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NOTES ON THE NEW SOUTH WALES MITRAS WITH SPECIAL REFERENCE TO THEIR PROTOCONCHS.

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(Figures 1–11.)

INTRODUCTION.

The late Charles Hedley (1918) allowed twelve species of *Mitra* as occurring in New South Wales.

These were: 892 *Mitra acromialis* Hedley, 893 *M. carbonaria* Swainson, 894 *M. cookii* Sowerby, 895 *M. glabra* Swainson, 896 *M. legrandi* Ten.-Woods, 897 *M. miranda* Smith, 898 *M. nodostaminea* Hedley, 899 *M. pacifica* Reeve, 900 *M. rhodia* Reeve, 901 *M. solida* Reeve, 902 *M. strangei* Angas, and 903 *M. volucra* Hedley.

Two additional species were described and named by T. Iredale (1929) from the "Triton" dredgings in Sydney Harbour. These were *Chrysame lemma* (p. 343, pl. xxxviii, figure 6) and *Mitropifex quasillus* (p. 346, pl. xxxviii, figure 18).

These species still stand, though there has been some revision in their names. This paper now raises the list of species to twenty-three by the addition of four new species, and five species now recorded from New South Wales for the first time. The four new species are *Mitra sinusigera* Laseron, *M. tasmantis* Laseron, *M. jervisensis* Laseron, and *M. cericosta* Laseron.

Those recorded for the first time are *Mitra eximia* Adams, *M. peregra* Reeve, *M. tuberosa* Reeve, *M. lugubris* Swainson, and *M. scutulata* Lamarck.

Apart from zoological classification, but curiously enough broadly paralleling it, these twenty-three species may be divided into groups based on distribution. Firstly there are six tropical species, representing an overlap into the Neoperonian region, all recorded from the north coast of New South Wales, and introduced no doubt by the warm Notonectian current. These are *pacifica*, *peregra*, *tuberosa*, *lugubris*, *eximia*, and *scutulata*.

The next group includes the species inhabiting the foreshores, or occurring just below low tide. Some of these have a limited goegraphical range, others occur widely distributed along the coast. They include the brown Mitras, separated by Iredale in *Vicimitra*. They are *contermina* Iredale replacing *carbonaria*, *cookii*, *exposita* Iredale replacing *glabra*, *rhodia*, *prosphora* Iredale replacing *solida*, *volucra*, and the new species *sinusigera*.

The final group includes the deep-water species, sometimes found dredged within the harbours, but mainly inhabiting the continental shelf. Most of these are heavily sculptured, and are generally akin to species found in similar locations in Tasmanian waters. The species are *acromialis*, *legrandi*, *miranda*, *nodostaminea*, *strangei*, *lemma*, *quasillus*, *tasmantis*, *jervisensis*, and *cericosta*. It is probable that the genetic relationship of some of these species must be looked for in the past rather than in other zoogeographical provinces, and will be found in the Cainozoic rocks of New Zealand and southern Australia, or in other parts of the world.

The Mitra Protoconch.

Though the single genus *Mitra* is here used, it is not suggested that the group is monogenetic, for undoubtedly many genera exist, but it is felt that any revised classification should be based on a wider geographical field, and that characters other than taxonomic must be considered if true genetic relationship is to be established. There has been

a good deal of work abroad on the Mitra radula, and considerable differences exist in this character in different species, but so far little work has been done on the radula of the eastern Australian species, and until there is information in this direction, it is well to resist the temptation to propose new genera locally. As more than 800 species have so far been described, mainly from the Pacific and Indian Oceans, the problem is certainly a world-wide rather than a local one. In fact many writers consider that the group is not only heterogeneous, but that more than one family is represented.

In New South Wales, Hedley figured the radula of *Mitra rhodia* (1917, p. 711, figure 16). Cooke also described the radula of *rhodia* from Sydney Harbour, and showed the rhachidium to have five, not four cusps as illustrated by Hedley. In view of the previous confusion as to the identity of these brown Mitras, it is not certain what particular species he studied. Iredale's genus *Vicimitra* was introduced on the basis of a radula figured by Cooke as from *Mitra solida*, and Iredale also included *contermina* and *exposita* in his new genus, but so far the radulae of these species are undetermined, and there seems no other reason why they should be so included.

Of characters other than the radula, the protoconch would seem to have great possibilities in establishing genetic if not phylogenetic relationship. In many other groups writers have used it as a basis of classification. Hedley used it in his monograph on the Turridae, it has been used in *Mathilda*, in the Pyramidellidae, the Rissoidae, the Volutes and other families. Its value for phylogenetic purposes is, however, open to considerable doubt.

It is generally recognized that origins persist in the embryology of animals, and this is the argument used by advocates of the protoconch for purposes of classification. But is the protoconch truly embryonic ? Where embryonic characters show ancestral origins it rarely happens that they have any relation to a creature's present environment, and thus they play no part in its normal functions. As maturity develops they become obsolete and rudimentary and often disappear entirely.

With this in mind consider the protoconch generally and the *sinusigera* protoconch particularly. In a series of papers read before the Linnean Society of New South Wales, from 1902 to 1912, Dr. H. L. Kesteven described the protoconchs of various local shells, and recorded a *sinusigera* protoconch from the common *Thais*. In the earliest paper he thought this type was peculiar to *Thais*, but later recognized that it is found in many families. Iredale (1911) found a juvenile *Mitra* in the Kermadecs with a *sinusigera* apex, and reviewing the question at length, pointed out that in the oceanic islands it occurs in widely diverse families, and is generally characteristic of a free-swimming larval stage. In his paper Iredale forecast its importance, and suggested that where the type of protoconch differed, the difference must be genetic but not phylogenetic. Kesteven (1912) admitted a specific difference alone, except where other characters are considered. He considered that the protoconch is not embryonic, that the real embryonic stage of the shell occurred before the protoconch developed, and it is in this initial stage that both phylogenetic and genetic origins must be sought.

The *sinusigera* protoconch bears this argument out. Its association with a free-swimming larval stage shows it to be a definite factor in the animal's present existence. It is found in gasteropods of widely different families, yet it does not occur in all the species of groups which are otherwise very closely related. For instance, the protoconchs of *Thais neglecta* and of *Mitra sinusigera* resemble each other very closely, yet it would hardly be suggested that these two species should be grouped together. Following this argument to its logical conclusion, it would seem that if the *sinusigera* protoconch is ancestral, it has only persisted in those species of particular groups in which it is necessary to their normal development, while in allied forms it has become entirely obsolete. As a major feature of classification it would therefore link many families in a remote past. If this be admitted, it is logical to admit that the same importance must be given to

protoconchs of other types, a course which in many families would create the utmost confusion and would be in disagreement with all other characters.

Nevertheless it is well at this stage not to be too dogmatic, for though as a whole the various types of protoconch may represent parallel development in different groups, in some they may have become so persistent as to constitute a family characteristic, as for instance in the heterotrophe protoconch of the Pyramidellidae. It is probable, however, that for the most part the true embryonic shell of the gasteropod is, as stated by Kesteven, absorbed in the protoconch or is cast before the secretion of the protoconch begins.

There can be no doubt as to the specific value of the protoconch, and it can be laid down that whenever the protoconch differs, different species are indicated. At times it may have genetic value. In this paper the protoconchs of as many species as possible are described and, combined with other characters, they certainly suggest relationship between some of the species. For instance, *contermina*, *rhodia* and *exposita* have very similar protoconchs, and are also closely related in shell characters. This group might easily be raised to subgeneric or even generic status. At the same time it is impossible to include them in Iredale's *Vicimitra*, with the type species of which they have nothing more in common than they have with other species of *Mitra*. *Mitra sinusigera*, on shell characters, would seem to be closely allied to the *rhodia* group, but on the protoconch alone would be widely separated. So also would *cookii*, which again has an entirely different type of protoconch. Further discussion on this point is deferred, but will be mentioned again in the main body of this paper when individual species are considered.

Notes on the Species.

Mitra rhodia Reeve.

(Figures 1, 1*a*.)

Hedley 900.

The small group of shallow water Mitras, which might be collectively referred to as the " Brown Mitras " has been the subject of considerable confusion. Many references appear in literature under a multiplicity of names, such as *carbonaria*, *glabra*, *badia*, *digna*, *pygmaea*, *cookii*, *rhodia* and others, many of which have already been discarded by previous writers, either as synonyms, or as applicable to different species from other localities.

Hedley (1918) in his Check List allowed *carbonaria*, *cookii*, *glabra*, *rhodia* and *solida* in this group. He rejected *badia* Reeve as the young of *carbonaria*, but allowed *rhodia* by the same author. Since that date Iredale (1929, p. 343) has rejected *solida*, *carbonaria* and *glabra*, proposing a new genus for *solida*, which he names *Vicimitra prosphora*, and substituting *Vicimitra contermina* and *exposita* as new species to replace *carbonaria* and *glabra* respectively. He considered *carbonaria* to be the Tasmanian shell. It is proposed to accept *contermina* without comment, as lack of access to good Tasmanian material precludes comparison, and there can be no doubt of the identity of the large New South Wales species under Iredale's name. The same applies to *exposita*, and *cookii* is a well-defined species.

Mitra rhodia and *badia* were both described by Reeve (1845). Unfortunately the original descriptions and illustrations are very unsatisfactory for identification; moreover, the locality of the types is given as unknown. When Hedley visited London in 1912, he examined shells which were labelled as the types of these species, both from Sydney, that of *rhodia* being described as living under stones in Sydney Harbour. When the Cuming Collection, on which Reeve worked, was presented to the British Museum, a great deal of guesswork was apparently used in identifying the types of his species. In view of the fact that Reeve, who had the reputation of being a very methodical worker, gave no locality for his types, it is not certain that these particular specimens are those

on which he based his species, and therefore we are thrown back on his written work only. His description of *rhodia* is as follows:

"Mitra rhodia:—The Rose-wood Mitre—Shell elongated, spire acuminate, rather smooth, transversely very finely striated, very dark brown, columella three-plaited, aperture short. Hab. ——— ?" (1845, Pl. 28, f. 225.)

This description, inadequate though it is, fits the common Sydney shell, and though the type locality is uncertain, long usage justifies the retention of Reeve's name. In order to clarify the position, the following fuller description is given, based on specimens from Shark Island, Port Jackson.

Shell conically acuminate, solid, colour dark brown, nearly black, occasionally red-brown, particularly from the outer beaches, with a narrow orange band just below the periphery, the colour fading on beach specimens to yellow brown. Protoconch of three whorls, the first flattened, the second and third globose, the whole dome-shaped and smooth. Adult whorls six, the first with faint, punctate, spiral striae, becoming slightly stronger in succeeding whorls, and persisting thus to the body whorl. Whorls slightly rounded, the body whorl slightly restricted at the base. Aperture about two-fifths of total length, acute posteriorly, rounded anteriorly, with a short, rounded canal. Inner margin regularly and slightly curved, with a narrow glazed band. Columella plaits two in the early stages, increasing to three, with suggestions of a fourth in very old specimens, thick, rounded and very oblique, the posterior the most prominent.

Dimensions.—Length, 24 mm., width, 8 mm. The largest specimen seen measured 27 mm., and this seems to be nearly the maximum size. A few specimens are relatively broader.

Habitat.—Between tide marks, under stones, but particularly abundant in beds of the common mussel, *Brachyodontes hirsutus*, at Shark Island, North Harbour, and other localities within Port Jackson, also at Long Reef and other outer reefs along the coast. On the north coast, this is replaced by *M. cookii* and *contermina* as the common species.

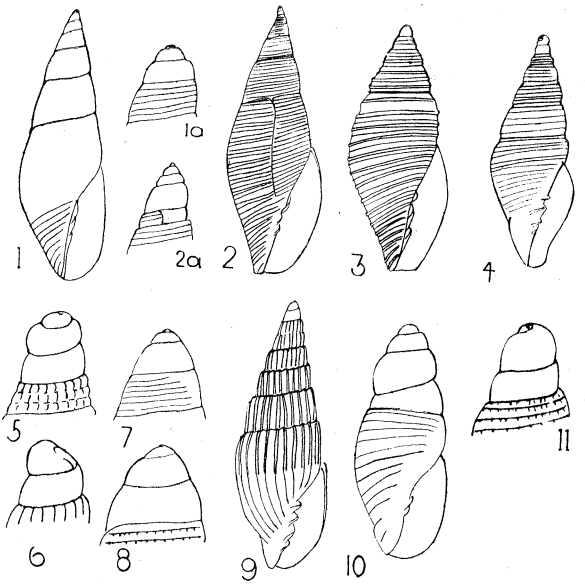
Mitra (Vicimitra) contermina Iredale.

(Figure 8.)

This is the largest of the New South Wales species, sometimes attaining a length of 3 inches. Immature specimens are sometimes confused with *M. rhodia*, but there should be no real difficulty in separating the species. Half-grown specimens of *contermina* have fewer and larger whorls, are broader, and have two to three thin columella plaits; the aperture is thinner with practically no glaze on the inner margin. The plaits increase from two in young specimens to five in the fully mature state. They are always conspicuously thin.

The protoconch has not previously been recorded. It is of three whorls, dome-shaped, dark brown, smooth and glossy, the first whorl minute, the next two increasing rapidly. Sculpture appears on the fourth whorl as radial punctate striae, and attains its maximum development on the third adult whorl. Beach specimens are invariably quite smooth, as the sculpture is very superficial and soon disappears with rolling. The last whorls of the adult shell increase very rapidly, the aperture is large and is practically half the total length of the shell. In very old specimens the shell is greatly thickened, and the outer margin of the aperture is flattened and even sinuate. There seem to be two forms, which may be sexual, one very much broader than the other.

The habitat of *M. contermina* is the outer reefs, though it occasionally comes into the mouths of the harbours. It lives in a slightly deeper zone than *rhodia*, and may be procured under stones just below low tide or in the deeper pools. It breeds in the late winter; the egg clusters are attached to the rocks, but details have not been observed. It ranges right along the coast, but is particularly abundant on the North Coast.



Figures 1–11.

1, 1*a*. *Mitra rhodia* Reeve. 2, 2*a*. *Mitra sinusigera* Laseron. 3. *Mitra tasmantis* Laseron. 4. *Mitra jervisensis* Laseron. 5. *Mitra cookii* Sowerby (protoconch). 6. *Mitra volucra* Hedley (protoconch). 7. *Mitra exposita* Iredale (protoconch). 8. *Mitra contermina* Iredale (protoconch). 9. *Mitra cericosta* Laseron. 10. *Mitra* sp. (protoconch). 11. *Mitra* (*Vicimitra*) *prosphora* Iredale (protoconch).

Mitra (Vicimitra) exposita Iredale.

(Figure 7.)

This species is occasionally taken alive at Long Reef, but invariably from below low water at spring tides. It would seem to inhabit slightly deeper water than its allied species, and thus the three species, *rhodia*, *contermina* and *exposita* are zoned in habitat, *rhodia* between tide marks, *contermina* at or below low tide, and *exposita* below this.

No live juveniles with protoconchs have been obtained, but amongst a number of *Mitra* tips collected by the late C. Hedley from Middle Harbour, is one with the protoconch attached to two mature whorls, which is recognizable as this species. The whole is dome-shaped, of three whorls, the first minute, the second and third expanding rapidly, brown and glossy. Sculpture appears first on the fourth whorl as numerous radial, faint, punctate lines, increasing until on the third, adult whorl they attain their maximum. The colour of the adult whorls is lighter than the protoconch and remains so at all stages.

Even in young specimens the straight-sided whorls are a distinctive feature, and the adult shell is much longer with a shorter aperture than the other allied species.

Mitra sinusigera, sp. nov.

(Figures 2, 2*a*.)

Shells smaller than other brown Mitras, bi-conical, dark brown, with faint broken patches of yellow below the suture. Protoconch sinusigera, of four and a half whorls, inclined and tilted at a considerable angle, colour bright yellow, smooth and glossy. Initial whorl dome-shaped, the next three expanding rapidly, the fifth overlapped by the first adult whorl, from which it is separated by a slight varix, curving backwards. Just before this stage a few undulations appear. On one specimen is what appears to be a trace of the sinusigera spur, but this generally is overlapped and hidden by the beginning of the adult shell.

Adult whorls five, with nearly flattened sides, the body whorl large and expanded. Sculpture appears on the first adult whorl as three broad radial ridges, increasing to five on the succeeding whorl. The transverse sculpture first appears as fine indentations between the radials, and later overriding them, but the radials are always predominant. The sculpture, though fine throughout, is more prominent in the mature shell, particularly on the base of the body whorl. The aperture is almost half the length of the adult shell, the outer margin expanded, canal short and truncate, inner margin with four thin columella plications, oblique and rounded.

Dimensions: Length, 17 mm., width, 6·5 mm.

Habitat.—Outer reefs, below stones at low tide. Long Reef, Collaroy (type); Twofold Bay (Roy Bell Collection); and a single tip from 25–30 fathoms off Crookhaven.

Remarks.—This was at first taken for the young of *M. contermina* which it greatly resembles, but the protoconch of course indicates something quite different. It is probable that it is much commoner than at first apparent, and that many beach specimens taken for *contermina* are this species which, without the protoconch, is practically indistinguishable.

The discovery of a sinusigera protoconch in a New South Wales *Mitra* is of considerable interest, and its wider implications have already been discussed in the Introduction to this paper.

An unidentified protoconch, which shows some similarity to that of *M. sinusigera*, is here figured for purposes of future reference (Figure 10). The specimen is of a juvenile *Mitra*, with one adult whorl, from shell sand, Port Stephens. The protoconch is four whorled, glassy and globose, tilted at an angle, the last whorl at an angle and half immersed in the adult whorl. The junction of the protoconch is marked by a slight varix, but the presence of the spur could not be detected owing to the overlap of the adult shell. The initial sculpture consists of faint radials, crossed by growth lines, and suggests that the ultimate mature shell will be smooth and pale-coloured.

Mitra cookii Sowerby.

(Figure 5.)

So far I have not seen this species alive, but it is very common on the beaches of the North Coast, where it replaces *rhodia* as the common species. When dredging at Point Halliday, a few miles to the south of the Manning River, a number of *Mitra* tips were taken in from 8–10 fathoms about a mile from the shore. At the time these could not be identified with any adult species, but later two specimens of half-grown *cookii* found on the beach showed the protoconch sufficiently to link them with those dredged. As this protoconch has not been previously recognized, the following description is given:

It consists of three whorls, the first small and dome-shaped, the second large and globose, the third smaller, and overlapped by the first adult whorl, so much so that it is nearly invisible on some specimens. There is a slight but distinct varix separating the adult sculpture. All three whorls are smooth, white and glassy. The first adult whorl is narrow, white, with three spiral keels, broken by transverse punctures. These become stronger in the succeeding whorl, which is yellow, and thence the sculpture becomes less marked and the colour deepens.

In the adult stage, the chocolate colour, white band, and splashed white markings make this species easily recognizable.

Mitra volucra Hedley.

(Figure 6.)

Amongst the dredgings from Point Halliday were two juvenile *Mitra*, sufficiently developed to link them with *M. volucra*, which is not uncommon on the nieghbouring

coast. The original description was from three specimens without tips collected by myself from Woolgoolga, about 100 miles further north, and this opportunity is taken to describe the protoconch, hitherto unknown.

It consists of two whorls, the first large and rounded and tilted at an acute angle, with possibly an initial whorl infolded and hidden, the second whorl slightly rounded, its axis normal with the adult shell, and partially enveloping the first whorl of the protoconch. The first adult whorl with a distinct shelf, its sculpture consisting of about eighteen transverse rounded ribs, which later become obsolescent. The colour of the protoconch is brown, that of the juvenile brown, mottled with white.

The range of *M. volucra* is approximately from the Clarence to the Manning Rivers, where it is the common shore species associated with *M. cookii*.

Mitra (Vicimitra) prosphora Iredale.

(Figure 11.)

This species is common on the beaches of the North Coast, and in Port Jackson on a sandy bottom, from 6–9 fathoms, Sow and Pigs Reef, Port Jackson. The protoconch, hitherto undescribed, is rather peg-like, the first whorl inflated, apparently infolded at the tip, the second regular, both smooth and white. The first mature whorl has strong radial punctate striae, which are prominent on the first three mature whorls; thence the shell is almost smooth.

Mitra tasmantis, sp. nov.

(Figure 3.)

Shell small, bi-conical, grey to white. Protoconch rather peg-like, of a single naticoid whorl. Mature whorls five, increasing regularly, slightly rounded, body whorl large and inflated, about two-thirds total length of shell, sutures slightly impressed. Sculpture predominantly spiral, on the first adult whorl faint spiral striae, then on each whorl four regular, equally-spaced, rounded keels. On the body whorl, the keels are of two orders: just below the suture are three fine spiral striae, thence the main keels alternate with single fine striae right to the base. Transverse sculpture is also present, more prominent in the early whorls and obsolete on the base. It consists of fine transverse ridges, between the keels, but not overriding them, except on the secondary keels on the body whorl, which are raised into minute, rounded tubercles. Outer margin of aperture rounded, acuminate posteriorly, truncate anteriorly, columella with a thin band of callus, plaits three, large, solid, and very oblique.

Dimensions: Length, 10·5 mm., breadth, 4 mm.

Localities.—50–70 fathoms, Twofold Bay (collected by Roy Bell, type); 6–9 fathoms, Sow and Pigs Reef.

Remarks.—In general form this species resembles *M. tasmanica* Ten.-Woods, but has very different sculpture, which separates it at once from all other Australian Mitras.

Mitra jervisensis, sp. nov.

(Figure 4.)

Shell small, bi-conical, whitish, flecked with brown. Protoconch a single inflated naticoid whorl. Mature whorls six, increasing regularly, slightly rounded, sutures slightly impressed, body whorl large, about half the total length of shell, its greatest diameter below the suture, tapering anteriorly. Sculpture predominantly spiral, the earlier whorls nearly smooth, consisting of finely incised channels, about six to the penultimate whorl, the uppermost rather deeper than the others, making a distinct band just below the suture. The sculpture persists to the base, where, however, it is less prominent. Transverse sculpture present, but not prominent, consisting of fine growth

lines. Aperture narrow, outer margin rounded, bent in sharply anteriorly, inner margin nearly straight. Columella plaits four, prominent but thin, transverse.

Dimensions.—Length, 11 mm., breadth, 4·2 mm., aperture, 5 mm.

Localities.—15 fathoms, Jervis Bay (type), also one immature specimen; 25 fathoms off Bateman's Bay; on beach, Jervis Bay (Miss G. Thornley).

Remarks.—The regular bi-conical shape, four columella plaits, and distinctive sculpture, should ensure future recognition of this species. I know of no other Australian species with which it could be easily confused.

Mitra cericosta, sp. nov.

(Figure 9.)

Shell small, elongate conical, greyish-white. Protoconch of two whorls, the first dome-shaped, the second even, merging into the adult shell. Mature whorls six, increasing regularly, with a narrow shelf at the sutures, body whorl nearly half the total length. Sculpture predominantly transverse, consisting of numerous straight rounded costae, about twenty-six on the penultimate whorl, about equal in width to the inter-costal spaces. The main costae terminate abruptly at the periphery, but continue in an attenuated form as thin lines right to the base. Spiral sculpture present, but only visible microscopically, when it appears as numerous fine lines, between and even overriding the costae, particularly in the earlier whorls. Aperture comparatively short and wide, outer margin curved, inner margin arcuate, columella plaits four, prominent, transverse.

Dimensions: Length, 15 mm., breadth, 5 mm., aperture, 6 mm.

Localities.—30–35 fathoms off Crookhaven.

Remarks.—This species is probably allied to a group of Tasmanian deep water Mitras, centring around *M. pumilio* May, all characterized by four columella plaits and prominent transverse sculpture. It differs from all, however, by its more elongate form, and much more numerous costae.

Mitra strangei Angas.

Hedley 902.

May 787.

This species was taken alive in 15 fathoms on a sandy bottom between Port Jackson Heads.

The protoconch is of two whorls, the first dome-shaped, comparatively large, the second showing traces of incipient sculpture. The third shows prominent sculpture finer, but similar to the adult shell. The animal is a very pale yellow, almost white, with a long, narrow foot, truncate in front. The tentacles are widely spaced, short, with small, black eyes about half-way to the tip. The siphon as seen was short, but as with other species was extendable to a much greater length.

Superficially at least, the animals of the Mitras present very few characters which can be used in their description. Hedley (1917, p. 711, Pl. xliii, Figures 15, 16) described the animal of *M. rhodia*. In all essentials his description is similar to the above, and applies very nearly to other local species. If the soft parts are to be used taxonomically differences will have to be sought in anatomical characters, particularly the radula.

In the Tasmanian list, May figures a strongly cancellate species as *strangei*, and this is evidently something different, probably *nodostaminea* of Hedley. Angas's description and figure are very good and show the spiral sculpture to consist of fine ridges which are predominant, but are crossed by very fine transverse lines. The type locality is " dredged, Middle Harbour", and our specimens from nearby match very well.

Mitra pacifica Reeve; **M. eximia** Adams; **M. tuberosa** Reeve; **M. lugubris** Swainson; **M. peregra** Reeve; **M. scutulata** Lamarck.

These six species, all collected at Woolgoolga on the North Coast, were kindly identified for me by Mrs. L. H. Woolacott from material in the Australian Museum. Only one, *M. pacifica*, is on Hedley's Check List, and the other five are, therefore, new additions to the New South Wales fauna. All are tropical species, and are more typical of the Queensland fauna. They may be looked upon as the overlap of the two faunas, and as casual visitors brought down in a larval form or on driftwood by the strong warm Notonectian Current which sweeps down the coast. Other tropical species, too worn for identification, have also been seen from this locality, also from Angowrie, slightly more to the north. No doubt many more will be recorded in the future.

It is as yet impossible to say to what extent these visitants have become permanently established in the area, what part they have in local ecology, and how far they may be looked on as a definite element in the Neoperonian Faunal Province. It would seem desirable in compiling check lists that such tropical invaders should be retained in a separate list, for the present at least, until such time as their place in the natural economy is revealed. This applies not only to Mitras but to many species in other families of tropical shells.

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SOME NEW AND UNUSUAL STONE IMPLEMENTS FROM AUSTRALIA AND NEW GUINEA.

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(Figures 1–21.)

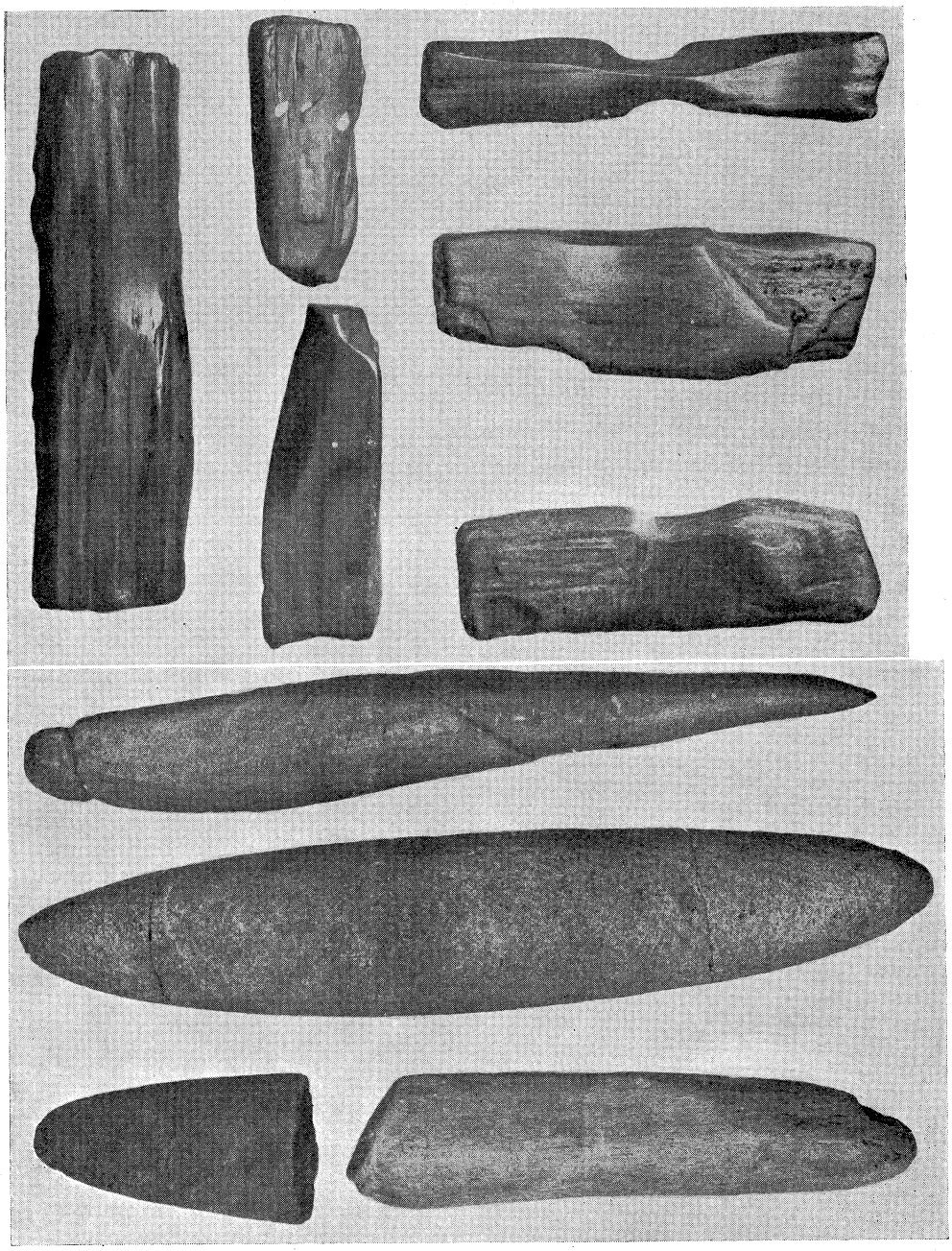
Abrading Stones.

Morella-type. During 1949 Mr. Duncan Mackay of Hereward Station, Morella, central Queensland, presented to the Museum a series of twelve complete and several imperfect specimens of a type of abrading stone not previously recorded in Australia. They were found in widely scattered places in the district, which is part of the Darling Downs, mostly near creeks and on claypans, but some were collected on hills some miles away from permanent water. One of the claypans yielded almost a dozen specimens. There is no evidence to suggest that they were produced by natural agencies, in fact, the polishing on them is obviously artificial.

They are all flat-sided pieces of silicified wood, mostly rectangular in transverse section, but some are plano-convex, oval, lozenge and triangular in section. Silicified wood is abundant in the district.

E.53229.1 (Figure 1) bears the greatest amount of use on its numerous polished surfaces, which are separated by sharp ridges. It is 10·2 × 2 × 1·8 cm., almost square in section, and the lower surface is flat with a deep groove in the middle; the opposite surface is flat at one end on which there is a very shallow groove, there is a deep groove in the middle, and the other end is ridged. One lateral margin or side is flat at one end which bears a very shallow groove, there is a second shallow groove in the middle, then a hump, and a third shallow groove at the other end adjoining a narrow grooved facet on its margin; the opposite side has a bevelled surface along each margin, between which is a flat face at each end, and a sharp ridge (between the grooves) in the middle. All of these surfaces are highly polished, and they bear in all eight grooves from some just begun to two almost 4 mm. deep. The grooves are from 1·6 to 2 cm. wide, and the deepest two are situated approximately in the middle of the lower and upper surfaces but not directly opposite one another.

E.53229.2–4 (Figures 2–3, 6) are three other well-used specimens of a similar type, 9 × 2·5 × 2, 9·3 × 3·5 × 1·5, and 11·5 × 3·4 × 1·8 cm. The largest one has broad upper and lower surfaces on each of which is a deep groove; these grooves are opposite one another, are closer to one end than the other, and are from 2 to 3 cm. wide. The grooves on both surfaces are formed by a narrow bevelled groove at each end and then a wider groove extending to the middle, there being two opposite narrow pairs and two opposite wide pairs of facets forming an encircling groove. The narrow pairs are separated by a narrow flat strip of unused cortex on each lateral margin. The surface is rough and ridged and the polishing extends from the groove at one end and halfway to the other end on one surface, and partly along the ridges on the other surface. One lateral margin is lightly polished from end to end, with the beginnings of a groove on each end, and the opposite side has the beginnings of a groove at one end. The second specimen has six grooves, among which two depressions form the groove on one broad flat surface, and the beginnings of the groove on the opposite surface; one lateral margin has two narrow bevelled grooves 2·5 and 4 cm. long, separated by a median ridge, and the opposite side has narrow grooves also. The third specimen has five grooves, four of which form an encircling groove closer to one end than the other. On one broad flat surface the groove is 3 cm. wide and 4 mm. deep, but the opposite groove is not so deep, and adjoins an



Figures 1–10.

1–6, Abrading stones of the *Morella*-type, made of silicified wood, from Morella, Queensland. 7, Stone figure of a lizard (?) from Mullaley, New South Wales. 8, Double-ended conical stone from the Adelaide River, Northern Territory. 9, Cylindro-conical stone from Point Plomer, New South Wales. 10, Distal end of a cylindro-conical stone from Attunga, New South Wales.

*62066—7

even shallower groove. The two opposite grooves are separated by a median ridge on one lateral margin, and the opposite but much wider lateral margin has a similar arrangement. A fourth specimen, similar to the last-mentioned one but smaller, being 6 × 1·5 × 1·3 cm., has four shallow grooves asymmetrically distributed around the middle.

There are four imperfect well-used specimens, E.53330.1–4, each one broken across the middle of the groove, and one across one end also, which are from 5 to 5·6 cm. long. The fracture faces are not patinated.

E.53229.5–12 and 53488.1 comprise eight complete and one broken specimens on which the use is not so pronounced. One, 8 × 2 × 1·7 cm., has two opposite slightly concave and polished surfaces, and a narrow bevel 2 mm. wide extending partly along one edge of each surface. Six others, from 7 to 11 cm. long, possess from one to five grooves, most of them as part of an encircling series. One of these, with five grooves, 3 × 3·5 cm. in width and thickness, is the stoutest example in the whole series. One is a curved piece of material.

On all of the above specimens the two ends are comparatively flat and patinated, and they bear no signs of any kind of use.

The two remaining specimens are similar to each other, are broken across the groove, and the fracture or cleavage surface, and the facets of the grooves, have since become patinated. E.53488.2 (Figure 4), is 5·5 × 2·5 × 2 cm., oval in transverse-section, and its surface has a dull water-rolled appearance. It has in all five faces tapering towards one end which bears one side of an encircling groove, made up of four facets, broken through the middle. E.53330.5 (Figure 5) is highly polished all over, 7 × 2·5 × 1·8 cm., and rectangular in transverse section. At one end of one of the broader surfaces is a wide bevelled groove, which slopes upwards at each end, and adjoins two narrow grooves which end abruptly against the patinated end. E.53488.2 is patinated all over, including the surface of the grooves, but on E.53330.5 the patination is worn through to the black surface underneath on the large groove, and the two narrow grooves adjoining it are both patinated and polished.

The *Morella*-type was apparently used as a polishing implement for shaping and finishing-off rounded wooden surfaces such as the shafts of clubs and other objects. Each of the well-worn specimens was no doubt used over a very long period of time for a groove to be worn to a depth of 4 mm. into the stone by the polishing of fine-textured surfaces. They were probably carried about by their owners. One, for example, 53299.1, has no less than eight grooves on its completely polished surfaces. In use the implement was apparently held at one end and turned over when a narrower or shallower groove was required.

Four complete and four broken specimens possess one thick and one thin lateral margin, the latter being a thin median ridge on some examples. Thus their wedge or triangular section would be ideal for the fitting to them of a withe hafting of the kind used on edge-ground axes. The withe would be bent around the thick lateral margin or back, fitted along the upper and lower surfaces, and tied tightly together at the thin margin. In view of the fact that the ends show no signs of use, the only reason for hafting them would be for some unknown and non-practical function. The groove is obviously a result of the way in which they were used for polishing purposes, and is a functional character.

Giligulgul-type.—The first examples of this hitherto unrecorded type were forwarded by Mr. J. M. Clift in 1946, and others subsequently. One was found on top of a dam excavation and had apparently been buried, but the others are surface specimens, from his property, Giligulgul, on the Darling Downs. His brother found one at Nangram Lagoon, and Mr. A. G. Davidson found one on his property, Guluguba, next to Giligulgul. The author found one at Lake Conjola, on the south coast of New South Wales. They

are made from water-worn pebbles comprising a variety of highly siliceous and fine-grained sedimentary rocks among which are chert, jasperoid, and shale, with the possible exception of one igneous rock.

They form an heterogeneous series as follows: Two side-blow flakes 4·5 and 5 cm. long, with longitudinal polished faces, one of which is figured (Figure 12); thicker portion of a split-pebble 4 cm. long, roughly flaked round one end, with a longitudinal polished face (Figure 3); three pebbles (Figure 4), 5, 5, and 10 cm. long, with transverse polished faces from 2·3 to 3 cm. wide, the largest one (Figure 17) of which is a perfect example from Guluguba, and one 6 cm. long from Lake Conjola whose face is unpolished; a long igneous (?) pebble (Figure 16), 11·6 × 6·2 × 4 cm. with one transverse polished face on the cleavage surface and another smaller one 5·4 × 4 cm. long on the outer surface; a triangular sector (Figure 15) 3·4 cm. long, with two polished faces meeting in a sharp edge (unused), the smallest specimen in the series, made of a banded stone; an irregular piece of chert, 5·7 cm. long, with two small polished faces meeting at one end; an elongate pebble (Figure 11), 9 cm. long from Nangram Lagoon, Queensland, with a flat face which is patinated but which bears no signs of polishing.

In fashioning these implements the split-pebble technique was employed, probably block-en-block in which the pebble was stood on an anvil-stone. In all specimens the cleavage surface is flat and sharp-edged, features which are accentuated by the fine-grained materials used and by their rubbing or polishing use. On several the percussion fissures are apparent and the polishing occurs only on the ridges, but on the others no impact spot, bulb, or fissures are present. The polished surface is longitudinal on four, transverse on five, and on two sides of one irregular piece longitudinal and transverse, meaning with or across the layering or grain of the stone respectively. This surface does not bear any striations from grinding so that it has been produced by contact with a fine-textured surface, as with the *Morella*-type, and on all specimens it is so flat and well-defined that at first sight it does not seem possible that the natives could have produced it. On most of the specimens, too, the polished surface is lightly patinated. Mullers often bear a very smooth or polished grinding surface, but it is much larger in area than on the *Giligulgul*-type, the function of which might have been the finishing-off of wooden weapons and other objects.

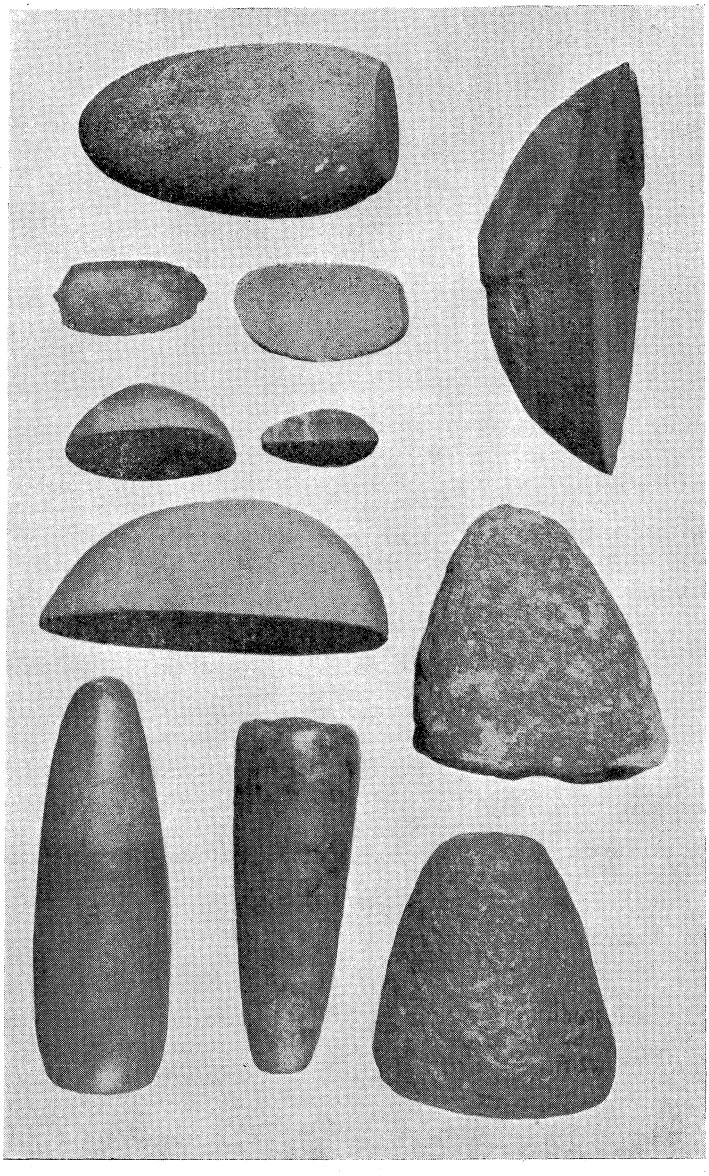
A Stone Figure from New South Wales.

(Figure 7.)

Mr. V. Ellis, of Mullaley, recently presented to the Museum a unique stone figure, the only one yet recorded in Australia. This figure represents a lizard, so far as one can judge, but of what type it is impossible to say, although a goanna is the most probable one. The aborigines used natural stones to represent various animal totems and their eggs, but to my knowledge there is no other record of a stone sculpture on the continent. This example was ploughed up in virgin land on a spur in the Kooringal portion of the Pilliga scrub, on the edge of the black soil plains, 15 miles from Mullaley which is situated in a triangle between Gunnedah, Boggabri and Coonabarabran on the northern tableland.

The figure is made of an igneous rock, probably basalt, weathered to a light grey on the surface. The stone occurs locally. It is 39·9 cm. long, and just more than 5 cm thick and wide. Two sides are flat and one convex, so that it is triangular in transverse section, although the tail is plano-convex. The head is defined by a deep encircling groove, 1 cm. wide and 3 mm. deep, but is not shaped in any other way, nor are the features indicated. The body increases in thickness from the neck, on the convex surface, and the thickest portion of the body is one-third of the length from the head. It then slopes downward to the tail, which terminates in a narrow convex and sharp edge. There are two narrow grooves on the body; one is a complete one which projects backwards in a semi-circular loop towards the tail on the convex and on one of the flat surfaces, and

forwards towards the head on the other flat surface, where there is a shallow groove up to 2 cm. wide in front of it, and then a narrow oblique groove which is evidently intended to be like the other encircling one but was not completed. Along the complete body groove the lower side has been ground away to form a step or slight difference in



Figures 11–21.

11–16, Abrading implements of Giligulgul-type found by Mr. J. M. Clift. 17, Abrading implement of Giligulgul-type found by Mr. A. G. Davidson. 18–19, Cylindro-conical sago-strippers from Aitape and Vanimo, northern New Guinea. 20, End of a cylindro-conical stone from Bulga, Hunter River Valley, New South Wales. 21, End of a cylindro-conical stone from Baradine, New South Wales.

the levels of the surface on each side, thus separating the body portion from the tail. There are no other markings, and the only other shaping of the specimen would appear to have been that of the tail. It was evidently a conveniently shaped piece of stone requiring very little work to produce this figure.

Cylindro-conical Stones and Sago-strippers.

The Australian Museum has acquired in recent years four cylindro-conical stones from north-eastern New South Wales and one from the Northern Territory which add considerably to the known distribution of these implements.

E.52565 (Figure 8) is a unique type presented by Captain W. Murphy, which he found on black soil plains, two miles from the Adelaide River and four miles east of Humpty Doo Station, in the Northern Territory. The only comment given by local natives to Captain Murphy was that it was made a long time ago, but Mr. W. E. Harney was told by one of the old men from the area that he had seen such stones in use—they were buried until required for certain ceremonies during which they were rubbed on a girl reaching puberty to ensure her fertility.

It is made of a coarse light-grey and light-buff coloured quartzite, comparatively soft in texture. Around the periphery of each of four cleavage faces, the specimen being in three pieces, is a ring of brown patination from 3 to 4 mm. thick. It is a bi-conical implement, 31·5 cm. long and 8 cm. in diameter in the middle, weighing 7 lbs. 3 oz. It is neatly shaped by pecking but bears no incised markings. It is asymmetrical, one half being slightly more convex than the other. On one end a thin spall has been knocked off, and the other end is rounded and unmarked. This is the only bi-conical implement of this type recorded in Australia.

E.53649 (Figure 9) is a straight cylindrical stone from Point Plomer, on the far north coast of New South Wales, in the C. C. Towle collection of stone implements in this Museum. It is made of a grey knotted schist, and the smooth surface is roughened by weathering on one side. The butt is an oblique flat surface. A large flake is missing from one side of the conical head (as shown in Figure 9), and two series of flakes have been struck off the edge of the butt. It bears no incised markings, and is 26 cm. long, 6 × 5·5 cm. in width and thickness across the butt. This is the only cylindro-conical stone known from the coast of New South Wales and it was found on a surface shell-midden.

The other three specimens are distal ends only. E.52402 (Figure 10) was presented by Mr. E. D. Coulter who found it on the top of a limestone ridge, 6 miles north-east of Attunga and 1¼ miles due east of the 20-mile peg on the Tamworth-Manilla road, on "The Braes", a station owned by Mr. Atkinson. With it were found edge-ground axes and a percussion stone. It is made of a local hardened gritstone, and was shaped by pecking. There are slight percussive abrasions on the rounded end. The cleavage face bears a brown iron-stained patination. It is oval in transverse-section, measuring 6·5 × 5·6 cm., and the piece is 12·5 cm. long. E.50752 (Figure 20) was presented by Mr. A. N. Eather who found it in open pastoral and farming country at Bulga, on the southern side of the Hunter River Valley. It is made of coarse sandstone and its surface is stained and discoloured by exposure. It is rectangular, with rounded corners, in transverse section measuring 7 × 5 cm. in width and thickness, and is only 8 cm. long. On the surface it bears about two dozen roughly parallel longitudinal rows of short straight incisions about 8 mm. long. The point is battered and several fragments were knocked off during this usage. E.53698 (Figure 21) was presented by Mr. G. H. McNaught who found it in plains country at Baradine, on the northern tableland of New South Wales. It is made of sandstone, is 8 cm. long, the pointed end has been battered to a flat a flat face 2 cm. in diameter and the other end is a battered convex surface 7 × 5 cm. in size. Its most recent functions, therefore, have been those of a hammerstone and pestle. It is possible that the Bulga and Baradine specimens reached these localities by trade from western New South Wales.

Three New Guinea implements, two of which are illustrated (Figures 18–19), in our collection are of interest in connection with the occurrence of the cylindro-conical stone in Australia, but whether the similarity in form of the implements in these two regions has any significance is not known. These specimens are three sago-strippers used to break up the pith in sago logs. They are made of a mottled serpentine, and are all very well shaped, highly polished cylindro-conical implements, each possessing a well-cupped base and a battered distal end. The outer edge of the base on each one is striated and is worn inwards from use. E.28679 from Uweal, Aitape district, is 10·5 long and 3·5 cm. in diameter, and E.29897 from Murik, Aitape district, is 12 cm. long and 3·5 cm. in diameter, both being presented by Mr. R. F. Armstrong; E.33010 from Vanimo is 10·5 cm. long and 3·5 cm. in diameter, and was presented by Mr. G. A. V. Stanley with a note stating that it had come from Netherlands New Guinea by trade. A similar implement, lacking the cupped base, is recorded on far-away Rossel Island by Armstrong (1928, p. 30, pl. XIIB), but hafted wooden sago-strippers of the same shape are used by many of the sago-working peoples of New Guinea. Collings (1949, pp. 18 and 21, Figures 2–3) has described several examples collected on the Kelabit Plateau by T, Harrisson, Curator of the Sarawak Museum, from Ulu Lawas in the Murut country, in Borneo, and one from Netherlands' New Guinea.

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THE AUSTRALIAN FRESHWATER CRABS (POTAMONIDAE).

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(Figures 1–7.)

Freshwater crabs of this family are common in the inland and northern portions of Australia, but are unknown from the south-east and south-west coastal areas. Most of the recorded species were described from specimens collected in Cape York. Only one species, *Paratelphusa leichardti* (Miers), is widespread in inland areas. It causes some damage to bore-drains as the burrows of the specimens increase seepage from the drains and so cut down the flow.

Family POTAMONIDAE.

The family is generally subdivided on the structure of the mandibular palp, though some authors recognize more than two subfamilies.

1. Terminal segment of the mandibular palp deeply cleft into two lobes, one dorsal and one ventral ..... subfamily Gecarcinucinae
— Terminal segment of the mandibular palp not deeply cleft into two lobes ..... subfamily Potamoninae

Subfamily POTAMONINAE.

There is no authentic record of a species of this subfamily from the Australian mainland although the generic name *Geotelphusa* was applied to some Australian species by one early author.

Subfamily GECARCINUCINAE.

Mandibular palp divided into two lobes, a dorsal and a ventral. The dorsal lobe is falciform and lies behind the incisor process of the mandible; the ventral lobe, which is a broad oval plate, more or less covers the exposed surface of the incisor process. Very commonly the abdomen of the adult male is broad at the base and suddenly narrowed at the fifth and sixth segments, but whether this is so or not, the length of the sixth segment is hardly ever less than (often exceeds) its minimum breadth, and the seventh segment (telson) is elongate triangular or tongue-shaped, not broadly triangular.

Key to Genera and Subgenera of the Subfamily Gecarcinucinae.

1. Front in adult less than one and one-half times as wide as orbit 2
— Front in adult usually much wider than, never less than one and two-thirds as wide as orbit 3

2. Lower, outer corner of orbit produced into a sort of gutter ..... *Gecarcinucus* (India)
— Orbits normal ..... *Cylindrotelphusa* (India and New Guinea)

3. Upper border of merus of chelipeds with a subterminal spine 4
— Upper border without subterminal spine 5

4. Post-orbital crests prominent ..... Subgenus *Paratelphusa** (Asia, Africa, Malaya)
— Post-orbital crests faint or obsolete ..... *Peritelphusa* (Malaya)

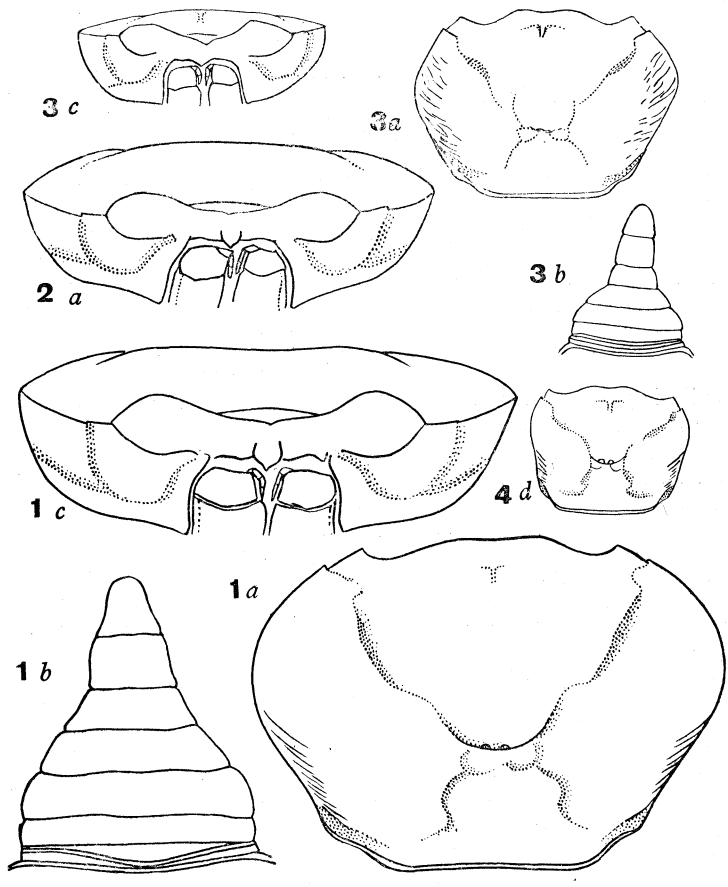
5. Post-orbital crests prominent 6
— Post-orbital crests low, indistinct 8

6. Epigastric and post-orbital portions of crest either continuous or almost in line ..... *Barytelphusa** (Asia, Malaya)
— Epigastric portion in advance of and slightly overlapping post-orbital portion of crest 7

7. Exopodite of external maxillipeds strongly flagellate ..... *Qziotelphusa** (Asia)
— Flagellum of exopodite of external maxillipeds vestigial or absent ..... *Phricotelphusa** (Asia)

8. Exopodite of external maxillipeds flagellate ..... *Liotelphusa** (Asia, Malaya, Australia)
— Exopodite of external maxillipeds non-flagellate ..... *Globitelphusa** (Asia)

* Subgenera of *Paratelphusa*.



Figures 1–4.

1. *Paratelphusa* (*Liotelphusa*) *leichardti*, Lawn Hill Creek, Northern Territory. 2. *Paratelphusa* (*Liotelphusa*) *leichardti*, Longreach, Queensland. 3. *Paratelphusa* (*Liotelphusa*) *plana*. 4. *Paratelphusa* (*Liotelphusa*) *planifrons*. (*a*) Male cephalothorax. (*b*) Male abdomen. (*c*) Frontal view. (*d*) Juvenile cephalothorax. Approximately x 1½ diameters.

Genus **Paratelphusa** Milne Edwards 1853.

In this genus it is unusual for the abdomen of the adult male to be regularly triangular; it is far more usual for its distal half to be narrowed, the narrowing beginning suddenly at the fifth or sixth segment. Whether this contraction is marked or not, the sixth segment is never broad, its length almost always being equal to and not unseldom exceeding its distal breadth; and the telson is never broadly triangular but is broadly semi-elliptical or tongue-shaped, or at least, elongate. The mandibular palp is of a peculiar pattern, the first two joints are not separately distinguishable, they certainly have no movement independent of one another, and the terminal joint is divided, from the base, into two lobes, one dorsal and the other ventral.

Subgenus **Liotelphusa.**

This subgenus is not sharply defined and it grades into *Phricotelphusa*, although the extremes are very distinct.

Antero-lateral borders of the carapace not spinose; epigastric and post-orbital crests obscure; lateral epibranchial spine small or minute; the exopodite of the external maxillipeds usually with a long, strong, plumose flagellum; the cervical groove distinctly cut only where it defines the mesogastric area posteriorly; species usually small. There are five Australian species of the subgenus.

Paratelphusa (Liotelphusa) leichardti (Miers), 1884.

(Figures 1–2.)

Telphusa leichardti Miers, 1884, Zool. Alert., 236.

Telphusa transversa Spencer, 1896, Horn Exped., II. Zool., 245.

Geotelphusa leichardti McCulloch, 1917, Rec. Aust. Mus., xi, 232.

Paratelphusa transversa Hale, 1927, Flora Fauna S. Austr., Crustacea, i, 154.

Diagnosis.—Lateral margins of the front divergent backwards; fronto-orbital breadth less than the length of the cephalothorax; penultimate leg much less than twice as long as the cephalothorax; post-frontal elevations obsolete or absent, branchial regions almost or quite smooth anteriorly.

Description.—A full description of this species is given by McCulloch (1917).

Type Locality.—South-west Queensland.

Distribution.—Inland and northern Australia including localities in South Australia, New South Wales, western Queensland (as far north and east as Hughenden and Charters Towers), Northern Territory (Darwin and Lawn Hill Creek) and Western Australia (King Sound).

This species can be separated into two well-defined forms : the typical form occurring in the southern part of the range, the inland streams of western Queensland and reaching towards the coast at Charters Towers; and the northern form occurring at Lawn Hill Creek and Darwin, Northern Territory, and at King Sound, Western Australia. Both the forms are figured. This common, wide-ranged species is not known from Cape York. The species is most closely allied to *transversa* (von Martens), which replaces it in Cape York.

Paratelphusa (Liotelphusa) plana (McCulloch), 1917.

(Figure 3.)

Geotelphusa leichardti var. *plana* McCulloch, 1917, Rec. Aust. Mus., xi, 236.

Description of Adult.—Carapace broadly oval, deep, length about three-quarters of the greatest breadth, depth less than half the length; upper surface relatively smooth, except for fine, oblique striae on the dorsal surface near the lateral borders of the epibranchial region. The striae are much more noticeable in juvenile specimens. Cervical groove rather strongly impressed for this subgenus, more prominent in the posterior mesogastric area and there quite deep, running towards the lateral epibranchial tooth, quite deeply impressed for the middle third of this portion; regions of the carapace thus fairly well defined; anterior border of the mesogastric area, however, not well defined except at the groove separating the epigastric crests; epibranchial region little, if at all, swollen; front about one-quarter of the greatest breadth of the carapace, slightly deflexed, smooth-edged and with the free edge almost straight; outer orbital angle sub-acute, not separated from the lower border of the orbit by a gap; antero-lateral border of the carapace well defined, strongly convexed; epigastric and post-orbital crests ill-defined, epigastric crest regions separated medianly by a very faint groove; abdomen of male tapering rather abruptly to the fifth and sixth segments; sixth segment with straight sides, almost as long as wide at its distal end; telson not quite as long as its proximal width, apex rounded; external maxillipeds with the exopodite longer than the ischium and bearing a strong, plumose flagellum; ischium longitudinally grooved, merus quadrangular and broader than long. Length of holotype, 23 mm., breadth, 30·5 mm.

Types.—Holotype male, allotype female and paratype (No. P.4110–P.4112) in the Australian Museum Collection.

Type Locality.—Eureka Creek, Walsh River, Cape York.

Distribution.—Walsh River and Cooktown, north Queensland.

In the holotype the oblique striae on the dorsal surface near the lateral borders of the epibranchial region are faint but still distinguishable. They are more prominent in the specimens examined from Cooktown. The species is distinguishable from *leichardti* on the form of the carapace and in the development of the oblique striae on the dorsal surface near the lateral borders of the epibranchial regions in *plana* which are absent in *leichardti*. The male abdomen also is different in the two species.

Paratelphusa (Liotelphusa) planifrons (Bürger), 1894.

(Figure 4.)

Telphusa planifrons Bürger, 1894, Zool. Jahrb. Syst., viii, 6.

Diagnosis.—Lateral margins of front parallel; fronto-orbital breadth equal to the length of the cephalothorax; breadth only slightly greater than the length.

Length of cephalothorax, 17 mm., breadth, 23 mm.

Distribution.—Cape York; Walsh River, north Queensland (10 May, 1925, W. D. Campbell); Mutchilba, Chillagoe Line, north Queensland (W. D. Campbell).

Only three very juvenile specimens (width, 15 mm.) referred to this species have been examined. However, the species can be distinguished readily from *plana* and the other species on its shape. In *planifrons* the lateral margins tend to be parallel so that the carapace has a squarish appearance, the width being only slightly greater than the length.

Paratelphusa (Liotelphusa) transversa (von Martens), 1869.

(Figure 5.)

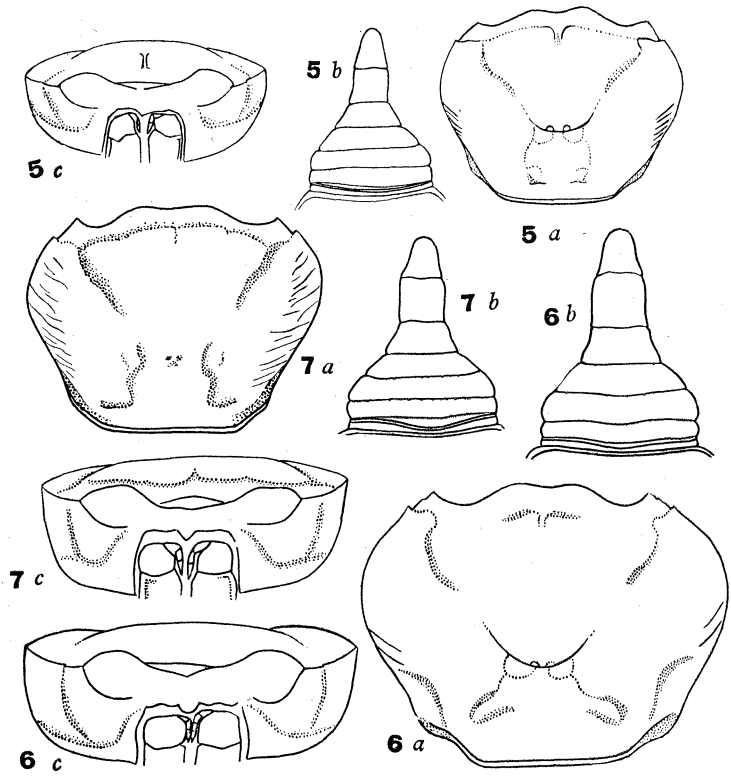
Telphusa transversa von Martens, 1869, Monats. Ak. wiss. Berlin, 609; Bürger, 1894, Zool. Jahrb. Syst., viii, 4.

Telphusa crassa Milne Edwards, 1869, Nouv. Arch. Mus. Paris, v, 177.

Diagnosis.—Carapace strongly convex from in front behind; upper surface smooth; epibranchial spine very reduced so that the antero-lateral borders appear almost entire; post-frontal crests absent.

A single male specimen from Mapoon, Batavia River (Australian Museum Collection, No. G.4219) is referred to this species. The proportions of the carapace do not correspond exactly with those given for the type specimen, but then this specimen is smaller.

Description of Specimen G.4219.—Carapace oval, almost circular in outline, deep, its length about three-fourths of its greatest breadth, depth greater than half its length; upper surface relatively smooth, without striae on the dorso-lateral portions of the epibranchial region; cervical groove deeply impressed only in the posterior mesogastric area, running towards the lateral epibranchial tooth, prominent only over the middle third of this portion; anterior border of the mesogastric area not well-defined except at the groove separating the epigastric crests; front about one-quarter the greatest breadth of the carapace, strongly deflexed, smooth-edged, with the free edge strongly emarginate in the middle; antero-lateral borders of the carapace well-defined, tending towards being parallel; epigastric and post-orbital crests, though ill-defined, forming a continuous line; abdomen of male tapering rather abruptly to the fifth and sixth segments; sixth segment with almost straight sides, as long as wide at its distal end; telson as long as its proximal width, apex rounded.



Figures 5–7.

5. *Paratelphusa (Liotelphusa) transversa.* 6. *Paratelphusa (Liotelphusa) valentula*, sp. nov. 7. *Paratelphusa (Barytelphusa) angustifrons.*
(*a*) Male cephalothorax. (*b*) Male abdomen. (*c*) Frontal view. Approximately x 1½ diameters.

Breadth of carapace, 26 mm., length, 21 mm.

Type Locality.—Cape York, north Queensland.

Distribution.—Cape York; Mapoon, Batavia River, Cape York (August, 1903, C. Hedley).

The species is much deeper than *plana* and the upper surface much more strongly arched. The much more strongly arched surface and strongly deflexed front, as well as slight differences in the shape of the male abdomen differentiate this species from *leichardti.*

Paratelphusa (Liotelphusa) valentula, sp. nov.

(Figure 6.)

Description of Adult.—Carapace squarish, length more than three-quarters of the greatest breadth, depth less than half the length; dorsal surface smooth or with very fine striae on the epibranchial regions; cervical groove deeply impressed only where it borders the posterior mesogastric area, running towards the lateral epibranchial tooth, clearly defined only in the middle third of this portion; epibranchial regions greatly swollen; front about one-quarter the greatest breadth of the carapace, slightly deflexed, smooth-edged, with the free edge slightly excavated; outer orbital angle sub-acute, not separated from the lower border of the orbit by a gap; epigastric and post-orbital crests

ill-defined; epibranchial spine prominent; abdomen of male tapering rather abruptly to the fifth and sixth segments; sixth segment with almost straight sides, slightly longer than the width at the distal end; fifth segment approaching in length its minimum breadth so that the abdomen is markedly constricted at the fifth segment; telson slightly longer than its proximal width, apex rounded.

Length of holotype male, 27 mm., breadth, 34 mm.

Types.—Holotype male (No. P.11982), allotype female (No. P.11983), and paratypes in the Australian Museum Collection.

Type Locality.—Coen, north Queensland.

Distribution.—Coen (Jan., 1943, Wassell); Coen River at Coen (June, 1949, R. Mackay).

This species is quite distinct from any of the other Cape York species. It is characterized by the swollen epibranchial regions. The male abdomen also is most distinctive.

Genus **Paratelphusa.**

Subgenus **Barytelphusa** Alcock.

No spine on the upper border of the merus of the chellipeds, antero-lateral border of the carapace crenulate or not, but never bearing a series of large teeth or spines; epigastric crests either united with the post-orbital crests to form one unbroken ridge on either side of the post-frontal mesogastric groove, or, if the epigastric crests are separated from the post-orbital crests, the break between them is vague and sometimes very indistinct and both crests form one common curve; exopodite of the external maxillipeds with a long, strong, plumose flagellum; cervical groove usually very broadly and deeply impressed in all its course, usually running to, or towards, the lateral epibranchial spine. The species are generally large and dark-brown in colour.

Paratelphusa (Barytelphusa) angustifrons (Milne Edwards), 1868.

(Figure 7.)

Telphusa angustifrons Milne Edwards, 1868, Bull. Soc. ent. Fr.; Milne Edwards 1869, Nouv. Arch. Mus. Paris, v, 171.

Geotelphusa angustifrons McCulloch, 1917, Rec. Aust. Mus., xi, 232.

Paratelphusa (Liotelphusa) podenzanae Colosi, 1919, Boll. Soc. Ent. Ital., l, 54.

Diagnosis.—Lateral margins of the front divergent backwards, fronto-orbital breadth less than the length of the carapace; pronounced post-frontal elevations extending between the epibranchial teeth; branchial regions markedly rugose, both anteriorly and posteriorly.

Description of Adult.—Carapace slightly arched, the three main divisions distinct, length about four-fifths the greatest breadth, the depth more than half the length; lateral half of each epibranchial region traversed by a number of fine oblique ridges becoming somewhat effaced in very large specimens; cervical groove distinct except for the region behind the post-orbital crests, the groove running to the lateral epibranchial tooth; mesogastric furrow deep; front one-quarter the greatest breadth of the carapace, little deflexed, margin entire, with sides convergent forward; external orbital tooth subacute, meeting the lower border of the orbit without a notch; antero-lateral margin of the carapace well-defined, very obscurely crenulate; epibranchial tooth small and blunt; epigastric crests broad, blunt, almost parallel to the front, outer ends incompletely separated from the post-orbital crests by a very vague break; post-orbital crests rounded, most clearly defined over their outer halves, running slightly backwards and then with a distinct forward bend from the region of the cervical suture to join the lateral margin

at the epibranchial tooth; male abdomen broad based, distally strongly contracted with broadly rounded apex, contraction of the sixth segment pronounced, segment just as long as broad at its distal end; telson broadly rounded, as long as broad promixally.

Length of normal carapace, 23 mm., breadth, 28 mm.

Distribution.—Cape York (type locality); Paira, near Somerset, Cape York (Hedley and McCulloch).

The type locality of *podenzanae* Colosi is also Cape York.

The species can be distinguished from all other recorded Australian species by the relatively strong development of the epigastric and post-orbital crests. The species differs from typical members of the subgenus in the relatively poor development of the cervical groove, the lateral portions of which are broken in the middle. The condition found in this species is very similar to that which occurs in the subgenus *Oziotelphusa* but the epigastric and post-orbital crests, though not as prominent as in most species of the subgenus *Barytelphusa*, are definitely in line. Colosi, after stating that this species would fall in the subgenus *Barytelphusa*, as defined by Alcock, placed it in *Liotelphusa* without any further explanation.

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THE AUSTRALIAN FRESHWATER PRAWNS OF THE FAMILY PALAEMONIDAE

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(Figures 1–11.)

The freshwater species of this family are found in the permanent waters of creeks and rivers and to a less extent of dams and waterholes. In the small standing water one is more likely to find prawns of the family Atyidae. The species appear to have a peculiar distribution in Australia. The dominant genus *Macrobrachium* occurs throughout northern Australia and inland Australia south into South Australia where there is at least one coastal species. It is apparently absent from south-west Western Australia but a species of *Palaemonetes* is recorded from there. Species are not known over most of Victoria, and on the east coast of Australia records are confined to Queensland. Intensive collecting around Sydney has failed to yield any freshwater species.

Family PALAEMONIDAE.

Caridea in which the first two pairs of legs are chelate, but dissimilar. The wrist of the second pair of legs is not divided and the rostrum is not hinged, but rigid.

Subfamily PALAEMONINAE.

A pleurobranch is present at the base of the third maxilliped; posterior margin of the telson with two pairs of spines and two or more plumose setae.

Only two genera of this subfamily are represented in the Australian freshwater fauna. The genus *Palaemonetes* is recorded with a single species from the south-west region of Western Australia. The genus *Macrobrachium* is widespread over the eastern half of the continent but is unknown in the coastal zone south from the Queensland border and over most of Victoria.

Genus **Macrobrachium** Bate, 1868.

Genotype, *Macrobrachium americanum* Bate, 1868.

Antennal and hepatic spines present; supraorbital and branchiostegal spines absent; mandible distinctly cleft, normally with a large three-segmented palp; dactylus of last three pairs of legs simple.

The species normally occur in freshwater but some may also be found in brackish and even salt water. Some Australian species seem to be entirely marine or really estuarine, for example, *novae-hollandiae* and *danae*, as an extensive search has failed to disclose any specimens in fresh water.

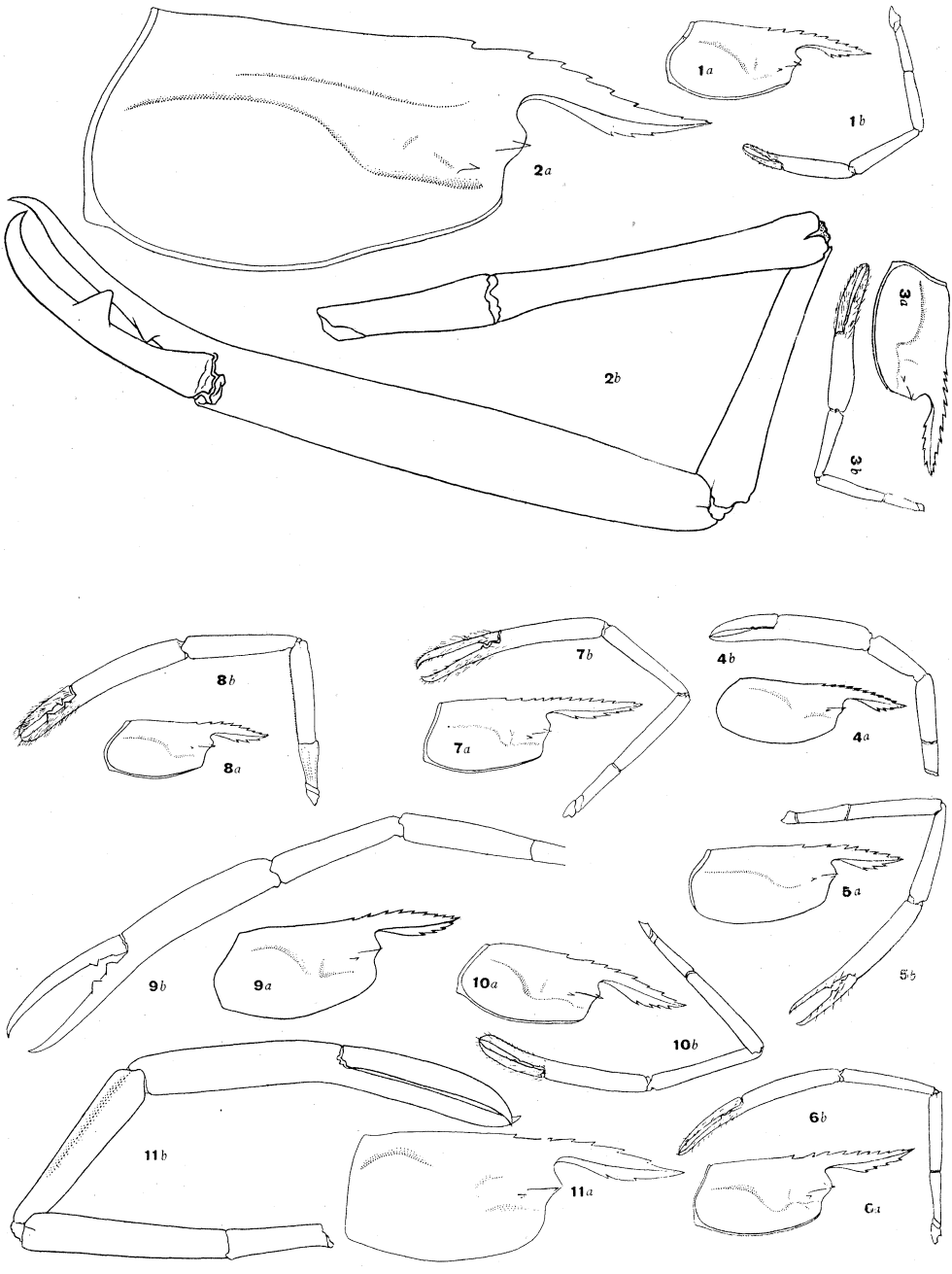
This genus has generally been considered as *Palaemon* while most species of *Leander* are now placed in *Palaemon*. *Leander* and *Palaemon* are typically marine though some species of *Palaemon* do occur in fresh water.

Macrobrachium novae-hollandiae (de Man), 1908.

Palaemon (*Eupalaemon*) *novae-hollandiae* de Man, 1908, Ann. Mag. Nat. Hist., (8), 1, 370.

Palaemon ornatus Haswell, 1882, Catalogue Austr. Crustacea, 196.

Macrobrachium novae-hollandiae Holthuis, 1950, Siboga Exped. 39, Decapoda 10, 155.



Figures 1–11.

1. *Macrobrachium tolmerum*, sp. nov. 2. *M. lar* (Fabricius). 3. *M. adscitum adscitum*, sp. nov. 4. *M. glypticum*, sp. nov. 5. *M. atactum atactum*, sp. nov. 6. *M. atactum ischnmorphum*, sp. nov. 7. *M. atactum sobrinum*, sp. nov. 8. *M. australiense eupharum*, sp. nov. 9. *M. australiense cristatum*, sp. nov. 10. *M. australiense australiense*, Holthuis. 11. *M. australiense crassum*, sp. nov.

(*a*) Cephalothorax. (*b*) Second periopod of male. Setae of fingers omitted from Figures 4, 9 and 11. Natural size.

This species, though common in the estuaries from Sydney to Brisbane, has never been collected in fresh water; in fact, no prawns of the subfamily Palaemoninae are known from the fresh waters of the Sydney district. There is some variation in the proportions of the chelae which, however, are always extremely long and on this character alone easily distinguishable from *danae* which has a similar distribution.

Macrobrachium danae (Heller), 1865.

Palaemon Danae Heller, 1865, Reise Novara Zool. 2, 120.
Palaemon danae de Man, 1908, Ann. Mag. Nat. Hist. 8, 1, 363.
Macrobrachium australe Holthuis, 1950 (in part), Siboga Exped. 39, Decapoda 10, 124.

Holthuis considers *danae* (Heller) a synonym of the freshwater species *australe* (Guérin Méneville). The species *danae* is restricted almost entirely to salt water though it may enter small freshwater springs and swamps at the shore-line. Ovigerous females are normally collected in salt water. Adult males have the second periopods equal and have a shorter carpus than in *australe*. The teeth on the cutting edges of the fingers also differ. There are a number of small teeth proximally but the distal tooth is the largest in *danae*.

Key to the Australian Freshwater Species of *Macrobrachium*.

1. Merus distinctly shorter than carpus 2
— Merus almost or quite equal to carpus 5
— Merus slightly greater than carpus 3

2. Large species; telson with apex long, acuminate, lateral spines not reaching the apex of the telson ... *rosenbergi* (de Man)
— Small species; telson with apex short, acuminate, the inner of the lateral spines extending well beyond the apex of the telson ..... *tolmerum*, sp. nov.

3. Telson with apex rounded, lateral spines short; large species. (Second periopods strongly tuberculate, palm not swollen) ..... *lar* (Fabricius)
— Telson with apex short, acuminate, inner of lateral spines extending beyond apex of telson; small species 4

4. Second periopods smooth; rostrum above only slightly convex, fingers appearing smooth; fingers as long as palm—
Palm greatly swollen ..... *adscitum adscitum*, sp. nov.
Palm not swollen ..... *adscitum* subsp.
— Second periopods tuberculate, all segments inflated; rostrum short, convex above, fingers appearing smooth, fingers shorter than palm, carpus only three times as long as wide and much shorter than palm ... *glypticum*, sp. nov.

5. Fingers of second periopods appearing bare or with only short hairs; second periopods long and thin, not obviously tuberculate 6
— Fingers of second periopods clothed with long, dense hairs; second periopods rather stout, obviously, though finely tuberculate 7

6. Rostrum with the upper margin slightly convex, apex not upturned; carpus as long as palm; fingers not quite as long as palm; carpus five to six times as long as wide ..... *atactum atactum*, sp. nov.
— Rostrum long, with the upper margin almost straight, apex slightly upturned; carpus generally longer than palm; fingers longer than palm; palm slightly swollen; carpus seven times as long as wide ..... *atactum ischnomorphum*, nov.
— Rostrum long, upper margin slightly convex, apex slightly upturned; carpus almost as long as palm; fingers almost as long as palm; carpus about six times as long as wide ..... *atactum sobrinum*, nov

7. Rostrum above strongly convex; carpus shorter than palm; carpus four to four and one-half times as long as wide ... *australiense eupharum*, nov.
— Rostrum above convex, apex not upturned; carpus shorter than palm; carpus four to four and one-half times as long as wide; periopods very stout, palm slightly swollen ..... *australiense cristatum*, nov.
— Rostrum above only slightly convex, apex slightly upturned; carpus as long as palm; carpus five to six times as long as wide ..... *australiense australiense* Holthuis
— Rostrum above convex at base, concave at apex, apex distinctly upturned; carpus about equal to palm; carpus five times as long as wide; fingers almost as long as palm ..... *australiense crassum*, nov

Macrobrachium rosenbergi (de Man), 1879.
(Figures 6 and 12.)

Palaemon carcinus auctt. (non Linnaeus, 1758).
Palaemon Rosenbergii de Man, 1879, Notes Leyden Mus. 1, 167.
Palaemon (Eupalaemon) carcinus rosenbergi Roux, 1933, Rev. Suisse Zool. 40, 344.
Macrobrachium rosenbergii Holthuis, 1950, Siboga Exped. 39, Decapoda 10, 111.

Roux records the species from the Katherine River, north Australia.

Description of Adult Male (Australian Material).—Telson with apex long, acuminate, the lateral spines not reaching the apex of the telson; rostrum rather long and thin, with a sharply pointed apex, extending as far as or slightly beyond the antennal scale, more or less straight but with apex slightly upturned, lateral carina showing a more decided dorsal curvature; rostrum dorsally bearing eleven to thirteen teeth, the first three lying behind the orbit, the lower margin with eight spines, dorsal margin convex over the basal half, concave over the apical part, lower margin more or less straight for most of its length; second periopods very long and stout, coarsely but rather sparingly tuberculate, the tubercles lying in more or less regular lines; carpus considerably longer than the merus but not nearly half as long again; carpus about equal to the palm; fingers shorter than the palm, in some cases only about one-half as long as the palm; teeth of the proximal half of the cutting edges of the fingers quite small; dactylus densely clothed in short setae.

Australian Distribution.—Queensland: Coen; Norman River.

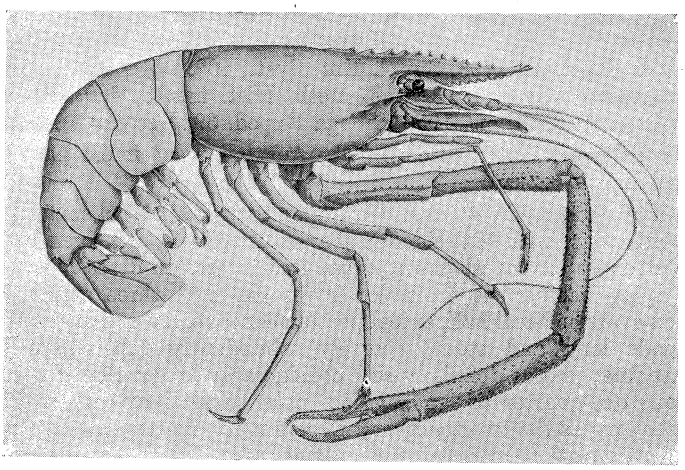


Figure 12.
Macrobrachium rosenbergi (de Man), J. R. Kinghorn, del.

This subspecies of large prawns can be distinguished from *Macrobrachium lar* described below from the Roper River by the structure of the telson, the tuberculation of the second periopods and the shape of the rostrum. I have reproduced a figure of this species prepared from specimen No. 4371 by J. R. Kinghorn. The rostrum generally has a slightly more upturned apex than represented.

Macrobrachium tolmerum, sp. nov.

(Figure 1.)

Description of Adult Male.—Telson with the apex short, acuminate, the inner of the lateral spines extending well beyond the apex of the telson; rostrum long, rather stout but with a sharply pointed apex, more or less straight but with a gentle upturning of the apex, deep in lateral view, particularly at the middle, the lateral carina showing a decided upward curvature; rostrum dorsally bearing eight to eleven teeth, usually ten, the first one to three teeth lying behind the orbit; three to four spines on the lower margin, dorsal margin definitely convex over at least the basal half, generally only slightly so, lower margin quite strongly convex; second periopods rather short and stout, rather finely, abundantly tuberculate; merus distinctly shorter than the carpus but at least three-quarters of it; carpus about as long as palm, fingers much shorter than palm, generally only half as long as palm; teeth of the proximal half of the cutting edges of the fingers quite small; carpus very narrowed at base, expanded at apex; fingers clothed with only short hairs; eggs very small and numerous, their length only 0·6 mm.

Length of adult male, 80 mm., length of adult female, 65 mm.

Types.—Holotype male (No. P.11988), allotype female (No. P.11989) and paratypes in the Australian Museum Collection.

Type Locality.—Black River, Macrossan, Queensland (October, 1943, E. F. Riek).

Distribution.—The species is known only from the type locality.

This species can be distinguished readily from the other small freshwater species on the size of the eggs and on the structure of the second periopods. On the size of the eggs one would be of the opinion that this was an estuarine species of the genus, but the specimens described above are from a purely freshwater habitat at least five miles above the tidal zone.

Macrobrachium lar (Fabricius), 1798.

(Figure 2.)

Palaemon lar Fabricius, 1798, Suppl. Ent. Syst., 402.
Palaemon ornatus Oliver, 1811, Enc. meth. Hist. nat. 8, 660.
Macrobrachium lar Holthuis, 1950, Siboga Exped. 39, Decapoda 10, 176.

This is a widely distributed species. The Australian specimens have a longer, more curved rostrum than is typical.

Description of Adult Male.—Telson with apex rounded, lateral spines short; rostrum rather short and stout, with a decided S-shaped curvature, the apex upturned, lateral carina not as strongly curved as the rostrum itself, rostrum dorsally with eight spines, the first two lying behind the orbit, lower margin with three spines, dorsal margin strongly convex over the basal half, apical portion concave, lower margin strongly convex; second periopods long and stout, coarsely, abundantly tuberculate but with the tubercles rather fine; merus definitely and considerably longer than the carpus, in some specimens about one-quarter as long again; palm much longer than either carpus or merus, almost as long as the two together; fingers much shorter than the palm, generally less than half its length; teeth of the cutting edges of the propodus and dactylus extremely large, propodus with tooth towards its base but dactylus with a still larger tooth about its middle, in addition, rudiments of two much smaller teeth more basad in some specimens; fingers devoid of obvious setae but external surface of dactylus densely clothed in short, stout spines.

The only definite Australian locality is the Roper River, north Australia. The type of *ornatus* was most probably collected somewhere on the north-west coast of Australia. The species can be distinguished from *rosenbergi*, which occurs on the eastern side of the Gulf and in Cape York, on the structure of the second periopods and on the shape of the rostrum.

Macrobrachium adscitum adscitum, sp. nov.

(Figure 3.)

Description of Adult Male.—Telson with apex short, acuminate, the inner of the lateral spines extending beyond the apex of the telson; rostrum short, deep in lateral view, with the apex directed forwards and in a few specimens slightly upturned at apex, upper surface slightly convex, lateral carina with only a very slight dip in the middle, lower margin convex, rostral teeth prominent, dorsally with from eight to eleven, but typically eight or nine, lower margin almost invariably with three teeth, rarely four; second periopods long and thin, except for the greatly swollen palm, appearing smooth but very finely tuberculate; merus slightly greater than carpus; fingers with only short, though sometimes dense hairs; carpus almost equal to palm; fingers as long as or slightly longer than palm.

Length of adult male, 75 mm., length of adult female, 45 mm.

Types.—Holotype male, allotype female and paratypes (No. P.3095) in the Australian Museum Collection.

Type Locality.—Accommodation Creek, near Ballandean, Queensland.

Distribution.—Queensland: Accommodation Creek; Oakey.

This species is characterized by the very swollen palm to the otherwise very long and thin second periopods. In some respects it approaches *atactum ischnomorphum* but differs noticeably in the relative length of the carpus.

Macrobrachium adscitum, subsp.

There is a very distinct subspecies from Angus River, Strathalbyn, south of Adelaide, South Australia, which differs mainly in the unswollen palm of the second periopods. It has the distinctive very long merus of *adscitum adscitum*. As the material examined was not sufficiently well preserved the subspecies has not been described.

Macrobrachium glypticum, sp. nov.

(Figure 4.)

Description of Adult Male.—Telson with the apex very short, only slightly acuminate, the inner of the lateral spines extending well beyond the apex of the telson; rostrum rather short, pointed, extending straight out, apex not upturned, both upper and lower margins convex, upper only slightly so, not very deep in lateral view, with the lateral carina straight; dorsally the rostrum bears eleven or twelve, occasionally more, small, close, teeth, the first three or four lying behind the orbit, lower margin with three, more rarely four or two teeth; second periopods massive, obviously, though finely, tuberculate, tubercles larger on carpus and merus; fingers appearing bare, with only very short hairs; all segments of second periopods stout, merus distinctly longer than carpus, carpus much shorter than palm, which is a little longer than merus, fingers somewhat shorter than palm, carpus only three times as long as wide at apex, base only half width at apex; teeth on cutting edges of fingers very small.

Length of adult male, 48 mm., length of adult female, 42 mm.

Types.—Holotype male (No. P.11992), allotype female (No. P.11993) and three paratypes in the Australian Museum Collection.

Type Locality.—Coen, north Queensland (21 Nov., 1945, Wassell).

The female bears eggs of rather large size. One of the second periopods of the holotype male is quite small and bears numerous long setae, over all segments but particularly on the fingers. This species is very distinct, and, although it has a long merus as in *adscitum*, does not appear to be closely allied to that species. Its affinities would seem to be with some Asiatic species as are the other northern species of our fauna.

Macrobrachium atactum atactum, sp. nov

(Figure 5.)

Description of Adult Male.—Telson with apex short, acuminate, the inner of the lateral spines extending well beyond the apex of the telson; rostrum long, slightly convex above and without the apex slightly upturned, moderately deep in lateral view, with the lateral carina showing only a slight upward curvature, with the greater part of the rostrum lying above it; dorsally the rostrum bears seven to ten teeth, the first two or three lying behind the orbit, lower margin with three to five teeth, strongly convex; second periopods long and thin, appearing smooth, though very finely tuberculate; fingers appearing smooth, with only short hairs; merus almost equal to the carpus; carpus as long as palm; fingers not quite as long as palm; palm five to six times as long as wide at apex; teeth on the basal half of the cutting edges of the fingers moderately developed.

Length of adult male, 80 mm., length of adult female, 55 mm.

Types.—Holotype male (No. P.12007), allotype female (No. P.12008) and paratypes in the Australian Museum Collection.

Type Locality.—Conondale, Mary River, Queensland.

Distribution.—Conondale (25 Apr., 1943, E. F. Riek); Running Creek, Queensland-New South Wales Border (14 Apr., 1941, E. F. Riek); Sandy Creek, Moorooka, Brisbane (23 May, 1941, E. F. Riek); Mt. Coot-tha, Brisbane (18 May, 1941, E. F. Riek).

Macrobrachium atactum ischnomorphum, nov.

(Figure 6.)

Description of Adult Male.—Telson as in *atactum atactum;* rostrum long and thin, extending almost straight out, upper margin almost straight, with a very slight upturning of the apex, not particularly deep in lateral view, with the lateral carina showing a definite upward curvature, with a little more than half the rostrum lying above it; dorsally the rostrum bears eight to ten teeth, the first two or three lying behind the orbit, lower margin with three to five teeth, moderately convex; second periopods long and very thin, appearing smooth though very finely tuberculate, fingers clothed in only very short hairs; merus almost equal to carpus; carpus generally longer than the palm but sometimes only equal to it; fingers longer than the palm; palm slightly swollen over its whole length; carpus seven times as long as wide; teeth on the cutting edges of the fingers usually quite small.

Length of adult male, 85 mm., length of adult female, 45 mm.

Types.—Holotype male (No. P.11995), allotype female (No. P.11996) and paratypes in the Australian Museum Collection.

Type Locality.—Elimbah Creek, Elimbah, Queensland (23 April, 1943, E. F. Riek).

Distribution.—Queensland: Elimbah; Waraba Creek, Caboolture (4 June, 1943, E. F. Riek).

This subspecies differs from the typical in the longer, thinner periopods with longer fingers and longer, less convexed rostrum which approaches that of *atactum sobrinum.*

Macrobrachium atactum sobrinum, nov.

(Figure 7.)

Description of Adult Male.—Telson as in *atactum atactum;* rostrum very long and thin, with the upper margin very slightly convexed over the basal half, apex very slightly upturned, rostrum moderately deep in lateral view, with the lateral carina showing a decided dorsal curvature so that the greater part of the rostrum lies above it; dorsally

the rostrum bears nine to twelve teeth, usually ten, the first two or three lying behind the orbit, lower margin with three to five spines, generally five, strongly, evenly convex; second periopods long and thin, appearing smooth though very finely tuberculate; fingers clothed generally with dense but short hairs; merus almost equal to the carpus; carpus almost as long as the palm; fingers not quite as long as palm; carpus about six times as long as wide at apex; carpus rather more narrowed at base than in typical subspecies; teeth at bases of fingers small.

Length of adult male, 85 mm., length of adult female, 50 mm.

Types.—Holotype male (No. P.11998) allotype female (No. P.11999) and paratypes in the Australian Museum Collection.

Type Locality.—Muttaburra, Queensland (27 May, 1945, E. F. Riek).

Distribution.—Queensland: Muttaburra; Longreach (25 May, 1945, E. F. Riek); Diamantina River (November, 1931, J. R. Kinghorn). Northern Territory: Lawn Hill Creek; Avon Downs, near Camooweal (May, 1935, Troughton and Fletcher).

This subspecies differs from the typical in the larger rostrum and somewhat more hirsute fingers.

Macrobrachium australiense australiense Holthuis, 1950.

(Figure 10.)

Palaemon australis Ortmann, 1891 (non Guérin Méneville, 1838) Zool. Jb. (Syst.) v, 709.

Macrobrachium australiense Holthuis, 1950 (nom. nov.), Siboga Exped. 39, Decapoda 10, 174.

Ortmann described this species from a series of specimens from three different localities in Queensland (Gayndah, Rockhampton and Peak Downs). The typical subspecies is redescribed from material collected at Enoggera Creek, Brisbane.

Description of Adult Male.—Telson with the apex short, acuminate, the inner of the lateral spines extending well beyond the apex of the telson; rostrum moderately long, upper surface gently convex with only a slight upturning at apex, rather deep in lateral view, with the lateral carina almost straight but with a slight upward curvature at the apex, with a little more than half the rostrum lying above the carina; dorsally the rostrum bears eight to ten teeth, the first two or three lying behind the orbit, lower margin with three to five spines, moderately convex; second periopods rather stout, obviously though finely tuberculate; fingers clothed with long dense hairs; merus almost equal to carpus; carpus as long as palm; fingers much shorter than the palm, carpus five to six times as long as wide at apex; teeth of cutting edges of fingers only moderately developed.

Length of adult male, 65 mm., length of adult female, 55 mm.

Distribution.—Gayndah; Rockhampton; Peak Downs; Enoggera Creek, Brisbane (9 October, 1943, and 7 December, 1941, E. F. Riek).

This species differs from *atactum* noticeably in the structure of the periopods.

Macrobrachium australiense eupharum, nov.

(Figure 8.)

Description of Adult Male.—Telson with the apex short, acuminate, the inner of the lateral spines extending well beyond the apex of the telson; rostrum short, strongly convex above, apex almost without any upturning, deep in lateral view, with the lateral carina straight; dorsally the rostrum bears eight to ten teeth, the first one or two lying behind the orbit, lower margin with three or four spines, both the dorsal and ventral

margins strongly convex; second periopods large, stout, obviously though finely tuberculate; fingers clothed with long, dense hairs; merus almost equal to carpus; carpus shorter than palm; fingers considerably shorter than palm; carpus four to four and one-half times as long as wide at apex; teeth of cutting edges of fingers moderately enlarged.

Length of adult male, 60 mm., length of adult female, 45 mm.

Types.—Holotype male (No. P.12001), allotype female (No. P.12002) and paratypes n the Australian Museum Collection.

Type Locality.—Burdekin River, Macrossan, Queensland (October, 1943, E. F. Riek).

Distribution.—Burdekin River (October, 1943, and January, 1942); Rosewood (February, 1944, E. F. Riek).

Ovigerous females were collected in October. This subspecies can be recognized readily by its very convex rostrum and the hirsute fingers of the finely tuberculate second periopods.

Macrobrachium australiense cristatum, nov.

(Figure 9.)

Specimens of this subspecies have been described and figured as a variety of *australis* by McNeill (1929).

Description of Adult Male.—Telson as in *eupharum;* rostrum short, convex above, apex not upturned, differs from *eupharum* in being slightly longer and thinner; second periopods large, very stout, propodus slightly swollen, obviously though finely tuberculate; fingers clothed with long dense hairs; merus almost equal to carpus; carpus shorter than palm; carpus four to four and one-half times as long as wide at apex, teeth of fingers generally quite large, limited to the basal half.

Length of adult male, 60 mm., length of adult female, 40 mm.

Types.—Holotype male (No. P.12004), allotype female (No. P.12005) and paratypes in the Australian Museum Collection.

Type Locality.—Pallal, Horton River, near Bingara, New South Wales.

Distribution.—N.S.W.: Pallal, Horton River and Johnstone River; Bourke; Narrabri, Namoi River; Junction Namoi and Barwon Rivers; Deniliquin; freshwater stream near Broken Hill; Wirrabilla Lagoon, Collarenebri; Riverina District; Cotter River, Australian Capital Territory; Murrumbidgee River, Australian Capital Territory.

This subspecies is very close to *eupharum* but differs slightly in the less convex rostrum though more obviously in the somewhat swollen palm of the very stout periopods and also less tuberculate periopods.

Macrobrachium australiense crassum, nov.

(Figure 11.)

Description of Adult Male.—Telson as in typical subspecies; rostrum long and rather thin, convex at base above but concave at apex, apex distinctly upturned, lateral carina with a slight upward curvature, with considerably more than half the rostrum lying above it; teeth of rostrum large, well spaced, eight or nine above, with two or three lying behind the orbit, three or four below, lower margin gently convex; second periopods large and stout, obviously tuberculate, more so than in the typical subspecies; fingers clothed with long, very dense hairs; merus almost equal to the carpus; carpus about equal to the palm; fingers almost equal to the palm; carpus five times as long as wide at the apex.

Length of adult male, 90 mm., length of adult female, 65 mm.

Types.—Holotype male (No. P.12010), allotype female (No. P.12011) and paratypes in the Australian Museum Collection.

Type Locality.—Cairns, Queensland (30 January, 1946, Wassell).

Distribution.—Cairns; Kuranda (16 August, 1942, I. S. R. Munro).

The specimens from Cairns were ovigerous. This is a very distinct subspecies which would probably best be considered a distinct species. The rostrum is so different and the periopods are more coarsely tuberculate and the fingers large and very densely hirsute.

Genus **Palaemonetes** Heller, 1869.

Subgenus **Palaemonetes** Heller, 1869.

Genotype, *Palaemon varians* Leach, 1814.

Mandible without a palp; branchiostegal spine present; supraorbital spine absent; propodus of fifth periopods with transverse rows of setae in the distal part of the posterior margin; outer margin of the uropodal exopod ending in a tooth and a movable spine.

Palaemonetes australis Dakin, 1915.

Palaemonetes australis Dakin, 1915, Proc. Zool. Soc. London, 572.

Palaemonetes australis Holthuis, 1950, Siboga Exped. 39 Decapoda 10, 10.

This is the only recorded Australian species.

Types.—Location of types not indicated.

Type Locality.—Northam (River Avon), Western Australia (W. J. Dakin).

Distribution.—Western Australia. Northam; Gin Gin Brook, 50 miles north of Perth; Bibra Lake; Serpentine River.

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THE FRESHWATER CRAYFISH (FAMILY PARASTACIDAE) OF QUEENSLAND

WITH AN APPENDIX DESCRIBING OTHER AUSTRALIAN SPECIES.

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(Figures 1–13.)

Freshwater crayfish occur in almost every body of fresh water from artificial dams and natural billabongs (standing water) to headwater creeks and large rivers (flowing water). Generally the species are of considerable size and therefore easily collected, but even so many of the larger forms are unknown scientifically. This paper deals with all the species that have been collected from Queensland. It also includes a few species from New South Wales and other States. No doubt additional species will be found and some of the more variable series, at present included under the one specific name, will be further subdivided.

From Queensland nine species are described as new, making a total of seventeen species (of three genera) recorded from that State. The type localities of all but two of these species are in Queensland but some are not restricted to the State. Clark's 1936 and subsequent papers have been used as the basis for further taxonomic studies of the Australian freshwater crayfish.

In Queensland the most widely distributed genus is undoubtedly *Cherax*. Ten of the species belong to this genus. These crayfish prefer the lower altitudes and a few species are able to live in somewhat brackish water. When the creeks dry out they burrow down until they reach the level of the ground water and thus survive till further rains. One species, *punctatus* Clark, is stated to be terrestrial. Four new species are recorded for this genus. Specimens of *dispar*, sp. nov., of south-eastern Queensland prefer the lower reaches of creeks where there is an abundant growth of freshwater plants. A very distinct subspecies, *dispar elongatus*, is described from the lakes and creeks of Fraser Island. *C. robustus*, sp. nov., also from Fraser Island, has evolved most probably from *depressus*, sp. nov., of the mainland. *C. depressus* occurs with *rotundus* at Mt. Coot-tha, Brisbane. *C. rhynchotus*, sp. nov., from Mapoon, Queensland, shows affinities with the Western Australian species.

Four new species of *Euastacus* are described, making a total of seven species of the genus to be recorded from Queensland. *E. hystricosus*, sp. nov., occurs at the headwaters of the Mary River, while a second *valentulus*, sp. nov., was collected from Currumbin Creek. *E. sulcatus*, sp. nov., is widely distributed through the Lamington National Park and *cunninghami*, sp. nov., is recorded only from the Cunningham's Gap area.

The genus *Tenuibranchiurus*, gen. nov., is erected for the reception of a new species, *glypticus*, somewhat resembling an *Engaeus* but differing in branchial structure. The species occurs at Caloundra, very close to the ocean beach, and at Mt. Gravatt, Brisbane. Specimens prefer the "wallum" swamps, where they dig deep burrows up to 3 feet or so in length in the dark, very humic soil. At both localities specimens were associated with *Cherax rotundus* Clark.

Crayfish grow considerably after reaching sexual maturity, so it is well to keep this fact in mind when describing new species, for there are often slight modifications, more particularly in the development of spines on the body and of the great chelae, both in juvenile and senile stages.

Family PARASTACIDAE Huxley.

Key to Queensland Genera of the Family.

1. Stems of podobranchs without lateral, wing-like expansions; first abdominal somite without distinct pleura; plane of propodus and dactylus of great chelae vertical so that the dactylus pinches vertically down on to the propodus; telson entirely calcareous; branchial formula 18 + ep. ..... *Tenuibranchiurus*

— Stems of podobranchs each produced laterally into a broad, wing-like expansion; pleura of first abdominal somite reduced in size but distinct; plane of propodus and dactylus of great chelae not vertical so that the dactylus pinches laterally down on to the propodus; posterior portion of the telson membranous; branchial formula 21 + ep. 2

2. Telson partially divided by a transverse suture; male genital aperture on a separately calcified papilla on the coxopodite of the fifth periopods; abdominal pleura spinose; rostral carinae tuberculate or spinose ..... *Euastacus*

— Telson without partial transverse suture; male genital aperture on a complex, uncalcified papilla; abdominal pleura without spines; spines on rostral carinae limited in number or absent ..... *Cherax*

Genus **Cherax** Erichson, 1846.

Genotype, *Astacus* (*Cherax*) *preissii* Erichson.

Telson without a transverse suture, posterior portion membranous; stems of podobranchs each produced laterally into a broad, wing-like expansion with the exceptions of that on the fourth periopods (that is, the most posterior podobranch); branchial formula 21 + ep.; abdomen without spines or tubercles; male genitalia a complex uncalcified papilla; plane of propodus and dactylus of first periopods not vertical; pleura of first abdominal somite distinct.

The branchial formula is often 20 + r + ep., the posterior arthrobranch of the seventh thoracic somite being virtually absent. This is definitely the condition in *dispar*, *albidus*, *rotundus*, *robustus* and *depressus*. In *bicarinatus* the posterior arthrobranchs of thoracic somites five, six and seven are all reduced.

Key to the Queensland Species of Cherax.

1. Rostrum with lateral spines (very small in *bicarinatus* and *destructor*) 2
— Rostrum without lateral spines 6

2. Areola narrow 3
— Areola wide, not greater than three times as long as broad 4

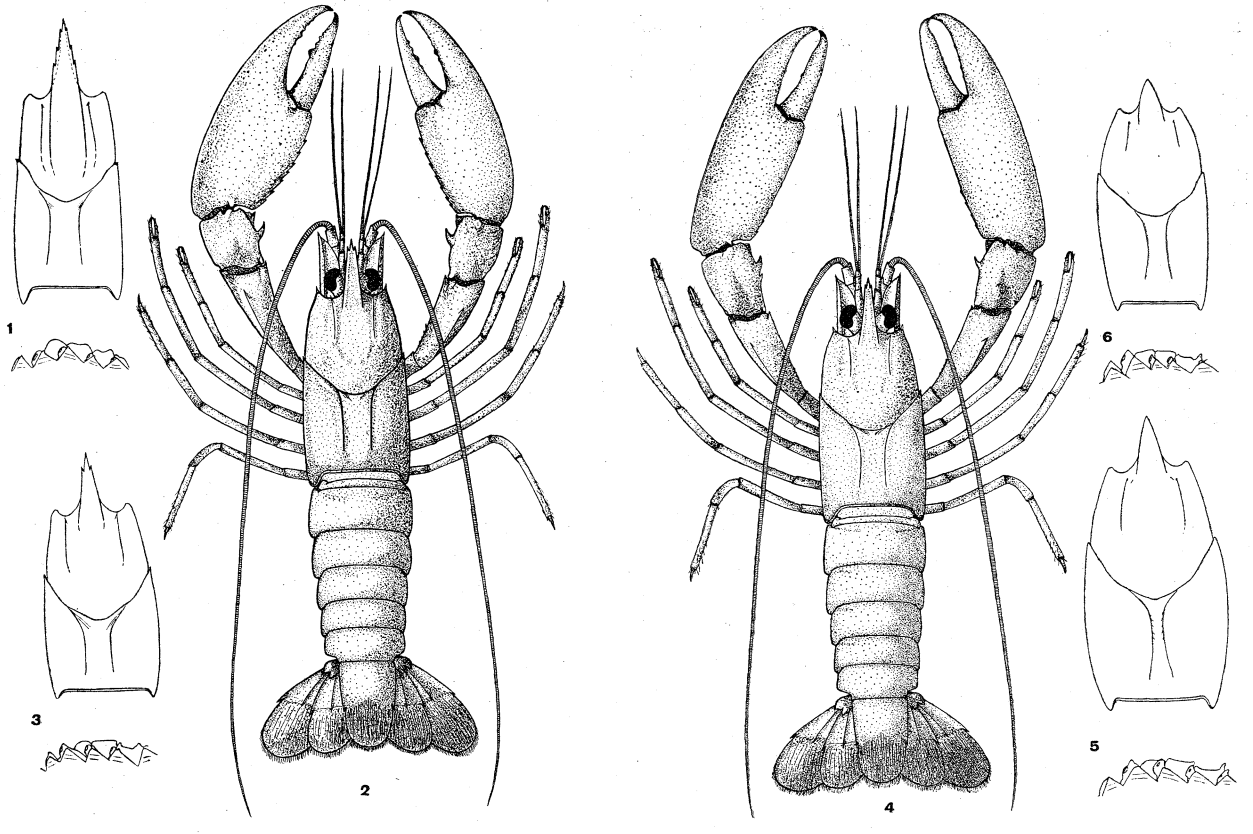
3. Rostral carina with a single small spine towards apex ..... *destructor* Clark
— Rostral carina with two conspicuous spines towards apex ..... *rhynchotus*, sp. nov.

4 Rostrum two times as long as broad at base; antenna not reaching beyond the telson; eyes small; rostral spines very small ..... *bicarinatus* (Gray)
— Rostrum more than two times as long as broad at base; antenna reaching beyond the telson; eyes large 5

5. Rostral carinae extending to the level of the posterior end of the post-orbital ridge; rostrum three times as long as broad at base, with three lateral spines on each side ..... *quadricarinatus* (von Martens)
— Rostral carinae extending only to the level of the anterior end of the post-orbital ridge; rostrum two and one-half to three times as long as broad at base, with only one lateral spine on each side towards the apex ..... *dispar*, sp. nov.

6. Sternal keel blunt; lateral processes of sternal keel increasing in length considerably in the posterior somites so that the coxopodites of the fourth periopods are wide apart; rostrum slightly greater than two times as long as broad at base ..... *albidus* Clark
— Sternal keel sharp; lateral processes of the sternal keel increasing only slightly in length in the posterior somites; rostrum two times or less as long as broad at base 7

7. Rostrum two times as long as broad at base; areola four to six times as long as broad; sternal keel sharp, continuous *rotundus* Clark
— Rostrum two times as long as broad at base; areola three to four times as long as broad; sternal keel with a slight depression between the bases of the second and third periopods ..... *robustus*, sp. nov.
— Rostrum two times as long as broad at base; areola six to eight times as long as broad; sternal keel with a deep depression between the bases of the second and third periopods ..... *depressus*, sp. nov.
— Rostrum only slightly longer than broad at base ..... *punctatus* Clark



Figures 1–6.

1. *Cherax quadricarinatus* (von Martens). Juvenile; from Batavia River. Cephalothorax (dorsal) and sternal keel (lateral view, with posterior end to left). 2. *Cherax dispar*, sp. nov. Holotype male. 3. *Cherax dispar*, sp. nov. Cephalothorax (dorsal) and sternal keel (lateral view). 4. *Cherax dispar elongatus*, nov. Holotype male. 5. *Cherax albidus*, Clark. Cephalothorax (dorsal) and sternal keel (lateral view). 6. *Cherax rotundus*, Clark. Specimen from Brisbane. Cephalothorax (dorsal) and sternal keel (lateral view).

All figures slightly less than natural size.

Cherax quadricarinatus (von Martens), 1868.

(Figure 1.)

Astacus quadricarinatus von Martens, 1868, Monats. Akad. Wiss., Berlin, 617.

Cherax quadricarinatus Clark, 1936, Mem. Nat. Mus., Victoria, x, 22.

This form is readily distinguished from the other Queensland species of the genus by the development of the carinae on the cephalothorax. The arcinae of the rostrum are continued posteriorly towards the cervical groove so that in that region four carinae are present, the two rostral carinae and the two post-orbital ridges.

Type Locality.—Cape York.

Distribution.—Batavia River, north Queensland (M. Ward); Richmond; Norman River; Telemon; Yirrkala, Darwin; Yam Creek, Darwin; Brooklyn Station, Mary River, tributary of Mitchell River (May, 1947, P. O. Flecker).

Specimens up to 210 mm. in length have been collected from the Norman River. Roux (1921) regards the species *Cheraps lorentzi* Roux 1911 as a synonym of *Cherax quadricarinatus* (von Martens). Clark (1936) considers both *lorentzi* and *aruanus* Roux as well as *albertsii* (Nobili) synonyms of *quadricarinatus*. A comparison of north Australian specimens with specimens from New Guinea shows that, in this case at least, we have well-defined subspecies. Material from Aru Islands has not been examined. The New Guinea subspecies can be distinguished by the stronger development of the rostral carinae which are continued almost to the cervical groove. This difference is quite pronounced even in juvenile specimens of the two subspecies. Also, the rostrum is relatively longer and thinner in the New Guinea subspecies.

Cherax dispar, sp. nov.

(Figures 2–3.)

Diagnosis.—Areola wide, two and one-half to three times as long as broad; great chelae seventy-five to eighty per cent. of the body length; eyes large, almost equal in diameter to the width of the rostrum at its base. The species can be separated readily from *rotundus*, with which it occurs at various localities, including the type locality, by the difference in the shape of the rostrum and the high cephalothorax, but more particularly by the wide areola and the relatively large eyes.

Description of Adult.—Carapace slightly higher than broad; cervical groove with one, but usually more, fine, sharply pointed spines on each lateral portion; areola wide, two and one-half to three times as long as broad; cephalic region of cephalothorax more than two times as long as areola; rostrum narrow, two and one-half to three times as long as broad at base, apex sharp, with a conspicuous sharp spine on each side towards the apex; post-orbital ridge sharp and somewhat raised, ending anteriorly in a well-developed sharp spine; eyes large, diameter almost equal to the width of the rostrum at its base; scaphocerite of antenna moderately broad, tending to be triangular, just reaching to the base of the flagellum of the antenna; antenna long, reaching beyond the telson; sternal keel moderately sharp, lateral processes increasing considerably in length in the posterior somites so that the coxopodites of the fifth periopods are wide apart; great chelae of the male long, typically seventy-five to eighty per cent. of the body length; propodus two and one-half times as long as broad; upper surface and cutting edge of propodus, cutting edge of dactylus and upper and lower surfaces of merus, covered with long setae; great chelae of female 65 to 70 per cent. of the body length.

Colour.—Light greenish-grey tending to blue on the abdomen, under surface almost colourless; great chelae blue on the upper surface, lighter in colour on the under surface. The chelae become blue only with maturity. Very young specimens (10 mm.) may be reddish and not bluish as is general.

Length of holotype male, 75 mm., length of allotype female, 65 mm.

Types.—Holotype male (No. P.11956), allotype female (No. P.11957) and paratypes in the Australian Museum Collection.

Type Locality.—Sandy Creek, Moorooka, Brisbane.

Distribution.—Sandy Creek, Moorooka, Brisbane; Enoggera Creek, Brisbane; Greenbank; Doughboy Creek, Brisbane; Caloundra; Cowan Cowan, Moreton Island.

Described from a series of two thousand specimens ranging in size up to 82 mm. body length, collected from the type locality, together with specimens from Moreton Island, Caloundra and Enoggera Creek, and a single specimen from both Greenbank and Doughboy Creek. The largest specimen is a female; females of only 50 mm. have been collected with eggs. The chelae of the immature male resemble those of the female in relative length. In the Moreton Island series the sternal keel is relatively blunt and the whole animal relatively longer and thinner. In the large series from the type locality there are many abnormal specimens. In these the rostrum is only slightly longer than broad at the base but the other features and appendages are of normal proportions. When the rostrum is broken off several ecdyses occur before the normal condition is reached again so that in time the rostrum of each of these specimens would have assumed normal proportions.

Cherax dispar elongatus, nov.

(Figure 4.)

Diagnosis.—Areola wide; eyes large; great chelae 80 to 85 per cent. of the body length. This subspecies differs from *dispar* in the relative size and shape of the great chelae and in their texture. It also differs in the slightly reduced rostrum. The species was not associated with *robustus*, sp. nov., which occurs in other lakes on Fraser Island.

Description of Adult.—Similar to *dispar*; rostrum slightly shorter; scaphocerite of antenna not reaching to the base of the flagellum of the antenna; great chelae long, 80 to 85 per cent. of the body length; propodus three times as long as broad, smooth and glossy but very finely punctate; dactylus only one-third as long as propodus. The lower margin of the propodus is straight, not curved as in typical *dispar*. The female differs in that the great chelae are only 60 to 65 per cent. of the body length.

Colour.—Greenish on thorax and abdomen; great chelae deep green tending to almost black on the upper surface, lighter in colour below. In the Lake Boemingan series the body is grey tinged with green and has numerous fine white spots on the branchiostegites. The chelae vary from green to deep blue.

Length of holotype male, 70 mm., length of allotype female, 55 mm.

Types.—Holotype male (No. P.11959), allotype female (No. P.11960) and paratypes in the Australian Museum Collection.

Type Locality.—Lake McKenzie, Fraser Island, Queensland.

Distribution.—Lake McKenzie, Lake Boemingan and Rocky Creek, Fraser Island.

Described from a series of forty-five specimens ranging in size up to 80 mm. collected from the type locality, together with twelve specimens from Lake Boemingan and twenty specimens from Rocky Creek. The Lake Boemingan specimens approach the typical mainland form and probably represent a more recent migration from the mainland than do the Lake McKenzie specimens.

Cherax dispar crassus, nov.

Diagnosis.—Chelae similar to those of *dispar elongatus* but with the tip of the propodus not as strongly curved. Dactylus relatively shorter than in the typical form.

Description of Adult.—Similar to *dispar* ; rostrum slightly shorter and with the rostral spines generally smaller; great chelae long, 80 to 85 per cent. of the body length; propodus three times as long as broad, surface very finely punctate; dactylus only one-third as long as propodus. The margins of the propodus are almost parallel but the width increases slightly till the junction with the dactylus.

Colour.—Similar to the typical form but with the chelae tending to be green.

Length of holotype male, 70 mm.

Types.—Holotype male (No. P.11962) and paratypes in the Australian Museum Collection.

Type Locality.—Caboolture, Queensland.

This form approaches *dispar elongatus* in the shape and size of the great chelae. It has been collected only from the Caboolture region, but as it is only possible to distinguish the subspecies on fully-grown specimens, the range will, in all probability, be extended.

Cherax destructor Clark, 1936.

Cherax destructor Clark, 1936, Mem. Nat. Mus. Victoria, x, 26.

Diagnosis.—Sternal keel moderately sharp; areola narrow; rostrum two times as long as broad at base, apex sharp, with a spine on each side; carapace broader than high.

Type Locality.—Melbourne, Victoria.

Distribution.—Cape York; Rockhampton; Burnett River; Barron Falls; Dunk Island.

Clark records this species from the several localities in Queensland listed above. I have not seen specimens collected in Queensland. Collections from many of the north Queensland localities contain only specimens of *Cherax depressus*, sp. nov., a species most closely allied to *rotundus* but superficially resembling a juvenile *destructor*.

Cherax albidus Clark, 1936.

(Figure 5.)

Cherax albidus Clark, 1936, Mem. Nat. Mus. Victoria, x, 28.

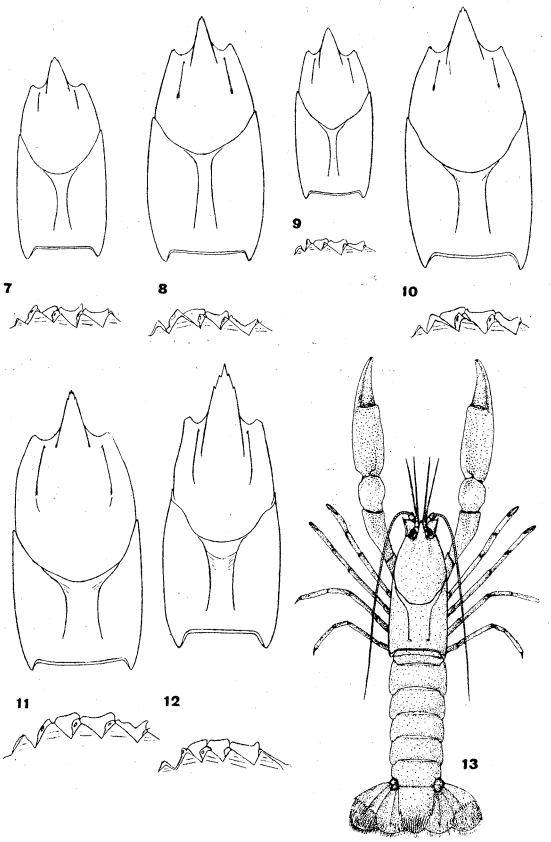
Diagnosis.—Sternal keel blunt; areola narrow, seven to eight times as long as broad; rostrum narrow, two to two and one-half times as long as broad. This species differs from *destructor* in the absence of lateral spines on the rostrum and in the relatively flat sternal keel with conspicuous openings on the lateral processes.

Description of Adult.—Carapace not quite as high as broad; areola narrow, seven to eight times as long as broad; cephalic region of cephalothorax less than twice as long as areola; rostrum narrow, two to two and one-half times as long as broad at base, apex sharp, without lateral spines; post-orbital ridge rounded; eyes small, diameter less than the width of the rostrum at its base; scaphocerite of antenna broad and rounded, not quite reaching to the base of the flagellum of the antenna; antenna not reaching beyond the telson; sternal keel blunt, lateral processes increasing only slightly in the posterior somites so that the periopods are not wide apart; great chelae stout, 75 per cent. of the body length.

Type Locality.—Nurrabiel, Victoria.

Queensland Distribution.—Eromanga; Longreach; Condamine; Chinchilla; Warrego River; Charleville; Diamantina River (billabongs); Essay, via Hughenden; Cunnamulla; Muttaburra.

This is the common species of crayfish of western Queensland. It is responsible for considerable damage to bore drains. The species has not previously been recorded from Queensland.



Figures 7–13.

7. *Cherax depressus* sp. nov. Type series. Cephalothorax (dorsal) and sternal keel (lateral view). 8. *Cherax depressus*, var. Specimen from Gladstone. Cephalothorax (dorsal) and sternal keel (lateral view). 9. *Cherax depressus*, var. Specimen from Cairns. Cephalothorax (dorsal) and sternal keel (lateral view). 10. *Cherax robustus*, sp. nov. Type series. Cephalothorax (dorsal) and sternal keel (lateral view). 11. *Cherax bicarinatus* (Gray). Specimen from Condamine. Cephalothorax (dorsal) and sternal keel (lateral view). 12. *Cherax rhynchotus*, sp. nov. Type series. Cephalothorax (dorsal) and sternal keel (lateral view). 13. *Tenuibranchiurus glypticus*, gen. et. sp. nov. Holotype.

All figures slightly less than x 2 diameters.

Cherax rotundus Clark, 1941.

(Figure 6.)

Cherax rotundus Clark, 1941, Mem. Nat. Mus. Victoria, xiii, 34.

Diagnosis.—Sternal keel sharp, continuous between the coxopodites of the second and third periopods; rostrum two times as long as broad at base, without lateral spines; areola narrow, four to six times as long as wide.

Description of Adult.—Carapace slightly higher than broad; areola narrow, four to six times as long as broad; cephalic region of cephalothorax less than twice as long as areola; rostrum broad, two times as long as broad at base, apex sharp, without lateral spines; post-orbital ridge sometimes ending anteriorly in a sharp spine; eyes small, diameter less than the width of the rostrum at its base; scaphocerite of antenna broad and rounded, not reaching the base of the flagellum of the antenna; antenna not reaching beyond the telson; sternal keel sharp, continuous, not depressed between the coxopodites of the second and third periopods; lateral processes of the sternum increasing only

slightly in the posterior somites so that the fifth periopods are not wide apart; great chelae stout, typically 70 per cent. of the body length; propodus two times as long as broad.

Type Locality.—Muddy Creek, Severn.

Distribution.—Muddy Creek, Severn; Greenbank (J. Peberdy); Milmerran (C. F. Fysh); Cedar Creek Falls, Tambourine Mountain; Petrie; Dayboro; Caloundra; Lyra; numerous localities within a 10-mile radius of Brisbane.

This is the most common species of crayfish in south-eastern Queensland where it occurs in almost every creek, often in large numbers. In dry weather specimens of this species build a cone of excavated earth round the entrance to the burrow and in some cases actually seal the opening in this manner. A true gynandromorph of the species was collected from Milmerran. This is the only one throughout the whole collection of some four to five thousand specimens, though partial gynandromorphs are quite common.

Cherax punctatus Clark, 1936.

Cherax punctatus Clark, 1936, Mem. Nat. Mus. Victoria, x, 29.

This is described as a terrestrial species of *Cherax*, some of the specimens having been collected under a rotten log, others burrowing down several feet to ground-water level. The burrows are marked by large cones of excavated earth.

Type Locality.—Coorari.

Distribution.—Coorari; Eumundi.

I have not examined specimens of this species but it is said to resemble *rotundus*. In dry weather *rotundus* also builds a cone of earth at the entrance to its burrow which may be quite removed from permanent water.

Cherax depressus, sp. nov.

(Figures 7–9.)

Diagnosis.—Areola narrow, six to eight times as long as broad; rostrum two times as long as broad at base, without spines, apex somewhat rounded; sternal keel sharp, with a deep depression between the coxopodites of the second and third periopods.

Description of Adult.—Carapace slightly higher than broad; areola narrow, six to eight times as long as broad; cephalic region of cephalothorax less than two times as long as areola; rostrum long, two times as long as broad, apex somewhat rounded, without lateral spines; post-orbital ridge blunt, ending anteriorly in a rounded boss; eyes small, diameter less than the width of the rostrum at its base; scaphocerite of the antenna broad and rounded, not reaching to the base of the flagellum of the antenna; antenna reaching to the telson; sternal keel sharp, but with a deep depression between the coxopodites of the second and third periopods, lateral processes not very long so that the coxopodites of the periopods diverge only moderately; great chelae stout, typically 65 to 70 per cent. of the body length; propodus two to two and one-half times as long as broad.

Colour.—Mottled grey with the joints red and the chelae tipped in red, or else blue-grey with the chelae tipped in red. The mottled grey is the more typical.

Length of holotype male, 80 mm., length of allotype female, 70 mm.

Types.—Holotype male (No. P.11964), allotype female (No. P.11965) and paratypes in the Australian Museum Collection.

Type Locality.—Mt. Coot-tha, Brisbane.

Distribution.—Mt. Coot-tha, Brisbane; Northbrook Creek, Brisbane Valley; Pullenvale; Eidsvold (Burnett River); Bundaberg; Gin Gin; Watalgan (M. Ward); Gladstone; Dunk Island; Cardwell; Herbert River; Cairns; Kuranda.

Described from a series of more than three hundred specimens from the type locality, together with numerous other specimens. The species occurs with *rotundus* at the type locality, but can be distinguished by the shape of the sternal keel, the general lack of spines on the body and the size of the chelae. The specimens from Bundaberg and Gladstone and further north may be sub-specifically distinct, as the sternal keel is not so deeply incised between the second and third periopods and the areola is somewhat narrower than in specimens from the Brisbane area. Clark (1936) records *destructor* from several localities in Queensland but an examination of material from some of the localities listed by that author has revealed the presence only of *depressus* or its variants. Superficially these two species are alike, but differ strikingly in the development of the sternal keel, that of *depressus* being much more strongly developed particularly between the third and fourth periopods.

Cherax robustus, sp. nov.

(Figure 10.)

Diagnosis.—Areola narrow, three to four times as long as broad; rostrum two times as long as broad at base, without spines, apex sharp; sternal keel sharp, with only a slight depression between the second and third periopods.

Description of Adult.—Carapace higher than broad. Areola narrow, three to four times as long as broad; cephalic region of cephalothorax two times as long as areola; rostrum broad, two times as long as broad at base, without spines but carinae pronounced and ending before the apex; post-orbital ridge ending anteriorly in a blunt spine; eyes small, diameter less than the width of the rostrum at its base; scaphocerite of antenna broad and rounded, not reaching to the base of the flagellum of the antenna; antenna reaching to the telson; sternal keel sharp and with only a very slight depression between the coxopodites of the second and third periopods; lateral processes not very long so that the coxopodites of the periopods diverge only moderately; great chelae of male long and stout, typically 80 to 85 per cent. of the body length; propodus two and one-half times as long as broad.

Colour.—Blue on the upper surface with the chelae deep blue to almost black.

Length of holotype male, 85 mm., length of allotype female, 80 mm.

Types.—Holotype male (No. P.11967), allotype female (No. P.11968) and paratypes in the Australian Museum Collection.

Type Locality.—Lake Birrabeen, Fraser Island.

Distribution.—Lake Birrabeen and Lake Tahwan, Fraser Island.

Described from a series of twenty-five specimens from Lake Birrabeen and twenty specimens from Lake Tahwan. Female specimens of this species lay their eggs in August.

The four species, *rotundus*, *depressus*, *punctatus* and *robustus* form a natural group. *Cherax rotundus* and *depressus* occur in association in the Brisbane area. The two species, though closely related, do not interbreed under natural conditions. To the south only *rotundus* appears to persist, while as one proceeds north, *depressus* becomes the dominant form, but the specimens are now no longer identical with those of the Brisbane area but show variation in the direction of *rotundus*, so that the Cairns and other north Queensland specimens can either be regarded as variants of *depressus* or of *rotundus*. For the present they have all been grouped as *depressus* until further collecting elucidates the complex. *Cherax robustus* of Fraser Island has most probably evolved from the mainland form through isolation. *Cherax rotundus* may or may not be specifically distinct from *punctatus* as the type descriptions are very similar; *rotundus* has similar burrowing habits to *punctatus* and with the drying up of temporary water masses specimens merely burrow down to ground-water level and so could quite easily be regarded as terrestrial if collected during a dry spell.

Cherax preissii (Erichson), and **Cherax bicarinatus** (Gray).

Some confusion has arisen regarding the specific identification of the two species *preissii* Erichson and *bicarinatus* Gray. The species *preissii* was described from south-west Australia, while the type locality of *bicarinatus* is Port Essington, Northern Territory. McCulloch (1914) in dealing with the Western Australian species describes two forms *preissii* and *preissii* var. *angustus* (McCulloch). His variety *angustus*, which is specifically distinct from his *preissii*, is recorded only from the south-west portion of Western Australia whereas the *preissii* of McCulloch is more widely distributed. In my opinion *preissii* of McCulloch is really *bicarinatus* Gray and *preissii* var. *angustus* McCulloch is specifically distinct. I have examined the type material of *preissii* var. *angustus* McCulloch in the Australian Museum and as McCulloch did not designate a holotype, I designate the single male specimen, Australian Museum Catalogue No. P.2749, as holotype, and No. P.2751 as allotype female. No. P.2750 is a paratype female (juvenile). The type of *preissii* is lost so one could regard the type specimens of McCulloch's variety as the neotypes of *preissii* and thus retain *preissii*, the genotype of *Cherax*.

Cherax bicarinatus (Gray), 1845.

(Figure 11.)

Astacus bicarinatus Gray, 1845, Eyre's Jour. Exped. Disc. Cent. Austral. (Appendix), 410.

Cheraps preissii McCulloch, 1914, Rec. West. Aust. Mus., i, 229.

Cherax bicarinatus Clark, 1936, Mem. Nat. Mus. Victoria, x, 23.

There is a doubtful record of this species from Queensland so I have given a description of the species based on this material.

Diagnosis.—Sternal keel sharp; areola wide, two and one-half times as long as broad; rostrum two times as long as broad at base, with two pairs of small, lateral spines towards the apex.

Description of Adult.—Carapace higher than broad; areola wide, two and one-half times as long as broad; cephalic region of cephalothorax greater than twice as long as areola; rostrum two times as long as broad at base, apex sharp, with two pairs of small lateral spines towards the apex; post-orbital ridge rounded; eyes small, diameter less than the width of the rostrum at its base; scaphocerite of antenna broad but tending to be triangular, widest in the middle, just reaching to the base of the flagellum of the antenna; antenna not reaching to the telson; sternal keel sharp, lateral processes increasing only slightly in the posterior somites so that the fifth periopods are not wide apart.

Type Locality.—Port Essington, Northern Territory.

Queensland Locality.—? Condamine.

Described from two male specimens collected at ? Condamine where they were associated with *albidus*. The two species are very readily distinguished by the rostrum and the width of the areola. This species differs from *destructor* in the width of the areola and the number of rostral spines. Whereas in *destructor* the areola is narrow in *bicarinatus* it is very wide, being only two and one-half times as long as broad.

Cherax rhynchotus, sp. nov.

(Figure 12.)

Diagnosis.—Areola narrow, four to five times as long as broad; eyes small, diameter less than the width of the rostrum at its base; rostrum large, two times as long as broad at base, rostral carinae each with two conspicuous spines on the apical third.

Description of Adult.—Carapace slightly higher than broad; areola narrow, four to five times as long as broad; cephalic region of cephalothorax less than two times as long as areola; rostrum long and broad, two times as long as broad at base, apex sharp, with two pairs of prominent lateral spines, the posterior pair lying at the junction of the apical and middle thirds of the rostrum; post-orbital ridge prominent, ending anteriorly in a sharp spine; eyes small, diameter less than the width of the rostrum at its base; scaphocerite of antenna moderately broad, widest in the middle or slightly towards base, just reaching to the base of the flagellum of the antenna; antenna reaching to the telson; sternal keel very sharp, slightly excavated between the second and third periopods, lateral processes of the keel not prominent. Chelae are absent from all except the allotype female and even in that case both are regenerating.

Length of holotype male, 85 mm., length of allotype female, 82 mm.

Types.—Holotype male, allotype female and seven paratypes in the Australian Museum Collection (No. P.4237).

Type Locality.—Mapoon, Queensland.

Described from a series of nine specimens from the type locality. There are both male and female specimens but a high percentage are intersexes. The species is allied to *bicarinatus*, but can be distinguished on the shape of the rostrum and the width of the areola. The areola is considerably wider in *bicarinatus*. The rostrum in *rhynchotus* is relatively longer, though broader and the two spines on each rostral carina are distinct, with the posterior one lying approximately at the junction of the apical and middle thirds. In *bicarinatus* the small spines are both more or less apical. There are three juvenile specimens from the Fly River, New Guinea, in the Australian Museum collection which are provisionally referred to this species.

Genus **Euastacus** Clark, 1936.

Genotype, *Euastacus elongatus* Clark, 1941.

Telson with the lateral margins divided by a transverse suture, membranous posteriorly; stems of podobranchs each produced laterally into a broad, wing-like expansion with the exception of that of the fourth periopods; branchial formula 21 + ep.; abdomen with spines and tubercles, sometimes restricted to the pleura; male genitalia a simple, separately calcified papilla; plane of propodus and dactylus of first periopods not vertical; pleura of first abdominal somite distinct.

The chelae vary in relative size and shape in the same individual as well as in growth stages so that their relative proportions are unsatisfactory specific characters. The genus is separated from *Astacopsis* chiefly on the structure of the gills. *Euastacus fleckeri* approaches *Astacopsis* in the reduction of the spines on the abdomen. The chief specific characters for *Euastacus* are the relative proportions of the rostrum, the tubercles of the branchiostegites and the spines of the abdomen, particularly those of the sixth somite, telson and uropods.

Key to the Queensland Species of Euastacus.

1. Rostrum almost two times as long as broad, apex sharp; post-orbital ridge ending anteriorly in a sharp spine ... 2
— Rostrum less than two times as long as broad, apex blunt and U-shaped; post-orbital ridge ending anteriorly in a slight boss ... 3

2. Sixth abdominal somite, telson and uropods with numerous sharp spines; branchiostegites strongly tuberculate and with a dorso-lateral row of sharp spines; rostral carinae with three pronounced spines; three rows of spines on each side of the abdomen ... *hystricosus*, sp. nov.
— Telson without dorsal spines; branchiostegites finely tuberculate and hirsute; spines of rostral carinae usually numerous (4–5); three rows of spines on each side of abdomen ... *sulcatus*, sp. nov.
— Telson without dorsal spines; branchiostegites strongly tuberculate; spines of rostral carinae numerous; two rows of spines on each side of the abdomen ... *valentulus*, sp. nov.
— Telson without dorsal spines; branchiostegites strongly hirsute; spines of rostral carinae usually numerous (4); two rows of spines on each side of the abdomen ... *cunninghami*, sp. nov.

3. Rostrum only slightly longer than broad, very much U-shaped; spines of the abdomen reduced to a single row on the pleural margins; branchiostegites with very few tubercles ... *fleckeri* (Watson)
— Rostrum moderately rounded; abdomen with three lateral rows of spines; branchiostegites strongly tuberculate ... *suttoni* Clark.

There appears to be a definite correlation between distribution and evolution within the Queensland species of the genus. As one proceeds north from New South Wales one finds that the species are to be collected only from higher and higher altitudes. *Euastacus* occurs almost at sea level at Sydney; *E. sulcatus*, which ranges from northern New South Wales into Queensland, generally is not collected below 1,500 feet; *E. suttoni* occurs only above 2,500 feet, while *E. fleckeri* of north Queensland lives only above the 3,000-foot level. Correlated with this distribution based on altitude one finds that the rostrum is progressively shortened and the abdominal spines reduced from *sulcatus* through *suttoni* to *fleckeri*.

Euastacus sulcatus, sp. nov.

Diagnosis.—Rostrum V-shaped, two times as long as broad; branchiostegites finely tuberculate and hirsute; telson without spines on the dorsal surface or else with one or two poorly developed.

Description of Adult.—Carapace slightly shorter than abdomen (about equal in length to the abdomen in the male); areola wide, two and a half times as long as broad; cephalic region of cephalothorax two times as long as areola; carapace punctate; branchiostegites closely tuberculate and hirsute; rostrum V-shaped, just two times as long as broad; carinae spinose, four or five spines on each side; post-orbital ridge ending anteriorly in a sharp spine; antenna reaching at least to the middle of the abdomen; abdomen spinose; in addition to the marginal pleural spines a row of spines at the junction of the pleura with the somites. Further, on somites three, four and five there may be spines or tubercles between the two rows mentioned above. The marginal spines decrease in size posteriorly so as to be reduced to mere bosses on the last somites. Telson typically without spines on the dorsal surface, but with numerous setae; great chelae stout, typically 70 per cent. of the body length, strongly inflated in the male. Additional spines occur on the median surface of the propodus.

Colour.—In the adult, bright blue with a whitish shield on the dorsal surface of the carapace and with the apical regions of the chelae and periopods white; chelae with the basal regions deep blue on the upper surface, very much lighter in colour on the under surface. Specimens from Running Creek show red in place of the blue of the type specimens except in that the chelae tend to be bluish.

Length of holotype male, 175 mm., length of allotype female, 200 mm.

Types.—Holotype male (No. P.11921), allotype female (No. P.11922) and paratypes in the Australian Museum Collection.

Type Locality.—Binna Burra, Lamington National Park, Queensland (January, 1943, E. F. Riek).

Distribution.—Lamington National Park and Tambourine Mountain.

Described from a series of more than one hundred specimens ranging in size up to 235 mm. (female), mainly from Binna Burra. The Tambourine specimens show a slight reduction in the development of the spines of the abdomen. The uppermost series does not pass beyond the stage of bosses. This species has not been collected below an altitude of 1,500 feet. It shows a tendency to wander overland in the damp rain-forest and may thus pass readily from one river system to another. Females of only 120 mm. length have been collected with eggs, while males of only 90 mm. are sexually mature. Eggs are laid towards the end of November or in December.

Euastacus cunninghami, sp. nov.

Diagnosis.—Rostrum V-shaped, twice as long as broad; branchiostegites densely hirsute, not spinose or tuberculate; telson without spines on the dorsal surface.

Description of Adult.—Carapace slightly shorter than abdomen in female, about equal to it in male; areola wide, about twice as long as broad; cephalic region of

cephalothorax twice as long as areola; carapace dorsally punctate; branchiostegites densely clothed with tufts of long setae, not obviously tuberculate; rostrum V-shaped, almost twice as long as broad; carinae spinose, four, rarely three or five, spines on each side; post-orbital ridge ending anteriorly in a sharp spine; antenna not reaching to the telson, only to the fourth abdominal somite; abdomen with only the pleura spinose, but the sixth somite is without spines or tubercles; in addition to the marginal pleural spines a row of bosses at the junction of the pleura with the somites. On somites three and four there may be a small spine mesad to the marginal pleural spine. Dorsal surface of the first three or four abdominal somites each shows a pair of small bosses; telson without spines on the dorsal surface but with numerous setae; great chelae relatively small.

Colour.—Dark reddish-black, lighter ventrally and at the joints; bosses on abdomen greyish-white; antennae reddish.

Length of holotype female, 135 mm., length of allotype male, 115 mm.

Types.—Holotype female (No. P.11929), allotype male (No. P.11930) and paratypes in the Australian Museum Collection.

Type Locality.—Western slopes of Cunningham's Gap, Queensland (23 October, 1948, E. F. Riek).

Described from a series of nine specimens. The two largest are females carrying eggs. The species is closely allied to *sulcatus*, but can be distinguished by the very hirsute branchiostegites and less spinose abdomen.

Euastacus valentulus, sp. nov.

Diagnosis.—Great chelae stout and somewhat inflated; rostrum two times as long as broad, tending to be U-shaped; branchiostegites strongly tuberculate; telson without spines on the dorsal surface; two rows of spines on each side of the abdomen.

Description of Adult.—Carapace slightly shorter than abdomen; areola moderately wide, two and one-half to three times as long as broad; carapace punctate; branchiostegites strongly tuberculate; rostrum two times as long as broad at base, sides almost parallel for the greater part, tending to be U-shaped, apex sharp; carinae of rostrum with a number of spines; post-orbital ridge ending anteriorly in a sharp spine; antenna reaching to the sixth somite of the abdomen; abdomen spinose; in addition to the marginal pleural spines a row of sharp spines at the junction of the pleura with the somites, but decreasing in size posteriorly; telson without spines on the dorsal surface; great chelae very stout, slightly inflated, typically 70 per cent. of the body length.

Colour.—Preserved specimens only. Chelae bluish.

Length of holotype male, 180 mm.

Types.—Holotype male and paratype male (juvenile) in the Queensland Museum Collection.

Type Locality.—Upper reaches of Currumbin Creek.

Described from only two specimens, the holotype and a smaller male.

Euastacus hystricosus, sp. nov.

Diagnosis.—Rostrum two times as long as broad, with three pronounced spines on each rostral carina; branchiostegites strongly tuberculate, with an irregular dorso-lateral row of sharp spines; sixth abdominal somite, telson and uropods with a number of sharp spines on the dorsal surface.

Description of Adult.—Carapace slightly shorter than abdomen; areola wide, two and one-half times as long as broad; cephalic region of cephalothorax two times as long as areola; carapace coarsely punctate; branchiostegites prominently tuberculate and with an irregular row of prominent sharp spines on the dorso-lateral portion; rostrum

two times as long as broad, pointed, tending to be U-shaped; carinae of rostrum with three sharp spines; post-orbital ridge ending anteriorly in a sharp spine; antenna reaching to the sixth somite of the abdomen; abdomen spinose; in addition to the marginal pleural spines a row of sharp spines at the junction of the pleura with the somites. Further, except on abdominal somites one and two, there is a third row of spines lying between the two mentioned above. Sixth abdominal somite with numerous, scattered, prominent spines on the dorsal surface; telson with numerous, scattered, prominent spines similar to those of the sixth abdominal somite; inner rami of the uropods with two longitudinal rows of prominent spines, one median along the carina, the other towards the outer, lateral margin; outer rami with a single row towards the outer, lateral margin; great chelae stout, not inflated.

Colour.—Preserved specimens rather dark. Chelae reddish; branchiostegites whitish; dorsal surface of the abdomen almost black. The smaller specimen appears to have been greenish, particularly on the abdomen.

Length of holotype male, 230 mm., length of allotype female, 155 mm.

Types.—Holotype male and allotype female in the Queensland Museum Collection.

Type Locality.—Yabba Creek, Yabba, Queensland.

Distribution.—Yabba Creek, Yabba; Bon Accord Creek, Montville; Conondale (25 April, 1943, E. F. Riek).

In a juvenile specimen from Conondale the rostrum is quite pointed and there are four spines on the rostral carinae.

Euastacus suttoni Clark, 1941.

Astacopsis serratus McCulloch, 1917 (in part), Rec. Aust. Mus., xi, 237.

Euastacus suttoni Clark, 1941, Mem. Nat. Mus. Victoria, xiii, 18.

Separated from *E. sulcatus*, which occurs nearer the coast, chiefly by the form of the rostrum and the tubercles of the branchiostegites. The two species are closely related.

Types.—In the National Museum Collection, Melbourne.

Type Locality.—Wyberba, Queensland.

Distribution.—Wyberba; Stanthorpe; Glen Aplin.

Specimens occur only above 2,500 feet at Glen Aplin and are bright red in the adult state.

Euastacus fleckeri (Watson), 1935.

Astacopsis fleckeri Watson, 1935, Mem. Qld. Mus., x, 232.

Euastacus fleckeri Clark, 1941, Mem. Nat. Mus. Victoria, xiii, 19.

This form is distinguished from the other Queensland species by the short, broad, rounded rostrum and the poor development of spines on the abdomen.

Types.—Holotype in the Queensland Museum Collection.

Type Locality.—Root's Creek, north Queensland.

Distribution.—Root's Creek; Mosman River and its tributaries; Daintree River; Mt. Lewis near Cairns (H. Flecker).

This species does not occur below 3,000 feet.

Genus **Tenuibranchiurus**, gen. nov.

Genotype, *Tenuibranchiurus glypticus*, sp. nov.

Cephalothorax shorter than abdomen; carapace higher than broad; cervical groove deeply impressed, rounded; branchiocardiac grooves prominent; areola wide; rostral

carinae reduced or almost absent; sternal keel narrow, posterior pair of lateral processes large and flattened; male genital aperture on an arcuate medial projection of the coxopodite of the fifth periopods. The aperture is on the ventral extremity of the projection. Abdomen slightly wider than cephalothorax, smooth, pleural margins of somites rounded; first abdominal somite with pleural portions very much reduced; telson without transverse suture, entirely calcareous; branchial formula typically 18 + ep.; stem of podobranch not produced into a wing-like expansion; pleurobranchs reduced, typically to one situated on the last thoracic somite.

This genus is separated chiefly on the branchial arrangement. The gill-structure approaches most closely to that of *Parastacoides* Clark in the reduction in size of the posterior arthrobranchs and in the number of pleurobranchs, but the trend has proceeded further in *Parastacoides* which has no pleurobranchs. In most specimens of *Tenuibranchiurus glypticus* there is only the somewhat reduced posterior pleurobranch but in some females there are three, quite pronounced pleurobranchs on the last three thoracic somites.

Tenuibranchiurus glypticus, sp. nov.

(Figure 13.)

Diagnosis.—Small; eyes reduced; cephalothorax higher than broad; abdomen longer than cephalothorax; great chelae 80 to 85 per cent. of the body length; propodus and dactylus lying in a vertical plane.

Description of Adult.—Carapace finely punctate, branchiostegites finely tuberculate; carapace much shorter than abdomen, much higher than broad, two and one-half times as long as broad; cervical groove deeply impressed, very oblique laterally; branchiocardiac grooves strongly marked, not meeting the cervical groove dorsal but being carried antero-laterally just below it for some distance, posteriorly ending in small, irregular, transverse grooves just before the posterior border of the cephalothorax; areola wide, only a little more than twice as long as broad, sides almost parallel posteriorly; rostrum broad, reaching only to the base of the third segment of the antennular peduncle, one and one-half times as long as broad, carinae poorly developed and in some cases partly obsolete; post-orbital ridges very much reduced; eyes relatively small, slightly greater in diameter than one-half the width of the rostrum at its base; antennule with the inner and outer flagella of equal size; antenna extending to the third segment of the abdomen, scaphocerite very broad anteriorly, ending in a short, sharp spine reaching to the middle of the second segment of the antenna and extending just beyond the rostrum; inter-antennal spine triangular, sharply pointed; exopodite of the third maxilliped long and flagellate; sternal keel narrow, moderately sharp, first two pairs of lateral processes rudimentary, third pair small, posterior pair large and broad, slightly flattened, processes between the fifth periopods small, lateral processes of the sternal keel without conspicuous openings; abdomen slightly wider than cephalothorax; telson rounded, one and one-half times as long as broad, a blunt spine on each lateral margin towards the posterior border; uropods rounded, slightly longer than telson, each ramus with a longitudinal, median carina ending in a small spine towards the posterior margin, outer rami each with a transverse suture along which there are a number of very fine spines; telson and uropods bordered with numerous long setae; lobes at base of uropods rounded; pleural portions of abdominal somites each with a few, long, thin setae; great chelae long and stout, 80 to 85 per cent. of the body length, held so that the dactylus lies vertically above the propodus and not medially to it; propodus two and one-half times as long as broad (lateral view), viewed dorsally at least four times as long as broad, upper margin feebly tuberculate with several irregular rows of tubercles, lower margin smooth. The tubercles extend over the whole of the dorsal and lateral surfaces of the propodus decreasing in size towards the ventral margin. Dactylus one-third as long as propodus, upper margin very feebly tuberculate; cutting edges of propodus and dactylus each with one or two

well-developed tubercles; upper margins of carpus and merus feebly tuberculate; podobranchs without lateral, wing-like expansions, anterior arthrobranchs much larger than the posterior ones. Typically there is only a single pleurobranch, situated on the last thoracic somite, but occasionally in the female there are three, more strongly developed pleurobranchs on the last three thoracic somites. In the female the great chelae are slightly smaller and the abdomen very slightly wider than in the male.

Colour.—Greyish-brown tending to bluish-grey on the great chelae.

Length of holotype male, 24 mm., length of allotype female, 24 mm.

Types.—Holotype male (No. P.11970), allotype female (No. P.11971) and paratypes in the Australian Museum collection. One male paratype in the collection of Melbourne Ward.

Type Locality.—Caloundra, Queensland.

Distribution.—Caloundra (E. F. Riek); Bulimba Creek, Mt. Gravatt, Brisbane (E. F. Riek).

Described from a series of twenty-one specimens ranging in size up to 26 mm. collected from the type locality together with two specimens from Bulimba Creek.

APPENDIX.—Other Australian Species.

This part of the paper deals with a number of new species and with the distribution of the better known forms.

Genus **Euastacus** Clark, 1936.

Euastacus nobilis crassus, nov.

Diagnosis.—Rostrum U-shaped, with a slight median spine, not twice as long as broad; branchiostegites closely tuberculate; abdomen almost devoid of spines except on the lateral margins of most pleura; telson without spines on the dorsal surface.

Description of Adult.—Male carapace equal in length to the abdomen (slightly less in female); areola wide, only twice as long as wide; cephalic region of cephalothorax more than twice as long as areola; carapace punctate, branchiostegites closely tuberculate and sparsely, finely hirsute; rostrum U-shaped, less than twice as long as broad at base, carinae with only a single or else two or three very slight tubercles, median apical spine short and blunt; post-orbital ridge ending anteriorly in a slight tubercle; antennae reaching only to the second segment of the abdomen; abdomen almost smooth, first segment with single pleural spines, second segment with a series (three to five, generally four) of sharp spines along the antero-lateral, pleural margin and a large rounded boss in the middle at the junction of the pleurum with the tergum, third and fourth segments with small, marginal pleural spines, fifth segment with the spine very reduced, sixth segment without a spine; telson and uropods without scattered spines on the dorsal surface but with tufts of setae; great chelae rather short, stout, propodus rather broad and inflated, carpus with a deep sulcus and three sharp spines on the meso-dorsal surface.

Colour.—Dorsal surface reddish-brown, cephalon darker; branchiostegites red; abdomen with anterior half of segments red, posterior darker, tending to black; chelae tipped with blue; joints red; spines not white but reddish; ventral surface red with ends of legs greenish, protopodites and sternal keel paler red, great chelae, below, tipped by deep blue. Young specimens are a much paler red below.

Specimens from Blundells, A.C.T., are of a different colour: Body blue-green; abdominal segments reddish over the anterior half, blue-green behind, blue laterally; claw of great chelae bright blue, underside of chelae white.

Length of holotype male, 115 mm., length of allotype female, 130 mm.

Types.—Holotype male (No. P.11937), allotype female (No. P.11938) and paratypes in the Australian Museum Collection.

Type Locality.—Small stream at Bendora, A.C.T. (12 March, 1949, E. F. Riek).

Distribution.—A.C.T.: Bendora; Blundells, Condor Creek (6 April, 1948, E. F. Riek). N.S.W.: Kosciusko (10 February, 1946, E. F. Riek).

The subspecies is described from a series of fifteen specimens from the type locality, the two largest females bearing young, together with three specimens from Blundells and a large series, with many juveniles, from Kosciusko. This subspecies, though close to the typical form, can be distinguished throughout all growth stages particularly by the more rounded rostrum. The branchiostegites are more tuberculate and the spination of the pleura and telson more reduced. There is a superficial resemblance to *fleckeri* (Watson) of north Queensland, but that species has an even more rounded rostrum and the cephalic portion of the cephalothorax is relatively short and the areola narrower.

Euastacus polysetosus, sp. nov.

Diagnosis.– Rostrum tending to be U-shaped, not twice as long as wide at base; branchiostegites finely hirsute; abdomen with only very small, marginal, pleural spines lacking on the first and sixth somites; telson and uropods with very fine spines on the dorsal surface.

Description of Adult.—Male carapace equal in length to the abdomen (slightly less in the female); areola wide, a little more than twice as long as wide; cephalic region twice as long as areola; carapace finely, closely punctate; branchiostegites finely, closely hirsute and shagreened; rostrum tending to be U-shaped, less than twice as long as wide at base, carinae with from two to four rounded spines similar to the apical spine; post-orbital ridge ending anteriorly in a slight tubercle; antenna reaching only to about the second segment of the abdomen; abdomen almost without spines, finely hirsute, particularly on pleura, first segment without spines, second with three (occasionally only two as in holotype), small, lateral pleural spines, third to fifth with single, even smaller, lateral pleural spines (very reduced in allotype female), sixth without spines; telson and uropods with scattered, very fine spines from which arise tufts of setae; great chelae somewhat inflated in male, carpus with a deep sulcus and three sharp spines on the meso-dorsal surface.

Colour.—Dark greenish to black, lighter in colour below; joints red; under surface of chelae reddish.

Length of holotype male, 105 mm., length of allotype female, 110 mm.

Types.—Holotype male (No. P.11917), allotype female (No. P.11918) and paratypes in the Australian Museum Collection.

Type Locality.—Tubrabucca Creek, Hunter River, Barrington Tops, N.S.W. (7 April, 1949, E. F. Riek).

Described from a series of fourteen specimens from the type locality. The species resembles *hirsutus* (McCulloch) in its lack of spines, even to those of the abdomen where the pleural spines are only well-developed on the second somite. The setae of the body, which are dense but very fine, are thickest on the branchiostegites.

Euastacus armatus (von Martens), 1866.

Specimens, tentatively placed in this species, from the Cotter River, near Canberra, A.C.T., approach *elongatus* Clark in the shape of the chelae, the spines of the rostrum and generally more strongly spinose body, but differ in the length of the antennae and spines of the telson. The normal adult size is only 150 mm. A series of nine specimens collected from the above locality (14 December, 1946, E. F. Riek).

With the new species of *Euastacus* described above there are six species known from New South Wales. In the Murrumbidgee and its smaller tributaries, *armatus* or possibly subspecies of it occur. In the far north coastal area one finds *sulcatus*, a widespread species in the Lamington National Park, south-east Queensland. Adequate collections have not been made in the central coastal area, but in the headwaters of the Manning juvenile specimens of the *sulcatus-spinifer* type occur. In the Hunter River at Barrington Tops is *polysetosus*, allied to *hirsutus* which occurs further south. The species *spinifer* is common in the Hawkesbury-Nepean system. In the Shoalhaven, in addition to *spinifer*, there is the distinct *hirsutus* known only from the headwaters. The species *nobilis* which prefers the smaller headwater streams and soakages is common around Sydney, while further inland at Bendora and Blundells in the Australian Capital Territory and at Kosciusko one has a distinct subspecies *nobilis crassus*.

The species *armatus* and *nobilis* occur also in Victoria with *elongatus* Clark, *yarraensis* (McCoy) and *bispinosus* Clark. There are no other recorded species of the genus in Australia.

Genus **Cherax** Erichson, 1846.

Cherax rotundus setosus, nov.

This subspecies differs from the typical form only slightly, but is characterized by the strong development of long setae on the under surface of the propodus of the chelae (first periopods). Such setae have not been observed on any species of this genus, so it is considered advisable to distinguish this form as a subspecies (of *rotundus*).

Length of holotype male, 80 mm.

Types.—Holotype male (No. P.4739) and one paratype male (No. P.4740) in the Australian Museum Collection.

Type Locality.—Booral, Karuah River, Port Stephens, N.S.W. (10 November, 1911).

There are also two juvenile specimens (P.4675) from a creek near Newcastle (May, 1907, D. G. Stead) in the Australian Museum Collection.

Cherax albidus Clark, 1936.

This species is common in Canberra, A.C.T. (21 December, 1948, 13 September, 1948, E. F. Riek). Females with eggs have been collected in September. Other localities are: Cotter River, A.C.T. (30 December, 1945, E. F. Riek); Laggan, near Crookwell, N.S.W. (12 April, 1946, E. F. Riek).

In a series of specimens of *albidus* from Koppio, near Todd River, 20 miles from Port Lincoln, South Australia, in the Australian Museum Collection, there is one very interesting abnormal specimen (P.4806). This particular specimen is an intersex of body-length 83 mm. which is apparently normal in all structures except in the placing of the genital apertures, which are four in number. It is not uncommon among specimens of the Australian Parastacidae to find intersexes with either three or four genital apertures. When three are present they are almost invariably two male and one female. In only one Australian specimen have I seen one male and two female apertures (in a specimen of *Cherax dispar*). When four are present (two male and two female), the male apertures are placed on the coxopodites of the fifth periopods, while the female apertures are placed similarly on the third periopods (the normal position of the apertures). In this specimen of *albidus*, while the two male apertures are placed normally, the two female apertures are quite abnormal in that they are situated on the fourth periopods, instead of on the third periopods and thus are on the segment next to the male apertures. These female apertures are quite well-developed and in no way distinguishable from normal apertures.

Genus **Engaeus** Erichson, 1846.

Engaeus parvulus, sp. nov.

Diagnosis.—Abdomen considerably shorter than cephalothorax; cervical groove obsolete, branchiocardiac grooves deeply impressed; areola narrow; carapace and abdomen with only scattered hairs; antennule with one flagellum reduced.

Description of Adult Male.—Carapace very finely punctate, branchiostegites smooth; faint transverse rugae between the reduced post-orbital ridges; carapace considerably longer than abdomen, much higher than broad; cervical groove only slightly impressed dorsally but more so laterally; branchiocardiac grooves strongly marked, not continued to the posterior border of the carapace; areola narrow, four times as long as wide, sides almost parallel posteriorly; rostrum short and broad, reaching to the middle of the third segment of the antennular peduncle, one and one-half times as long as broad, carinae poorly developed, generally not continued to the apex; post-orbital ridges very reduced; eye small, slightly greater in diameter than one-half the width of the rostrum at its base; antennule with the inner flagellum quite reduced, one-quarter to one-third (or a little more) the length of the outer flagellum; antenna not reaching to the abdomen; sternal keel broad and flat, posterior lateral processes quite large, processes between the fifth periopods small; lateral processes of the sternal keel without conspicuous openings; abdomen very short and narrow; telson rather pointed behind, one and one-half times as long as broad, with a slight median longitudinal sulcus; outer ramus of uropods rather pointed, inner ramus more rounded, each ramus with a longitudinal median carina turning to a sulcus before the hind border, outer ramus with an irregular transverse suture at the junction of the middle and apical thirds; lobes at base of uropods rounded; great chelae long and stout, slightly longer than the body, held so that the dactylus lies vertically above the propodus; propodus in lateral view only twice as long as broad, upper margin with five or six small sharp spines, lower margin with four or five denticles; dactylus slightly less than half the propodus, with one or two enlarged teeth on the cutting edge; carpus with three to five sharp spines; merus with two or three spines on the upper surface and several on the lower.

Description of Adult Female.—Similar to the male but abdomen considerably broader and relatively a little longer, the chelae of more even size, one not noticeably enlarged and not quite as long as the body.

Colour.—Bright red with slight darkening, in some specimens, of the branchiostegites and abdominal pleura.

Length of holotype male, 43 mm., length of allotype female, 47 mm.

Types.—Holotype male (No. P.11973), allotype female (No. P.11974) and paratypes in the Australian Museum Collection.

Type Locality.—Blundells, Condor Creek, A.C.T. (31 March, 1948, E. F. Riek).

Described from a series of more than fifty specimens, though most of them are juvenile. This is the first species to be recorded from north of the Victorian border but the genus is widespread in Victoria and Tasmania.

Genus **Parastacoides** Clark, 1936.

Parastacoides setosimerus, sp. nov.

Diagnosis.—Lateral spine of the telson at the apical fifth, apex evenly rounded; merus with a distinct spine on the upper surface towards the apex; carpus with distinct tubercles (three or more) on the meso-dorsal margin, anterior one largest; areola relatively narrow, twice as long as wide; spine on median longitudinal carina of inner rami of uropods almost at posterior margin, posterior border devoid of spines, outer rami with only one distinct longitudinal carina, continued across the suture only to the middle of the posterior portion and ending without spine, the outer carina distinct only over the basal quarter of the ramus.

Description of Adult.—Carapace very finely punctate, branchiostegites finely tuberculate; carapace not quite as long as abdomen (distinctly less in female), a little higher than broad; cervical and branchiocardiac grooves deeply impressed; areola relatively narrow, twice as long as wide; rostrum almost twice as long as wide at base, pointed, tapering more rapidly at apex; post-orbital ridges short and narrow, but sharp; eyes small, diameter slightly less than one-half the width of the rostrum at its base; antennule with the inner flagellum slightly shorter than outer; antenna not reaching to the telson; sternal keel blunt, wide and flat between the third and fourth periopods, lateral processes of the fourth periopods strongly angled so that there is a distinct groove between them; processes between the fifth periopods very small, close together; abdomen not quite as wide as cephalothorax (distinctly wider in the female); telson with apex evenly rounded, the lateral spine at the apical fifth, somewhat longer than wide; spine on median longitudinal carina of inner rami of uropods almost at the posterior margin, posterior border devoid of spines, outer rami with only one distinct longitudinal carina, continued across the suture only to the middle of the posterior portion and ending without spine, the outer carina distinct only over the basal quarter of the ramus; telson and uropods finely hirsute; great chelae evenly tuberculate, more so above on propodus and dactylus, carpus above with a slight sulcus, with distinct tubercles (three or more) on the meso-dorsal margin, the anterior one largest; merus with a distinct spine on the upper surface towards apex.

Colour.—Greenish with a reddish tinge; basal segments of all legs and third maxillipeds reddish, not so obvious on the posterior pair, basipodites bluish-grey, anterior cephalothorax and chelae somewhat lighter than the rest of the dorsal surface; joints whitish-grey.

Length of holotype male, 58 mm., length of allotype female, 70 mm.

Types.—Holotype male (No. P.11976), allotype female (No. P.11977) and paratypes in the Australian Museum Collection.

Type Locality.—Mt. Rufus, 4,000 feet, Tasmania (25 January, 1949, E. F. Riek).

Distribution.—Mt. Rufus and Lake St. Clair, Tasmania.

Described from a series of twenty-one specimens. The species approaches *tasmanicus* (Erichson) but differs at least in the structure of the telson and uropods.

Parastacoides leptomerus, sp. nov.

Diagnosis.—Lateral spine of the telson at the apical quarter, apex acutely rounded; merus with a minute spine on the upper surface towards apex; carpus with irregular small tubercles on the meso-dorsal margin, but no pronounced anterior tubercle; areola relatively broad, less than twice as long as wide; spine on the median longitudinal carina of the inner rami of the uropods well before the posterior border, posterior border devoid of spines; outer rami with a single long carina continued across the suture only to the middle of the posterior portion and ending without spine.

Description of Adult.—Carapace very finely punctate, branchiostegites very finely tuberculate; carapace a little shorter than abdomen, distinctly so in female, a little higher than broad; cervical grooves deeply impressed, branchiocardiac grooves less so; areola relatively broad, less than twice as long as wide; rostrum not twice as long as broad at base, evenly tapered to sharp apex, carinae sharp; post-orbital ridges rather long, sharp, each ending posteriorly in a distinct boss; eyes small, diameter slightly less than one-half the width of the rostrum at its base; antennule with the inner flagellum slightly shorter than the outer; antenna not reaching to the telson; sternal keel relatively sharp but rounded between the third and fourth periopods, lateral processes of the fourth periopods large, flattened, only a shallow groove between them, processes between the fifth periopods small, sharp; abdomen not quite as wide as cephalothorax (a little wider in the female); telson with apex acutely rounded, distinctly

longer than wide, the lateral spine at the apical quarter; a faint, median longitudinal sulcus over the apical three-quarters; spine on median longitudinal carina of inner rami of uropods well before the posterior border, posterior border devoid of spines, outer rami with a single longitudinal carina continued across the suture only to the middle of the posterior portion and ending without a spine; telson and uropods finely hirsute; great chelae evenly tuberculate, more so above on propodus and dactylus, carpus above with a slight sulcus, with irregular small tubercles on the meso-dorsal margin but no pronounced anterior tubercle; merus with only a minute spine on the upper surface towards apex.

Colour.—Greenish with a reddish tinge; basal segments of all legs and of third maxillipeds reddish, not so obvious on posterior pair; lower surface of chelae greenish-grey, tips pale reddish; joints whitish-grey.

Length of holotype female, 53 mm., length of allotype male, 40 mm.

Types.—Holotype female (No. P.11979), allotype male (No. P.11980) and paratypes in the Australian Museum Collection.

Type Locality.—Lake Lilla and outlet stream, Cradle Mt., Tasmania (1 February, 1949, E. F. Riek).

Described from a series of seven specimens. The species differs from *setosimerus* in the structure of the telson and uropods, the areola and of the great chelae.

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STUDIES IN ICHTHYOLOGY.
No. 15.*

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(Figures 1–14.)

Family GEOTRIIDAE.

Genus **Mordacia** Gray, 1851.

Mordacia mordax (Richardson, 1846.)

Mordacia mordax (Richardson) Whitley, Austr. Zool. vii, 1932, p. 262, pl. xiii, figures 9 and 10 and text-figures a (3 and 4).

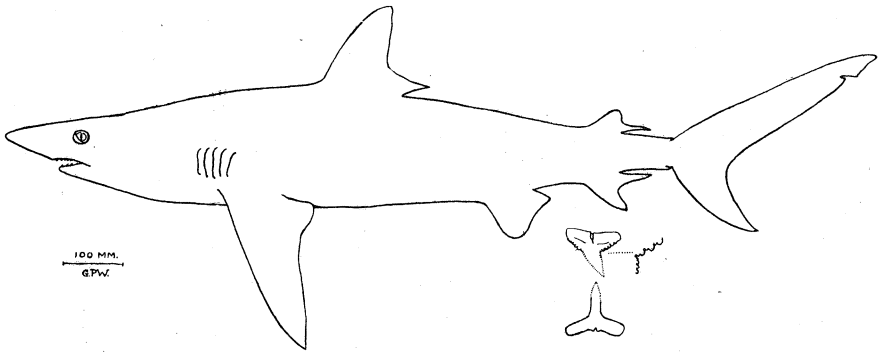
Add to synonymy: *Petromyzon tasmaniensis* Lauterer (Australien and Tasmanien, 1900, p. 252), a hitherto overlooked name.

Family GALEIDAE.

Genus **Galeolamna** Owen, 1853.

Galeolamna tufiensis Whitley, 1949.

(Figure 1.)



Whaler Shark, *Galeolamna tufiensis* Whitley.
Holotype from Tufi, Papua. G.P.W. del.

Galeolamna tufiensis Whitley, Proc. Roy. Zool. Soc. N.S. Wales 1947–8 (Jan., 1949) p. 24, Tufi (type) and Port Moresby.

Head normal, predorsal profile not gibbous. Eyes rather large, subcircular, with nictitating membrane; pupil a vertical slit. Interorbital flat, slightly convex. Snout broadly rounded. Head 3 7 in total length. Preoral length less than width of mouth. No spiracle. Dental formula: $\frac{10\ ?.\ \ 1.\ \ 11}{13.\ \ \ 1.\ \ 12}$ = c. $\frac{22.}{26}$ Teeth of upper jaw deflected; deeply notched on outer margin, shallowly on inner; strongly serrated on shoulders and serrated on cusps; generally broader than high. Teeth of lower jaw erect, entire, rather peg-shaped, higher than broad. A small symphysial tooth in each jaw; teeth on either side of the symphysial ones slightly smaller than other lateral ones. Nostrils nearer mouth than end of snout and nearer eye than end of snout. No nasal cirrhus. Labial folds very short. Endolymphatic openings inconspicuous. Last two gill-slits over pectoral.

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* For No. 14, see RECORDS OF THE AUSTRALIAN MUSEUM, Vol. xxii, no. 3, 27 January, 1950, p. 234.

Build heavy anteriorly and tapering posteriorly. Lateral line without flexure. No interdorsal ridge. Caudal peduncle rounded in transverse section with lunate pit above and below. Pit organs inconspicuous. No umbilical scar. Shagreen; denticles imbricate, each with several carinae.

Referring to the symbols listed in *Proc. Linn. Soc. N. S. Wales* (Whitley, 1943), the dimensions in mm. are as follow :—

Specimen.	A. Female Holotype.	B. Male Paratype.	C. Male Paratype.	D. Female Paratype.	E. Male Paratype.
H.1	320	144	143	143	500
2	392	172	170	166	630
3	123	54	63	64	207
4	171	75	71	72	330
5	385	170	165	163	c545
6	795	355	315	345	c1.340
7	28	16	17	17	22
8	24	15	15	17	25
9	168	74	72	76	308
10	—	—	—	— (no spiracle)	—
11	21	11	11	10	34
12	99	45	43	43	165
13	104	59	56	56	153
14	143	62	60	60	270
15	8	4	2	2·5	10
16	9	5	3	2·5	10
17	48	23	20	20	99
18	43	23	16	18	96
B.1	1,101	522	485	495	1,890
2	850	365	350	360	1,430 ?
3	535	235	210	219	813
4	220	103	93	92	330 ?
5	c200	80	80	64	260 ?
6	49	27	24	26	99
7	49	25	22	24	101
8	—	14	14	—	185
9	—	18	14	—	260
F.1	178	97	95	94	390
2	139	63	62	64	300
3	57	28	30	29	110
4	320	164	138	139	560
5	65	31	32	31	145
6	56	26	27	26	130
7	58	26	28	25	82
8	95	53	41	48	185
9	90	38	38	36	160
10	64	28	29	30	120
11	54	26	25	26	80
12	82	49	39	45	130
13	—	—	—	—	—
14	296	123	120	119	510
15	83	36	33	34	205 ?
16	465	195	160	190	780
17	82	36	32	36	172
18	92	30	32	30	190
19	50	20	19	18	92
20	200	98	85	86	360
21	380	216	188	200	655
22	199	105	96	98	330

Additional measurements are : Total length, 1,481 mm. or about 4 ft. 10 in. overall. Second to fourth gill-slits subequal, about 54 mm. Eye to first gill-opening, 179 mm. Tip of snout to outer angle of nostril, 81 mm.; inner angle of nostril to mouth, 66 mm. Middle of vent to end of tail, 670 mm., and thus in posterior half of shark.

Fins as usual in Galeidae. First dorsal origin nearer pectoral (230 mm.) than ventrals (340 mm.). Second dorsal fin rather large, but smaller than anal. Origin of second dorsal slightly behind that of anal, and the end of its base slightly before that of anal (but in paratypes B and C, the origins and ends are about opposite). Pectoral angle reaching below first dorsal origin. Upper caudal lobe shorter than the head, the lower somewhat pointed.

Liver dark, weight 6 oz. Stomach contents too digested for identification, apparently some finely chopped seaweed. Spiral valve of the scroll type. Uteri flaccid; no embryos, so evidently had bred.

Colour, grey above, white below, the junction between the two on level of lowest part of eye and gradated along body. Fins dark grey above. Pupil dark blue with

slight brassy ring and a smoky and brassy iris surrounded by grey rings. Nictitating membrane grey.

Described and figured from the holotype, a spent female, 1,481 mm. or 4 ft. 10 in. long and weighing 40 lb. 4oz. Austr. Mus. regd. no. IB.2334.

Locality : Off Tufi Harbour, North-eastern Division of Papua; hooked on long line, 1 October, 1948. M.V. " Fairwind " Fisheries Survey.

Variation.—The larger of two male paratypes (specimen B), with same data, is much smaller than the female holotype but agrees with it in most characters. However, the snout is more gothic-arched from the ventral aspect, there is a small pointed nasal lobe, the head goes 4·29 in total length and there is an umbilical scar, so it is probably a first-year immature shark. Total length, 738 mm. Weight, 4 lb. 3 oz. Liver weight, 7 oz. Stomach empty. Median rostral cartilage bifurcate ventro-anteriorly.

The smaller of the two male paratypes with same data as holotype (specimen C), is 673 mm. long. Weight, 3 lb. 3 oz. Head nearly 4 in total length. Very like specimen B but has almost lost the umbilical scar. Stomach empty. Liver whitish, weight 3 oz.

A small female paratype (specimen D), was actually caught on a line trolled at 4 to 4½ knots with garfish bait outside Feiaba Bay, near Tufi, Papua, on 4 October, 1948. Total length, 695 mm. Weight, 3 lb. 8 oz. Head 4·18 in total length. Dental formula $\frac{12.\ 1.\ 13}{13.\ 1.\ 13} = \frac{26.}{27}$ Umbilical scar present. Liver weight, 5 oz. Epigonal organ developed. Uteri mere strips. For heterogonic variation, see table of dimensions above.

An adult male paratype (specimen E), was caught on a meat bait at Port Moresby, Papua, on 5 November, 1948. It was 2,545 mm. or about 8 ft. 8 in. long. General characters as in Tufi specimens. Head 4 in total length, predorsal profile slightly gibbous; pupil lenticular; interorbital convex; endolymphatic openings well separated, 275 mm. from snout; nictitating membrane white; pit organs conspicuous. Dental formula $\frac{13.\ 1.\ 13}{10.\ 1.\ 13} = \frac{27.}{24}$ Origin and end of anal base behind levels of those of second dorsal. Upper caudal lobe longer than head. No interdorsal ridge. No umbilical scar. Claspers well developed. Liver weight, 35 lb., light-brown and in good condition. Stomach contained a pink, soft oily substance. Testes festooned all along coelome. Vesiculae seminales spent. Spiral valve of scroll type. Skin about 5 mm. thick; flesh tough and red at periphery. Eye to first gill-opening, 310 mm.; tip of snout to outer angle of nostril, 100 mm.; inner angle of nostril to mouth, 91 mm.; ramal length, 190 mm.

On 7 July, 1948, a " White Shark " was caught at Port Moresby but was not preserved. It was a female, doubtless of this species. Length, 9 ft. 2 in. Contained about a dozen embryos, 23 inches long, with yolk-sacs 2 inches in diameter. Liver very oily, weighed 42 lb. (Mr. A. M. Rapson, MS.).

This new species, which may be called the Tufi Whaler Shark, is distinguished from others in the genus mainly by its dentition (up to 27 teeth across jaw) and absence of an interdorsal ridge. The flesh is white and free from blood-streaks in small specimens and the species should be a potential food-fish.

Family RHENOPTERIDAE.

Genus **Rhenoptera** Van Hasselt, 1823.

Rhenoptera neglecta Ogilby.

Rhinoptera polyodon (*?*) Krefft, Industr. Progress N. S. Wales, 1871, p. 778. Australian coast (listed only). Not of Gunther.

Rhinoptera javanica De Vis, Proc. Roy. Soc. Qld. ii, 1886, p. 12. Moreton Bay, Queensland. Not of Muller and Henle.

Rhinoptera neglecta Ogilby, Mem. Qld. Mus. i, 27 Nov., 1912, p. 32, and of authors. Moreton Bay, Queensland. *Id.*, Whitley, Fish Austr., i, 1940, pp. 221 and 225, figs. 251 and 258.

Rhenoptera sp., Whitley, Austr. Zool. xi, 1945, p. 40. Carnarvon, W. Austr.

Three selected male specimens of this species were presented by Mr. Athel D'Ombrain who obtained them off Stockton near Newcastle, in April and May, 1949, and May, 1950. (Austr. Mus. regd. nos. IB. 2339, 2512 and 2513.) New Record for New South Wales.

Total length	990 mm.	1,060 mm.	1,130 mm.
Width of disc	890 mm.	880 mm.	936 mm.
Length of tail	460 mm.	510 mm.	580 mm.
Interorbital	120 mm.	142 mm.	151 mm.
Width of mouth	93 mm.	94 mm.	97 mm.
Preoral length	94 mm.	90 mm.	95 mm.
Internarial	75 mm.	75 mm.	74 mm.
Weight	24½ lb.	36 lb	30 lb.
Liver weight	—	3½ lb.	4 lb. 5 oz.

Skin smooth. Six or seven rows of teeth. 39 to 56 papillae along upper lip.

Family OPHICHTHYIDAE.

Genus **Malvoliophis** Whitley, 1934.

Cyclophichthys, subgen. nov.

Orthotype, *Ophichthus cyclorhinus* Fraser-Brunner, Ann. Mag. Nat. Hist., (10) xiii, 1934, p. 466, figs. 1*a–c*. Low Isles, Qld. = *M.* (*C.*) *cyclorhinus*.

A Snake Eel with pectoral fins present, gill-openings lateral, well separated, and snout short. Dorsal commencing before pectorals, instead of behind as in *Ophichthus*. Anterior nostrils cup-shaped; no fringe along upper lip. Anal fin ending just before tail-tip. Teeth conic, some on vomer. Crossbands on head and body.

Similar to *Malvoliophis* (*pinguis*), but that genotype has a perforated cone or tube for each anterior nostril and has the head spotted.

Family MURAENIDAE.

Lycodontis rhodocephalus (Bleeker, 1865.)

Gymnothorax rhodocephalus Bleeker, Ned. Tijidschr. Dierk., ii, 1865, pp. 50, 134 and 292. Amboina.

Two Queensland specimens (from Lindeman and High Islands) are in The Australian Museum. New record for Australia.

Family SYNGNATHIDAE.

Genus **Leptonotus** Kaup, 1853.

Kaupus, subgen. nov.

Orthotype, *Leptonotus costatus* Waite and Hale, Rec. South Austr. Mus., i, 1921, p. 301, fig. 43. South Australia.

Differs from the type of the genus (*Syngnathus blainvilleanus* Eydoux and Gervais, 1837) in having shorter snout and a ridge on the operculum anteriorly. It also apparently matures at about half the size of the more typical species of the genus.

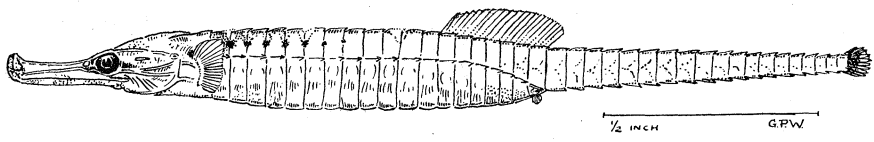
Genus **Choeroichthys.**

Choeroichthys suillus, sp. nov.

(Figure 2.)

D.21. A.5. P.18. C.10. Rings 18 plus 20. Subdorsal rings 5 plus 1. Brood-rings, 14, thoracic.

Eyes and nostrils projecting. Two complete opercular keels each side. No keels on shields between the body- or tail-ridges. Sculpture of shields striate, not reticulate. Spines on rings not serrate.



Pipefish, *Choeroichthys suillus* Whitley.
Holotype from Port Denison, Queensland. G.P.W. del.

Colour brown. Light and dark pattern on snout, chin and throat. Dark-brown bar through eye. A row of reddish spots along upper sides anteriorly. Three pairs of light blotches across back. Brood-pouch with dark scalloping over the light margin. Anterior two-thirds of caudal fin dusky-brown, posterior third yellowish. Other fins light yellowish.

Length, 2 inches. Port Denison, Queensland. Holotype, Austr. Mus. regd. no. IA.1806.

Differs from other species (see Weber and Beaufort, 1922, p. 60) in ring-counts and in lacking keels on rings between ridges.

Family HEMIRAMPHIDAE.

Genus **Reporhamphus** Whitley, 1931.

Reporhamphus caudalis, sp. nov.

Two small garfishes bore the manuscript name *Hemirhamphus caudalis* in The Australian Museum, probably having been so labelled by De Vis or Saville-Kent.

D. 16. A. 15.

Length of pectoral, 13 mm. Head (without beak), 21 mm. Preorbital, nearly 4 mm. Eye, 6 mm. Upper jaw about twice as wide as long.

Tricuspid teeth in up to four rows. Nostril openings large, without long barbel. Beak about one-sixth of total length. Dorsal originating before anal. Base of ventrals midway between root of tail and front part of operculum. Body rather compressed. Scales deciduous. Lower caudal lobe long, like that of a flying fish.

Colour in alcohol greyish to silvery. A silver patch around vent and stripe along side.

Length, $5\frac{1}{4}$ inches. Austr. Mus. regd. no. I.444 (holotype, larger, and paratype).

Cape York, Queensland.

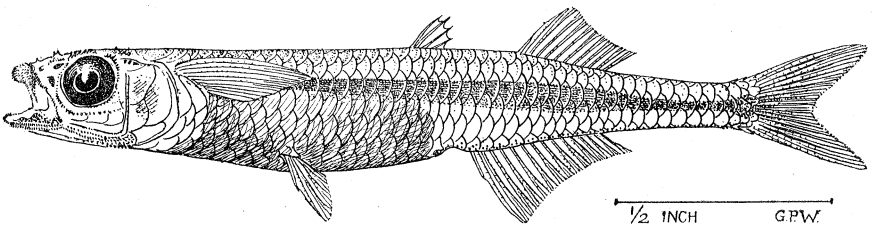
Family ATHERINIDAE.

Genus **Atherion** Jordan & Starks, 1901.

Atherion Jordan and Starks, Proc. U.S. Nat. Mus., xxiv, 4 Oct., 1901, pp. 199 and 203. Haplotype, *A. elymus* Jordan and Starks from Misaki, Japan.

Atherion maccullochi Jordan & Hubbs.

(Figure 3.)



Hardyhead, *Atherion maccullochi* Jordan and Hubbs.
A specimen from Low Isles, Queensland G.P.W. del.

? Atherina villosa Duncker and Mohr, Mitt. Zool. Mus. Hamburg, xlii, 1926, p. 135, fig. 10. New Pomerania and New Guinea.

Atherion maccullochi Jordan and Hubbs, Stud. Ichth. Monogr. Silversides (Stanford Univ.), 18 Dec., 1919, p. 30. Lord Howe Island. Types in Stanford Univ. *Id.*, Whitley, Sci. Rept. Gt. Barr. Reef Exped., iv, 9, 1932, p. 278 (Low Isles, Queensland). Here figured from one of the Queensland specimens recorded by me in 1932.

Genus **Atherinason** Whitley, 1934.

Atherinason Whitley, Vict. Nat., 50, 1934, p. 242. Orthotype, *Atherina dannevigi* McCulloch. *Id.*, Schultz, Proc. U.S. Nat. Mus., 98, 1948, p. 19.

Atherinason dannevigi verae, subsp. nov.

This is a hitherto unnamed northern form with D. viii/i, 12 and fewer lateral scales (sixty-three to seventy) than the Tasmanian type. Types (regd. no. IA.3247) in Australian Museum, from Port Jackson, New South Wales.

Family MUGILIDAE.

Mugil catalarum, sp. nov.

D. iv/i, 9; A.iii, 8,; P.i, 16; Sc.39 to hypural. Tr.16 below first dorsal to 9 on caud. ped. Predorsal sc.*c.* 22.

Head (37 mm.) 3·7, depth (41 mm.) 3·3 in standard length (138 mm.) or 4·2 in total length (175 mm.). Snout, measured obliquely, 9·5 mm.; eye, 10 mm.; interorbital, 17 mm.; postorbital, 19 mm.; pectoral, 26 mm.; depth of caudal peduncle, 15 mm.; axillary pectoral scale, 8·5 mm. Nostrils nearly 3 mm. apart.

Adipose eyelids well developed, partly overlapping pupil. Snout shorter than eye. Interorbital convex. Scales extend well forward on snout. Nostrils not widely separated, the distance between them equals rear end of preorbital which is denticulated. Maxillary exposed, reaching beyond free edge of preorbital and below front of eye. Upper lip terminal, slightly thickened; lower lip thin. Both lips with a row of simple teeth along edges. No palatal teeth. Lower jaw with symphysial crest.

Rostro-dorsal profile convex. Back not keeled. Scales cycloid with narrow membranous edges over which circuli extend; about 9 radii. Origin of first dorsal nearer caudal base than end of snout; origin of second dorsal about level of twenty-fifth scale;

second dorsal origin and end behind levels of those of anal; both these fins scaly anteriorly. First dorsal, pectorals and probably ventrals with axillary scales. Pectoral base level with eye, the fin much shorter than head and not reaching level of first dorsal, only extending to ninth or tenth body-scale. Ventrals more than half head. Caudal forked.

Colour in formalin greyish above, golden to yellowish on sides and white below. Scales each with a median dusky streak (above) or spot (below). Adipose eyelids pale yellowish; gold area on operculum. Fins mostly white with grey infuscations. A blue blotch over pectoral base. Eye bluish. Some yellow at anal and ventral bases and encircling vent.

Described from the holotype, a specimen 138 mm. in standard length or 175 mm. (nearly 7 inches) overall. Austr. Mus. regd. No. IB.2242.

Loc.—La Foa, River Bogny, west coast of New Caledonia; July ,1948. Dr. Réné A. Catala. Named in honour of Dr. and Madame Catala to whose collecting The Australian Museum is indebted for many interesting New Caledonian Fishes.

This species is near the "Frog-mouth Mullet" (*Mugil* sp.) figured from Kapakapa, Papua (Whitley, 1949, p. 342), but the mouth-opening is more acutely angled, snout shorter than eye, body deeper and the scales have narrow membranous edges.

The Papuan mullet is near *Mugil cephalus* Linné, 1758, and of authors, but differs from Cuvier and Valenciennes' plate 307 in having nostrils closer together and below upper level of orbit and in proportions (notably the broad interorbital); it also has most fins scaly. From *M. dobula* Gunther, 1861, it is distinguished by the obtuse (instead of acute) angle of the mouth-opening, has chin-space broader, fewer predorsal scales, etc. This Papuan variety may be described as follows :—

D.iv/i, 8; A.iii, 8; P.2, 14. Sc. 40 to hypural. Tr. 15 below first dorsal to 9 on caudal peduncle. Predorsal sc. 21.

Head (99 mm.) 3·7, depth (85 mm.) 4·4 in standard length (375 mm.) or 5·4 in total length. Snout (measured obliquely), 29 mm.; eye, 21 mm.; interorbital, 54 mm.; postorbital, 62 mm.; pectoral, 64 mm.; depth of caudal peduncle, 35 mm.

Adipose eyelids well developed, partly covering pupil. Maxillary not concealed. Snout longer than eye. Anterior nostril pore-like, posterior small, lunate, 10 mm. away. Interorbital convex. Preorbital serrae minute. Upper lip terminal, not particularly thick, protractile. Lower jaw with symphysial crest. Bands of fine "teeth" (cilia) in jaws and on palate. Cleft of mouth extending nearly to below eye. Chin-space wide. A broad opercular flap formed by the branchiostegal membrane.

Rostro-dorsal profile gently convex. Scales cycloid with broad membranous edges (or cilia may extend to edge) and few closely-bunched radii. Origin of first dorsal fin slightly nearer snout than root of caudal. Second dorsal, anal, pectoral and caudal fins scaly. Anal origin slightly before level of soft dorsal origin which is above the twenty-third or twenty-fourth lateral scale. Pectoral much shorter than head, reaching ninth body-scale, not reaching below first dorsal. Axillary scales present at first dorsal, pectorals and ventrals, that of pectoral (25 mm.) 2·5 in that fin; that of ventral about half that fin.

Colours in formalin greyish above, white below. Dark streaks along middle of lateral scales form stripes along body. Eye bluish with pale yellowish adipose membranes. A blue mark over pectoral base. Fins mostly dark grey. Pectoral and anal with whitish margins, ventrals white. Upper lip and maxillary grey.

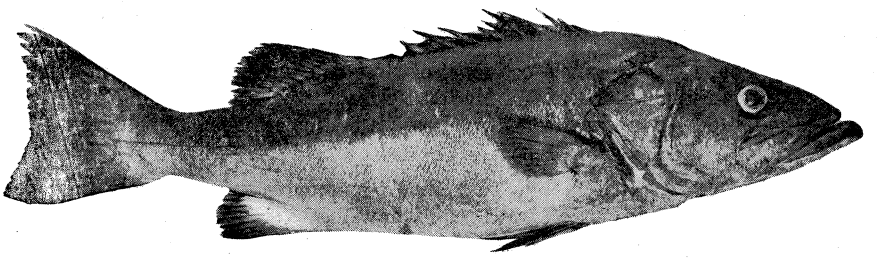
Described from a specimen, 440 mm. in length to caudal fork, or a little over 18 inches (460 mm.) overall; weight, 1 lb. 15 oz. This was figured in "Australian Museum Magazine" (Whitley, 1949, p. 342).

Loc.—Kapakapa, Papua; seine net haul in creek at village; 11 October, 1948. M.V. " Fairwind " Fisheries Survey. Field No. C.53. Another specimen, L.C.F. 24 cm. Same data. No. C.52.

Does not agree with any species in Weber and de Beaufort's " The Fishes of the Indo-Australian Archipelago", whose key-characters distinguish it.

Family EPINEPHELIDAE.

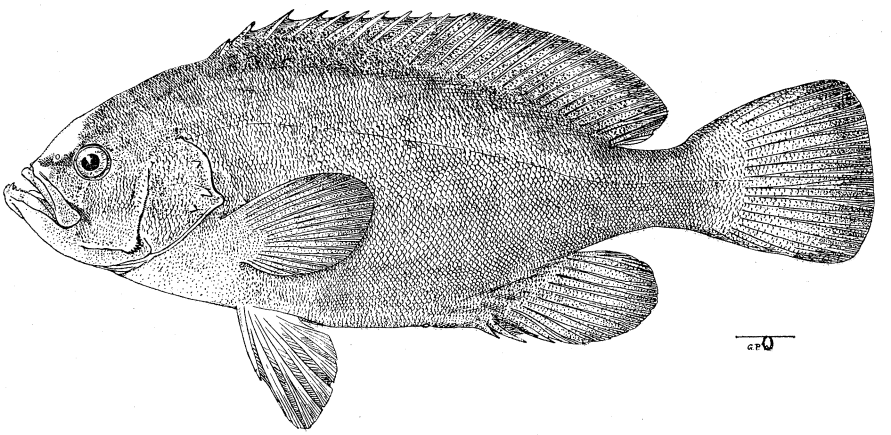
Polyprionum oxygeneios (Bloch & Schneider, 1801.)
(Figure 4.)



Hapuku, *Polyprionum oxygeneois* (Bloch and Schneider).
A specimen from Port Augusta, South Australia. South Austr. Museum photo.

The " Groper " or Hapuku of New Zealand is an important food fish which is occasionally caught in Australian waters. A 53-lb. specimen was recorded from the Hippolyte Rocks, Tasmania, by Saville-Kent in 1886. The F.I.V. " Endeavour " trawled specimens in the Great Australian Bight, between 100 and 200 fathoms, in Western Australia in March, 1912, and off the continental shelf of eastern Bass Strait, the latter constituting a new record for Victoria. The Hapuku may also be added to the South Australian fauna as a 3-foot specimen weighing 22 lb. was caught in Port Augusta in September, 1948, and was kindly sent to Sydney for my inspection by the Director of the South Australian Museum (Mr. H. M. Hale); this is the specimen figured here.

Altiserranus woorei, sp. nov.
(Figure 5.)



Rock Cod, *Altiserranus woorei* Whitley.
Holotype from off Laurieton, New South Wales. G.P.W. del.

A uniformly coloured rock cod with the compressed habit of *Alphestes*, *Aethaloperca*, *Altiserranus* and *Aulacocephalus*, but with 19 dorsal rays, an extraordinarily high number in the family, and diagnostic for the species.

D.xi, 19; A.iii, 10; V.i, 5.

Three opercular spines, upper one further removed from middle one than the latter is from the lowermost. Mouth reaching half-way below eye. Maxillary scaly, without distinct supplemental bone. Villiform teeth on vomer, palatines and jaws, slightly enlarged near symphyses, particularly two short blunt canines in lower jaw. Inner teeth depressible. Mandibular teeth uniserial. Both nostrils rounded.

Form compressed. Scales very small, ctenoid, those of l.lat. with simple tube. Third anal spine longest. Caudal truncate, other fins rounded.

Colour fairly uniform brownish-grey, not much lighter below, and darkest towards ends of fins. Eye dull blue with yellow ring and brown iris. Inside of mouth greyish-white. Interorbital grey, gelatinous.

Described from the holotype, a gutted specimen 14½ inches from snout to middle caudal rays. Austr. Mus. regd. no. IB.2489.

Loc.—Off Laurieton, New South Wales, late March, 1950.

Named after Mr. J. C. Woore, who has supplied The Australian Museum with rarities from the Sydney Fish Markets over many years, in appreciation of his services.

Family TERAPONTIDAE.

Genus **Leiopotherapon** Fowler, 1931.

Archerichthys, subgen. nov.

Orthotype, *Archeria jamesonoides* Nichols, 1949.

New name to replace *Archeria* Nichols (Nichols, 1949, p. 5) which is preoccupied by *Archeria* Case (Case, 1915, p. 170), a genus of reptiles. *A. jamesonoides* Nichols, although differing slightly in formulae, is evidently synonymous with my *Leiopotherapon suavis* (Whitley, 1948) from the same river system in northern Queensland. An illustration (Figure 6) of the holotype of *Leiopotherapon* (*Archerichthys*) *suavis* is here supplied.

Scortum ogilbyi, sp. nov.

The following description of a species near *S. hillii* (Castelnau, 1878), about 9 inches long, from the Norman River, Queensland, was originally prepared by the late James Douglas Ogilby, after whom it is now named. It was not separated from *hillii* in Ogilby and McCulloch's "Revision of the Australian Therapons" (Ogilby and McCulloch, 1916, p. 121, Norman River specimens only).

Jaws with a broad band of villiform teeth, and an outer series of close-set, recurved, movable teeth; a small patch of minute teeth on the vomer and an elongate triangular band of similar teeth along each palatine; pterygoids and tongue smooth. Preorbital and preoperculum both coarsely serrated. D.xiii, 12; A.iii, 8 to 10; P.16 to 17. Gill-rakers of moderate length, slender and numerous (8 + 16 to 11 + 24). As for *hillii*, the other differences between the Norman River fish and Castelnau's description are: His "back straight," ours ordinarily convex; his depth 3 in length (s.c.), ours 2·66; his eye 4·5 in head, ours 3·85 to 4; his l.lat. 61, ours 50 with sc. 73 to 75, and tr. 15 to 17/1/28 to 31; his caudal forked, ours probably subtruncate; his second anal spine as long as but stronger than the third, ours with second spine enormously enlarged, and one-fifth longer than third.

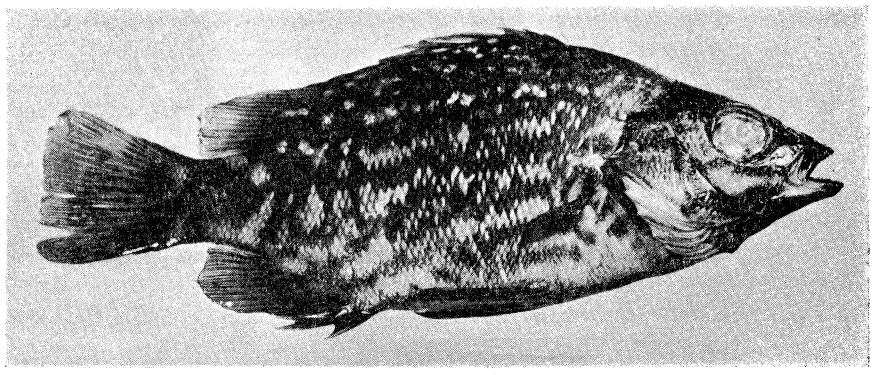


Fig. 6. — Grunter, *Leiopotherapon* (*Archerichthys*) *suavis* Whitley
Holotype from Coen district, Queensland. H. Hughes photo.

Family AMTHIDAE

Anthias pulchellus caesiopercula, subsp. nov.

The typical *Anthias pulchellus* Waite, 1899, from deep water off New South Wales and Victoria, has D.x, 16 to 17; A.iii, 8; P. 15–16; l.lat. 41 to 45 and tr. about 5/1/13. From southern Queensland comes a new subspecies which I name *caesiopercula*. It was trawled by the F.I.V. "Endeavour," 5¼ miles N.E. of Cape Moreton in 50 fathoms, 5 September, 1910, and approaches the genus *Caesioperca* in its formulae which are: D.x, 18–21; A.iii, 7–8; P.14 (rarely 15); l.lat. 42–45 and tr. 6 to 8/1/16 to 18. The holotype (no. E.2878) and thirteen paratypes are unspotted, yellowish-brown in preservative with blue eyes, and range from 4 to 5 inches in length.

Lepidoperca occidentalis, sp. nov.

D.x, 15; A.iii, 7; P.15; C.15; l.lat. 43. Depth (30 mm.) 3·1, head (36 mm.) 2·6 in standard length (95 mm.). Snout about half eye (13 mm.) which is nearly 2·8 in head. Interorbital (9 mm.) 4·3 in head. Preorbital scaly. Maxillary barely reaching middle of eye, its width more than pupil. More than 23 gill-rakers. Second anal spine less than half head. Caudal emarginate, upper lobe longer. Colour in preservative pale-brown with blue eyes. In some there is a black blotch at tips of soft dorsal and anal fins.

Described from the holotype, the larger of two (no. E.2493) trawled by the F.I.V. "Endeavour" in Western Australia (between Cape Naturaliste and Geraldton in 20 to 100 fathoms). A paratype (Austr. Mus. regd. no. I.12494) with same data and another (I.12400) taken 80 miles west of the meridian of Eucla, Western Australia, 80 to 120 fathoms, March, 1912.

Reaches 4¾ inches in length. Differs in proportions, more concave caudal, more gill-rakers, and fewer fin-rays, etc., from its congeners: *L. coatsii* (Regan, 1913) from Gough Island; *L. inornata* Regan, 1914, from New Zealand; and *L. tasmanica* Norman, 1937, from Tasmania.

Family ACINACEIDAE.

Genus **Acinacea** Bory de St. Vincent.

Acinacea Bory de St. Vincent, Voy. iles Afriq., i, 1804, p. 93 (*fide* Sherborn) and Dict. Class. Hist. Nat., i, 1822, p. 93, pl. cv. Haplotype, *A. notha* Bory, 1804, from tropical Atlantic Ocean.

Gempylus Cuvier, Règne Anim. ed. 2, ii, April, 1829, p. 200. Haplotype, *G. serpens* Cuvier. Variants : *Gempris* Voigt, 1832 and *Gemphylus* Swainson, 1839.

Lemnisoma Lesson, Voy. Coquille, Zool. ii, 1, 1830, p. 160. Haplotype, *L. thyrsitoides* Less. from Paumotus.

Acinaces Agassiz, Nomencl. Zool. 1846, Index Univ. Emend. of *Acinacea*, not *Acinaces* Gerstacker, 1858, in Coleoptera.

Lemniscosoma Agassiz, Nomencl. Zool. 1846, Index Univ. Emend. for *Lemnisoma*.

Lucoscombrus Van der Hoeven, Handb. Dierkunde, Amsterdam, ii, 1855, p. 367 (*fide* Neave); Handbk. Zool. (trans. Clark) ii, 1858, p. 161. Logotype, *L. serpens* (Cuv.), selected by Whitley, Rec. Austr. Mus., xvii, 1929, p. 119.

The 27 to 32 dorsal spines distinguish this genus from all other " Gempylidae."

Acinacea notha Bory.

" *Serpens marinus* " Sloane, Voy. Jamaica, i, 1707, p. 26, pl. i, fig. 2. About Tropic of Cancer—*fide* Fowler, Acad. Nat. Sci. Phil. Monogr. vi, 1944, pp. 75, 295, 422, 463 and 499, pl. II (q.v. for synonymy, etc.).

Acinacea notha Bory de St. Vincent, Voy. iles Afriq., 1804, p. 93; Dict. Class. Hist. Nat., i, 1822, p. 93, pl. cv. Tropical Atlantic Ocean.

Gempylus serpens Cuvier, Règne Anim. ed 2, ii, April, 1829, p. 200. On Sloane. *Id.*, Valenciennes, Discip. ed., 1841, p. 121, pl. xlix, f.2. *Id.*, Gunther, J. Mus. Godeffr., 1873, pl. LXVIII, Figure B, and later authors.

Lemnisoma thyrsitoides Lesson, Voy. Coquille, Zool. ii, i, " 1830 "=1831, p. 160. Paumotus.

Scomber serpeas Cuvier and Valenc., Hist. Nat. Poiss., viii, " 1831 " = Jan., 1832, p. 208. *Ex* Solander, ms, Near Canary Islands, 22nd Sept., 1786.

Gempylus coluber Cuvier and Valenc., Hist. Nat. Poiss., viii, " 1831 " = Jan., 1832, p. 211. Tahiti.

Lucoscombrus serpens Van der Hoeven, Handb. Dierkunde (Amsterd.), ii, 1855, p. 367.

Gempylus ophidianus, Poey, Mem. Hist. Nat. Cuba ii, 1861, p. 246, pl. xviii, fig. 1. Cuba, *fide* Fowler, Proc. Acad. Nat. Sci. Philad. 1904, p. 767.

Acinacea notha has priority over the later synonyms.

Genus **Leionura** Bleeker, 1860.

The generic name *Thyrsites* was first formally introduced by Lesson (Voy. Coquille Zool. ii, 1, " 1830 " = 1831, p. 158, pl. xv. Haplotype, *T. lepidopodea* Cuvier MS. from Brazil and Atlantic Ocean), the earlier " Les Thyrsites " of Cuvier's Règne Animal (Ed. 2, ii, April, 1829, p. 200) being a vernacular name only.

Thyrsites is usually quoted from Cuvier and Valenciennes (Hist. Nat. Poiss., viii, " 1831 " = Jan., 1832, p. 196, with *Scomber atun* Euphrasen as type) but Lesson's name, with *T. lepidopoidea* (Cuv. and Val. " 1831 " = Jan., 1832, p. 205, pl. 220) as genotype

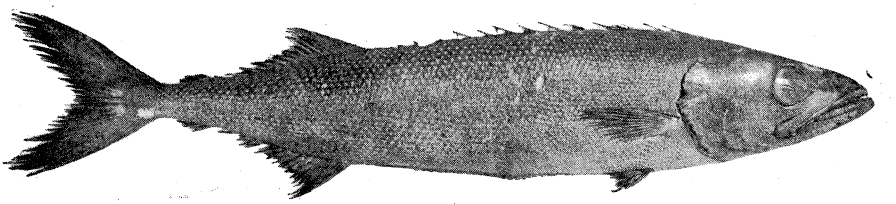
is earlier. *Thyrsitops* Gill, 1862 (type also *T. lepidopoidea*) thus falls as a synonym of *Thyrsites* Lesson and the *Thyrsites* of Cuvier and Valenciennes and authors (*non* Lesson), with genotype *T. atun*, may be called *Leionura* Bleeker (Nat. Tijdschr. Ned. Ind., xxi, 1860, p. 68, *ex* Kuhl and Van Hasselt, MS. Haplotype *L. esox* Bleeker = *Thyrsites atun* sensu lato); see Whitley (Rec. Austr. Mus., xviii, 1931, p. 150) for other synonymy.

Forest and Legendre, Bull. Inst. Oceanogr. Monaco, 966, 1950, pp. 5 *et seq*, have given a modern account of "*Thyrsitops lepidopoides*", which should now be called *Thyrsites lepidopodea* (Lesson).

Family RUVETTIDAE.

Ruvettus tydemani Weber, 1913

(Figure 7.)



Oil Fish, *Ruvettus tydemani* Weber.
A specimen from Victoria. H. Hughes photo.

Ruvettus tydemani Weber, Siboga Exped., lvii, Fische 1913, p. 401, pl. viii, fig. 4, Binongka Island, East Indies.

An Oil Fish or Palu was trawled in 50 fathoms, about 100 miles south of Gabo. Island, Victoria, in March, 1948. It has been recorded and illustrated in the Australian Museum Magazine (ix, 1948, p. 256 and figures) but the following technical characters are noteworthy.

D. xv, 17 plus 2; A.18 plus 2, its origin below second dorsal ray; P.2, 12, reaching below seventh dorsal spine; V.i, 5; C. with 15 branched rays. L.lat. *c*, 93; l.tr. *c*, 43 (14/1/28 behind pectoral); 34 abdominal scutes.

Head (203 mm.) 3·9 in length to caudal fork (805 mm.), height (148 mm.) 5 4 in same. Total length 34¾ inches, weight 8¼ lb. Depth of posterior nostril (6 mm.) about 6 in orbit. Twenty-six teeth in upper jaw.

Left eye: Horizontal diameter, 36 mm.; vertical diameter, 39 mm.

Right eye: Horizontal diameter, 37 mm.; vertical diameter, 41 mm.

Thus eye about 5 in head. Maxillary (111 mm.) barely reaching below posterior margin of eye; its depth, 18 mm. Snout, 70 mm.; interorbital (53 mm.) 3·8 in head; caudal peduncle 31 mm. wide and 35 mm. deep.

Austr. Mus. regd. no. IB.2039.

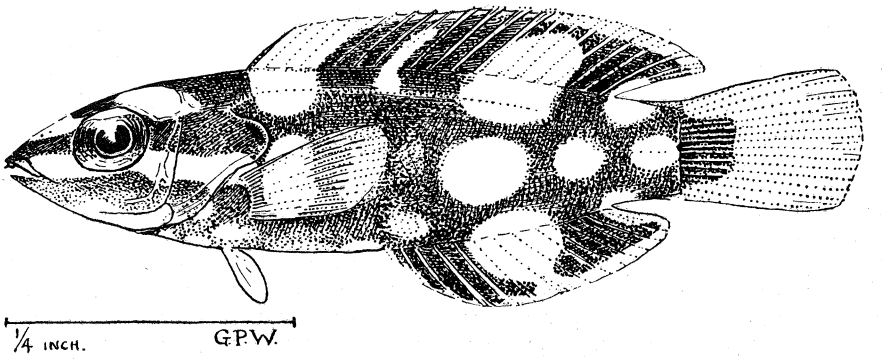
It differs from *R. whakari* (Griffin), 1927, p. 146, pl. xv, fig. 7. Bay of Plenty, New Zealand) in fin and scale-counts, in having a keel of abdominal scutes, spines extending some distance before the eyes, ventrals farther back in relation to pectoral base, and slightly different proportions.

Family CORIDAE.

Genus **Coris** Lacepede, 1802.

Coris cyanea Macleay.

(Figure 8.)



Double Head, *Coris cyanea* Macleay.
Juvenile from Lord Howe Island. G.P.W. del.

Coris cyanea Macleay, Proc. Linn. Soc. N.S. Wales, vii, April, 1883, p. 588. New Guinea. Type in Australian Museum. *Id.*, Whitley, Austr. Zool., viii, 1937, p. 227, pl. xiii, Figure 3 (Middleton Reef).

Coris aygula Ogilby, Mem. Austr. Mus., ii, 1889, p. 68. (Lord Howe Island; changes with growth.) Not *C. aygula* Lacépède, 1802, from Mauritius.

The accompanying figure shows the smallest known Doublehead from Lord Howe Island. It is 0·73 inches overall and has the following characters.

D.ix, 12; A.iii, 12; P.2, 12; C.13. Though scales are developed, the l.lat. is not complete. Head (5·8 mm.) 2·5, depth (4 mm.) 3·6 in standard length (14·6 mm.). Eye (1·8 mm.) longer than snout depth of caudal peduncle, 2·3 mm.; pectoral, 3·5 mm.; total length, 18·5 mm. The ground-colour, after long preservation in alcohol, is chocolate-brown with light yellow spots on top of head, sides of body, and fins, as figured, and light yellow bands along sides of head. The ventral fin is inserted well forward and does not reach half-way to vent; the last anal rays are rather short. Austr. Mus. regd. no. IA.2419 (smaller specimen).

The Australian Museum has several larger specimens showing that this juvenile colour-phase, with some variation in pattern, occurs in fish up to at least 66 mm. in total length. These have D. viii to ix, 12; A.iii, 12; P.2, 12; C.12 to 13. L.lat. 63 to 65 to hypural (46 to 47 along top portion of l.lat.); l.tr. 4 to 5/1/25 to 28. There is of course no bump on the head. Ogilby (1889, p. 69), in an excellent review of the colour-variation with growth, mentions a 4-inch specimen which is not very different from the above juveniles.

It seems then that the Doublehead starts life in rock-pools and maintains this juvenile coloration until about 10 cm. long. The colouring is more uniform at 20 cm. or so, and the bump on the head probably does not develop before about 40 cm. The adult may reach 142·5 cm. and exceed 100 lb. in weight, a very different animal from the juvenile.

The Doublehead of Lord Howe Island has usually been named *Coris aygula*, one of Lacépède's species from Mauritius which has a number of nominal synonyms (see Weber and Beaufort, 1940, p. 247). The Australasian counterpart has been named *cyanea* by Macleay.

Klunzinger (1871, p. 539) was of the opinion that *Labrus cingulum* Lacépède was the young of *Coris aygula* and his lead has been followed by later authors except Ogilby, and Gunther (1909, pp. 279–280), so that two very differently coloured fishes, with identical fin and scale-counts, have been regarded as the young of *Coris aygula*, sensu lato. They differ as follows :—

A. Generally light-coloured with a couple of red saddle-marks on back and head dark-spotted. Dorsal fins with dark ocelli and other ornamentation ..... *cingulum*

AA. Dark-coloured with large light blotches. No dark spots on head. No marked ocelli on dorsal ..... Lord Howe I. juveniles.

According to Klunzinger, the *cingulum* form reached about 26 cm. and became *aygula* at about 30 cm., but Gunther (l.c.) gave *cingulum* a maximum of 10 inches and Bennett, in his "Fishes of Ceylon" says his *Labrus aureovittatus* (a synonym of *cingulum*) grows to 18 inches. J. L. B. Smith, in "The Sea Fishes of Southern Africa" (1949, p. 292, pl. 101, figure 806 and text-figure as juvenile *Coris angulata*) figures the *cingulum* form in colour and in line from specimens $4\frac{1}{2}$ and 5 inches long. The smallest New Caledonian example of this form, from Dr. Catala, is about $\frac{3}{4}$ inch long and has the dark spots on the head, two red patches on the back each with black ocellus above on the dorsal fin, and a black crescent down the caudal base. Both *cingulum* and the juveniles I identify as *cyanea* are found at Lord Howe Island and specimens of the same length show the two very distinct patterns so that they are evidently separate species, and I consider that *cingulum* is a "good" species which should be removed from the synonymy of *aygula*, whereas the Lord Howe juvenile here figured is evidently the young of the Doublehead as identified by Ogilby. The late A. R. McCulloch, who collected this and other specimens, was of the same opinion.

Genus **Hemicoris** Bleeker, 1861.

Hemicoris pallida (Macleay).

Coris pallida Macleay, Proc. Linn. Soc. N.S. Wales, vi, July, 1881, p. 100. Endeavour River, Queensland.

Coris papuensis Macleay, Proc. Linn. Soc. N.S. Wales, viii, July, 1883, p. 275. South-east New Guinea.

Coris coronata De Vis, Proc. Linn. Soc. N.S. Wales, ix, March, 1885, p. 883. Murray Island, Queensland.

Hemicoris pallida Whitley, Gt. Barrier Reef Exped. Sci. Rept., iv, 9, 1932, p. 294, figure 4.

Coris papuensis and *C. coronata* are evidently hitherto unnoticed synonyms of the above species.

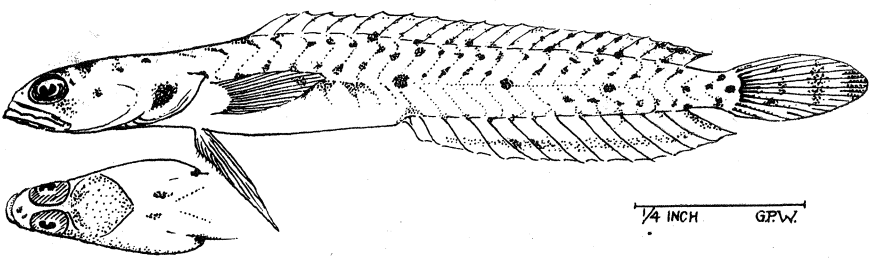
Family KRAEMERIIDAE.

Parkraemeria, gen. nov.

Orthotype, *P. ornata*, sp. nov.

A genus of small sand-inhabiting fishes which comes down to *Kraemeria* in Schultz's key to the family Trichonotidae (Schultz, 1943, pp. 261–262) but differs from that genus in having the chin normal in form, not produced like a scoop, in having many more pectoral rays, and in its ornate coloration. Since Schultz's revision, Fowler (Fowler 1943, p. 86, figure 22) has named *Gobitrichinotus*, which has a longer trunk than *Parkraemeria* and other differences in proportions and pattern, and Beaufort (1948, p. 476) has described *Apodocreedia* which has no ventral fins and is very different in all respects.

Parkraemeria ornata, sp. nov.
(Figure 9.)



Sand Fish, *Parkraemeria ornata* Whitley.
Holotype from Narrabeen, New South Wales. G P.W. del.

Head (7 mm.) 3·8, depth (3·3 mm.) 8·1 in standard length (27 mm.). Trunk and head (14 mm.) more than tail without caudal (11·5 mm.). Pectoral length, 4 mm. Eye little over 1 mm. D.*c.* 4, 16; A.*c.* 12 ? P.c. 15. V.i, 5. C.*c.* 10. Myomeres 23. No l.lat.

Upper profile rounded, lower rather flat. Head naked. Eyes large. Interorbital very narrow with a mucus tube occupying almost all of it. Preoperculum round, spineless, striated; operculum with acute tip. Lower jaw projecting beyond upper. Mouth extending to behind eye, with a row of fine teeth in each jaw. No enlarged canines. Gill-slits wide, restricted to sides, separated by narrow isthmus. Form elongate, rounded anteriorly, compressed posteriorly. Body naked. No lateral line. Dorsal originating over hinder half of pectoral, ceasing before caudal peduncle. Paired and caudal fins pointed. Fifth (innermost) ventral rays longest.

Colour, pale brownish-yellow with conspicuous dark reddish-brown spots, widely spaced and irregularly shaped on head, body and fins, as figured. Four spots between mandibular rami, otherwise ventral surface is nearly all plain pale-yellowish. Five or six dark round spots along median line of side.

Described (and figured) from the holotype, a specimen 27 mm. in standard length or 33 mm. (1·3 inches) overall. Austr. Mus. regd. no. IA.3777.

Loc.—Narrabeen lagoon, near Sydney, New South Wales; netted by the author, December, 1928.

A slightly larger paratype (regd. no. I.8099), 1½ inches long, was obtained in the same lagoon by A. F. Basset Hull in 1907.

Family DIADEMICHTHYIDAE.

Genus **Diademichthys** Pfaff, 1942.

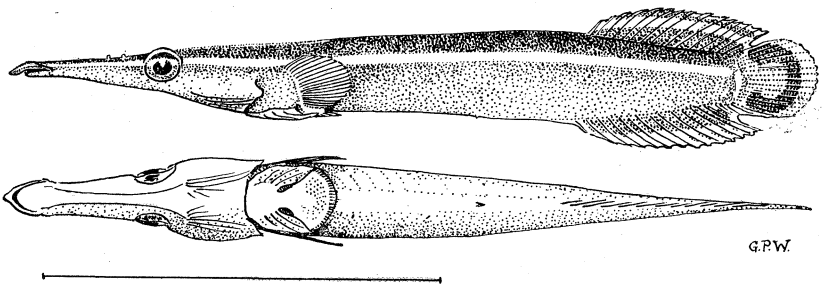
Diademichthys Pfaff, Vidensk. Medd. Dansk. nat. Foren., cv, 9 May, 1942, p. 413. Orthotype, *D. deversor* Pfaff.

Coronichthys Herre, Stanford Ichth. Bull., ii, 4, 24 August, 1942, p. 120. Orthotype, *C. ornata* Herre.

Pfaff's name has three months' priority over Herre's for this remarkable Clingfish which lives in the protection of sea-urchins.

Diademichthys lineatus (Sauvage).

(Figure 10.)



Clingfish, *Diademichthys lineatus* (Sauvage).
A specimen from New Caledonia. G.P.W. del.

Crepidogaster lineatum Sauvage, Bull. Soc. Philom. Paris, (7) vii, 1882, p. 158. New Caledonia.

? *Diademichthys deversor* Pfaff, *loc. cit.*, p. 413, pl. iii and text-figures 1–3. Java Sea and Mauritius.

? *Coronichthys ornata* Herre, *loc. cit.*, p. 122, figure 1. Coron, Philippines.

Diademichthys lineatus Whitley, Austr. Mus. Mag., x, 1950, p. 127 and figure.

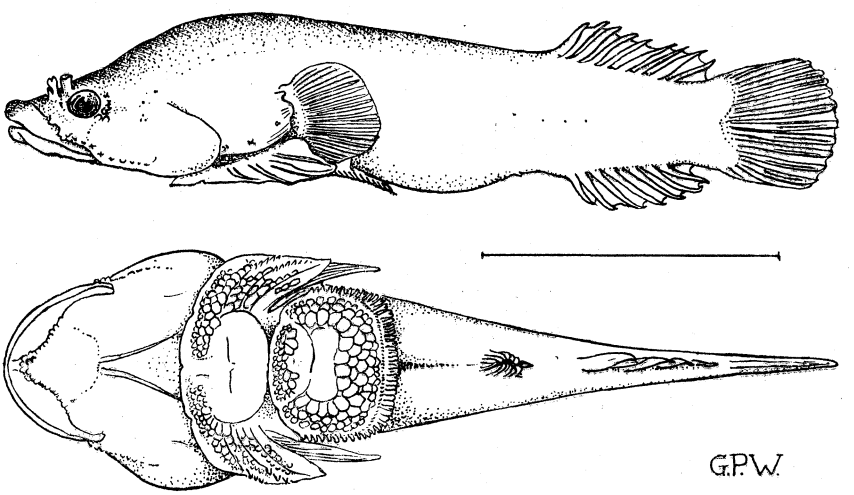
This species is here figured from a virtual topotype, 2 inches long, from Anse Vata, Noumea, New Caledonia (Dr. R. Catala); Austr. Mus. regd. no. IB.2319. It has D.15, A.14, V.4 and C.2 plus 15 plus 2. It appears to differ from *deversor* and *ornatus* as follows :—

A. 15 to 16 dorsal and more than 20 pectoral rays. Anal origin before that of dorsal. No mark on chin ... *lineatus*
AA. 12 dorsal and 18 pectoral rays. Anal and dorsal origins opposite. A dark mark below chin ..... *ornatus*
AAA. 13 to 14 dorsal and more than 19 pectoral rays. Anal origin behind that of dorsal. No chin mark. Tail crescent-mark faint ..... *deversor*

Family GOBIESOCIDAE.

Trachelochismus pinnulatus (Bloch & Schneider.)

(Figure 11.)



Clingfish, *Trachelochismus pinnulatus* (Bloch and Schneider).
Topotypical specimen from New Zealand. G.P.W. del.

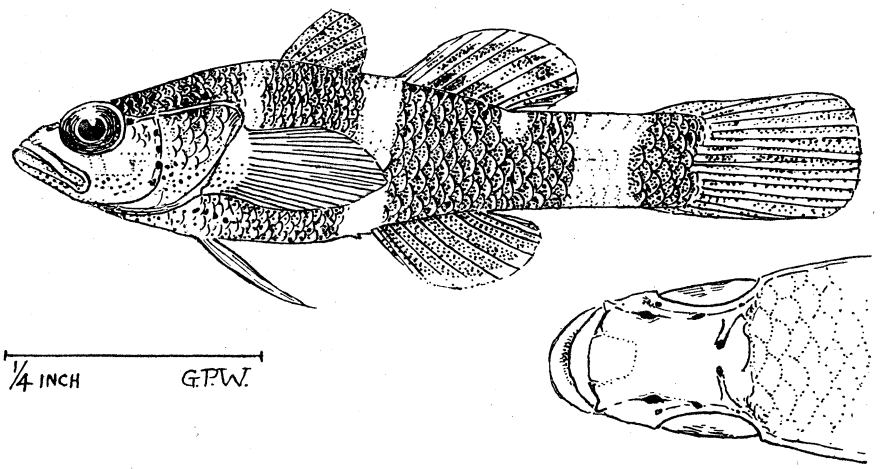
This New Zealand species is figured from a Queen Charlotte Sound topotype (Austr. Mus. regd. no. IB.2439), 70 mm. long, with D.9, A.7, V.4, C.10 plus short lateral rays.

Family ELEOTRIDAE.

Genus **Lindemanella** Whitley, 1935.

Lindemanella iota Whitley.

(Figure 12.)



Gudgeon, *Lindemanella iota* Whitley.
Holotype from Lindeman Island, Queensland. G.P.W. del.

Lindemanella iota Whitley, Rec. Austr. Mus., xix, 1935, p. 241. Lindeman Island, Queensland; freshwater. Holotype in Australian Museum. *Id.*, Koumans, Zool. Meded., xxii, 1940, p. 170.

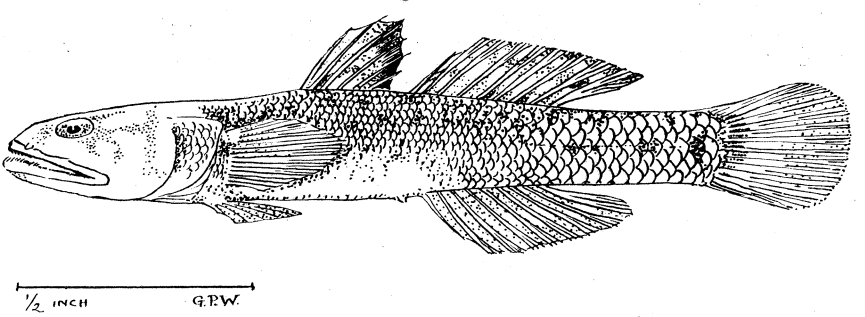
The holotype of this species is now figured for the first time. Koumans thought this might be the young of *Ophiocara aporos* (Bleeker) but the coloration (recalling that of *Brachygobius* spp.) is very different, scales do not extend far forward over the interorbital, and there are more than two preopercular pores on each side.

Family GOBIIDAE.

Genus **Waiteopsis** Whitley, 1930.

Waiteopsis paludis Whitley.

(Figure 13.)



Goby, *Waiteopsis paludis* Whitley.
Holotype from Port Hacking, New South Wales. G.P.W. del.

Waiteopsis paludis Whitley, Austr. Zool., vi, 1930, p. 122. Gundamaian, Port Hacking, N.S. Wales. Types in Australian Museum. *Id.*, Koumans, Prelim. Revis. Gobioid, 1931, p. 162. *Id.*, Whitley, Fish. N.S.W. (McCulloch), ed. 3, 1934, supplement. *Id.*, Koumans, Zool. Meded., xxii, 1940, p. 169. *Id.*, Ivey, Proc. Roy. Zool. Soc. N.S. Wales, 1949–50 (2 April, 1951), p. 55 (habits).

Ellogobius abascantus Whitley, Rec. Austr. Mus., xx, 1937, p. 17, figure 4. Bateman's Bay, N.S. Wales. Types in Australian Museum. *Id.*, Koumans, Zool. Meded., xxii, 1940, p. 171.

The holotype of *Waiteopsis paludis* is illustrated here; apparently *Ellogobius abascantus* is generically and specifically synonymous, the differences in scale-counts, extent of maxillary, and shape of dorsal fin, etc., evidently being due to growth and variation or sex.

Family ECHENEIDAE.

Echeneis squalipeta Daldorf.

Echeneis squalipeta Daldorf, Skr. nat. Selsk. (Copenhagen), ii, 2, 1793, p. 157.

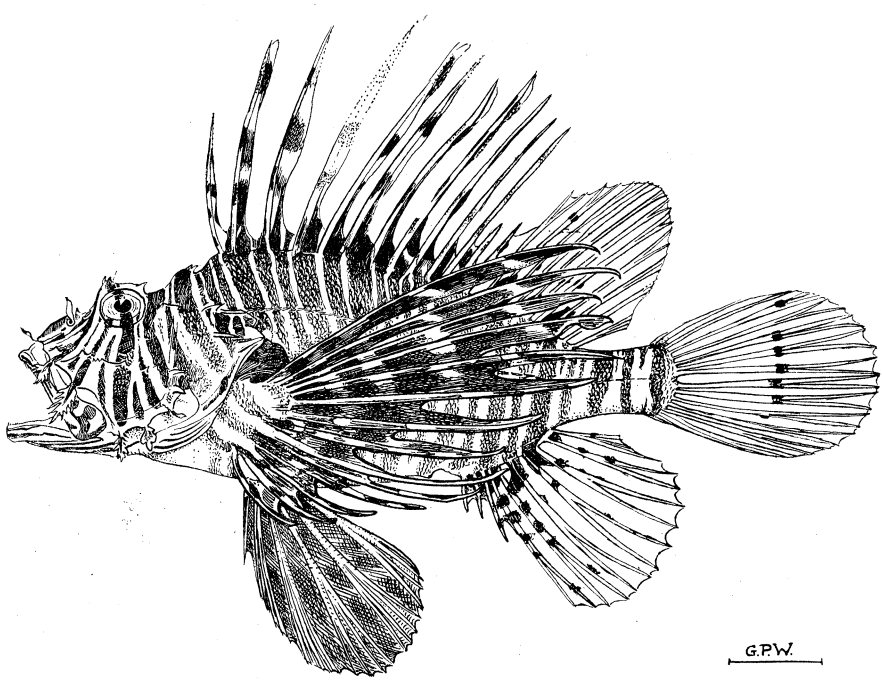
Add to synonymy the overlooked name : *Echeneis tropicus* Andrew Murray, Edinb. New Philos. Journ., (n.s.) iv., 1856, p. 287, figures 1–3, preoccupied by *E. tropica* Domndorff, Zool. Beytr., iii, 1798, p. 321, which is a *Phtheirichthys*.

Family SCORPAENIDAE.

Subfamily PTEROINAE.

Pterois volitans castus, subsp. nov.

(Figure 14.)



Butterfly Cod, *Pterois volitans castus* Whitley.
Holotype of subspecies from Port Hedland, Western Australia. G.P.W. del.

The Butterfly Cod *Pterois volitans* (Linné) is a very well-known fish but its geographical variations have been little studied. In The Australian Museum, Western Australian specimens are easily distinguishable from typical *volitans* by having few (2 to 13) spots on the tail fin instead of very numerous ones. This new subspecies has D, xii, i, ll; A. iii, 7; P.14; C.14 and general appearance as here figured from a specimen 180 mm. in standard length or 9½ inches overall, the largest of a series of six.

The development of supraorbital tentacles and the length of pectoral fins vary considerably, but the constantly plainer posterior fins indicate that a subspecies has developed in Western Australia. Most of the specimens are from Broome but one (with an abnormal left ventral fin of a spine and only three rays) came from the Abrolhos Islands; the figured specimen came from Port Hedland (holotype of subspecies; regd. no. I.12941). All the fourteen pectoral rays are simple and the nape and interorbital are scaly. Japanese specimens of *P. lunulatus* Temminck and Schlegel in The Australian Museum have much lighter ventral fins with dark spots, and have dark lunate marks on the pectorals.

Ranipterois, gen. nov.

Orthotype, *Brachypterois serrulifer* Fowler = *Ranipterois serrulifer.*

New name for *Brachypterois* Fowler (Proc. U.S. Nat. Mus., lxxxv, 1938, pp. 51 and 79) which is preoccupied by *Brachypterois* Jordan and Seale (Bull. U.S. Bur. Fish., xxv, 1905 (1906), p. 189) which Fowler (Mem. Bern. Bish. Mus., x, 1928, p. 67) made synonymous with *Bathypterois* Gunther.

NEW GENERIC NAMES.

The following generic names of fishes are preoccupied. References to literature will be found in Neave's "Nomenclator Zoologicus". The genotypes of the new genera are those of the ones they replace.

Todarus Grassi and Calandruccio, 1896 = *Nettodarus*, gen. nov. (Todaridae *olim* = Nettodaridae, nov.). Type, *Nettastoma brevirostre* Facciolà, 1887 = *Nettodarus brevirostris.*

Xiphostoma Spix, 1829 = *Spixostoma*, gen. nov. (Xiphostomatidae *olim* = Spixostomatidae nov.) Type, *S. cuvieri* (Spix).

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