDENSIAN Province (north subtorrid), including the coast from 9° north nearly to Cape Verde, and also the Cape Verde Islands. Length on the African coast, three hundred and fifty miles. A species of *Actæodes* (A. faba) occurs here, the only one of this warm-water genus yet known in the Atlantic.

3. The BIAFRIAN Province (south subtorrid), including part of the African coast near the equator, about the Bight of Biafra, and reaching to 7° or 8° south; and also the islands Ascension and St. Helena. Length on the African coast, nine hundred miles.

II. NORTH TEMPERATE SUBKINGDOM.

1. The CANARIAN Province (warm temperate), including the west coast of Africa to the latitude of the Canaries, and embracing these islands. Length on the African coast, one thousand miles. In this province there are several species from more tropical regions, which here reach their northern limit, such as *Pilumnus Forskalii*, also from the Red Sea; *Thalamita admete*, East Indies, Natal, &c.; *Grapsus strigosus*, East Indies, &c.; *Goniograpsus messor*, East Indies, Red Sea, &c. *Oplophorus spinosa* (= Palæmon spinosa, *Brullé*), *Leptopodia lanceolata*, *Cycloes cristata*, *Squilla oculata*, are reported only from the Canaries; though the Cycloes resembles closely a Japan species, if it be not identical with it. Many of the species of the British Channel here reach their southern limit; for example, *Inachus dorhynchus*, *Maia squinado*, *Pisa tetraodon*, *Xantho rivulosus*, *Portunus corrugatus*, *Gonoplax angulata*, *Goniograpsus varius*, *Atelecyclus cruentatus*, *Dromia vulgaris*, *Porcellana platycheles*, *Galathea strigosa;* these are found also in the Mediterranean. There are besides many other Canarian species that are found in the Mediterranean, which do not extend to the north, e. g., *Herbstia condyliata*, *Actæa rufo-punctata*, *Eriphia spinifrons*, *Lupa hastata*, *Amphitrite hastata*, *Portunus holsatus*,

Calappa granulata, Dorippe lanata, Homola spinifrons, Albunæa symnista, Scyllarus latus, Arctus ursus, Gnathophyllum elegans, Palæmon Treillianus, Pagurus callidus. The cosmopolites, *Plagusia squamosa* and *Acanthopus planissimus* are also found at the Canaries. The *Leptopodia sagittaria* occurs here, at the West Indies, and at Valparaiso.

2. The MEDITERRANEAN Province. The Azores and Madeira belong to this province. The characteristic species, distinguishing it from the more northern provinces are, *Lissa chiragra, Doclea ovis, Acanthonyx lunulatus, Panopæus Herbstii* (also, N. American), *Platyonychus nasutus, Goniograpsus maurus, Heterograpsus* 6-*dentatus, Brachynotus* 6-*dentatus, Ilia nuclea* and *I. rugulosa, Latreillia elegans;* and at Madeira, *Acanthopus planissimus* and *Grapsus pictus* are very common species. Above we have mentioned some of the species that are found at the Canaries also; and beyond we give a list of those found in the seas of Britain.

The relations of the Mediterranean region to Japan are mentioned by De Haan. The genera strikingly Mediterranean which occur in Japan, are *Latreillia, Nika, Caridina, Ephyra, Sicyonia, Achæus, Pandalus, Lysmata;* and the species of the last three, together with *Squilla mantis,* are probably identical, viz., *Pandalus pristis, Lysmata seticaudata,* and the *Achæus Cranchii,* which last is at least hardly distinguishable, according to De Haan, from the *A. japonicus. Portunus corrugatus* is also closely like a Japan species, according to De Haan. The *Cycloes* of the Canaries is another of the Atlantic species, allying the Atlantic region to Japan, as above mentioned. Doclea is also an Oriental genus, represented in the Occidental kingdom by Libinia. It has but one described species out of the Oriental kingdom.

3. The LUSITANIAN Province (temperate), along the western coast of Portugal. Length, three hundred miles.

4. The CELTIC Province (cold temperate) so named by Milne Edwards, including the Atlantic coast of Spain and France, the British Channel, and Southern Britain and Ireland. The more characteristic genera are *Inachus, Hyas, Pisa, Eurynome, Perimela, Cancer* (*C. pagurus*), *Portumnus, Portunus, Polybius, Ebalia, Atelecyclus, Bernhardus, Galathea, Munida, Axius, Calocaris, Homarus, Crangon, Nika, Hyppolyte, Pandalus.* Several of the species of the Celtic province, which reach to the Canaries, and occur also in the Mediterranean, are mentioned above. The following is a list of the Decapods common to the Celtic province and the Mediterranean :—

DECAPODA COMMON TO THE CELTIC PROVINCE AND THE MEDITERRANEAN.*

1. *Brachyura.*

Maia squinado, A.
Pisa tetraodon, A.
" lanata (Gibsii), A.
Achæus Cranchii, A.
Stenorhynchus phalangium, A.
Eurynome aspera.
Perimela denticulata, A.
Xantho floridus, A.
" rivulosus, A.
Pilumnus hirtellus.
Portunus pusillus.
" Rondeletii, A.
" depurator (plicatus), A.
" marmoreus.
" corrugatus, A.
" holsatus.
Carcinus mænas, A.
Portumnus latipes, A.
Gonoplax angulata, A.
Goniograpsus varius, A.
Pinnothera pisum.
Thia polita.
Corystes dentatus.

2. *Anomoura.*

Dromia vulgaris, A.
Porcellana platycheles, A.
" longicornis, A.
Bernhardus Prideauxii, A.
" Forbesii.
" streblonyx.
Clibanarius oculatus.
Galathea strigosa, A.
" squamifera.

3. *Macroura.*

Callianassa subterranea.
Arctus ursus, A.
Palinurus vulgaris, A.
Homarus vulgaris, A.
Nephrops norvegicus.
Crangon fasciatus, A.
" vulgaris.
" cataphractus, A.
Nika edulis, A.
Alpheus ruber, A.
Athanas nitescens, A.
Hippolyte varians, A.
" viridis, A.
Palæmon serratus, A.
Pasiphæa sivado.
Penæus sulcatus (caramote), A.

The genus Xantho, in *X. rivulosus* and *X. floridus* here reaches its extreme cold limit. *Nephrops norvegicus*, although more properly pertaining to the next province north, occurs also within the limits of this; and it has even been taken in the Mediterranean. *Stenorhynchus phalangium* and *Portunus pusillus*, reach south into the Mediterranean and north to the Frigid zone; *Portunus holsatus*, *Galathea strigosa*, and *Porcellana platycheles*, south to the Canaries and north into the subfrigid.

5. The CALEDONIAN Province (subfrigid), including Northern Scotland, the Shetlands, Orkneys, and the Ferroe Islands. *Hyas coarctatus*, *Portunus arcuatus*, *Galathea nexa*, *Munida Rondeletii*, *Calocaris Macandreæ*, *Nephrops norvegicus*, *Hippolyte spinus*, *Pandalus annuli-*

* Those species that are reported by Lucas from Algiers, are followed by the letter A.

cornis, and *Pasiphœa Savignii*, appear to belong especially to this province, besides some species of *Bernhardus* and *Crangon*. *Lithodes maia* also occurs here.

III. SOUTH TEMPERATE SUBKINGDOM.

The provinces of the South Temperate zone, along the west coast of Africa, are, the ANGOLA (warm temperate, three hundred and sixty miles long), BENGUELA (temperate, nine hundred miles long), and CAPENSIAN (subtemperate, four hundred and fifty miles long). Nothing is known of the Crustacea of the coasts, excepting in the last mentioned province, upon which we have already remarked. *Hymenosoma orbiculare* is one of the Table Bay species; and it belongs to a group that is represented only about the southern extremity of South America and in New Zealand. *Palinurus Lalandii*, another species, is one of the largest of known Macrourans.

South of the subtemperate region, in the *cold temperate*, stands in the Atlantic, the island of Tristan D'Acunha, which may be another province, the TRISTENSIAN. As mentioned by Krauss, the *Spheroma tristense*, Edw., is common to this island and Table Bay.

III. ORIENTAL KINGDOM.

Turning Cape Agulhas, we soon come into a different Zoological world. The coast immediately east to longitude 30°, belongs still to the Temperate zone, and must constitute a distinct province, which we call the ALGOA province (from Algoa Bay), the length of which, measured from Cape Agulhas, is full five hundred and fifty miles.

Passing beyond this, we reach the Natal province, and here we recognise at once the seas of India and the Pacific Ocean. Krauss mentions eighty-one Natal species of Podophthalmia, not thirty of which are peculiar to this region. *Twenty* are found in the Indian Ocean, *eighteen* in the Red Sea, *thirteen* in Japan, *eight* in Australia, *five* in the Isle of France, besides *three* European species, and *three* American. We observe further that, twenty-two of the species of Podophthalmia occur in the Pacific Islands, among which are four species supposed by Krauss to be peculiar to Natal, viz., *Pagurus* (*Clibanarius*, D.) *virescens*, Kr., *Pagurus* (*Calcinus*, D.) *elegans*, *Galene*

natalensis, Kr., *Platyonychus* (*Kraussia*, D.) *rugulosus*, Kr., all of which occur at the Hawaiian Islands.*

Of the *European* species, one is the cosmopolite *Gonodactylus chiragrus*, Latr. The others are *Alpheus Edwardsii*, and *Gammarus pulex*, Fabr. *Megalopa mutica* and *Hippolyte ensiferus*, also reported from South Africa, do not occur at Port Natal. The *American* are the cosmopolites *Goniograpsus pictus*, and *Gonodactylus chiragrus*, together with *Eriphia gonagra*, Edw. The *Sesarma reticulata*, Say, and *Plagusia tomentosa*, Lk., also South African, are not from Port Natal.

It is obvious, therefore, that the great ocean, from the east coast of Africa to the Hawaiian and Paumotu Islands, covering two-thirds of the surface of the globe, makes one great kingdom, closely related in its species, although including several zoological provinces and subordinate districts. This fact respecting the oceans is strikingly in contrast with those relating to the continents adjoining. A list of the genera of Decapods peculiar to this kingdom, and others of the genera and species common to this and the other two kingdoms, are given on pages 1549, 1550.

This kingdom may be viewed as consisting of three SECTIONS.

First, the *African*, including the African coast to the head of the Red Sea and Persian Gulf, with the adjoining islands, Madagascar, Mauritius, etc.

Second, the *Asiatic*, from Van Diemens Land and New Holland, by the East Indies to North Japan.

Third, the *Pacific*, including the Pacific Islands west of New Guinea, from New Zealand to the Hawaiian Islands.†

The principal provinces of these three sections are as follows:—

A. AFRICAN SECTION.

1. The NATAL Province (south subtorrid), including also South Madagascar, and the Isle of France and Bourbon. This region is

* The *Galene hawaiensis*, D., is so closely like the *G. natalensis*, that we believe there is not sufficient reason for considering them distinct.

† The species of these three sections are separately presented in Table VI. The two columns *N.* and *S.*, under *East Africa*, include the AFRICAN species; the column *E. Indies and Indian Ocean*, and the two columns *N.* and *S.*, under *West Pacific*, the ASIATIC species; the two columns *N.* and *S.*, under *Middle Pacific*, the PACIFIC species.

called the "Madecasse" by Edwards, a name here not accepted, as the larger part of Madagascar is in the torrid and not subtorrid region.

2. The ABYSSINIAN Province (torrid), including the east coast of Africa and the Red Sea, excepting its northern third, and also the larger part of Madagascar and the islands of that part of the Indian Ocean.

3. The ERYTHREAN Province (subtorrid), including the northern subtorrid part of the Red Sea, and probably also the Persian Gulf.

B. ASIATIC SECTION.

I. ASIATIC TORRID SUBKINGDOM.

1. The INDIAN Province (torrid), including the East Indian Islands, Northern Australia, from its most western to its most eastern cape, and the coast of Asia to latitude $12\frac{1}{2}°$ on the coast of Cochin China.

2. The LIUKIU Province (subtorrid), including the islands of Liukiu and Formosa, the Meicoshimah Islands, and the southeastern coast of Niphon, along by Jeddo, with the eastern side of Kiusiu; the province has but little space on the coast of Asia, along a part of Cochin China.

A third province exists on the west coast of Australia.

II. ASIATIC NORTH TEMPERATE SUBKINGDOM.

1. The TONQUIN Province (warm temperate), including the Gulf of Tonquin and coast of China, south of 25°.

2. The CHUSAN Province (subtemperate), including the coast of China north of 25° and the Yellow Sea, together with the western part of Kiusiu, along by Nagasaki.

The *temperate* region is nearly or quite absent from the China coast.

3. The SAGHALIAN Province (subfrigid), including the Asiatic coast within the Japan Sea, and part of the western and the northern shores of Niphon, with the islands Saghalian, Yeso, and others.

The cold temperate region does not appear to be represented on the Asiatic coast, but is found on the east coast of Niphon, where it forms along with the subtemperate region, what may be called the NIPHON Province.

III. ASIATIC SOUTH TEMPERATE SUBKINGDOM.

1. The SWAN RIVER Province (warm temperate), on the *west* coast of Australia.

2. The FLINDERS Province (temperate), along the southern coast of Australia.

3. The MORETON Province (warm temperate and temperate), on the *east* coast of Australia.

4. The BASS Province (subtemperate), from north of Port Jackson to Van Diemens Land.

5. The TASMANIAN Province (cold temperate), including Van Diemens Land.

C. PACIFIC SECTION.

I. PACIFIC TORRID SUBKINGDOM.

1. The POLYNESIAN Province (torrid). To this province belong the Pacific Islands east of the East Indies, within the torrid region, including all the groups between 20° south, and the Hawaiian Islands on the north, embracing also the New Hebrides and nearly all of New Caledonia. There are probably several subordinate districts, but as they are imperfectly indicated by the Crustacea, we do not attempt to lay them down. Tongatabu and Tahiti lie on the borders of the subtorrid region, in somewhat cooler waters than the Feejee or Samoan Islands.

2. The HAWAIIAN Province (north subtorrid), Hawaiian Islands and others in the same range, to the north of west.

3. The RARATONGAN Province (south subtorrid), including nearly all the Hervey Islands south of west from Tahiti, with Pitcairn's and the Gambier Islands, Ducie's, and some other islands in that vicinity.

II. PACIFIC SOUTH TEMPERATE SUBKINGDOM.

1. The KERMADEC Province (warm temperate and temperate). A few islands north of New Zealand lie in this province, and probably also Norfolk Island, a little farther to the west.

2. The WANGAROA Province (subtemperate). Includes the north part of New Zealand, of which the Bay of Islands is the prominent port.

3. The CHATHAM Province (cold temperate), embracing the Chatham Islands and Middle New Zealand, nearly to its southern extremity.

In the above, the Torrid zone of the Oriental kingdom embraces in each of its regions three provinces, as follows :—

	African Section I.	Indian Section II.	Pacific Section III.
I. TORRID REGION.	1. Abyssinian.	2. Indian.	3. Polynesian.
II. NORTH SUBTORRID REGION.	1. Erythrean.	2. Liukiuan.	3. Hawaiian.
III. SOUTH SUBTORRID REGION.	1. Natalensian.	2. West Australian.	3. Raratongan.

1. SPECIES COMMON TO THE THREE SECTIONS, THE AFRICAN, THE INDIAN, AND THE PACIFIC.

1. *Brachyura.*

Parthenope horrida.—I. Fr., Red Sea; E. I.; Haw.
Atergatis limbatus.—R. Sea; E. I.; Feej.
Atergatis floridus.—Natal; E. I.; Tonga, Paumotus; Tahiti.
Carpilius maculatus.—I. Fr.; E. I.; Jap.; Samoa, &c., to Paumotus.
Carpilius convexus.—R. Sea; E. I., Jap.; Feej., Haw.
Actæa hirsutissima.—R. Sea; Samoa.
Chlorodius niger.—R. Sea (N.); E. I.; Feej., Tonga, Samoa.
Trapezia ferruginea. — R. Sea; E. I.; Pacific.
Cymo Andreossyi.—R. Sea; E. I.?; Samoa, Tahiti.
Scylla serrata.—Natal; R. Sea; E. I., Jap.; Samoa.
Lupa sanguinolenta. — Nat.; I. Fr., R. Sea; E. I.; Haw.
Thalamita admete.—Nat.; R. Sea; E. I.; Samoa, Wake's, Haw.
Thalamita crenata.—Nat.; R. Sea (S.); E. I., Jap., Feej.
Cleistostoma Boscii.—Nat.; R. Sea; [E. I.?]; Feej.
Podophthalmus vigil.—I. Fr.; E. I., Jap.; Haw.
Ocypoda brevicornis.—I. Fr.; E. I.; Tonga.
Acanthopus planissimus. — Nat.; E. I.?; Samoa, Tahiti, Paumotu, Haw. [also Madeira].
Calappa tuberculata. — Nat.; I. Fr., R. Sea; E. I.; Feej., Tonga, Haw.
Calappa fornicata.—I. Fr.; E. I.; Feej.

2. *Anomoura.*

Pagurus difformis.—I. Fr.; E. I.; Feej.
Pagurus punctulatus.—E. I.?; E. I.; Haw.
Calcinus tibicen. — Nat.; E. I.; Samoa, Wake's, Tahiti, Paumotus, Haw.
Calcinus elegans.—Nat.; E. I.?; Wake's, Paumotus, Haw.
Aniculus typicus.—I. Fr.; Jap.; Wake's, Paumotus.
Clibanarius virescens.—Nat.; E. I.; Feej.
Cenobita rugosa.—Nat.; E. I., Jap.; Feej.; Samoa, Tonga, Paumotus.
Birgus latro.—I. Fr.; E. I., Jap.; Samoa, Swain's, Paumotus.

3. *Macroura.*

Parribacus antarcticus. — I. Fr.; E. I.; Samoa, Paumotus.

Panulirus penecillatus.—R. Sea; E. I.; Pacific.
Hippolyte marmoratus.— ?; E. I.; Pacific; Haw.
Stenopus hispidus.—I. Fr.; E. I.; Paumotus.

4. *Anomobranchiata.*

Pseudosquilla stylifera.—I. Fr.; ?; Feej., Haw.
Gonodactylus chiragrus.—Nat.; I. Fr., R. Sea; E. I.; Feej., Tonga.

Of the above species, a few occur in both the torrid and subtorrid regions of these three sections of the Oriental kingdom, that is, in the Erythrean, Natalensian, Indian, Liukiuan, Polynesian, and Hawaiian Provinces. These are:—*Lupa sanguinolenta*, *Podophthalmus vigil*, *Calappa tuberculata*, *Acanthopus planissimus*, *Calcinus tibicen*, *C. elegans*, and *Gonodactylus chiragrus*. *Grapsus pictus* is not included; it has not yet been reported from the eastern coast of Africa. The above list must be much increased as the species of the different regions are better understood. Some of the species have a range of over twelve thousand miles. Many species common to Natal and Japan or the Hawaiian Islands, are given in the above list. We add below a list of—

2. SPECIES COMMON TO THE NATAL AND THE LIUKIUAN (SOUTH JAPAN) OR HAWAIIAN PROVINCES OF THE SUBTORRID REGIONS, AND NOT YET OBSERVED IN THE TORRID REGION INTERMEDIATE.

Micippa thalia.—Nat. and Jap.
Xantho affinis, De H.—Nat. and Jap.
Xantho obtusus, De H.—Nat. and Jap.
Carpilius petræus, De H.—Nat. (I. Fr.) and Jap.
Charybdis granulatus.—Nat. and Jap.
Thalamita prymna.—Nat. and Jap.
Gelasimus arcuatus.—Nat. and Jap.
Gelasimus lacteus, De H.—Nat. and Jap.
Ocypoda cordimana.—Nat. and Jap.
Sesarma picta.—Nat. and Jap.
Sesarma affinis.—Nat. and Jap.
Kraussia rugulosa.—Nat. and Haw.
Galene natalensis.—Nat. and Haw.
Dromia hirsutissima.—S. Afr. and Haw.
Calappa spinosissima.—I. Fr. and Haw.
Doto sulcatus, Nat., Jap., and R. Sea.

The Natal province, includes properly two districts, the *Natal* and the *Mauritius*, the latter distinguished by its more torrid character and its larger number of East Indian species, among which are the following:—*Doclea ovis*, *Camposcia retusa*, *Carpilius maculatus*, *Œthra scruposa*, *Melia tessellata*, *Eriphia levimana*, *Calappa fornicata*, *Aniculus typicus*, *Birgus latro*, *Parribacus antarcticus*, etc. Among the species common to the two, not also East Indian, are the following:—*Elamena Mathœi* (a species found also in the *northern* or subtorrid part of the Red Sea), *Ocypoda cordimana* and *Orchestia Bottæ*.

The following are some of the species peculiar to Port Natal:—*Pisa fascicularis*, *Antilibinia Smithii*, *Acanthonyx Mac Leaii*, *A. scutellatus*, *A. 4-dentatus*, *Eriphia Smithii*, *Menippe Martensii*, *Pilumnus xanthoides* and *P. granulatus*, *Actœodes Ruppelii*. Among those of the Isle of France or Mauritius are, *Stenocionops cervicornis*, *Dynomene hispida*, *Hemigrapsus Latreilli* (the genus Hemigrapsus is not yet known to occur in the Torrid region), *Atergatis sinuatifrons*, A. and W., *Carpilius signatus*, A. and W., *Dromia fallax* and *D. hispida*, etc.; also *Caprella scaura*, and *C. nodosa*.

The *Erythrean* province, or the subtorrid portion of the Red Sea, includes several species not reported from more southern parts of the sea, as *Elamena Matthœi*, *Menœthius monoceros* (a Natal species), *Paramicippa platipes*, *Myra fugax*, Rüpp., *Oreophorus horridus*, Rüpp., *Nursia granulata*, Rüpp., *Macrophthalmus depressus*, Rüpp.

The *Abyssinian* province in its Red Sea portion contains seven species of *Atergatis*, of which *A. sculptus*, *A. exsculptus*, and *A. Savignii* are not elsewhere reported. *Lambrus pelagicus*, *Actœa asper*, *Ruppellia tenax?*, *Thalamita chaptalis*, are other species, besides many that are common in the East Indies. *Dromia unidentata* is found in both the northern and southern parts.

The *Indian* province is characterized more particularly by the following genera:—*Egeria*, *Doclea*, *Micippa*, *Tiarinia*, *Menœthius*, *Lambrus*, *Parthenope*, *Ceratocarcinus*, *Cryptopodia*, *Tlos*, *Atergatis*, *Carpilius*, *Actœa*, *Xantho*, *Zozymus*, *Panopœus*, *Actœodes*, *Etisus*, *Chlorodius*, *Pilumnus*, *Eriphia*, *Lupa*, *Amphitrite*, *Thalamita*, *Charybdis*, *Lissocarcinus*, *Podophthalmus*, *Ocypoda*, *Sesarma*, *Xenophthalmus*, *Xanthasia*, *Calappa*, *Matuta*, *Leucosia*, *Ixa*, *Iphis*, *Arcania*, *Platyonychus*, *Paguristes*, *Pagurus*, *Calcinus*, *Clibanarius*, *Cenobita*, *Birgus*, *Remipes*, *Thalassina*, *Thenus*, *Panulirus*, *Atya*, *Alpheus*, *Palœmon*, *Penœus*, *Acetes*, *Squilla*, *Gonodactylus*, etc., and by the comparatively few species, if any, of the following Torrid zone genera, viz.—*Pericera*, *Acanthonyx*, *Mithrax*, *Ruppellia*, and *Hymenocera*, besides others that have been mentioned as peculiarly Occidental or Africo-European.

The relation of the Japan Seas to the Mediterranean, and also to the Natalensian have been remarked upon. The warm-water genera of *Xanthidæ* and *Lupinæ* are abundantly represented in the Liukiuan province, so also the *Calappinæ*, *Scyllaridæ*, *Sesarminæ*, *Palinuridæ*, and *Squillidæ*. *Eriocheir penecillatus*, *Curtonotus longimanus*, *Trichia*

dromiiformis, and *Oncinopus arenaria* are peculiar species. The *Ranina dentata* occurs here of a larger size than in the East Indies.

The *Tonquin* province is characterized by species of *Dorippe*, and by *Liagora rubro-maculata*, with some Leucosidæ. The *Acanthodes armatus* of De Haan from the east coast of Niphon appears to belong to the Niphon province; and the giant *Macrocheira Kæmpferi* of De Haan to the Saghalian.

The Japan Seas are allied to the Hawaiian through certain species, as mentioned beyond. Through species of *Sicyonia* they are related to Rio Janeiro as well as the Mediterranean. The species occurring both in the Japan Seas and at Port Natal, are given on page 1574.

The *Swan River* province on Western Australia, although of the warm temperate region, contains the following species identical with species of the Natal province, viz., *Penæus canaliculatus* and *Gonodactylus 3-spinosus;* also the cosmopolite, *Gonodactylus chiragrus*, and the East India species, *Thenus orientalis*. The following species found in this province, have not been mentioned from other localities, viz., *Gelasimus forceps* and *Philyra porcellana*.

The Crustacea of the eastern coast of Australia have been little studied, excepting those of Port Jackson and the vicinity. This province is characterized by the presence of *Halimus tumidus*, D., *Myctiris longicarpus*, *Ozius truncatus*, Edw., *Helœcius cordiformis*, *H. inornatus*, D., *Chasmagnathus levis*, D., and *C. subquadratus* (possibly N. Zealand), *Helice crassa*, *Plagusia glabra*, D., *Paguristes frontalis* (?), *Callianassa* (*Trypœa*) *australiensis*, D., *Hippolyte spinicaudis*.

The absence of the Xanthidæ is one of the prominent characters here observed, a group of species that occur but sparingly in any subtemperate region. Among the Tetradecapods there is the Chilian genus *Amphoroidea*, affording a species closely like that of Valparaiso. The other genera of Tetradecapoda observed, are *Idotœa*, *Spheroma*, *Orchestia*, *Allorchestes*, *Hyperia*.

In the great Pacific section of the Oriental kingdom, the *Polynesian* kingdom is of great extent, covering twenty degrees either side of the equator through the ocean to 130° west. Nearly the same genera are represented as in the East Indies, mentioned on page 1575. Among the exceptions, according to present knowledge, are *Egeria*, *Doclea*, *Tiarinia*, *Parthenope*, *Cryptopodia*, *Tlos*, *Panopœus*, *Lupa*, *Podophthalmus*, *Leucosia*, *Ixa*, *Arcania*, *Platyonychus*, *Thalassina*, *Acetes*, *Thenus*, etc., while there are present, species of *Pericera*, *Rup-*

pellia, Cymo, Domœcius, Galathea, Œdipus, Harpilius, Hymenocera, Regulus. Dromia and *Ranina* have not been observed in the Pacific except in the Hawaiian province. No species of *Penœus* has yet been reported from the Torrid region in this ocean. The *Maioidea* are few and small, the *Xanthidæ* and *Eriphidæ* numerous, and often large. Some of the species common to the Pacific and East Indies have already been mentioned.*

The Hawaiian province contains the following species, not elsewhere observed:—*Lahaina ovata*, D., *Perinea tumida*, D., *Huenia simplex* and *H. brevirostris, Xantho intonsus*, D., *Medœus ornatus, Chlorodius nodosus, Pseudozius inornatus*, some *Trapeziæ, Thalamita pulchra, Lupa pubescens, Macrophthalmus telescopicus, Gelasimus minor, Ocypoda levis*, D., *O. Urvillii, Hemigrapsus crassimanus, Sesarma trapezium*, and *S. obtusifrons, Cyclograpsus granulatus, C. cinereus, Nucia speciosa*, D., *Albunœa speciosa, Porcellana cinctipes, Galathea spinirostris, Scyllarus latus*, Randall, *Nika hawaiensis, Atyoida bisulcata*, Rand., *Alpheus levis, A. pacificus, A. pugnax, A. diadema, Palœmon debilis*, D., *P. acutifrons*, D., *P. grandimanus*, Rand., *P. gracillimanus*, Rand., *Penœus velutinus.*

It is most closely related to the southern part of the Japan Seas, containing the following Japan species:—*Penœus canaliculatus, Podophthalmus vigil, Ranina dentata, Pagurus carinatus*, Rand. (=P. asper, *De H.*); and the following genera that are represented in Japan and not in the Torrid region, viz.:—*Galene, Kraussia* (D.), *Nika, Scyllarus, Hemigrapsus.* Several Polynesian species occur here, as *Amphitrite vigilans* (Feejees), *Thalamita integra, Goniograpsus thukujar* (Feejees), *Grapsus rudis* (Ladrones), *Porcellana coccinea* (Paumotus), *Hippolyte marmoratus* (Paumotus), *Calcinus tibicen, C. elegans, C. latens, Pagurus punctulatus, Chlorodius cytherea*, besides *Grapsus pictus, Acanthopus planissimus*, and *Calappa tuberculata*, which have a wide range. *Lupa sanguinolenta* occurs here and also in the East Indies and at the Isle

* The following oceanic Entomostraca occur in the Pacific, or East Indies, and Atlantic:—*Pontella (Pontellina) turgida*, Atlantic, 0° to 8½° N., and 4½° S., 17°–31° W.; Pacific, near Hall's and Pitts' Islands, 1°–3° N., 173° E.—*Pontella (Pontellina) crispata*, Atlantic, 8½° N., 23° 45′ W.; 5°–7° N., 174½°–177° E.—*Undina vulgaris*, Straits of Banca; Atlantic, 9° S., 17½° W., and 4½° S., 25° W. *Oithona plumifera*, Atlantic, 4½°–7° N., 20°–22° W.; also 1° S., 30½° W.; Pacific, near Kingsmill Islands.—*Corycœus varius*, Atlantic, 1°–7° N., 18°–22° W., and 1°–7° S., 20°–30° W.; Pacific, 15½° S., 138½° W.; 33° S., 153½° E.; Ladrones.—*Candace pachydactyla*, Atlantic, 11° S., 14° W.; 4½° S., 25° W.; 8½° S., 150° W.; 1° S., 30° W.; China Sea, 300 miles northeast of Singapore.

of France. The relations to the Natal province are similar to those with Japan, as before observed (p. 1574). *Goniograpsus plicatus*, a Hawaiian species, according to Krauss, is also South African.

Little is known respecting the species of the *Raratongan*, or *Kermadec* provinces.

The *Wangaroa* province (Northern New Zealand) is distinguished by an absence of Cancroid forms, as in Southeastern Australia, and rather a prevalence of Grapsoid species. No *Squillidæ* have yet been observed. Among the species peculiar to the province are the following:—*Paramithrax Gaimardii, Eurynolambrus australis*, Edw., *Portunus integrifrons, P. cantharus, Goniograpsus strigilatus, Hemigrapsus crenulatus, H. Gaimardii, Halicarcinus varius, H. pubescens, Lomis hirta* (possibly from Middle or Southern New Zealand), several *Porcellanæ, Paguristes pilosus, Bernhardus cristatus, B. novi-zealandiæ, Clibanarius cruentatus, Gebia hirtifrons, Paranephrops planifrons, P. tenuicornis, B. æquimanus, Alope palpalis, Hippolyte spinifrons, Palæmon affinis*, with species of the Tetradecapodan genera, *Idotæa, Armadillo, Spherillo, Oniscus, Scyphax*, D., *Lygia, Cymothoa, Nerocila, Ægа, Spheroma* (several species), *Orchestia, Allorchestes, Iphimedia, Melita, Œdicerus, Hyperia.*

The genus *Hymenicus*, which is near *Hymenosoma*, and the *Plagusia tomentosa* found also at Table Bay, show a relation to the Capensian province (South Africa). *Palæmon Quoyanus* is also stated by Krauss to be a South African species, found at Port Natal.

The genera *Ozius, Hemigrapsus*, and *Chasmagnathus*, and some of their species, are common to the Bass province (Australia) and North New Zealand, showing a relation between the two. Yet the difference in species is still so great, that they are properly distinct provinces. New Zealand is over twelve hundred miles from New Holland, and its Crustacea are hardly as much like those of New Holland as those of Valparaiso. The following genera characterize both Chili and North New Zealand:—*Cancer, Ozius, Cyclograpsus, Paguristes*, and *Betæus;* and the *Cancer Edwardsii* and *Plagusia tomentosa* appear to be common to the two provinces, while the genus Cancer is not elsewhere known out of America and Northern Europe. *Palæmon affinis* of the Bay of Islands, as Edwards observes, is hardly distinguishable from *P. squilla* of the coasts of France and Britain. The species of *Portunus* in these southern seas are representatives of the most characteristic of European genera, and they belong rather to the

cold temperate than subtemperate regions of the Australian and New Zealand Seas. *Portunus integrifrons* is reported from Tasmania (Van Diemens Land). Ozius represents Xantho of the British Channel.

ARCTIC AND ANTARCTIC KINGDOMS.

With our existing knowledge of species, the Arctic and Antarctic kingdoms widely differ; but much of this difference may be owing to the greater extent of land in the northern kingdom, and not a little to our limited knowledge of the latter. In the Arctic Frigid zone, there are the following genera of Podophthalmia:—*Hyas* 1 species, *Stenorhynchus* 1, *Cancer* 1, *Portunus* 1, *Carcinus* 1, *Lithodes* 2, *Bernhardus* 3, *Galathœa* 2, *Crangon* 2, *Sabinea* 1, *Argis* 1, *Hippolyte* 18, *Pandalus* 3, *Palœmon* 1, *Thysanopoda* 3, *Mysis* 3, *Myto* 1. Out of these, only *Lithodes* and *Galathea* are at present known to occur in the Antarctic kingdom, and as yet we are not certain that either reaches beyond Fuegia, near the limits of the subfrigid and frigid regions: further researches are required. The Thysanopoda of the north are represented in the south by a species of Euphausia.

Among the Tetradecapoda, the following exist in the Arctic kingdom:—Idotæidea, *Idotœa*, 9 species, *Glyptonotus* 1; Oniscoidea, *Lygia*, 1, *Jœra* 2, *Jœridina* 1, *Asellus* 1, *Janira* 1, *Henopomus* 1, *Munna* 1; of Cymothoidea, *Ægа* 3; Serolidea, *Praniza* 1, *Anceus* 1; Tanaidea, *Tanais* 6, *Crossurus* 1, *Bopyrus* 1, *Phryxus* 2, *Dajus* 1; of Caprellidea, *Proto* 2, *Caprella* 6, *Ægina* 2, *Cercops* 1, *Podalirius* 1; Gammaridea, *Dulichia* 1, *Siphonœcetes* 1, *Unciola* 1, *Laphystius* 1, *Orchestia* 2, *Stegocephalus* 1, *Anonyx* 2, *Leucothoe* 2, *Acanthonotus* 3, *Iphimedia* 14, *Œdicerus* 1, *Gammarus* 13, *Photis* 1, *Melita* 2, *Pardalisca* 1, *Ischyrocerus* 2, *Microcheles* 1, *Lepidactylis* 1, *Pontiporeia* 1, *Ampelisca* 1, *Protomedeia* 1, *Phoxus* 1; Hyperidea, *Lestrigonus* 1, *Hyperia* 1, *Metœcus* 1, *Themisto* 2.

From the Antarctic kingdom, there are at present known, *Glyptonotus* 1, *Idotœa* 1, *Cirolana* 1, *Serolis* 1, *Uristes* (related to Anonyx) 1; of Hyperidea, *Cyllopus* 1, *Tauria* 1, *Themisto* 1; and if we add Southern Fuegia, *Eurypodii* 2 or 3, *Halicarcinus* 1, *Munida* 1, *Grimothea* 1, *Lithodes* 3, *Tylus* 1, *Oniscus* 1, *Styloniscus* 1, *Jœra* 1, *Pterelas* 1, *Spheroma* 3, *Serolis* 3, *Anonyx* 1, *Amphithoe* 1, *Gammarus* 1, etc. The contrast is again very striking. *Serolis* and some allied forms, with *Glyptonotus* are the most characteristic of southern Isopoda, and the

first of these genera is not known in the north. *Halicarcinus* characterizes the south but not the north. *Hippolyte* and *Crangon* are common in the north, and have not yet been detected in the south. *Lithodes* is common to both. *Eurypodius* is wholly southern, but has its analogue in *Oregonia* of Northwest America. If then we were to characterize the kingdoms by any of the species, we should call the Arctic, the *Hippolyte kingdom*, about half of the known species of the genus Hippolyte being Arctic; and the southern, the *Serolis kingdom*. The names imply a higher zoological rank for the Arctic than the Antarctic Seas.

The *Arctic* kingdom is naturally divided into three provinces. One occupying the North Atlantic Ocean; one corresponding, north of the Pacific; and the third, a Polar province. The limits of the Polar province we cannot exactly lay down. But the more Frigid seas which afford only Tetradecapods (and perhaps a species or so of Decapods) should be considered as constituting a distinct province from that in which species of Hippolyte and Crangon are common. These provinces are the *Norwegian*, the *Camtschatican*, and the *North Polar*.

The *Norwegian* includes the coast of Norway and Iceland, with a part probably of Greenland; characterized by *Lithodes maia*, *Hyas araneus*, *Bernhardus pubescens*, *Galathea rugosa*, *Crangon lar*, *C. 7-carinatus*, and many species of Hippolyte, etc. The *Camtschatican* comprises Kamtschatka, the Aleutian Islands, and the neighbouring part of the North American coast, and extending it may be some distance beyond Behring's Straits, and is characterized by the *Lithodes camschatica*, *Telmessus chirogonus*, *Bernhardus splendescens*, *Crangon salebrosus*, *Hippolyte armata*, *H. cornuta*.

In these Polar seas, the species have often a wide range, and probably pass from one ocean to the other through the Polar oceans. Thus *Crangon boreas*, *Carcinas mœnas*, *Pagurus streblonyx*, *Hippolyte aculeatus*, are not only found on opposite sides of the Atlantic, but also in the North Pacific.

The *Antarctic* kingdom may also consist of three provinces:—

1. The Fuegian Province, including Fuegia, the Falklands, South Georgia; and characterized by *Lithodes antarctica*, *L. verrucosa*, *L. granulata*, species of *Eurypodius*,* *Halicarcinus*, *Galathea*, *Spheroma*, and *Serolis*.

* The species of Eurypodius probably belong more especially to the South Patagonian or the Araucanian province, although occurring also in the Fuegian.

2. The AUCKLANDIAN Province, embracing the Aucklands and perhaps the south extremity of New Zealand.

3. The SOUTH POLAR province, including the South Shetlands (whence comes the huge *Glyptonotus* of Eights), and also the Antarctic lands of Wilkes and Ross.

The group Hymenicinæ, including the genera Hymenosoma, Halicarcinus, and Hymenicus, is peculiarly a southern type, and through these genera the extremities of the continents have a common character. The first characterizes the Cape of Good Hope, the second Patagonia and Fuegia, and the third New Zealand. The Patagonian genus reaches north to Valparaiso, into the same temperature region (the subtemperate) that affords the Hymenosoma of South Africa and Hymenicus of New Zealand, and this subtemperate region is the highest northern limit of the group. Halicarcinus is developed in its greatest perfection in Fuegia.

ORIGIN OF THE GEOGRAPHICAL DISTRIBUTION OF CRUSTACEA.

The origin of the existing distribution of species in this department of zoology deserves attentive consideration. Two great causes are admitted by all, and the important question is, how far the influence of each has extended. The first, is *original local creations;* the second, *migration.*

Under the first head, we may refer much that we have already said on the influence of temperature, and the restriction of species to particular temperature regions. It is not doubted that the species have been created in regions for which they are especially fitted; that their fitness for these regions involves an adaptation of structure thereto, and upon this adaptation, their characteristics as species depend. These characteristics are of no climatal origin. They are the impress of the Creator's hand, when the species had their first existence in those regions calculated to respond to their necessities.

The following questions come up under this general head:—

1. Have there been local centres of creation, from which groups of species have gone forth by migration?

2. Have genera only and not species, or have species, been repeated by creation in distinct and distant regions?

3. How closely may we recognise in climatal and other physical

conditions, the predisposing cause of the existence of specific genera or species?

With regard to the *second* head, migration, we should remember, that Crustacea are almost wholly maritime or marine; that marine waters are continuous the globe around; and that no seashore species in zoology are better fitted than crabs for migration. They may cling to any floating log and range the seas wherever the currents drift the rude craft, while the fish of the sea-shores will only wander over their accustomed haunts. Hence it is, that among the Pacific Islands the fishes are often to a considerable extent peculiar to particular groups of islands, while the Crustacea are much more generally diffused.

A direction and also a limit to this migration exist, (1) in the currents of the ocean, and (2) in the temperature of its different regions. Through the Torrid zone, the currents flow mainly *from the east* towards the west; yet they are reversed in some parts during a certain portion of the year. But this reversed current in the Pacific never reaches the American continent, and hence it could never promote migration to its shores. Again, beyond 30° or 35° of north or south latitude, the general course of the waters is *from the west*, and the currents are nearly uniform and constant. Here is a means of eastward migration in the middle and higher temperate regions. But the temperature regions in these latitudes are more numerous than in the tropics, and species might readily be wafted to uncongenial climates, which would be their destruction; in fact they could hardly escape this. Moreover, such seas are more boisterous than those nearer the equator. Again, these waters are almost entirely bare for very long distances, and not dotted closely with islands like the equatorial Pacific.

In the northern hemisphere, on the eastern coasts especially, there are warm currents from the south and cold currents from the north. The former overlie the latter to a great extent in the summer and may aid southern species in northward migrations. Cape Hatteras is nearly the termination of the summer line of 70° (see Maury's Chart), a temperature which belongs to the subtorrid region in winter. On the China coast, at Macao there is a temperature of 83° in July, and in the Yellow Sea, of 78° to 80°. But such northward migrations as are thus favoured, are only for the season; the cold currents of the winter months destroy all such adventurers, except the individuals of

some hardier species that belong to the seas or have a wide range in distribution. Sea-shore Crustacea are not in themselves migratory, and are thus unlike many species of fish. Even the swimming Portunidæ are not known voluntarily to change their latitudes with the season.

The following is a brief recapitulation of the more prominent facts bearing on these points.

1. The distribution of individuals of many species through twelve thousand miles in the Torrid zone of the Oriental seas.

2. The very sparing distribution of Oriental species in Occidental seas.

3. The almost total absence of Oriental species from the west coast of America.

4. The world-wide distribution within certain latitudes of the species we have called cosmopolites.

5. The occurrence of closely allied genera at the Hawaiian Islands and in the Japan seas.

6. The occurrence of the same subtorrid species at the Hawaiian Islands and at Port Natal, South Africa, and not in the Torrid zone intermediate, as Kraussia rugulosa and Galene natalensis.

7. The occurrence of identical species in the Japan seas and at Port Natal.

8. The occurrence of the same species (Plagusia tomentosa) in South Africa, New Zealand, and Valparaiso; and the occurrence of a second species (Cancer Edwardsii (?)) at New Zealand and Valparaiso.

9. The occurrence of closely allied species (as species of Amphoroidea and Ozius) in New South Wales and Chili.

10. The occurrence of the same species in the Japan seas and the Mediterranean, and of several identical genera.

11. The occurrence of a large number of identical species in the British seas and the Mediterranean; and also in these seas and about the Canary Islands.

12. The occurrence of closely allied, if not identical, species (as of Palæmon) in New Zealand and the British seas; and also of certain genera that are elsewhere peculiarly British, or common only to Britain and America.

13. An identity in certain species of Eastern and Western America.

The following are the conclusions to which we are led by the facts:

I. The migration of species from island to island through the tropical Pacific and East Indies may be a possibility; and the same species may thus reach even to Port Natal in South Africa. The currents of the oceans favour it, the temperature of the waters is congenial through all this range, and the habits of many Crustacea, although they are not voluntarily migratory, seem to admit of it. The species which actually have so wide a range are not Maioids (which are to a considerable extent deep-water species), but those of the shores; and some, as Thalamita admete, are swimming species.

II. The fact, that very few of the Oriental species occur in the Occidental seas, may be explained on the same ground, by the barrier which the cold waters of Cape Horn and the South Atlantic present to the passage of tropical species around the Cape westward, or to their migration along the coasts.

Moreover, the diffusion of Pacific tropical species to the Western American coast is prevented, as already observed, by the westward direction of the tropical currents, and the cold waters that bathe the greater part of this coast.

III. When we compare the seas of Southern Japan and Port Natal and find species common to the two that are not now existing in the Indian Ocean or East Indies, we hesitate as to migration being a sufficient cause of the distribution. It may, however, be said that driftings of such species westward through the Indian Ocean may have occasionally taken place; but that only those individuals that were carried during the season quite through to the *subtorrid* region of the South Indian Ocean (Port Natal, etc.), survived and reproduced, the others, if continuing to live, soon running out under the excessive heat of the intermediate equatorial regions. That they would thus run out in many instances is beyond question; but whether this view will actually account for the resemblance in species pointed out is open to doubt.

IV. When further, we find an identity of species between the Hawaiian Islands and Port Natal—half the circumference of the globe, or twelve thousand miles, apart—and the species, as *Galene natalensis*, not a species found in any part of the torrid region, and represented by another species only in Japan, we may well question whether we can meet the difficulty by appealing to migration. It may however be said, that we are not as yet thoroughly acquainted

with the species of the tropics, and that facts may hereafter be discovered that will favour this view. The identical species are of so peculiar a character that we deem this improbable.

V. The existence of the Plagusia tomentosa at the southern extremity of Africa, in New Zealand, and on the Chilian coasts, may perhaps be due to migration, and especially as it is a southern species, and each of these localities is within the subtemperate region. We are not ready however to assert, that such journeys as this range of migration implies are possible. The oceanic currents of this region are in the right direction to carry the species eastward, except that there is no passage into this western current from Cape Horn, through the Lagulhas current, which flows the other way. It appears to be rather a violent assumption that an individual or more of this species could reach the western current from the coast on which it might have lived; or could have survived the boisterous passage, and finally have had a safe landing on the foreign shore. The distance from New Zealand to South America is five thousand miles, and there is at present not an island between.

VI. Part of the difficulty in the way of a transfer of species between distant meridians might be overcome, if we could assume that the intermediate seas had been occupied by land or islands during any part of the recent epoch. In the case just alluded to, it is possible that such a chain of interrupted communication once had place; and this bare possibility weakens the force of the argument used above against migration. Yet as it is wholly an assumption, we cannot rely upon it for evidence that migration has actually taken place.

VII. The existence of the same species on the east and west coasts of America, affords another problem, which migration cannot meet, without sinking the isthmus of Darien or Central America, to afford a passage across. As yet we know of no evidence that this portion of the continent has been beneath the ocean during the recent epoch. An argument against such a supposition might be drawn from the very small number of species that are identical on the two sides, and the character of these species. *Libinia spinosa* occurs at Brazil and Chili, and has not been found in the West Indies. *Leptopodia sagittaria*, another Maioid, occurs at Valparaiso, the West Indies, and the Canaries.

VIII. The large number of similar species common to the Mediterranean and British seas may be due to migration, as there is a con-

tinuous line of coast and no intermediate temperature rendering such a transfer impossible; and the passage farther south to the Canaries of several of the species is not beyond what this cause might accomplish. Still, it cannot be asserted that in all instances the distribution here is owing to migration; nor will it be admitted unless other facts throw the weight of probability on that side.

IX. But when we find the same Temperate zone species occurring in distant provinces, these provinces having between them no water communication except through the Torrid or Frigid zone, and offering no ground for the supposition that such a communication has existed during the recent epoch, we are led to deny the agency of voluntary or involuntary migration in producing this dissemination. An example of this, beyond all dispute, is that of the Mediterranean Sea and Japan. No water communication for the passage of species can be imagined. An opening into the Red Sea is the only possible point of intercommunication between the two kingdoms; but this opens into the Torrid zone, in no part of which are the species found. The two regions have their peculiarities and their striking resemblances; and we are forced to attribute them to original creation and not intercommunication.

X. The resemblances found are not merely in the existence of a few identical species. There are genera common to the two seas that occur nowhere else in the Oriental kingdom, as *Latreillia*, *Ephyra*, *Sicyonia*, &c.; and species where not identical have an exceedingly close resemblance.

Now this resemblance in genera and species (without exact identity in the latter) is not explained by supposing a possible intercommunication. But we may reasonably account for it on the ground of a similarity in the temperature and other physical conditions of the seas; and the well-known principle of "like causes, like effects" forces itself upon the mind as fully meeting the case. Mere intercommunication could not produce the resemblance; for just this similarity of physical condition would still be necessary. And where such a similarity exists, creative power may multiply analogous species; we should almost say, *must*, for, as species are made for the circumstances in which they are to live, identical circumstances will necessarily imply identity of genera in a given class, and even of specific structure or of subgenera.

If, then, the similarity in the characters of these regions is the

occasion of the identity of genera, and of the very close likeness in certain species (so close that an identity is sometimes strongly suspected where not admitted), we must conclude that there is a possibility of actual identity of species, through original creation. This, in fact, becomes the only admissible view, and the actually identical species between Japan and the Mediterranean are examples.

XI. When we find a like resemblance of genera and species between Temperate zone provinces in opposite hemispheres that are almost exact antipodes, as in the case of Great Britain aud New Zealand, we have no choice of hypotheses left. We must appeal directly to creative agency for the peopling of the New Zealand seas as well as the British, and see in both, like wisdom, and a like adaptedness of life to physical nature. The Palæmon affinis of the New Zealand seas is hardly distinguishable from the common P. squilla of Europe, and is one example of this resemblance. It may not be an identity; and on this account it is a still better proof of our principle, because there is no occasion to suspect migration or any other kind of transfer. It is a creation of species in these distant provinces, which are almost identical, owing to the physical resemblances of the seas; and it shows at least, that a very close approximation to identity may be consistent with Divine Wisdom.

The resemblance of the New Zealand and British seas has been remarked upon as extending also to the occurrence in both of the genera Portunus and Cancer. It is certainly a wonderful fact that New Zealand should have a closer resemblance in its Crustacea to Great Britain, its antipode, than to any other part of the world—a resemblance running parallel, as we cannot fail to observe, with its geographical form, its insular position, and its situation among the temperate regions of the ocean. Under such circumstances, there must be many other more intimate resemblances, among which we may yet distinguish the special cause which led to the planting of peculiar British forms in this antipodal land.

The close resemblance in species and genera from Britain and New Zealand, and from Japan and the Mediterranean, and the actual identity in some species among the latter, proves therefore that, as regards the species of two distant regions, identity as well as resemblance may be attributable to independent creations, these resemblances being in direct accordance with the physical resemblances of the regions. As this conclusion cannot be avoided, we are compelled in all cases to try

the hypothesis of migration by considering something beside the mere possibility of its having taken place under certain assumed conditions. The possibility of independent creations is as important a consideration. After all the means of communication between distant provinces have been devised or suggested, the principle still comes up, that it is in accordance with Divine Wisdom, to create similar and identical species in different regions, where the physical circumstances are alike; and we must determine by special and thorough investigation, whether one or the other cause was the actual origin of the distribution in each particular case. Thus it must be with reference to the wide distribution of species in the Oriental tropics, as well as in the European temperate regions, and the Temperate zone of the South Pacific and Indian Oceans.

XII. With respect to the creation of identical species in distant regions, we would again point to its direct dependence on a near identity of physical condition. Although we cannot admit that circumstances or physical forces have ever created a species (as like can only beget like, and physical force must result simply in physical force), and while we see in all nature the free act of the Divine Being, we may still believe the connexion between the calling into existence of a species and the physical circumstances surrounding it to be as intimate nearly as cause and effect. The Creator has in infinite skill, adapted each species to its place, and the whole into a system of admirable harmony and perfection. In his wisdom, any difference of physical condition and kind of food at hand, is sufficient to require some modification of the intimate structure of species, and this difference is expressed in the form of the body or members, so as to produce an exactness of adaptation, which we are far from fully perceiving or comprehending with our present knowledge of the relations of species to their habitats.

When therefore we find the same species in regions of unlike physical character, as, for example, in the seas of the Canaries and Great Britain—regions physically so unlike—we have strong reason for attributing the diffusion of the species to migration. The difference between the Mediterranean and Great Britain may require the same conclusion for the species common to these seas. They are so far different, that we may doubt whether species *created* independently in the two could have been identical, or even have had that resemblance that exists between varieties; for this resemblance is usually of the

most trivial kind, and effects only the least essential of the parts of a species.

The continental species of Crustacea from the interior of different continents, are not in any case known to be identical; and it is well understood that the zoological provinces and districts of the land are of far more limited extent than those of the ocean. The physical differences of the former are far more striking than those of the latter. As we have observed elsewhere, the varieties of climate are greater; the elevation above the sea may vary widely; and numberless are the diversities of soil and its conditions, and the circumstances above and within it. Hence as the creation of each species has reference most intimately to each and all of these conditions, as well as to other prospective ends, an identity between distant regions is seldom to be found, and the characteristic groups of genera are very widely diverse. Comparatively few genera of Insects have as wide a range as those of Crustacea; and species with rare exceptions, have very narrow limits. Where the range of a species in this class is great, we should in general look to migration as the cause rather than original creation; but the considerations bearing on both should be attentively studied before either is admitted as the true explanation.

Throughout the warmer tropical oceans, a resemblance in the physical conditions of distant provinces is far more common and more exact than in the Temperate zone. And hence it would seem that we could not safely appeal to actual differences as an argument against the creation of a species in more than one place. The species spread over the Oriental Torrid zone may hence be supposed to owe their distribution to independent creations of the same species in different places, as well as to migration. Yet we may in this underrate the exactness of physical identity required for independent creations of the same species. We know that for some chemical compounds, the condition of physical forces for their formation is exceedingly delicate; and much more should we infer that when the creation of a living germ was concerned, a close exactness in the conditions would be required in order that the creation should be repeated in another place. Infinite power, it is true, may create in any place; but the creation will have reference to the forces of matter, the material employed in the creation. The few species common to the Oriental and Occidental torrid seas seem to be evidence on this point; the fact that the Oriental species have so rarely been repeated in the Occidental

seas, when the conditions seem to be the same, favours the view that migration has been the main source of the diffusion in the Oriental tropics.

As we descend in the order of Invertebrates, the species are less detailed in structure, with fewer specific parts and greater simplicity of functions, and they therefore admit of a wider range of physical condition; the same argument against multiplication by independent creations in regions for the most part different, does not, therefore, so strongly hold. As we pass, on the contrary, to the highest groups in Zoology, the argument receives far greater weight; and at the same time there are capabilities of migration increasing generally in direct ratio as we ascend, which are calculated to promote the diffusion of species, and remove the necessity of independent creations.

Migration cannot therefore be set aside. It is an actual fact in nature, interfering much with the simplicity which zoological life in its diffusion would otherwise present to us. Where it ends, and where independent creations have taken place, is the great problem for our study. This question has its bearings on all departments of Zoology; but in few has migration had the same extended influence as in that of Crustacea. Molluscs, if we except oceanic species, are no travellers, and keep mostly to narrow limits.

XIII. There is evidence in the exceedingly small number of Torrid zone species identical in the Atlantic and Indian Oceans, that there has been no water communication across from one to the other in the Torrid zone, during the period since existing species of Crustacea were first on the globe.

XIV. As to zoological centres of diffusion for groups of species, we can point out none. Each species of Crustacea may have had its place of origin and single centre of diffusion in many and perhaps the majority of cases. But we have no reason to say that certain regions were without life, and were peopled by migration from specific centres specially selected for this end. If such centres had an existence, there is at present no means by which they may be ascertained. The particular temperature region in which a species originated may be ascertained by observing which is most favourable to its development: we should thus conclude that the *Ranina dentata*, for example, was created in the subtorrid region and not the torrid, as it attains its largest size in the latter. By pursuing this course with reference to each species, we may find some that are especially fitted for almost

every different locality. Hence, we might show, as far as reason and observation can do it, that all regions have had their own special creations.

The world throughout all its epochs in past history, has been furnished with life in accordance with the times and seasons, each species being adapted to its age, its place, and its fellow species of life.

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at all to those of the Torrid
in this Kingdom
Zone: But only that the range
of species as a whole from North
to South differed strikingly from the range
of species in the Africo-European
Section: So in subdividing the
Oriental Kingdom; I did not
mean to imply that the species of
Temperate New Holland were allied
to those of the East Indies, more
than to those of New Zealand; for
this would be contrary to the
grand law of distribution based
on temperature. In fact New Zealand
and Southern Australia, & especially
Tasmania, have quite close relations
in species, though not as close,
as far as I have studied the
species as between New Zealand
& Western S. America from Chili
to Tierra del Fuego. I should

say homeness that the species of Tasmania have not yet been particularly described or Catalogued and it is possible that a strong resemblance may be made out that we now know of. — [On our own Coast Cape Cod off Massachusetts is a very remarkable boundary both (in species of Mollusca and Crustacea]. — I regret that I did not use the term Section in place of Kingdom. But the species seemed to me to be so different between the Sections — that is the temperate of one from the temperate of the other &c &c. that I chose the stronger term — looking at the three Kingdoms as in a certain sense an independent Kingdom Species in Creation — a difference due still in a large degree to the different sea temperatures along the

Coasts. — But I will not detain you longer. I would give much to have the pleasure of talking over the subject with you. — Please mention to Mr. Lubbock that his letter and his valued paper came to hand safely. I am greatly interested in all his labors and gratified with their

I am out of my patience that my plates are not yet out — May an all engraved and almost ready. But I cannot hurry the person who has charge of them and so it [illegible] an always delighted to hear from you and of [illegible] Jamies D. Dana

I have not a well defined dissection to appeal to. I have so often, as I remark above, seen the mouth far posterior to the organs referred to, that I had hardly doubted the ~~two~~ relation I have suggested until you expressed your opinion ~~about it.~~ I was not aware of the objectionable character of ~~the~~ the terms Kingdom & Subkingdom as I have used them in my Chapter on Dist. of Crustacea, until I read your inferences from them. The Study of Crustacea had led me to regard the two American Coasts Eastern & Western, as having a nearer relation to one another than to other Coasts or Seas; and also Western Africa & the Pacific as having a general resemblance in the range of Species. On this

account, as to exhibit this relation, I divided the earth into three meridional sections, the occidental, Africo European & Oriental, which I importunately named Kingdoms. All the earlier half of my Chapter had exhibited the fact that the zonal Zones of temperature, the torrid, temperate & frigid, and even the subzones were very different in species from one another, and that the species of the same Zone over the world were more closely related than species of different Zones in any country. In using the term Occidental Kingdom, I did not mean to imply that the species of the temperate Zone had any close resemblance or any resemblance

1557 no species common to W. America & central Pacific, except few cosmopolitan

1498 on number of species in Tropical zone ~~(96~~

1501 less numerous but higher

1504 Tropics most prolific in Crustacean life

1528 General discussion on above heads

(191)