The Fauna and Geography
of the
Maldive and Laccadive Archipelagoes

Being the Account of the Work carried on and of the Collections made by an Expedition during the years 1899 and 1900

Edited by

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Reports.

MARINE CRUSTACEANS.

PARTS X. AND XI.

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(With Plates XLVII. and XLVIII. and Text-figures 122—6.)

X. THE SPIDER-CRABS (OXYRHYNCHA).

The Oxyrhyncha are a fairly well characterized group. Sharply separated, on the one hand from the Dromiacea by the coxal opening of the oviduct, the loss of the first abdominal limb in the female, and the normal shape and position of the last pair of legs (except in two or three cases as *Ocinopus* (Fig. 123), *Grypachaeus* and *Zebrida*), and on the other hand from the Oxystomata by the square mouth and the normal maxillipeds (Pl. XLVII. fig. 5 *b*), they differ from the Brachyrhyncha in the shape of the body, which is narrowed in the fore part, so that in most cases it is triangular, and has a well-marked rostrum (Pl. XLVII., and Text-figs. 122 and 123), and usually in the imperfection of the orbits. Slender legs and weak chelae are another common feature, but not a diagnostic one. Their prevailing habitat may be summed up by saying that they are the crabs of the weed and weed-like animals, but this statement needs some explanation and qualification.

The loss of their tail-fin has left the crabs, as a whole, a distinctly slower-moving group than most of the tailed Reptantia. To this there are, indeed, exceptions—as, for instance, the Ocypodes on land and the swimming crabs in the water—but for the bulk of the Brachyura it holds good, and each of the sections of the tribe has had to meet the difficulty in its own way. In the Brachyrhyncha the cuticle has generally become thickened into a stout armour, while the crab keeps fairly active in its habits, at all events after dusk, and usually defends itself vigorously with its strong chelae when it is attacked. In this legion protective coloration and shape are comparatively rare, and the habit of covering the body with foreign objects decidedly so (*Caphyra*), though the custom of hiding under stones is common. The remaining groups have, so to say, accepted the situation. Driven by the loss of their tail-fin to lead a sluggish life, they have found safety in exaggerating this inertness and combining it with various devices for escaping observation. The Dromiacea hold foreign bodies over their backs with their hind legs, the Oxystomes bury themselves in sand or shingle, and in each of these groups the most characteristic features, to which they owe their distinctness, are due to the method of concealment[1]. The

[1] See above, p. 434.

typical members of the Oxyrhyncha—the Maiidae[1]—have adopted another plan. They hide themselves by covering their bodies with bits of seaweeds, zoophytes, or sponges, which are held on by hooked or jagged hairs of special shape found on the body and limbs of the true spider-crabs and not elsewhere (Pl. XLVII. figs. 3 *c* and 4 *d*). They are gathered and placed in position by the crab itself, which uses for this purpose its chelipeds. These limbs are specially shaped so as to have a mobility not found in other crabs, and are thus able to reach distant parts of the body and legs. In order that they may adhere better, the fragments of weed, etc. are treated with a secretion given out by glands on the first maxilliped[2]: and they not only remain in a living state, but often continue to grow, so that in some genera it is not uncommon to find the whole crab as completely hidden by a single sponge as any *Dromia*. Besides seaweeds, the organisms used include sponges, hydroids, polyzoa, and ascidians, and in some cases barnacles and tubicolous worms add themselves as self-invited guests. Several different kinds of organisms may sometimes be found on the back of one crab, but in most cases, very possibly in all, the species planted by it are those amongst which it is living and are changed if it be placed in other surroundings where they would be conspicuous. This implies considerable care in the choice of the clothing, and indeed such may easily be seen to be bestowed if a captive individual, say a *Maia squinado*, be watched while it is disguising itself. I have even seen this species cover its back with shingle when no weed was available. The number of hairs naturally varies, as does also the extent to which the crab is hidden, but it rarely happens (*Epialtus*) that they are quite wanting.

[1] *Key to the families of the Oxyrhyncha.*

I. Carapace thin and flat. First leg (cheliped) not long or specially mobile or with fingers bent at an angle with the hand. Male opening sternal. [No orbits. Second joint of antennal stalk slender, fused with epistome but not with front. No hooked hairs.] *Hymenosomidae.*

II. Carapace not thin *and* flat (except *Ocinopus*). First leg either mobile or powerful with bent fingers. Male opening coxal.

A. Chelipeds specially mobile, rarely much larger than the other legs or with fingers bent at an angle on the hand. Second joint of antenna well developed, generally fused with epistome and often with front. Orbits generally more or less incomplete. Hooked hairs almost always present. *Maiidae.*

B. Chelipeds not specially mobile, usually much longer and heavier than the other legs and with fingers bent on the hand at an angle towards the side on which the fixed finger is set. Second joint of antenna small, short, and not fused with epistome or front. Orbits well made. Hooked hairs almost always wanting. *Parthenopidae.*

Key to the subfamilies of the Maiidae.

I. Second joint of antenna very slender throughout its length. [No orbits. Eyestalks generally long.] *Inachinae.*

II. Second joint of antenna not very slender.

A. No true orbits (eyestalks hidden under a supraocular spine or sunken in the sides of a great rostrum). Second joint of antenna truncate-triangular. Eyestalks very short. *Acanthonychinae.*

B. True orbits, containing both supra- and postocular elements sheltering the eyes, are more or less completely formed, except in a few genera where the eyestalks are long and slender. Second antenna-joint broad, usually not truncate-triangular. Eyestalks long or short.

1. A large, cupped, usually blunt postocular process present. Eyestalks short. Cornea of eyes not completely hidden when they are folded back. *Pisinae.*

2. Postocular process, if present, usually sharp and not cupped, but if not so then cornea hidden (as also in most other cases). Eyestalks usually long. *Maiinae.*

Key to the subfamilies of the Parthenopidae.

I. Carapace usually triangular, sometimes suboval or subpentagonal. Rostrum simple. Chelipeds much bigger than the other legs. Branchial regions of the body deeply separated from cardiac. *Parthenopinae.*

II. Carapace usually sharply pentagonal. Rostrum cleft into two. Chelipeds of moderate size. Branchial regions of the body not deeply separated from cardiac. *Eumedoninae.*

[2] For an account of those structures in the Spider-Crabs which are specially adapted to their habit of clothing themselves, see Aurivillius, *Kong. Svenska Vet.-Ak. Hand. Bt.* XXIII. no. 4 (1889).

Such habits as these need a corresponding habitat, and the Spider-Crabs are essentially haunters of weeds, and weed-like animals. The larger kinds cling to the rocks and stones on which grow the organisms they clothe themselves with. The walking-legs of such species usually end in strong, sharp, curved claws by which they can hold fast to the ground. Smaller kinds often live on the weed itself, and these frequently bear hooked or even sub-chelate claws on the hinder legs with which to cling to the branches, while one or both of the second and third pairs are long—probably because they are used in climbing (Pl. XLVII. figs. 1, 3 and 4). The first pair (chelipeds) are also sometimes used, monkey-wise, in clambering. Research will no doubt show that some of the peculiar features of particular species and genera are adaptations to special kinds of sessile organisms. At present I can only recall the flat, leaf-like body of *Huenia*, which resembles the *Halimeda*-weed among which it is generally found (see below, p. 686), and it is certainly the case that very many species show no preference whatever in this respect.

The habit of living on or among sessile organisms is probably kept up by some of the members of the other two families of the Oxyrhyncha, although it is the Maiidae alone which clothe themselves in the way described above. Further information, however, is much needed on this point. The Hymenosomidae (Fig. 122) seem clearly adapted by their structure—their delicate bodies and slender legs with hooked end-joints—for living on plants or zoophytes. They may certainly sometimes be found in such situations, but are also reported to have been taken under stones[1], a position for which their flat backs are not unsuitable. Among the Parthenopidae, the Eumedoninae are probably guests of other organisms. *Zebrida* has, indeed, been taken among the spines of a sea-urchin whose colouring it assumes. But the Parthenopinae (Pl. XLVII. fig. 5) have an entirely different habitat. The members of this subfamily have left the weed (that they originally had the same habits as the Maiidae seems likely from the occurrence of hooked hairs, slight and few in number, in certain members of the genus *Lambrus*) and have taken up the same habitat as the Oxystomata—that is to say beds of sand and shingle. The result is a series of modifications strikingly like some of those which are found in the latter group[2]. The overlapping wings of the carapace which hide the legs of *Calappa* and *Tlos* reappear in such forms as *Cryptopodia*, *Heterocrypta* and *Oethra* and less strongly marked in *Lambrus*, especially *L. calappoides*. The long chelipeds of some Leucosiids are repeated in an altered shape in various species of *Lambrus* and *Parthenope*. The bent fingers of *Ranina* and some species of *Calappa* are found throughout the group. In *Lambrus calappoides* we find again the flat hands of *Calappa* held against the breast. But the most striking of these likenesses is the arrangement of the inward channel for the breathing-stream in *Aulacolambrus*, which, while it is wholly new, yet strongly recalls that of the Leucosiidae. In this subgenus, the underside of the carapace (pterygostome) is traversed, on each side, just outside the third maxilliped, by a deep groove which is covered in, not like the analogous channel in the Leucosiidae by the maxillipeds, but by thick fringes of hairs borne by the maxillipeds and by the carapace, becoming thus a closed tube leading from the front of the body to the opening of the gill-chamber at the base of the chelipeds (Pl. XLVII. fig. 6). A similar

[1] Adams and White, *Crustacea of the Samarang*. The authors make the same statement about *Trapezia*, which is certainly a coral crab. Perhaps these genera take shelter under stones when they are by some accident removed from the neighbourhood of their natural habitat, growing organisms. Or, again, it may be that the hollows under the stones from which the *Elamena* was taken were lined, as such hollows often are, with a scrubby growth of weed.

[2] See above, pp. 434, 435.

arrangement is found in the other subgenera of *Lambrus*[1]. In this case, however, there are two shallow grooves, an outer one running outward and an inner one running forward from the gill-opening, and both uncovered (Pl. XLVII. fig. 5 *b*). The rough, knobbed back of the Parthenopinae is like that of *Calappa*, but a similar texture is so common among crabs that little can be argued from it. Probably it is less conspicuous on a sandy bottom with coral pebbles than a quite smooth object would be.

We have already stated that the Oxyrhyncha are among the sluggish groups of crabs. When they are seized they do not attempt to defend themselves with their chelae, but move their legs feebly and aimlessly. Indeed the Parthenopinae—like the Calappidae in this respect also—often seem to be hypnotised by being moved, drawing up their legs under them and remaining still. In general the intelligence of the group is of a low order, with the single exception of their cleverness in disguise, which, after all, is probably no more than a fairly simple reflex.

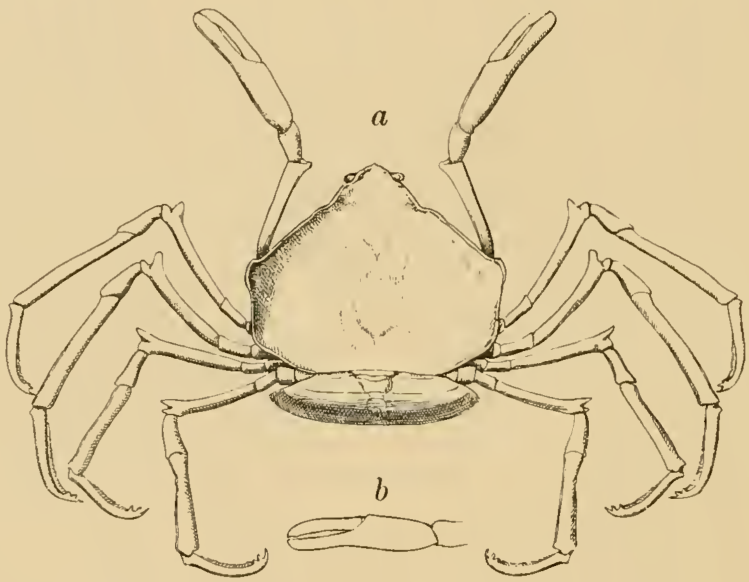


FIG. 122. *Elamena gracilis*; *a*. whole animal, *b*. outside of hand.

Of the 29 species in the collection made by the expedition, three are new. The rest are all recorded from the Indian region by Major Alcock[2], with the exception of two which were described as new by Miss Rathbun in her account of Prof. Agassiz's Maldive Crabs[3]. The following systematic list sets forth these species in order.

Family **Hymenosomidae.**

Genus *Elamena* H. M.-Edw., 1837.

1. *Elamena gracilis*, n. sp. (Fig. 122)

Diagnosis: "An *Elamena* in which the sides of the hinder part of the body are straight from the 4th to the 1st pair of legs, and then turn inwards almost at right angles to

[1] Owing to lack of material I am unable to say whether this groove is found throughout Parthenopinae.

[2] In his series of papers on the Indian Crabs in the *Journ. As. Soc. Bengal.*

[3] *Bull. Mus. Harvard*, XXXIX. 5 (1902).

join the fore part, which is triangular, with very slightly irregular sides; the front also triangular but with indications of two teeth at its sides; the eyes showing a small part of the cornea at the sides of the front when seen from above; the chelipeds short, slender, with narrow, spooned fingers about as long as the palms; and the walking-legs slender, with a spine at the end of the meropodite, and the last joint strongly hooked, with a group of little thorns underneath at the tip and a fringe of hair all along."

Length of longest specimen: 6 mm. Breadth: 7 mm. Colour: in spirit, pale yellow; when alive, legs black-brown, rest of body transparent.

A female was taken at Minikoi, and a male and female at Hulule, Male Atoll, all on the reef.

Family **Maiidae.**

Subfamily **Inachinae.** Genus *Achaeus* Leach, 1815.

2. ? *Achaeus spinosus* Miers, 1879. Alcock, I. p. 171[1].

My specimen agrees with Alcock's and Miers' descriptions, but the last *two* pairs of legs have strongly curved end-joints. Miers and Alcock only mention the last pair.

Dredged in Mahlos Atoll in 24 fathoms.

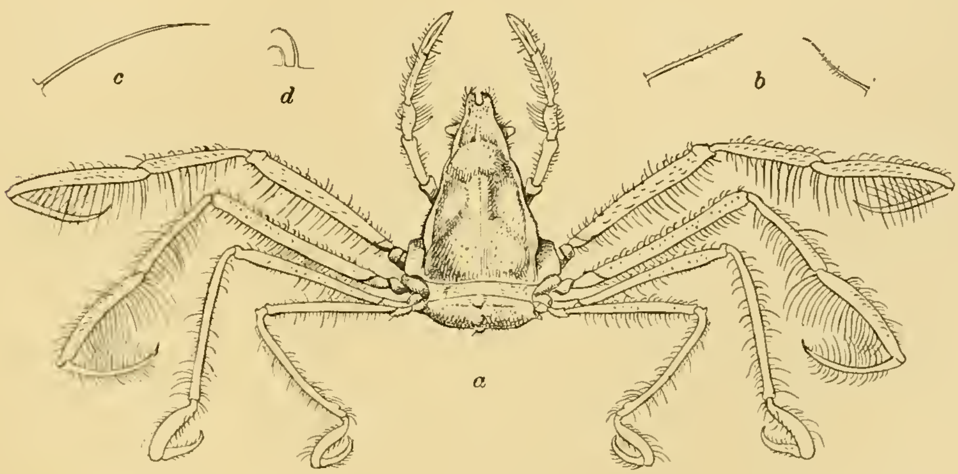


FIG. 123. *Ocinopus aranea*; *a*. whole animal, *b*. two of the hairs on the hinder pair of legs, *c*. one of the long hairs on the legs of the second and third pairs, *d*. hooked hairs.

Genus *Ocinopus* de Haan, 1837.

3. *Ocinopus aranea* de Haan, 1837. Alcock, I. p. 183 (Fig. 123).

The shape of the lobes at the tip of the rostrum in this species varies somewhat.

A very common crab, taken practically throughout the group in 19—45 fathoms.

[1] For a statement of the principles on which references are given in this series of papers see above, p. 192. Major Alcock's paper on the Indian Oxyrhyncha appeared in *Journ. As. Soc. Bengal*, LXIV. ii. 2, p. 157 (1895).

Subfamily **Acanthonychinae.** Genus *Xenocarcinus* White, 1847.

4. *Xenocarcinus tuberculatus* White, 1847. Alcock, I. p. 192.

Dredged outside Fadifolu Atoll, in 70 fathoms.

Genus *Menaethius* H. M.-Edw., 1834.

5. *Menaethius monoceros* (Latr.), 1825. Alcock, I. p. 197.

A common species, taken in Male, Fadifolu, Minikoi, and Goifurfehendu Atolls down to 6 fathoms.

Genus *Huenia* de Haan, 1837.

6. *Huenia proteus* de Haan, 1837. Alcock, I. p. 195 (Pl. XLVII. figs. 1, 2).

In the extraordinarily variable shape of its body, this crab is fully worthy of its name. The simplest form is found in most of the males, which are flat and triangular, much like *Menaethius*, with a long, sharp rostrum (Pl. XLVII. fig. 1). What may be the habitat of these males is yet to be settled: the specimen figured carried a large flat piece of a green weed, held on its rostrum by means of the hooked hairs always found there in this species. On the other hand, most of the females and some of the males—true males, not "unsexed females" with parasites—have the body widened into a leaf-like shape by outgrowths of the hepatic and branchial regions (Pl. XLVII. fig. 2). These individuals, at least in most cases, live on the flat *Halimeda*-weed, which they closely resemble both in shape and colour. Figure 124 is given to show this likeness. Some of the females, however, come near the three-cornered shape of the ordinary male. This, and the fact that intermediates are found in both sexes, prevents us from calling the phenomenon "dimorphism." Another interesting feature is shown by the walking legs. The last joint in these limbs is strongly toothed, and can be shut back at a sharp angle on the one before it. In the broad individuals the legs are short and stout and keeled to look like the edges of *Halimeda* "leaves," and here the whole under-edge of the last joint but one is hairy; but in the triangular form, where the legs are long and slender, there is a special tuft of hairs to meet the end-joint, and this tuft is often raised on a knob. The whole structure thus formed is all but subchelate and seems clearly adapted for holding on by.

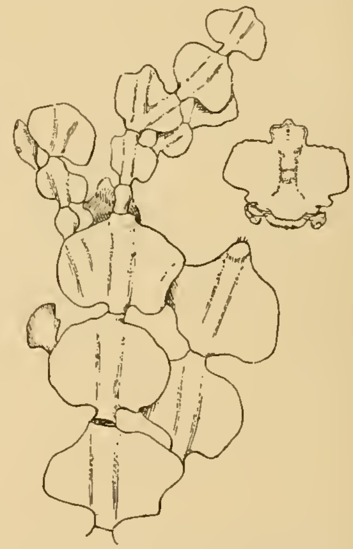


Fig. 124. A sprig of *Halimeda*-weed with a specimen of *Huenia proteus*, showing the likeness of the latter to a "leaf" of the weed.

The surface of the body of these crabs may be seen under a high magnification to have the curious graving shown in fig. 1 *a*, on Plate XLVII.

The species was taken in Male Atoll on the reef, and dredged from 22 fathoms in Kolumadulu Atoll.

Subfamily **Pisinae.** Genus *Naxioides* A. M.-Edw., 1865.

The synonymy of this genus is discussed by Rathbun, *Proc. Biol. Soc. Washington*, XI. p. 157 (1897).

7. *Naxioides hirta* A. M.-Edw., 1865.

Naxia hirta, Alcock, *loc. cit.* p. 218.

Taken in Kolumadulu, Suvadiva, Haddumati, and South Nilandu Atolls in 30—40 fathoms.

8. *Naxioides spinigera*, n. sp. (Pl. XLVII. fig. 3).

Diagnosis: "A *Naxioides* with the horns more than half the length of the body, bearing the accessory thorn a third of their length from the end; the body hairy, with many knobs and thorns, of which the largest are three in a row on the gastric region, two on the cardiac, one on the intestinal, three in a triangle on the branchial, with one in front of them, and one on each eye-hood, these latter being quite upright, but bent slightly forwards at the tip, no thorn at the angle of the mouth, two knobs on the pterygostome, two thorns on the outside of the basal joint of the antenna; the chelipeds slender, little longer than the body, the fingers half the length of the palm, finely toothed and meeting along nearly their whole length, a spine at the end of the arm; and the walking legs slender, the first pair very long, a long spine at the end of the meropodite of this limb, a short one on the next, and none on the hinder two."

Length: 11 mm. Breadth: 8 mm. Colour in spirit: white.

Allied to *N. cerastes* (Ortm.), 1894.

Three males dredged in 30 fathoms in North Male Atoll.

Genus *Halimus* Latr., 1829.

For the synonymy of this genus, which is identical with *Hyastenus* White, 1847, and not *Naxia* Leach, 1828, see Rathbun, *Proc. Biol. Soc. Washington*, XI. p. 157 (1897).

9. *Halimus tenuicornis* (Pocock), 1890. Alcock, I. p. 215.

The colour of this species as preserved in formalin is white with bright pink markings. It was dredged in South Nilandu, Male, Mulaku, Felidu and North Male Atolls in 25—30 fathoms.

10. *Halimus gracilirostris* (Miers), 1879. Alcock, I. p. 215.

Dredged throughout the group in 20—70 fathoms.

11. *Halimus diacanthus* (de Haan), 1837. Alcock, I. p. 210.

Found on a black crinoid dredged in 30 fathoms in South Nilandu Atoll.

12. *Halimus calvarius* (Alc.), 1895. Alcock, I. p. 213.

Dredged in South Nilandu, Mulaku, Suvadiva, Haddumati, and North Male Atolls in 19—40 fathoms.

13. *Halimus convexus* (Miers), 1884. Alcock, I. p. 216.

The one specimen in the collection is a female, and differs from Miers' (a male) in that: (i) the horns are less strongly divergent, (ii) the palm is slenderer and the fingers much less gaping. The species is allied to *H. calvarius* but differs in that: (i) the horns are more slender and diverge more strongly, curving, as well as slanting, outwards, (ii) there is no trace of a knob on the gastric mound, which is also more prominent, (iii) there is no epibranchial spinule or intestinal spine, (iv) the carapace is narrower, and (v) the palm is rather more swollen. It was dredged in 30 fathoms in Suvadiva Atoll.

14. *Halimus espinosus*, n. sp. (Pl. XLVII. fig. 4).

The group of forms akin to *H. diacanthus* (including var. *elongata* Ortm., 1893, *H. subinermis* Zehnter, 1894, *H. convexus* Miers, 1884, and *H. calvarius* Alc., 1895) are in all likelihood no more than varieties of one variable species. The collection contains a specimen of another such form, which I describe here. The following characters, taken together, separate it from its allies mentioned above: (i) carapace narrow (10 : 6); (ii) gastric region swollen, with traces of the knob; (iii) horns rather less than half the length of the carapace, straight, not very divergent; (iv) a spinule on each branchial region and a low knob in place of the intestinal spine; (v) the outer angle of the basal antennal joint not strongly marked. The specimens, which are both males, were dredged in Haddumati Atoll in 35 and 39 fathoms.

15. *Halimus agassizi* Rathb., 1902.

Halimus agassizii, Rathbun, *Bull. Mus. Harvard*, XXXIX. 5, p. 133, fig. 6.

The females of this species have very slender chelipeds with long narrow palms and short fingers, which gape very slightly. Miss Rathbun's only specimen was taken in the same locality as ours, Nilandu Atoll, and in practically the same depth, 24 fathoms.

Genus *Phalangipus* Latr., 1825.

Miss Rathbun (*Proc. Biol. Soc. Washington*, XI. p. 159, 1897) has shown that this name must be substituted for *Egeria* Leach, 1815, which is preoccupied.

16. *Phalangipus arachnoides* Latr., 1825. Alcock, I. p. 223.

Dredged in Mulaku, South Nilandu, and Felidu Atolls, in 25—36 fathoms.

Genus *Tylocarcinus* Miers, 1879.

17. *Tylocarcinus styx* (Hbst.), 1803. Alcock, I. p. 235.

Taken on the reef in Male, Fadifolu, and Goifurfehendu Atolls.

Subfamily **Maiinae.** Genus *Schizophrys* White, 1848.

18. *Schizophrys aspera* (A. M.-Edw.), 1834. Alcock, I. p. 243.

Taken on the reef in Male and Fadifolu Atolls, and dredged in 34 fathoms in Felidu and 20 fathoms in Suvadiva Atoll.

Genus *Cyclax* Dana, 1852.

19. *Cyclax* (*Cyclomaia*) *suborbicularis* (Stimps.), 1857. Alcock, I. p. 245.

Taken on the reef at Hulule, Male Atoll.

Genus *Micippa* Leach, 1816.

20. *Micippa philyra* (Hbst.), 1803. Alcock, I. p. 249.

Taken on the reef at Hulule, Male Atoll, and dredged in Kolumadulu, South Nilandu, Fadifolu, Suvadiva and North Male Atolls in 20—35 fathoms.

21. *Micippa margaritifera* (Hend.), 1893. Alcock, I. p. 253.

Dredged in Suvadiva Atoll in 43 fathoms.

22. *Micippa parca* Alc., 1895. Alcock, I. p. 253.

I think that this form should have specific rank, rather than that of a variety of *M. margaritifera*, given to it by Alcock.

Dredged in 20 and 25 fathoms in Mahlos and South Nilandu Atolls respectively.

Genus *Macrocoeloma* Miers, 1879.

23. *Macrocoeloma nummifer* Alc., 1895. Alcock, I. p. 255.

Almost all the spines on my specimens end in a round knob. Alcock does not mention this, but such knobs were present on several of the spines in the individual he figures. In my specimen thickenings of a like kind are set on the tips of the front. Alcock's figure, however, shows none. The knobs cannot be rubbed off and do not seem to be due to foreign growths of any kind.

The species was dredged in 30 fathoms in South Nilandu, and in 23 fathoms in Mahlos Atoll.

Family **Parthenopidae.**

Subfamily **Parthenopinae.** Genus *Lambrus* Leach, 1815.

24. *Lambrus* (*Rhinolambrus*) *bispinosus* Rathb., 1902.

Lambrus (*Rhinolambrus*) *bispinosus*, Rathbun, *Bull. Mus. Harvard,* XXXIX. 5, p. 134, figs. 1, 2.

In her description of this species, Miss Rathbun says that the upper side of the hand bears *two* lobes. Later she says that the species is separated from *L. confragosus* (among other differences) by the presence of only *one* lobe in this position. Her figure and my specimens bear out the latter statement.

Dredged in South Nilandu Atoll in 25 fathoms.

25. *Lambrus* (*Rhinolambrus*) *pelagicus* Rüpp., 1830. Alcock, I. p. 267.

The granules on the back are quite well marked in my specimens, as in Milne-Edwards' figure (*Nouv. Arch. Mus.* VIII. Pl. XIV. fig. 4). It would seem that Alcock had found in the Andamans local races both of this species and of *L. gracilis*, in which the granules were reduced in size and distinctness.

Dredged in Mulaku, Suvadiva, and Addu Atolls, in 28—43 fathoms.

26. *Lambrus* (*Rhinolambrus*) *gracilis* Dana, 1852. Alcock, I. p. 269.

The specimens which I assign to this species agree with Alcock's description fully, except that the surface of the carapace is not absolutely smooth, there being several granules round the cardiac spine and along the branchial ridges.

Dredged in Felidu, Fadifolu and Suvadiva Atolls, in 22—43 fathoms.

27. *Lambrus* (*Rhinolambrus*) *turriger* Ad. and Wh., 1847. Alcock, I. p. 269 (Pl. XLVII. fig. 5).

Dredged in South Nilandu, Felidu, Mulaku, Haddumati, Suvadiva, Kolumadulu and North Male Atolls, in 25—42 fathoms.

28. *Lambrus* (*Aulacolambrus*) *sculptus* A. M.-Edw., 1872. Alcock, I. p. 272 (Pl. XLVII. fig. 6).

Dredged in South Nilandu, Felidu, Mulaku, and Suvadiva Atolls, in 20—43 fathoms.

29. *Lambrus* (*Parthenolambrus*) *calappoides* Ad. and Wh., 1847. Alcock, I. p. 275.

Dredged in South Nilandu and Suvadiva in 36 and 35 fathoms respectively.

XI. ON THE CLASSIFICATION AND GENEALOGY OF THE REPTANT DECAPODS.

Besides the brachyurous Crabs, Boas' Reptantia[1] comprised sundry groups which are not brachyurous, that is have a pair of biramous limbs on the sixth segment of the abdomen, which bears traces of adaptation to other purposes than reproduction, such as swimming or holding on a shell, and have also no fusion between the rostrum or front and the epistome and no angle on the endopodite of the first maxilliped. The following are the names of these groups: Eryonidea, Scyllaridea (= Loricata), Nephropsidea (= Homaridea and Astacidea), Thalassinidea, Paguridea, Galatheidea, and Hippidea, the last three being together known as Anomala by Boas and most other writers.

Our present object is to arrange these divisions according to their relationships, and to do this we must first of all form an idea of the ancestor from which they may be supposed to be descended. More space would be needed than can be spared here to set forth in detail the process of comparison of the various types with one another and with the prawns of the Stenopidea and Penaeidea, by which this result may be reached, and indeed this might after all be hardly worth while, for the following statement will, I think, commend itself to those who have studied the subject as on the whole probable.

The forebears of the reptant Decapods, if they could be examined, would probably show the following characters:

(1) The *rostrum* of a good size, flat but keeled, and narrowly triangular.

(2) The *carapace* subcylindrical, free from the epistome both at the sides and in the middle, overlapped behind by a process of the first abdominal segment on each side, and marked by the following grooves: on the back two running transversely (the first, line *e* of Boas, is Bouvier's

[1] See above, Art. IV. vol. I. p. 424.

cervical groove, and the second, line *c* of Boas, is Bouvier's branchial groove, ordinarily known as the cervical groove; it would be well if these were known as the first and second cervical grooves); at the sides three transverse grooves slanting forwards, the first two being prolongations of the two cervical grooves and the third being line *a* of Boas; and two irregular longitudinal grooves, the upper, line *d* of Boas, connecting the first cervical groove with the fore edge below the antenna, and the second, line *b*, b^1 of Boas, starting from the lower end of *a* and joining the lower ends of the two cervical grooves with the fore edge some way below the line d^1 (see Fig. 125).

(3) The *abdomen* long, straight, tapering somewhat from the second segment backwards, moderately broad, not greatly compressed but with pleura bent downwards and terga well arched. Both terga and pleura stout and overlapping. The telson pointed.

(4) The *eyes* well developed and pigmented. The eye-stalks of moderate length, made up of two cylindrical joints, of which the second is longer than the first.

(5) The *first antenna* with a straight stalk of three short, subequal subcylindrical joints, and two subequal flagella, which are longer than the stalk, but shorter than the flagellum of the second antenna.

(6) The *second antenna* with the basal joint free, a scale which is broad but not leaf-like and ends in a sharp point that represents the tooth on the outer angle in the prawns, and a flagellum which is slender and about as long as the body.

(7) The *mandible* with a broad cutting edge, a small stump to represent the molar process, and a stout, curved, three-jointed palp.

(8) The *first maxilla* with the plate which represents the basipodite broader than that which represents the coxopodite, and the endopodite of a good size, and divided into two joints, the second of which is directed outwards.

(9) The *second maxilla* with the coxopoditic and basipoditic plates both cleft, so that four lobes result, these lobes all narrow, and the scaphognathite ending behind in an angle, which is rather less than a right angle.

(10) The *first maxilliped* with a many-jointed flagellum on the exopodite, a two-jointed endopodite which is not very broad and an epipodite. The basipoditic plate deep, but not broad.

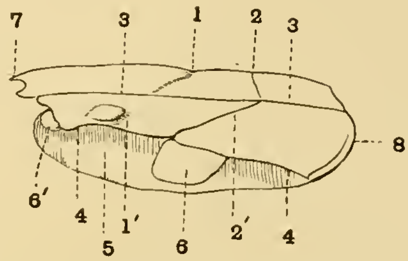


FIG. 125. Cephalothoracic carapace of *Callianassa novaebritanniae* from the left side, 1. first cervical groove—the line *e* of Boas and "cervical groove" of Bouvier, 2. second cervical groove—the line *c* of Boas and Bouvier's "branchial groove," ordinarily known as the "cervical groove," 1′ and 2′. continuations of 1 and 2 at the sides of the carapace, 3. upper longitudinal line—the *linea thalassinica* and perhaps also the *linea homolica*—the front part of which is the line *d* of Boas, 4. lower longitudinal line—the *linea anomurica* and perhaps also the *linea dromiidica*—the front part of which is the line *b* of Boas, 5. a soft area at the side of the carapace, 6, 6′. hard plates in this area, 7. *rostrum*, 8. thickened hinder edge of the carapace. The second cervical groove is here represented only by a line or crack in the carapace. It is, however, in the same place as the cervical groove of other Callianassas, and there is a good deal of evidence that a groove may be represented by a crack. The *linea thalassinica*, for instance, is sometimes a groove in part of its length.

(11) The *second maxilliped* with the exopodite longer than the endopodite, carrying a jointed flagellum, and the endopodite slender, with the last joint at the end.

[1] A backward prolongation of the upper of these lines (*d*), known as the *linea thalassinica*, is found in many Thalassinidea, and a similar prolongation of the lower (*b*), known as the *linea anomurica*, in the Anomala. The *linea homolica* and *linea dromiidica* correspond in position with the first and second of these respectively, but as they are not continuous with *d* and *b* it is doubtful how far they can be looked upon as homologous. In any case the term *linea anomurica* loosely applied to the longitudinal suture of the Homolidae (as on p. 575 above) is wrong.

(12) The *third maxilliped* with the exopodite shorter than the endopodite, carrying a straight, jointed flagellum directed forwards, and the endopodite narrow, with separate ischiopodite and meropodite.

(13) All the *legs* seven-jointed. The first three pairs chelate with normal chelae, the first the greatest, equal, the fourth pair simple, the fifth pair simple (?) and having its last two joints slightly twisted so that, when the basal joints are pressed against the sides of the body, while the last joint of the fourth pair points downwards and backwards, that of the fifth pair points forwards and inwards[1].

(14) The *gills* many, including mastigobranchs and podobranchs on all the thoracic limbs but the last, arthrobranchs on all but the first and last, and pleurobranchs on the last four.

(15) The *thoracic segments* which bear the legs with distinct sterna, which are not very broad, but grow broader from before backwards, and are all fused except the last[2].

(16) The first pair of *abdominal limbs* unbranched. Those of the second to fifth segments with two fairly broad branches, the inner of which bears an *appendix interna* (Fig. 126 *c*). The last pair about as long as the telson, with broadly oval branches, across the outer of which is a suture.

The internal anatomy of the various groups is not yet well enough known to allow of general statements being made about it.

The animal was hatched in the Zoea stage, with a segmented abdomen but no limbs behind the third maxilliped, and passed through a *Mysis* stage with exopodites on all the legs.

The descendants of the crustacean which we have thus reconstructed fall into two sets, one comprising the Eryonidea, Scyllaridea, and Nephropsidea, in which the abdomen is strong and well-armoured, stretched out unprotected, and used as a swimming organ by means of its tail-fin, and the other containing the rest of the groups, in which it has for some reason become a burden and a source of danger to be protected and kept from exposure, even though it be still shaped and used for swimming. The first of these sets is on a lower and more primitive grade of organisation than the second. This is shown (1) by the abdomen, with its stout armour, overlapping terga and pleura, strong processes to clip the carapace on the first segment, broad tail-fin, and, in the Eryonidea and Scyllaridea, *appendices internae*. To this form of abdomen, which is always carried at length, I shall restrict the term "macrurous." (2) by the legs, which in the Eryonidea and Nephropsidea are chelate in the first three pairs and have seven joints (except for the first pair of the Nephropsidea) whereas in all other Reptantia they have only six, owing to the fusion of the basipodite and ischiopodite, (3) by the large number of the gills, (4) by the slender third maxillipeds with their long flagella directed forwards, (5) by the broad antennal scale of the Eryonidea and Nephropsidea. Of course some of the foregoing characters are found in primitive members of other groups, but they stamp this set of groups as a whole. Of the three macrurous groups, the Eryonidea and Scyllaridea are more nearly allied together than either of them is to the Nephropsidea. They have both lost, or much reduced, their rostrum (except *Palinurellus*), reduced the inner lobes of the second maxilla, and fused their carapace at the sides with the epistome, but they have kept the *appendices internae*. Their body

[1] This character, though it is most prominent in the Anomala and Thalassinidea and the lower Crabs, is seen to some extent even in the more primitive groups, as the Palinuridae and Potamobiidae.

[2] A primitive feature, found not only in Boas' Anomala but also in the Thalassinidea, Potamobiidae and Parastacidae and in the prawn *Stenopus*. In *Penaeus* the anterior sterna are free, but the last two are joined by secondary thickenings in the membrane between them.

shows a tendency to be flattened. The Nephropsidea differ from them in all these respects. Between the Eryonidea and the Scyllaridea the most striking difference lies in the fact that in the former all the legs are chelate and in the latter none are so. The Eryonidea are the more primitive in keeping the antennal scale, the joint between the ischiopodite and meropodite, and the chelae on the first three legs.

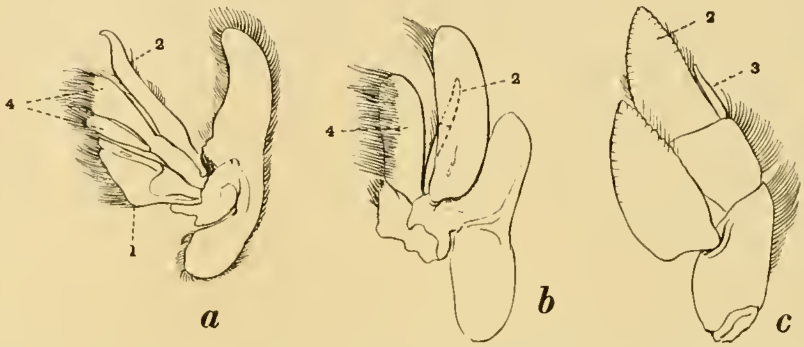


Fig. 126. Limbs of *Axius acanthus*; *a*. second maxilla, *b*. first maxilliped, *c*. abdominal limb of the third pair. 1. gnathobase or first lobe of coxopodite, 2. endopodite, 3. *appendix interna*, 4. lobes of basipodite.

In considering the second set of groups, we have first to settle whether to look upon them as of common descent and treat them as a whole, or whether we must find a separate point of origin for each of them from among the Macrura. Now it may be allowed at the outset that there is but one character that every member of them shares with the rest. In the macrurous groups the first three pairs of legs are all alike, adapted either to seizing or to crawling—chelate, that is, or simple. But in the modified groups we are now dealing with the third pair is never adapted to the same end as the first. In the overwhelming majority the first pair are chelate or subchelate[1] and the third used for walking, and in the Hippidae, where the first are simple and straight, the third are hooked and flattened for burrowing or swimming. Nor is this point an unimportant one, for the likeness of the first three legs is a heritage from the penaeid prawns, and as such is of considerable value. Moreover it is possible to find a number of characters which, while they are not seen in every member of the non-macrurous groups, are yet common in each of them, and do not occur elsewhere. These are: (1) a large gnathobase, or inner coxopoditic lobe, on the second maxilla (Fig. 126 *a*), (2) the shape of the first maxilliped, which has a broad but shallow basipoditic lobe, whose inner margin is in the same line with that of the coxopodite[2], and a broad basal half to the exopodite (Fig. 126 *b*), (3) the flagella of the maxillipeds turned inwards and curved forwards at their ends, (4) reduction in various ways of the abdomen, (5) the presence of backward prolongations of the longitudinal lines of the carapace[3]. Since, however, numbers (3) to (5) are less strongly marked in the more primitive forms of some of the groups, it is doubtful whether much stress can be laid upon them.

Taking it for granted, then, that the non-macrurous Decapods had a common, if remote, ancestor, it remains to be seen where that ancestor must be placed with regard to the

[1] *Gebicula* seems at first sight to be an exception to this, but there is on the propodite a strong tooth near the end which seems almost certain to be used in the same way as the "thumb" of the allied *Upogebia*.

[2] Found also in at least one species of *Nephropsis*.

[3] See above, footnote to p. 691.

macrurous groups. For this purpose we must add to the list above certain other characters which, either from their own primitive character or because they are found in many of the primitive members of the groups we are trying to place, may be attributed to the forebears of these groups: (6) a large gill-formula, including all the gills of the ancestral reptant[1], (7) a small thorn-like antennal scale[2], (8) the last pair of legs not only on a free sternum[3] as in the Potamobiidae and Parastacidae, and slightly twisted at the end as in most macrurous Reptantia, but distinctly smaller than the fourth pair, removed from them, and carried more dorsally, (9) a rather short and broad *rostrum*, (10) *appendices internae* on abdominal limbs[3], (11) a transverse suture on the telson[4].

Numbers (6) to (9) of these remove the crustaceans in which they are found from the neighbourhood of the Eryonidea and Scyllaridea, since they are primitive features that the latter have lost. Numbers (6) and (10) remove them for the same reason from the Nephropsidea, to which, nevertheless, they are more akin than to the other macrurous groups. The jaws and the last thoracic sternum, but not the structure of the gills or the grooves on the carapace, are more like those of the Potamobiidae than those of the Nephropsidae.

Assuming, as above, a common descent for the Crabs, Anomala and Thalassinidea, we must at the same time admit that they very early divided into two widely separated branches, one containing the Crabs and the other the remaining groups. The characters by which this separation is shown are the following: (1) The great reduction of the abdomen in the Crabs. This is entirely independent of similar developments in the higher Anomala, for the more primitive of the Paguridea and Thalassinidea, though they share the tendency, common to the whole assemblage of families under discussion, to shelter and protect their abdomen, have as yet been hardly more affected by it than, say, the burrowing genera of Nephropsidea, which are quite macrurous, while the primitive Galatheidea are little better in this respect. Moreover, in the Crabs, the reduction has gone so far that the abdomen, having lost its sixth pair of limbs (except for doubtful, unbranched vestiges in some Dromiidea), is now fitted for, and shows traces of no other function than those connected with reproduction, while in the Anomala and Thalassinidea, though some of its macrurous features are always reduced, it has kept the sixth pair of limbs and nearly always uses them either for swimming or for holding on a shell. The Lithodinea alone form an exception to this statement, but in them the asymmetry of the abdomen clearly recalls its former use, as in the Hermit crabs, to hold on a shell. These two types of abdomen—of which one does, while the other does not, show traces of adaptation to some other function than that of reproduction—I propose to call the "brachyurous" and "anomurous" respectively. (2) The carapace, which in the Anomala and Thalassinidea remains free, is in the Crabs fused with the epistome both at the sides and (except in *Homolodromia*) in the middle, under the front. (3) The antennal scale, which in many Anomala and Thalassinidea remains and is moveable, is never found in that condition in the Crabs. (4) The endopodite of the first maxilliped is broad and has nearly always an outer angle in the Crabs (see above, p. 425, fig. 110), but has not this shape in the Anomala and Thalassinidea, though some Hippidea approach it. (5) There are never *appendices internae* on the abdominal limbs of the Crabs, whereas these structures are present in most Thalassinidea and some Anomala. (6) The third pair of maxillipeds of the Crabs are

[1] See above, p. 692. This is shown by *Jaxea*, *Homolodromia*, etc.

[2] Among the Crabs found only in *Homolodromia*, where it is fused to the stalk.

[3] Not found in the Crabs.

[4] Found in certain Galatheidea and Paguridea.

usually broad, forming a cover to the mouth, whereas those of the Thalassinidea and Anomala are only exceptionally so. These characters, however, are in themselves hardly enough to negative the supposition that the Crabs have originated from one of the other non-macrurous groups. What does make it impossible to derive them from the Anomala is the presence in the primitive crab *Homolodromia* of podobranchs on some of the legs, while an origin from the Thalassinidea is equally untenable on account of the less primitive condition of the grooves of the carapace and the reduction of the endopodite and flagellum of the first maxilliped in the latter group.

We are now left with the Thalassinidea and the three divisions of the Anomala still unaccounted for. Among these there can be no question that the Thalassinidea are, as a whole, the most primitive. Their straight symmetrical abdomen, with well-developed biramous limbs on all the segments except the first, and the sixth pair broad and flat in all but *Thalassina*, the presence in most of *appendices internae*, and in some of good pleura, the simple legs of the fourth pair and sometimes also of the fifth, the *rostrum* usually well-developed, the moveable antennal scale seldom wholly lost, and the large gill-formulae of many genera, extending from the second maxilliped to the fourth leg, with mastigobranchs, podobranchs, arthrobranchs and sometimes pleurobranchs—all these point to the same conclusion. Nor can there be any doubt that the Paguridea and the Thalassinidea are closely akin and have branched off from the same not very remote ancestor. The only differences between the Axiidae and the primitive Pagurids with symmetrical abdomen such as *Pylocheles* are the presence of a pleurobranch on the last leg, a suture across the telson in some species (which is never found in Thalassinidea), better developed eyes[1], the loss of epipodites on the legs, a reduced rostrum, subchelate legs of the fourth pair, and the branches of the last pair of abdominal limbs narrow and not adapted for swimming. The first three of these features, being primitive, show that the Paguridea are not to be derived from any of the existing Thalassinidea and the remainder make it equally impossible to derive the latter group from the former. The two meet at a point below our present horizon.

The Galatheidea join the stem from which the last two groups arise before its bifurcation, that is, they are less closely akin to either of these than the latter are to one another. The fact that they may have epipodites on some of the legs, and the more primitive shape of the rostrum and sixth pair of abdominal appendages make it impossible to place their ancestor within the present limits of the Paguridea. The suture on the telson and the pleurobranch on the last leg remove it also from the Thalassinidea. And the general shape of the body, depressed, with broad flat abdomen carrying long pleura and bent under the thorax, is so different from the compressed body, with straight abdomen, of the primitive Paguridea and Thalassinidea that there can be little doubt that the ancestral Galatheid left the non-macrurous stock, after the Crabs indeed, but before it gave rise to the Thalassinids or Hermit-crabs. As for the *linea anomurica*, this is found not only in the Galatheidea and Paguridea but also very distinctly in *Callianassa novaebritanniae*, and it is curious to notice that it is wanting in the primitive Pagurids such as *Pylocheles*, and most Thalassinids as in *Axius*, and that in the Galatheid *Aeglea*, which is also primitive in many respects, the hinder part is again wanting. Thus it would seem as though this line appeared only in the higher and more typical forms of each group. The Hippidea present a very difficult problem. On

[1] Such species as *Axiopsis clypeatus*, however, have the eyes well developed, though not so large as those of the Paguridea.

the whole, however, their general shape of body, with a bent abdomen carrying good pleura, subcylindrical or depressed cephalothorax, and fourth pair of legs like the third rather than the fifth, shows a nearer kinship to the Galatheidea than to any of the other groups, and in the absence of any evidence to the contrary this judgment must stand. As for their likeness to the Raninidae among the Crabs, an admission that this indicated relationship would lead to great difficulties, as for instance that the Raninidae must either be removed from the closely related Oxystomes or the latter be supposed to be derived by modification from the highly specialised Hippidea—in itself a very unlikely speculation.

Each of the above groups has its peculiar habits and habitat. The Galatheidea hide under stones or dwell in weed. The Thalassinidea generally make burrows, but the more primitive genera among them show a tendency to shelter in weed or sponges. The Paguridea (except Lithodinea) place their abdomen in the hollow of some foreign body, which is usually a gastropod shell, but in the primitive genera may be a stone or a sponge. The Hippidea bury themselves in the sand. Of these habits, that of the Galatheidea is the least specialised and could easily have given rise to the others.

We are now in a position to sum up in the form of a tree the results reached in this and former articles (Pl. XLVIII.). When this is done two facts of importance appear. First that the proper place of the Thalassinidea is in the midst of the anomurous groups, and that they must no longer be classed with the Macrura, and secondly that, when this change is made, the Anomura, like the Brachyura, become a true, monophyletic group. Thus the reptant decapods fall into three divisions, Brachyura, Anomura[1] and Macrura. To the subject of the taxonomic value of these groups and their relation to the natant families I hope to return later on. For the present they may be called suborders[2].

The following keys give more precisely the classification of the groups discussed above:

Key to the reptant suborders of the Decapoda.

I. 3rd pair of legs like the first, either chelate or simple and subcylindrical. Abdomen macrurous (straight, symmetrical, well armoured, with good pleura and strong, broad tail-fin, a lobe on the first segment clipping the carapace). Gnathobase of 2nd maxilla narrow. Basipoditic lobe of 1st maxilliped usually deep. Exopodites of maxillipeds with lash directed forwards. Gills numerous. [Last thoracic segment with legs not differing greatly from the rest and sternum rarely free.] *Macrura.*

II. 3rd pair of legs unlike the first[3], never chelate. Abdomen rarely macrurous. Gnathobase of 2nd maxilla typically broad. Basipoditic lobe of 1st maxilliped broad but shallow, its inner edge in a line with that of the coxopodite. Exopodites of maxillipeds with lash, when present, nearly always bent inwards. Gills usually few. Last thoracic segment with limbs often differing greatly from the rest and sternum free or not.

1. Carapace not fused with epistome. Last thoracic sternum free, its legs differing always clearly in size and position and nearly always in shape from the third pair. Abdomen anomurous (reduced in some of its features but showing clear traces of some other function than that of reproduction and almost always carrying biramous limbs on the 6th segment) or, rarely,

[1] Unlike Boas' term "Anomala," the name "Anomura" has had very different meanings in the pages of different writers. This fact allows it to be used here with a denotation which it has not had before.

[2] The Brachyura is ranked lower on p. 427.

[3] See footnote to p. 693.

macrurous. A moveable antennal scale often present. Third pair of maxillipeds usually narrow. *Anomura*.

2. Carapace fused with epistome at the sides and nearly always in the middle. Last thoracic sternum fused with the rest, its legs often like the others. Abdomen brachyurous (small, straight, symmetrical, bent under the thorax, showing no traces of any other function than that of reproduction, and without biramous limbs on the 6th segment). Never a moveable antennal scale. 3rd pair of maxillipeds usually narrow. *Brachyura*[1].

Key to the tribes of the reptant Macrura.

I. Carapace fused at the sides to the epistome. Rostrum small or wanting (except *Palinurellus*). Inner lobes of 2nd maxillae and 1st maxillipeds reduced. An *appendix interna* on some of the abdominal limbs, at least in the female, but the exopodite of the last pair without sharp suture. Body often depressed.

1. Carapace gripped by first abdominal segment alone. First joint of antenna not fused with epistome; a scale present on this limb. All the legs, except sometimes the last pair, chelate; the first longer than the rest. Unbranched limbs on the first abdominal segment. Tail-fin not softer behind than before, without sutures. Telson pointed. *Eryonidea*.

2. Carapace gripped between a lobe on the 1st abdominal segment and a knob on the side of the last thoracic segment. First joint of antenna fused with epistome; no scale on this limb. None of the legs much longer than the rest or, except sometimes the first pair, chelate. No limbs on the 1st abdominal segment. Tail-fin divided by indistinct sutures into a soft hinder half and a harder front half. Telson roughly squared behind. *Scyllaridea*[2].

II. Carapace free from the epistome. Rostrum of good size. Inner lobes of 2nd maxillae and 1st maxillipeds not reduced. No *appendix interna*, but the exopodite of the last abdominal limb divided by a suture. Body subcylindrical. [Carapace gripped by first abdominal segment only. 1st joint of antenna free. A scale present. First three legs chelate, first pair the longest. Telson firm, squared, often sutured.] *Nephropsidea*.

Key to the tribes of the Anomura.

I. End-joints in 2nd to 4th legs curved and flattened. First pair styliform or subchelate. [Tail-fin not adapted for swimming. Abdomen bent under thorax. Rostrum small or wanting. 3rd pair of maxillipeds carry no mastigobranchs.] *Hippidea*[2].

II. End-joints in 2nd to 4th legs not curved and flattened. First pair not styliform, rarely subchelate.

1. 6th abdominal limb adapted for swimming (except in *Thalassina* where it is styliform. Pleura usually well developed. Abdomen symmetrical.

a. Body depressed. A pleurobranch to the last leg. Often a transverse suture on the telson. Abdomen more or less bent under the thorax. *Galatheidea*.

b. Body compressed. No pleurobranch to the last leg. No transverse suture on the telson. Abdomen straight. *Thalassinidea*[3].

[1] For a classification of the Crabs, with keys, see above, vol. I. pp. 426 ff.

[2] Keys to the families of these groups will be given in the articles which deal with them.

[3] For a classification of this group, with keys, see *Ann. Mag. N. H.* (7), XII.

2. 6th abdominal limb, when present, has the branches neither broad nor styliform but adapted for holding the body into hollow objects. Pleura very rare. Abdomen nearly always asymmetrical and either soft and twisted, or bent under the thorax. *Paguridea.*

Key to the subtribes of the Paguridea.

I. Abdomen straight or twisted. Carapace firm and more or less compressed in the fore part, soft in the hinder part. Fourth pair of legs unlike the third. Rostrum almost or quite wanting. *Pagurinea.*

II. Abdomen bent under the thorax. Body crab-like. Carapace firm all over. Fourth pair of legs like the third. Rostrum spiniform. *Lithodinea.*

EXPLANATION OF PLATE XLVII.

FIG. 1. *Huenia proteus*, male of triangular shape; *a.* whole animal, *b.* part of the fine graving of the back, greatly magnified.

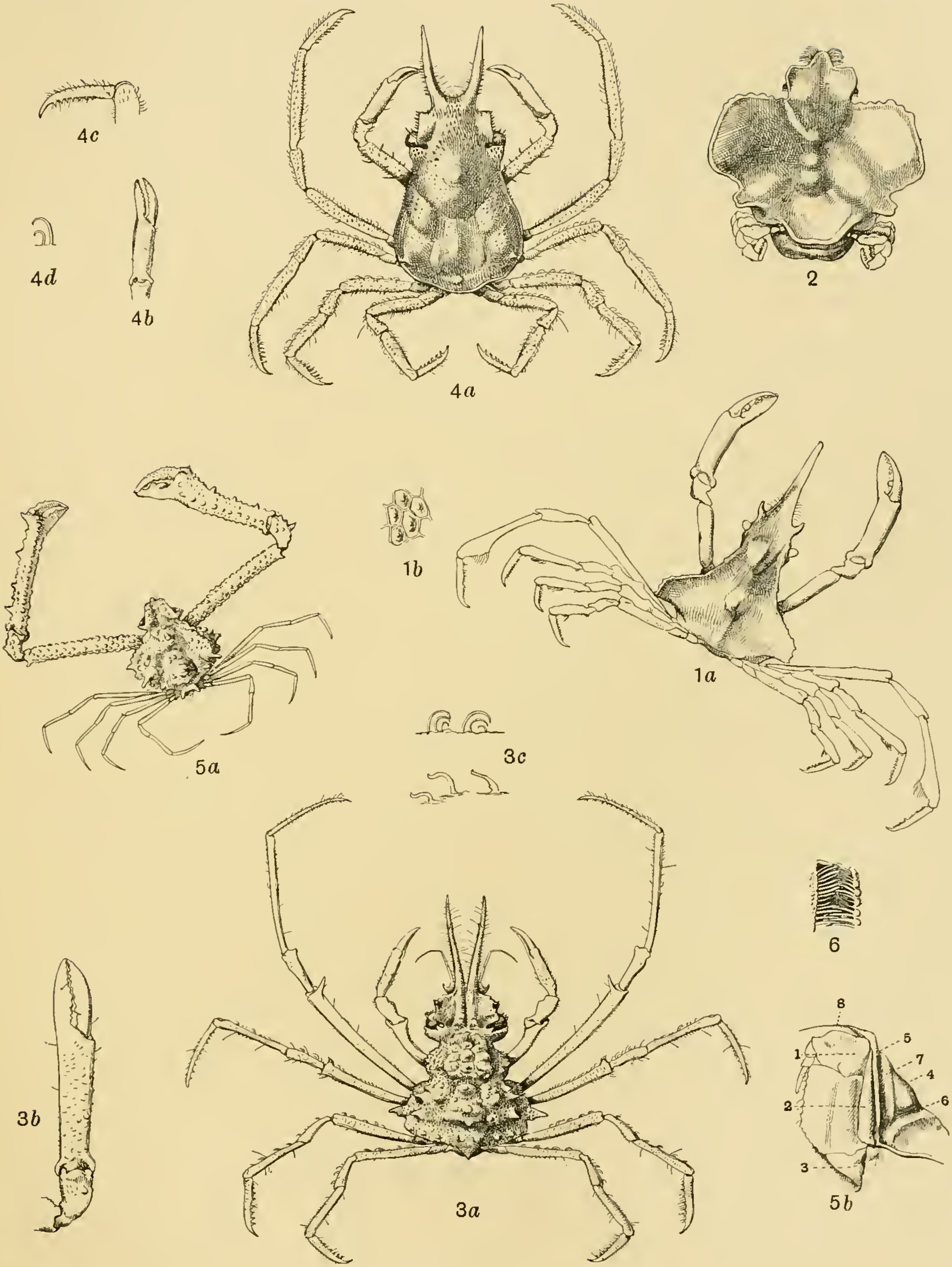
FIG. 2. *Huenia proteus*, female.

FIG. 3. *Naxioides spinigera*, male; *a.* whole animal, *b.* outside of hand, *c.* hooked hairs of two different shapes.

FIG. 4. *Halimus espinosus*, male; *a.* whole animal, *b.* outside of hand, *c.* end-joint of a walking leg, *d.* hooked hairs.

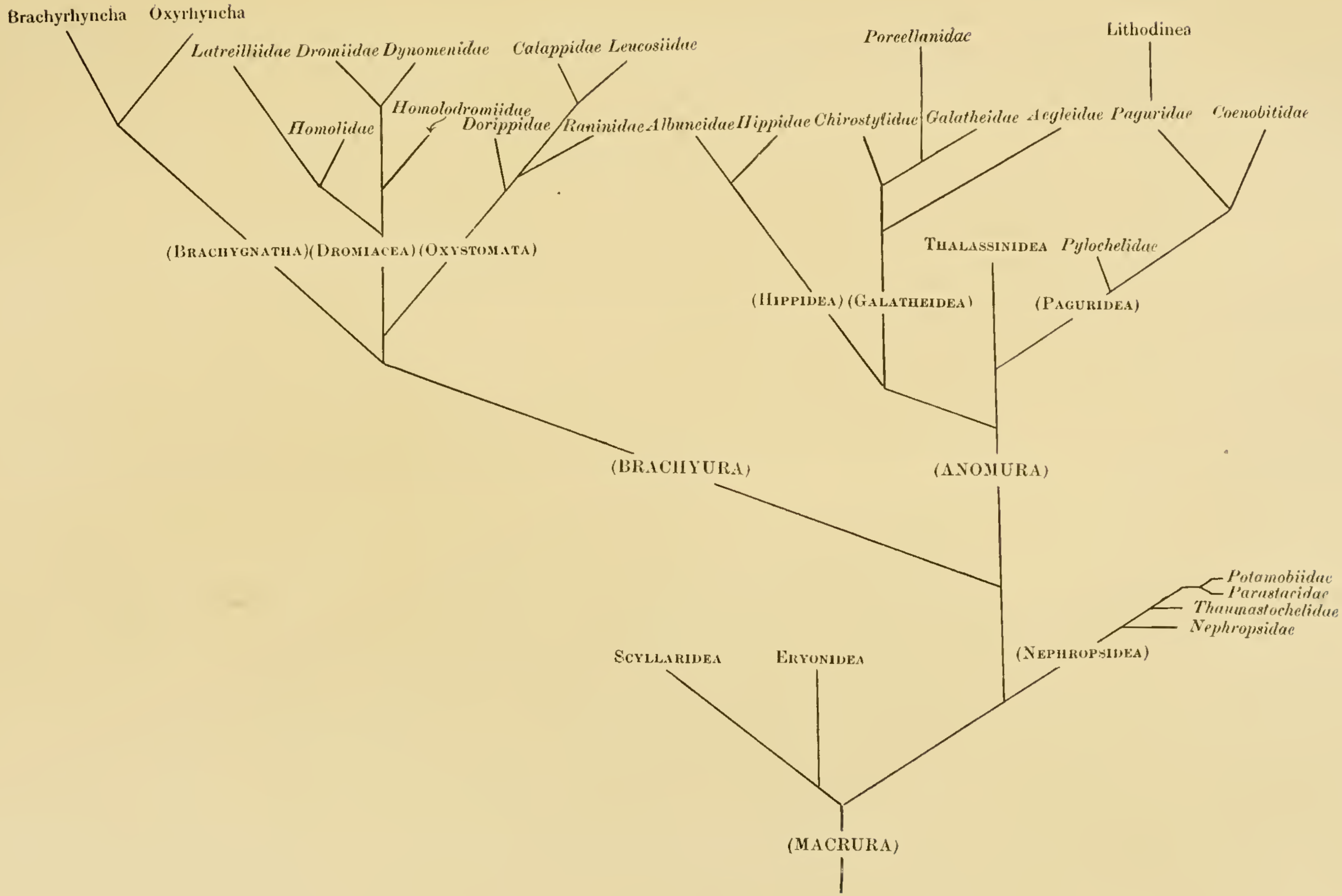
FIG. 5. *Lambrus* (*Rhinolambrus*) *turriger*; *a.* whole animal, *b.* part of under side to show grooves for breathing stream. 1. endopodite of 3rd maxilliped, 2. exopodite of the same, 3. base of epipodite of the same, covering opening to gill-chamber, 4. ridge on under side of body (not outer edge), 5. outer end of inner groove, 6. outer end of outer groove, 7. inner groove, 8. fore edge of mouth.

FIG. 6. *Lambrus* (*Aulacolambrus*) *sculptus*; part of inner groove corresponding to (7) in fig. 5, showing the covering of hairs.



E. W. del.

BORRADAILE——OXYRHYNCHA.



GENEALOGICAL TREE OF THE REPTANT DECAPODA.

The groups in the first row have all reached the same grade of organisation as the Crabs. Those in the second row are in the Anomalous grade, the third row in the Thalassinid grade, and all below in the Macrurous grade. (The Brachyrhyncha and Oxyrhyncha should be in the first row with the Latreilliidae, etc.)