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**The Macrophthalminae of Australasia;
with a review of the evolution and morphological
diversity of the type genus *Macrophthalmus*
(Crustacea: Brachyura)**

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The Macrophthalminae of Australasia; with a review of the evolution and morphological diversity of the type genus *Macrophthalmus* (Crustacea: Brachyura)

The Australasian species of the brachyuran subfamily Macrophthalminae Dana are little known both inside and outside Australasia. Eighteen Australasian species of five genera are here recorded, with keys given for their identification, from the collections in various Australasian institutions. Sixteen species are redescribed, and indications are given of the changes observed in the relative proportions (used taxonomically by many previous authors) with increase in size of the animals. The genus *Macrophthalmus* Latreille, is reviewed in the light of the greatly increased information available on many of the species since the last review by Tesch (1915). Six subgenera of *Macrophthalmus* are described and a key given for their identification; and the intrageneric evolution is discussed. A bibliography of taxonomic literature on the Macrophthalminae is included.

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INTRODUCTION

The Australasian species of the Indo-West Pacific subfamily Macrophthalminae have never been reviewed, as have the Japanese species (Sakai, 1939), the Indian species (Alcock, 1900; Kemp, 1919), the South African species (Barnard, 1950, 1955), the Malagasy species (Crosnier, 1965) and the Malay species (Tweedie, 1937).

The constituent genera of the subfamily have also received little attention. *Cleistostoma*, *Paracleistostoma* and *Tylodiplax* have received one review this century, that of Guinot & Crosnier (1963), while the only other genus to receive a review, *Macrophthalmus*, was last reviewed in 1915 by Tesch. This latter publication is now inadequate for several reasons. First, it is particularly inadequate as regards Australasian species since the Leiden Museum, upon whose collections the monograph was based, possessed at that time very little Australasian material, and species endemic to that region were characterised by merely repeating the all too brief original specific descriptions. Second, many new species have been described, and more material of many little known species has become available, since the publication of Tesch's review. Third, several authors (including Kemp, 1919, p. 391; Tweedie, 1941, p. 25) have pointed out inaccuracies in Tesch's characterizations of some species, and the present author has noted inaccuracies in those of other species. Fourth, Tesch made use of a number of relative proportions in defining and distinguishing between the reviewed species. On the use of these relative proportions Tweedie (1937, p. 163) has stated:—"The numerous species of this genus [*Macrophthalmus*] are notoriously difficult to identify with certainty, partly because the characters separating them are often vague and difficult to define and perhaps even more because in their postlarval development many species change their proportions in respect of both the carapace and chelipeds. These proportions have been largely used in defining and describing the species and such descriptions are not always made from fully adult specimens, or if they are, no account of developmental changes is given."

In this paper it is thus hoped to (a) place the little known Australasian fauna on record; (b) describe little known species *de novo* from material in various Australasian institutions, with changes observed with size in the relative proportions used by Tesch (1915), and others, documented; (c) review the morphological diversity seen in the genus *Macrophthalmus*, in the light of species described since 1915 and the increased knowledge available on other, then poorly known, species; (d) consolidate the, at present, scattered literature; and (e) to provide as complete as possible synonymies.

The terminology used follows that of Rathbun (1918, pp. 6-8, Figs 1, 2).

Measurements used are as follows:

Length of carapace is measured along the median line, from anterior to posterior margin.

Breadth of carapace is measured at the widest point.

Breadth of front is measured along the anterior margin.

Length of propodus of cheliped is measured from the articulation with the carpus to the tip of the immovable finger, along the lower margin.

Dimensions given under 'material examined' in the specific descriptions are those of carapace breadth.

(Measurements were made with vernier calipers or with a microscope eyepiece micrometer and are given correct to 0.1 mm, except in a few cases where they are given correct to the nearest 0.25 mm.)

THE SUBFAMILY MACROPHTHALMINAE DANA, 1852

Macrophthalminae Dana, 1852, p. 312; Miers, 1886, p. 237; Ortmann, 1894a, p. 741; Alcock, 1900, pp. 290-91; Tesch, 1918, p. 57; Sakai, 1939, p. 611.

The Macrophthalminae contains seven genera: *Macrophthalmus* Latreille, 1829; *Cleistostoma* de Haan, 1835; *Camptandrium* Stimpson, 1858; *Paracleistostoma* de Man, 1895; *Tylodiplax* de Man, 1895; *Leipocten* Kemp, 1915; and *Australoplax* Barnes, 1966b. (Barnes (1966b) having shown that of the three species placed in the genus *Euplax* H. Milne Edwards, 1852, two including the type species are to be referred to *Macrophthalmus* and the third to *Australoplax*; while the genus *Hemiplax* Heller, 1865 is in this paper fused with *Macrophthalmus*.) Of these seven genera, *Camptandrium* and *Tylodiplax* contain no Australasian species and are not dealt with in this paper.

The subfamily is almost exclusively Indo-West Pacific, occurring from South Africa (Barnard, 1950) in the west to Polynesia (Nobili, 1906c), and possibly Chile (H. Milne Edwards, 1852, but see Porter, 1913; Rathbun, 1918; Garth, 1957) in the east, and from Japan (Sakai, 1965) and Korea (Kim, 1958) in the north to Tasmania (Tweedie, 1941), New Zealand (Bennett, 1964) and Campbell Island (Filhol, 1885) in the south. The subfamily however also penetrates into the South Atlantic, for a short distance up the west coast of southern Africa (Barnard, 1954a).

All species are predominantly littoral, but a few have also been recorded sublittorally. They occur in burrows or under stones, in substrates ranging from soft mud to firm sand, in both estuarine and fully marine conditions.

KEY TO THE AUSTRALASIAN GENERA OF THE MACROPHTHALMINAE

- (1) (a) Pereiopods with transverse/oblique row of large tubercles across lower surfaces of meri. . . *Leipocten* Kemp
- (b) Pereiopods without any transverse or oblique rows of tubercles across lower surfaces of meri. . . 2
- (2) (a) Merus of external maxilliped larger than ischium; latter with large triangular anterointernal protruberance. . . 3
- (b) Merus of external maxilliped smaller than or subequal to ischium; latter without large triangular anterointernal protruberance. . . 4
- (3) (a) Carapace domed; front without well developed 'horns' at anterolateral angles. . . *Cleistostoma* de Haan
- (b) Carapace flattened; front with well developed anterolateral 'horns'. . . *Paracleistostoma* de Man
- (4) (a) Cutting margins of dactylus and immovable finger of male chelae obscured externally by dense hair; dactylus without differentiated tooth on cutting margin. . . *Australoplax* Barnes
- (b) Cutting margins of dactylus and immovable finger of male chelae not obscured externally by hair; dactylus with differentiated tooth on cutting margin. . . *Macrophthalmus* Latreille

Within the subfamily two distinct generic groups are present; one group consisting of *Macrophthalmus* and *Australoplax*, the other of *Cleistostoma*, *Paracleistostoma*, *Camptandrium*, *Tyloidiplax* and to a lesser extent *Leipocten*. The contrasting characters of these two groups of genera can best be shown in the form of the table below.

<i>Macrophthalmus</i> etc.	<i>Cleistostoma</i> etc.
1. Lateral carapace margins more or less straight, either parallel or posteriorly convergent. Anterolateral margins with 2-4 well demarkated teeth.	Lateral carapace margins parenthetical or divergent posteriorly. Anterolateral margins with blunt tooth-like protruberances or more commonly entire.
2. Ocular peduncles frequently long.	Ocular peduncles short.
3. Palm of male chela elongate. Immobile finger straight or deflexed downwards, cutting margin frequently with large tooth.	Palm of male chela short and globose or feeble. Immobile finger straight or deflexed upwards, cutting margin without differentiated tooth.
4. Abdomen of male composed of seven separate segments.	Abdomen of male with varying degrees of segmental fusion, usually segments two to five fused.
5. Merus of external maxilliped smaller than or subequal to ischium; subrectangular with breadth exceeding length. Ischium with length exceeding breadth. Two distal segments of palp large.	Merus of external maxilliped larger than ischium; sub-circular. Ischium with breadth exceeding length or subequal. Two distal segments of palp poorly developed.
6. First male pleopod straight or slightly curved.	First male pleopod recurved upon itself.

I. The Genus *Macrophthalmus* Latreille, 1829

Macrophthalmus Latreille, 1829, pp. 44-5; Ortmann, 1897, pp. 340-42; Alcock, 1900, pp. 375-83; Tesch, 1915, pp. 149-203; Kemp, 1919, pp. 383-94; Tweedie, 1937, pp. 163-69; Sakai, 1939, pp. 623-28; Barnard, 1950, p. 101; Crosnier, 1965, pp. 122-36.

Hemiplax Heller, 1865, p. 40; Tesch, 1918, p. 57; Sakai, 1939, p. 628.

Euplax H. Milne Edwards, 1852, p. 160; Tesch, 1918, p. 57 (part); Sakai, 1939, p. 630.

Generic description

Front. Narrow (ratio of breadth of front to breadth of carapace between 1: 3.0 and 1: 12.0), depressed; frequently with median furrow, constriction between bases of ocular peduncles, and bilobed anterior margin (never pointed).

Orbits. Long, narrow, furrows, occupying whole of anterior border of carapace between front and external orbital angles. Upper orbital border usually sinuous; disposed transversely or sloping backwards; usually studded with small rounded granules. Lower orbital border projecting, studded with large granules or tubercles.

Antennae. Moderately long, base short and situated in inner angle of orbit.

Epistome. Long and narrow. Central region with concavity, rounded convexity or straight.

Anterolateral carapace teeth. External orbital angle forms first lateral tooth. Tooth development variable, external orbital angle and second lateral tooth usually large, third lateral tooth usually small, fourth lateral tooth rarely present. Teeth directed outwards and forwards in varying degrees.

Carapace. Depressed; rectangular or trapezoid. Breadth always exceeding length, but ratio between two dimensions variable between 1:1.10 and 1: 2.30. Lateral margins parallel or posteriorly convergent. Regions usually well demarkated, separated by furrows. Frequently granular or hairy.

Ocular peduncles. Generally long. Cornea reaching to, or beyond bases of external orbital angles.

Chelipeds. In males well developed, equal or subequal. Merus triangular in section; palm large and elongate, in adults length of propodus exceeding length of carapace; dactylus and immovable finger spoon-tipped, often deflexed downwards and inwards, differentiated tooth present on cutting margin of dactylus and frequently on immovable finger. In females poorly developed, without differentiated teeth on cutting margins of either immovable finger or dactylus.

Periopods. Second and third pairs large and subequal, first and fourth pairs small (fourth pair smallest). Meri long, triangular in section, and with distal subterminal spine on upper margins, often concealed in hair.

Male abdomen. Composed of seven, distinct, separate segments; the first two small, remainder excepting small telson, subequal. Narrow; lateral segmental margins converging more or less smoothly towards telson.

External (third) maxilliped. Subrectangular merus smaller than, or subequal to, ischium; with breadth exceeding length. Ischium large, with length exceeding breadth, without row of hairs across base. Well developed palp articulates at anteroexternal angle of merus. Maxillipeds leave small hiatus when folded.

First male pleopod. Straight or slightly curved.

Type species: *M. transversus* (Latreille, 1817).

Comments. Fifty-five species of the genus *Macrophthalmus* have been described, but of these probably only about 35 species are valid. These species exhibit a wide range of structural diversity, and *Macrophthalmus* is probably one of the most diverse of all brachyuran genera. All but three species (discussed later) however, fall into one or other of four large species-groups, each with its own characteristic and distinct facies. These species-groups are here described as subgenera and the relationships between the subgenera are later hypothesised.

The subgenera of Macrophthalmus

(a) *Macrophthalmus*.

Front narrow. Carapace relatively very broad (ratio of length to breadth in the order of 1 : 2.0), usually with small sparse granules or smooth; without longitudinal, transverse or oblique rows of granules on the branchial regions; with three verrucose granular clumps, however, longitudinally in line on each branchial region. Lateral teeth relatively narrow based and strongly pointed. Cornea extends to tip of, or beyond, external orbital angles. Central region of epistome with rounded protruberance. Longitudinal ridge present close to and parallel with lower margin, on outer surface of propodus of male chela; immovable finger and dactylus short compared with length of palm, latter often with large proximally directed tubercle on inner surface near carpal joint. Pereiopods relatively slender. Abdomen of male broad compared with length. External maxillipeds broad; merus markedly smaller than ischium; ischium large with little or no surface sculpturing.

The subgenus *Macrophthalmus* contains besides the type species, *M. transversus* (Latreille, 1817), the following: *M. brevis* (Herbst, 1804); *M. parvimanus* Guérin, 1834; *M. dilatatus* (de Haan, 1835); *M. telescopicus* (Owen, 1839); *M. crassipes* H. Milne Edwards, 1852; *M. sulcatus* H. Milne Edwards, 1852; *M. convexus* Stimpson, 1858; *M.*

dentatus Stimpson, 1858; *M. grandidieri* A. Milne Edwards, 1867; *M. graeffei* A. Milne Edwards, 1873b; *M. latipes* Borradaile, 1903; *M. consobrinus* Nobili, 1906c; *M. sandakani* Rathbun, 1914; *M. hilgendorfi* Tesch, 1915; *M. simdentatus* Shen, 1936; *M. malaccensis* Tweedie, 1937; *M. malayensis* Tweedie, 1937; *M. travancorensis* Pillai, 1951; *M. milloti* Crosnier, 1965.

(b) *Mareotis* subgen. n.

Front very narrow. Carapace moderately broad (ratio of length to breadth in the order of 1 : 1.4–1.5), usually with numerous large granules; with longitudinal and/or transverse rows of granules and/or hairs on the branchial regions; without verrucose clumps of granules. Lateral teeth broad based and rectangular. Cornea extends to base of external orbital angles. Central region of epistome with concave excavation. Longitudinal ridge on outer surface of male chela absent in most species, feeble if present; no proximally directed tubercle on inner surface of palm. Immobile finger and dactylus long compared with length of palm. Pereiopods large. Abdomen of male narrow compared with length. External maxilliped narrow; merus markedly smaller than ischium; ischium with marked surface sculpturing.

The subgenus *Mareotis* contains besides the type species, *M. japonicus* (de Haan, 1835), the following: *M. depressus* Rüppell, 1830; *M. tomentosus* Souleyet, 1841; *M. definitus* Adams & White, 1848; *M. pacificus* Dana, 1851; *M. setosus* H. Milne Edwards, 1852; *M. crinitus* Rathbun, 1913; *M. teschi* Kemp, 1919; *M. abercrombiei* Barnes, 1966a.

(c) *Mopsocarcinus* subgen. n.

Animals of small size. Front broad. Carapace subquadrate (ratio of length to breadth in the order of 1 : 1.2), smooth or with small granules; without conspicuous aggregations of granules into rows or clumps on branchial regions. Lateral teeth broad based, subrectangular, but pointed at anteroexternal angle. Ocular peduncles short and stout, cornea extending to base of external orbital angles. Central region of epistome straight. Palm of male chela somewhat inflated; longitudinal ridge on outer surface of propodus present; tubercle on inner surface absent; dactylus and immobile finger moderately short, immobile finger straight or deflexed only at tip. Pereiopods slender. Breadth of abdomen moderate. External maxilliped narrow; merus subequal to ischium; both merus and ischium heavily sculptured.

The subgenus *Mopsocarcinus* contains besides the type species, *M. boscii* Audouin/Savigny, 1825, the following: *M. quadratus* A. Milne Edwards, 1873a; *M. punctulatus* Miers, 1884; *M. erato* de Man, 1888b; *M. franchettii* Maccagno, 1936.

(d) *Venitus* subgen. n.

Animals of large size when adult. Front narrow. Carapace subquadrate (ratio of length to breadth in the order of 1 : 1.2–1.3), heavily granulated with large granules and/or tubercles; without well defined rows of granules (poorly defined rows of granules present in some specimens of some species, but never constantly in any species) and without verrucose clumps on branchial regions. Lateral teeth large, broad based, and elongate and sharply pointed in adults. Cornea extends to base of external orbital angles. Central region of epistome straight. Longitudinal ridge on outer surface of male chela absent; tubercle on inner surface absent; immobile finger of moderate length, undeflexed. Pereiopods large.

with large granules and/or spines on margins when adult. Abdomen of male large and elongate. External maxilliped of moderate breadth; merus markedly smaller than ischium, very broad (breadth slightly exceeding that of ischium); ischium with little surface sculpturing.

The subgenus *Venitus* contains besides the type species, *M. latreillei* (Desmarest, 1822), the following: *M. pectinipes* Guérin, 1839; *M. leptophthalmus* (H. Milne Edwards, 1852); *M. gastrodes* Kemp, 1915.

There remains three species that do not fall into any of the four subgenera so far proposed, these species all having been placed in the genus *Hemiplax* by various authors at one time or another. Two of the species are evidently closely related, but the third is distinct. *Hemiplax* is here incorporated into *Macrophthalmus* as a subgenus, while the third species, referred to above, which shows affinities neither with the subgenus *Hemiplax* nor with the other subgenera described, excepting in so far as the common generic characters, is placed in a separate subgenus.

(e) *Hemiplax* Heller, 1865.

Front broad. Carapace moderately broad (ratio of length to breadth in the order of 1 : 1.5), finely granulate; with transverse and oblique granular rows on each branchial region; without clumps of granules. Lateral teeth large, broad based, pointed. Cornea extends to base of external orbital angles; ocular peduncles being stout. Central region of epistome straight. Longitudinal carina present partially on lower margin and partially on outer surface of male chela in adults; no tubercle on inner surface of palm; carpus with spine on upper and inner margin; dactylus and immovable finger elongate, immovable finger deflexed and without a differentiated tooth. Pereiopods moderately well developed. Abdomen of male broad. External maxilliped narrow; merus subequal to ischium; merus and ischium sculptured.

The subgenus *Hemiplax* contains besides the type species *M. hirtipes* (Jacquinot, 1853), only *M. boteltobagoe* (Sakai, 1939).

(f) *Tasmanoplax* subgen. n.

Front of medium breadth. Carapace moderately broad (ratio of length to breadth in the order of 1 : 1.5), finely granulate; with two longitudinal granular rows in anterior/posterior position on each branchial region; without clumps of granules. Lateral teeth broad based and rectangular. Central region of epistome with large convexity. Cornea extends to base of external orbital angles. Longitudinal ridge present on outer surface of male chela; without tubercle on inner surface of palm; without spine on carpus; dactylus and immovable finger elongate, latter deflexed and without differentiated tooth. Pereiopod development moderate. Abdomen of male narrow. External maxilliped narrow; merus subequal to ischium; merus and ischium sculptured.

The subgenus *Tasmanoplax* contains only the type species *M. latifrons* Haswell, 1882b.

KEY TO THE SUBGENERA OF *MACROPHTHALMUS*

- | | |
|---|---------------------------|
| (1) (a) Epistome with central protruberance. | ...2 |
| (b) Epistome with straight or concave central region. | ...3 |
| (2) (a) Merus of external maxilliped subequal to ischium. | ... <i>Tasmanoplax</i> |
| (b) Merus of external maxilliped markedly smaller than ischium. | ... <i>Macrophthalmus</i> |

- (3) (a) Merus of external maxilliped subequal to ischium. . . . 4
 (b) Merus of external maxilliped markedly smaller than ischium. . . . 5
- (4) (a) Carapace subquadrate. . . . *Mopsocarcinus*
 (b) Breadth of carapace equal to approx 1.5 × length. . . . *Hemiplax*
- (5) (a) Epistome with marked concavity in central region. . . . *Mareotis*
 (b) Epistome with straight or slightly concave central region. . . . *Venitus*

The Australasian species of the genus Macrophthalmus

(a) *Subgenus Macrophthalmus*

KEY TO THE AUSTRALASIAN SPECIES OF THE SUBGENUS *MACROPHTHALMUS*

- (1) (a) Ocular peduncles not extending beyond tips of external orbital angles . . . 2
 by more than half the length of the cornea, if at all.
- (b) Ocular peduncles extending beyond tips of external orbital angles by . . . *M. telescopicus*
 more than length of cornea.
- (2) (a) Carapace surface coarsely granular; external orbital angle with tip close . . . *M. crassipes*
 to, and on same level as, that of second lateral tooth; backwardly
 directed tubercle present on inner surface of palm of male chela, near
 carpal joint.
- (b) Carapace surface smooth; external orbital angle with tip separate from, . . . *M. convexus*
 and projecting well beyond, that of second lateral tooth; no back-
 wardly directed tubercle near carpal joint on inner surface of palm of
 male chela.

1. *Macrophthalmus (Macrophthalmus) telescopicus* (Owen, 1839)

(Plate 1(a), Fig. 1)

Synonymy

Gelasimus telescopicus Owen, 1839, p. 78, Plate 24, Fig. 1.

Macrophthalmus telescopicus: H. Milne Edwards, 1852, p. 155; Dana, 1852, p. 314; Stimpson, 1858, p. 97; Ortmann, 1894a, p. 744; 1894b, p. 58; Rathbun, 1906, p. 834; Stimpson, 1907, p. 95; Tesch, 1915, p. 161, Plate 5; 1918, p. 58; Kemp, 1919, p. 387, Plate 24, Figs 10 & 11; Stephenson *et al.*, 1931, p. 56; Balss, 1934, p. 522; Tweedie, 1937, p. 164; Balss, 1938, p. 76; Sakai, 1939, p. 623, Plate 73, Fig. 1; Edmondson, 1946, p. 311, Fig. 185; Tinker, 1965, p. 122, Plate 49; Crosnier, 1965, p. 126.

Macrophthalmus compressipes Randal, 1839, p. 123; Gibbes, 1850, p. 180.

Macrophthalmus podophthalmus Souleyet, 1841, p. 241, Plate 3, Figs 6 & 7; H. Milne Edwards, 1852, p. 155; Haswell, 1882a, p. 88; Miers, 1886, p. 249; Lanchester, 1900, p. 760.

Macrophthalmus verreauxi H. Milne Edwards, 1848, p. 358; 1852, p. 155, Plate 4, Fig. 25; Hess, 1865, pp. 142 & 171; de Man, 1880b, p. 184; Haswell, 1882a, p. 89; Alcock, 1900, p. 377; Borradaile, 1903, p. 433; Nobili, 1906b, p. 317; Rathbun, 1910a, p. 322, Fig. 6; Laurie, 1915, p. 470.

Material examined. 23 ♂♂ (7.7–22.5 mm); 38 ♀♀ (7.75–28.5 mm).

Western Australia (Exmouth Gulf—Yampi Sound); Queensland (Cape York—Moreton Bay); New Caledonia (Oubatche); Lord Howe Island.

Description. Front deflexed; markedly constricted between bases of ocular peduncles; smooth margined, anterior margin being bilobed in males and straight in females; and with faint median furrow.

Upper orbital border curved and backwardly sloping; margin studded with medium sized granules. Lower orbital border 'serrated' by large granules along margin.

Three well defined anterolateral teeth present. External orbital angle large, pointed, directed outwards and slightly forwards; anterior margin studded with granules, posterior margin smooth; separated from second lateral tooth by wide incision. Second lateral

tooth pointed, directed outwards and slightly forwards; both margins granular; base broader than preceding tooth; extending laterally for variable distance, sometimes extending as far as tip of external orbital angle (as in many females and a few males) or else extending to about half that distance (as in most males); separated from third lateral tooth by wide incision. Third lateral tooth pointed, directed outwards and slightly forwards; both margins granular; base broader than either of two preceding teeth; extending laterally for variable distance similarly to second lateral tooth. Posterior to third lateral tooth, small bulge present in carapace margin, in position of fourth lateral tooth of *M. latreillei* and *M. dentatus*.

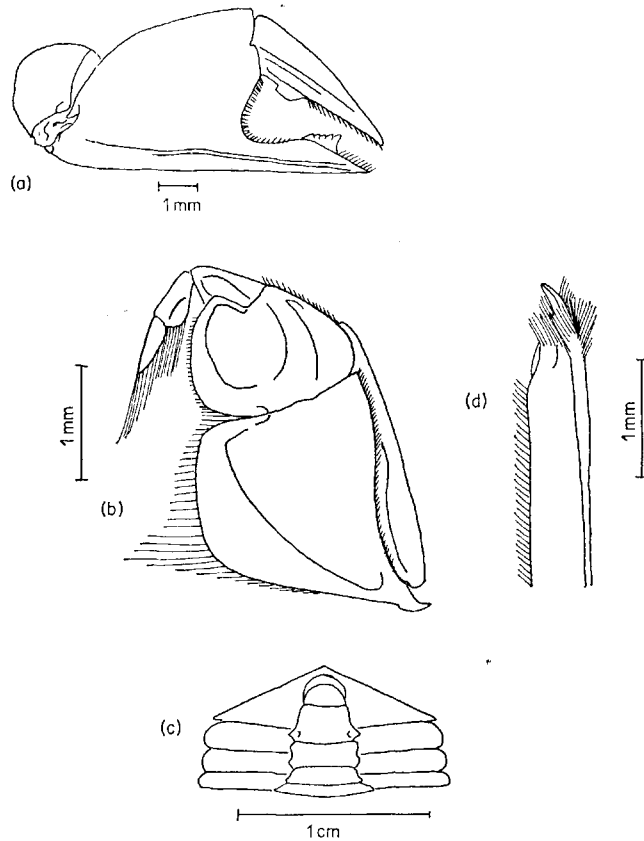


FIG. 1. *M. telescopicus*.

(a) Male chela (right), outer surface. (b) External maxilliped (left), outer surface. (c) Male abdomen and sternum. (d) 1st male pleopod (left), sternal surface.

Carapace smooth, except on branchial regions where heavily granular and near postero-lateral margins where hairy; with indistinct furrows, excepting circumgastric; with poorly developed clumps of granules on branchial regions. Lateral margins with row of short hairs, margins parallel or slightly bulging posterior to bulge in position of fourth lateral tooth. Greatest carapace breadth between external orbital angles.

Ocular peduncles very long, extending beyond tips of external orbital angles by between two-elevenths and seven-twelfths of their length.

Male cheliped. (a) Merus. Upper margin with row of large tubercular granules; inner margin with fringe of long hairs; outer margin with medium sized granules. Lower surface heavily haired; inner and outer surfaces hairless and with scattered granules.

(b) Carpus. Outer surface covered with small granules; inner surface with scattered hairs and granules, latter forming a row near joint with propodus.

(c) Palm. Outer surface closely covered with small granules; granular ridge well developed, continuing onto immovable finger with reduction in granules; inner surface with dense mat of hairs distally and centrally (continuous with those of immovable finger and dactylus), granules proximally, centrally and near upper and lower margins. Upper and lower margins closely covered with granules.

(d) Immovable finger. Undeformed. Outer surface with granules near margins; inner surface heavily hairy. Cutting margin with long, crenulated, tooth in central region.

(e) Dactylus. Outer surface with close covering of small granules near upper margin; inner surface with mat of hairs near cutting margin and two parallel longitudinal rows of hairs near upper margin. Upper margin with series of tubercular granules; cutting margin with large quadrangular tooth near base and isolated conical tubercles over remainder.

Male abdomen. Lateral margins of fourth segment convergent towards fifth segment; of fifth segment concave; of sixth segment with sharply pointed protruberance in morphologically anterior position.

External maxilliped. Internal margin of ischium straight; external margin concave proximally and convex distally. Internal margin of merus convex; external margin smoothly curved; anterior margin deeply indented.

First male pleopod straight, with well-developed terminal process and without hairs on internal margin.

Dimensions and relative proportions

Carapace breadth (mm)	7.5	10.0	15.0	20.0	22.5
$\frac{\text{Carapace breadth}}{\text{Carapace length}}$	1.58	1.66	1.66	1.66	1.66
$\left. \begin{array}{l} \text{Length of chela} \\ \text{Carapace breadth} \end{array} \right\}$	♂	0.46	0.53	0.70	—
	♀	0.37	0.37	0.38	0.39
$\frac{\text{Carapace breadth}}{\text{Breadth of front}}$	5.07	5.41	5.66	5.75	5.79

Distribution. Red Sea (de Man, 1880b); India (Alcock, 1900); Singapore (Lanchester, 1900); Japan (Sakai, 1939); Australia (Haswell, 1882a; Miers, 1886); Pacific Islands (Owen, 1839; Gibbs, 1850; Tinker, 1965).

Comments. Tesch (1915) synonymised the *Gelasimus telescopicus* of Owen (1839), the *M. compressipes* of Randall (1839), the *M. podophthalmus* of Souleyet (1841), the *M. verreauxi* of H. Milne Edwards (1848) and the *M. telescopicus* (Owen) of the same author

(1852) into the one *M. telescopicus*. There exists no doubt that Owen's and Randall's species are synonymous, but doubt however exists over the status of Souleyet's and H. Milne Edwards' (1848) species. The distinction between these three 'species' is based on the form of the anterolateral teeth (degree of flatness and pointedness of the external orbital angle, etc.). Kemp (1919) accepted Tesch's synonymy only as a temporary measure and suggested that further research would be necessary to prove the three 'species' to be in fact synonymous. Crosnier (1965) examined specimens of *podophthalmus* and *verreauxi* which 'greatly resembled the types' and came to the conclusion that the differences between those two species and *telescopicus* were not sufficient to justify three separate species.

Although the author has seen specimens from a somewhat restricted area, the variations observed in these specimens permit certain conclusions, relating to the validity of Tesch's synonymy, to be made. A large degree of variation in the length of the ocular peduncles was noted, this variation showing no correlation with size or geographical area. A similar degree of variation was shown by the anterolateral teeth (with no correlation between teeth variations and size of the ocular peduncles); in some specimens the external orbital angles were directed partially forwards, in others straight outwards, and the size of the second lateral tooth varied from being half as long as the external orbital angles to being equisized with those teeth. In all other respects the various specimens, with the exception of those from Lord Howe Island, were identical. The Lord Howe Island specimens differed in the degree of expression of several characters from the other specimens seen. They showed (a) more anteriorly directed external orbital angles, (b) coarser and more extensive granulation on the branchial region, (c) more extensive hair on the inner surface of the male chela, (d) longer ocular peduncles, (e) slightly larger third lateral carapace teeth and (f) comparatively broader male abdominal segments, especially the sixth. These specimens may represent a geographical race of *M. telescopicus* on the isolated Lord Howe Island, insufficient specimens have however been examined to further determine their status.

The variation seen in the form of the external orbital angles in the other specimens has included specimens resembling Crosnier's figures of both *M. podophthalmus* and *M. verreauxi*, even within specimens from a single locality, and yet there appears to be no correlation between any of the variable characters that might indicate that *M. telescopicus* is in fact composed of a number of sibling species. Hence it would appear that *M. telescopicus* possesses a large degree of variation in a small number of characters, and if this species is shown to exhibit a similar variability in other parts of its range, then it would seem probable that Tesch's synonymy is substantially correct.

2. *Macrophthalmus (Macrophthalmus) crassipes* H. Milne Edwards, 1852

(Plate 1(b), Fig. 2)

Synonymy

Macrophthalmus crassipes H. Milne Edwards, 1852, p. 157; Hess, 1865, p. 142; Haswell, 1882a, p. 89; de Man, 1890, p. 76, Plate 4, Fig. 7; Ortmann, 1894a, p. 744; 1897, p. 345; Rathbun, 1910a, p. 323; Tesch, 1915, p. 174, Plate 7; Rathbun, 1924, p. 12; Tweedie, 1937, p. 164.

Macrophthalmus carinimanus: Haswell, 1882a, p. 88; McNeill, 1962, p. 41, Plate 2, Fig. 2; *nec* H. Milne Edwards, 1837, p. 65.

? *Macrophthalmus sandakani*: Rathbun, 1924, p. 12, Plate 1, Fig. 3; *nec* Rathbun, 1914, p. 82.

Material examined. 160 ♂♂ (6.7–37.0 mm); 118 ♀♀ (8.3–33.0 mm).

Queensland (Cape York–New South Wales border); New South Wales (Queensland

border—Sydney); Western Australia (Roebuck Bay); Northern Territory (Darwin); New Guinea (Port Moresby).

Description. Front deflexed; markedly constricted between bases of ocular peduncles; smooth margined; with bilobed anterior margin and median furrow.

Upper orbital border strongly curved and markedly sloping; margin 'beaded' by small granules. Lower orbital border 'serrated' by large tubercular granules.

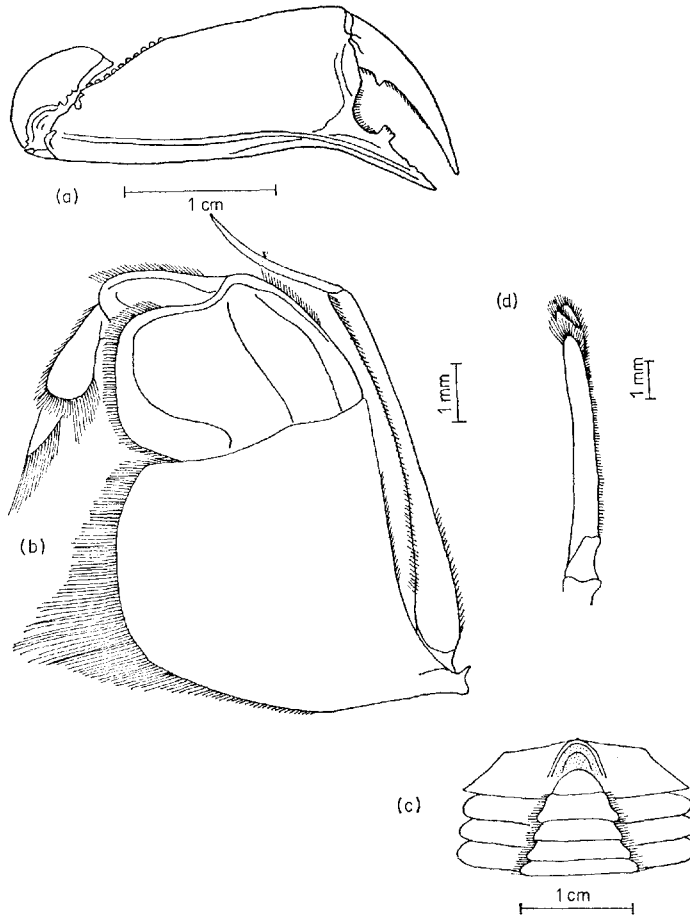


FIG. 2. *M. crassipes*.

(a) Male chela (right), outer surface. (b) External maxilliped (left), outer surface. (c) Male abdomen and sternum. (d) 1st male pleopod (right), sternal surface.

Two well defined and one poorly defined anterolateral teeth present. External orbital angle narrow, elongate, pointed, directed outwards and slightly forwards; anterior margin with granules continuous with those of upper orbital border, posterior margin smooth; separated from second lateral tooth by deep, but very narrow incision. Second lateral tooth large, wedge-shaped, directed outwards and slightly forwards; anterior margin smooth, posterior margin straight or concave, granular; tip extends to same level as that of external

orbital angle; separated from third lateral tooth by small, narrow incision. Third lateral tooth small or absent; if present both margins granular.

Carapace covered in small to medium sized granules; with well defined, deep furrows; with distinct clumps of granules on branchial regions; with abruptly sloping sides. Lateral margins markedly convergent posteriorly, with row of long hairs along length. Greatest carapace breadth between external orbital angles and second lateral teeth.

Ocular peduncles long and narrow; cornea not protruding beyond tip of external orbital angle.

Male cheliped. (a) Merus. Upper margin with few, isolated, tubercular granules in proximal half; inner margin hairy; outer margin with compact row of tubercles distally. Lower surface finely granulated and hairy on inner half; inner surface smooth proximally and with close covering of hair distally; outer surface more or less smooth.

(b) Carpus. Hairless. Outer surface smooth; inner surface with large spine and tubercular granules dorsally, and with a similar arrangement, but with more tubercular granules, ventrally and near joint with palm.

(c) Palm. Elongate. Outer surface finely granular near upper margin, smooth near lower margin except near strongly marked longitudinal ridge; inner surface heavily hairy (continuous with hair on immovable finger and dactylus), sparsely granular, but with individual granules larger than those on outer surface, with large spine or spines proximally, near and directed towards carpus. Upper margin with row of prominent granules along whole length; lower margin smooth.

(d) Immobile finger. Deflexed. Outer surface smooth to naked eye, except for continuation of longitudinal ridge, granular microscopically; inner surface densely hairy. Cutting margin with large, crenulated, quadrangular or hemispherical tooth, one third length of margin from base, and with series of large granules distally.

(e) Dactylus. Strongly curved. Outer surface smooth; inner surface heavily hairy. Cutting margin with small quadrangular tooth near base, distally with large granules; upper margin smooth.

Pereiopod meri with hair along upper margins concealing subterminal spines.

Male abdomen. Lateral margins of fourth segment convergent towards fifth segment; of sixth segment with bulge occupying morphologically anterior half.

External maxilliped. Internal margin of ischium convex; external margin straight. Internal margin of merus convex; external margin curving smoothly into anterior margin, without developed posteroexternal convexity; anterior margin shallow and concave.

First male pleopod slightly curved, with well developed terminal process and without hairs on internal margin.

Dimensions and relative proportions

Carapace breadth (mm)		7.0	10.0	15.0	20.0	25.0	30.0	35.0
$\frac{\text{Carapace breadth}}{\text{Carapace length}}$		1.75	1.90	2.00	2.05	2.11	2.15	2.22
$\frac{\text{Length of chela}}{\text{Carapace breadth}}$	} ♂	0.36	0.37	0.42	0.51	0.62	0.70	0.77
		♀	0.33	0.33	0.31	0.31	0.30	0.30
$\frac{\text{Carapace breadth}}{\text{Breadth of front}}$		4.83	5.55	6.15	6.58	6.94	7.14	7.22

Distribution. Malaya (Tweedie, 1937); Gulf of Siam (Rathbun, 1910a); China (Ortmann, 1897); Caroline Islands (de Man, 1890); Australia (H. Milne Edwards, 1852).

Comments. This species is one of the commonest and most widespread Australian species.

Haswell (1882a) and McNeill (1962) both recorded the allied species *M. carinimanus* (= *M. brevis*, fide Tesch (1915)) from Australia, the former from Holborn Island and Sydney, the latter from Sydney alone. Both authors deposited their identified material in the Australian Museum, where the specimens were re-examined by the present author and found to be of *M. crassipes*.

Rathbun (1924) recorded *M. sandakani* as occurring near Cape Jaubert, Western Australia (the only Australasian record of this species). From her description of the specimen, and from her figuring of the chela (Fig. 3) and the dorsal surface of the entire animal (Plate I), it seems quite probable that the young male referred to belongs to *M. crassipes*, the author being unable to find any points of difference between the description and figures, and that species.

3. *Macrophthalmus (Macrophthalmus) convexus* Stimpson, 1858 (Plate 1(c), Fig. 3)

Synonymy

Macrophthalmus convexus Stimpson, 1858, p. 97; Miers, 1880, p. 307; Haswell, 1882a, p. 89; de Man, 1888a, p. 354, Plate 15, Fig. 4; Ortmann, 1894a, p. 745; 1897, p. 344; Alcock, 1900, p. 343; de Man, 1902, p. 493, Plate 19, Figs 6, 6(a); Stimpson, 1907, p. 97, Plate 13, Fig. 2; Rathbun, 1910a, p. 323, Plate 2, Fig. 3; Tesch, 1915, p. 175, Plate 7; 1918, p. 59; Kemp, 1919, p. 389, Plate 24, Fig. 2; Balss, 1922, p. 145; Boone, 1934, pp. 201–204, Plates 104–106; Tweedie, 1937, p. 163; Sakai, 1939, p. 625, Fig. 97; nec Stephenson, 1946, p. 191; Barnard, 1954b, p. 98 (fide Crosnier, 1965).

Macrophthalmus inermis A. Milne Edwards, 1867, p. 286; 1873a, p. 277, Plate 12, Fig. 5; Rathbun, 1906, p. 834.

Material examined. 52 ♂♂ (7.0–32.5 mm); 47 ♀♀ (9.0–31.0 mm).

Western Australia (Roebuck Bay); Queensland (Cooktown—Port Curtis); New Guinea (Daru Island); Solomon and Santa Cruz Islands; New Hebrides; Fiji; Gilbert Islands.

Description. Front deflexed; markedly constricted between bases of ocular peduncles; smooth margined; with bilobed anterior margin and median furrow.

Upper orbital border curved, backwardly sloping; margin 'beaded' with small granules. Lower orbital border 'serrated' by large tubercular granules.

Two well-defined and one poorly-defined anterolateral teeth present, 'beaded' with small granules along margins. External orbital angle large, pointed, directed outwards and forwards (tip in adults lying in same transverse plane as anterior margin of upper orbital border); separated from much smaller second lateral tooth by wide incision. Second lateral tooth small, pointed, directed straight outwards; separated from third lateral tooth by small incision. Third lateral tooth very small or absent.

Carapace smooth and shiny to naked eye (except for granular clumps on branchial regions), lateral areas microscopically granular; with faint, shallow furrows, excepting circumgastric; with well developed granular clumps on branchial regions. Lateral margins markedly convergent posteriorly, with rows of long silky hair along their lengths. Greatest carapace breadth between external orbital angles.

Ocular peduncles long and narrow; cornea only passing slightly, if at all, tip of external orbital angle.

Male cheliped. (a) Merus. Inner margin with series of granules and row of long, fine, hairs; upper and outer margins without granules or hairs. Inner surface with large granules; lower and outer surfaces finely granular.

(b) Carpus. Hairless. Outer surface smooth; inner surface with row of large tubercles near joint with palm.

(c) Palm. Hairless. Outer surface smooth above longitudinal ridge, heavily granular below ridge; inner surface finely granular, without spine near carpal

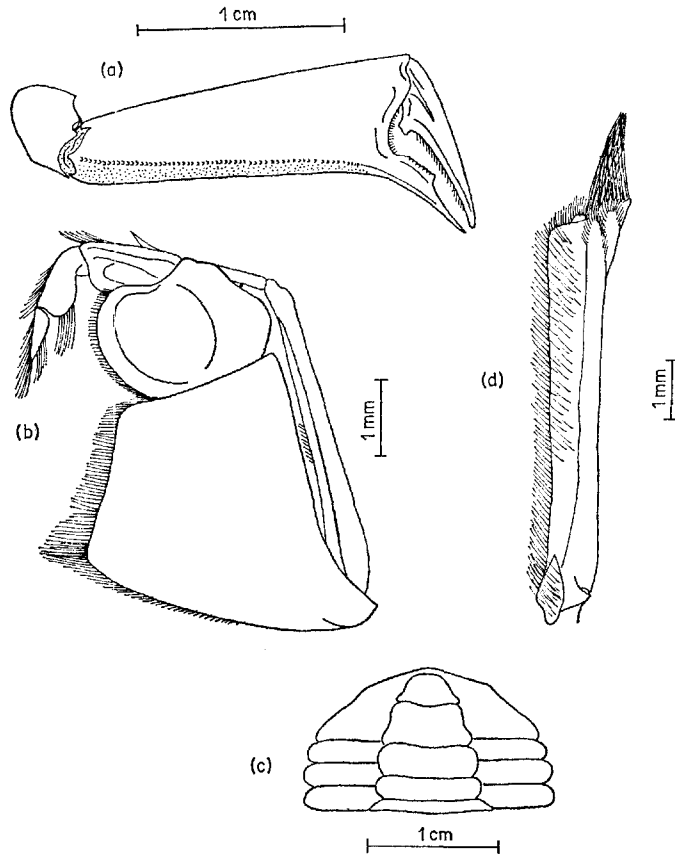


FIG. 3. *M. convexus*.

(a) Male chela (right), outer surface. (b) External maxilliped (left), outer surface. (c) Male abdomen and sternum. (d) 1st male pleopod (left), sternal surface.

joint. Upper margin with row of small granules along entire length; lower margin irregularly granular.

(d) Immovable finger. Deflexed. Outer surface smooth except for continuation of longitudinal ridge; inner surface heavily hairy. Cutting margin with large, long, crenulated tooth in proximal half.

(e) Dactylus. Curved. Outer surface smooth; inner surface heavily hairy. Cutting margin with small quadrangular tooth near base, with granules distally.

Pereiopod meri with few fine hairs on upper margins.

Male abdomen. Lateral margins of last and penultimate segments with bulge in morphologically anterior positions; of other segments convex.

External maxilliped. Internal and external margins of ischium more or less straight, distally convergent. Internal margin of merus convex; external margin with almost semi-circular posteroexternal convexity and smaller anteroexternal convexity.

First male pleopod straight, with tuft of long terminal hairs, but without hair on internal margin.

Dimensions and relative proportions

Carapace breadth (mm)	7.0	10.0	15.0	20.0	25.0	30.0	33.0
$\frac{\text{Carapace breadth}}{\text{Carapace length}}$	1.75	1.82	1.88	1.94	1.97	2.04	2.18
$\frac{\text{Length of chela}}{\text{Carapace breadth}}$	♂ 0.43	0.45	0.49	0.58	0.70	0.75	—
	♀ —	0.33	0.33	0.33	0.33	0.34	—
$\frac{\text{Carapace breadth}}{\text{Breadth of front}}$	5.83	6.25	7.14	7.55	8.06	8.22	8.25

Distribution. India (Alcock, 1900); Malaya (Tweedie, 1937); Indonesia (de Man, 1902); Japan (Sakai, 1939); Australasia (Miers, 1880; Boone, 1934); Pacific Islands (Rathbun, 1906).

Comments. The synonymy given agrees with that of Tesch (1915) in the placing of *M. inermis* as a synonym of *M. convexus*, but disagrees with Tesch and follows Laurie (1915) in separating *M. graeffei* from *M. convexus* as a distinct species.

(b) *Subgenus Mareotis*

KEY TO THE AUSTRALASIAN SPECIES OF THE SUBGENUS *MAREOTIS*

- (1) (a) Carapace with concave granular row on each protogastric region. ... *M. definitus*
- (b) Carapace without concave granular row on each protogastric region. ... 2
- (2) (a) Carapace without longitudinal rows of hair or granules on each branchial region. ... *M. abercrombiei*
- (b) Carapace with distinct longitudinal rows of granules and/or hairs, sub-parallel to each other and to the posterolateral carapace margins, on each branchial region. ... 3
- (3) (a) Greatest carapace breadth occurring across external orbital angles. ... *M. setosus*
- (b) Greatest carapace breadth occurring behind external orbital angles. ... 4
- (4) (a) No differentiated tooth on cutting margin of immovable finger of male chela. ... *M. pacificus*
- (b) Distinct tooth present on cutting margin of immovable finger of male chela. ... 5
- (5) (a) Inner surfaces of dactylus and immovable finger of chela heavily hairy. ... *M. crinitus*
- (b) Inner surfaces of dactylus and immovable finger without hair. ... *M. japonicus*

1. *Macrophthalmus (Mareotis) definitus* Adams & White, 1848

(Plate 1(d), Fig. 4)

Synonymy

Macrophthalmus definitus Adams & White, 1848, p. 51; Ortmann, 1897, p. 342; Rathbun, 1910b, p. 307, Plate 2, Fig. 1; Tesch, 1915, p. 198; 1918, p. 59; Barnes, 1966a, p. 46.

Macrophthalmus depressus: Ortmann, 1894a, p. 745; *nec* Rüppell, 1830, p. 19.

Material examined. 4 ♂♂ (18·0–21·25 mm); 3 ♀♀ (14·25–15·0 mm).

Solomon Islands (Ysabel Island).

Description. Front deflexed; constricted between bases of ocular peduncles; with deep median furrow; sparsely granular surface; straight anterior margin and with granules along proximal half of lateral margins.

Upper orbital border curved and transverse; margin studded with rounded granules. Lower orbital border studded with large tubercular granules decreasing in size towards external orbital angle.

Three distinct anterolateral teeth present, 'beaded' along outer margins with rounded granules. External orbital angle broad, rectangular, directed outwards and slightly forwards; anterior margin with granules continuous with those of upper orbital border; separated from second lateral tooth by wide U-shaped incision. Second lateral tooth large, broad, rectangular, projecting beyond former tooth; outer margins slightly divergent posteriorly; separated from third lateral tooth by wide V-shaped incision. Third lateral tooth broad, wedge shaped and bluntly pointed.

Carapace with heavily granular surface except over gastric, cardiac, intestinal and contiguous branchial regions which are smooth and shiny; with scattered hairs on branchial regions, densest marginally; with deep furrows; with two concave granular rows, one on each anteroprotogastric region; with transverse, concave, row of granules, extending from third lateral tooth across branchial region; with smaller, slightly concave, row of small granules above insertion of fourth pereopod; without clearly defined longitudinal granular rows, but with two short rows present in position of inner longitudinal row of other species in an anterior/posterior position. Greatest carapace breadth between third lateral teeth, behind which lateral margins subparallel and with row of hairs.

Ocular peduncles long and narrow; cornea extending to base of external orbital angle.

Male cheliped. (a) Merus. Inner margin with large rounded granules and long hairs; upper margin with long hairs; outer margin with irregular covering of granules. Inner surface heavily hairy; outer surface with similar hairy mat, but slightly less well developed; lower surface heavily granular.

(b) Carpus. Elongate. Upper margin irregularly granular; lower margin with row of large granules. Inner surface hairy, and with large tubercles near joint with palm; outer surface smooth to naked eye, microscopically with small granules in upper portion.

(c) Palm. Outer surface smooth to naked eye, microscopically with small granules, largest near upper margin, without longitudinal ridge; inner surface heavily hairy, with large granules near lower margin. Upper margin with row of granules; lower margin with scattered granules.

(d) Immobile finger. Deflexed. Outer surface smooth; inner surface densely hairy. Lower margin smooth; cutting margin with large crenulated tooth in centre, and large granules distal to tooth.

(e) Dactylus. Curved. Outer surface with microscopical granules; inner surface densely hairy. Upper margin with very small granules; cutting margin with small but distinct tooth near base, large granules distally.

Pereiopod meri large, tapered distally; with close covering of hair on both upper surfaces, rows of granules along all margins, row of long hairs and large distal spine on upper margin. Carpi and propodi hairy. Dactyli lanceolate.

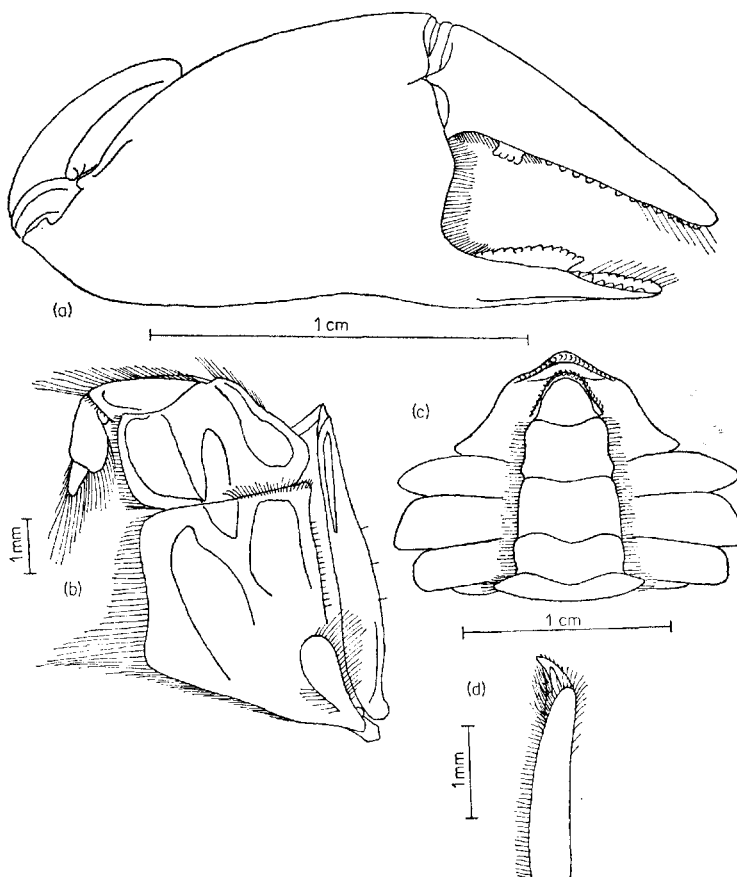


FIG. 4. *M. definitus*.

(a) Male chela (right), outer surface. (b) External maxilliped (left), outer surface. (c) Male abdomen and sternum. (d) 1st male pleopod (left), sternal surface.

Male abdomen. Lateral margins of fourth segment convex, of sixth segment concave with slight convexity in morphologically anterior position. Third segment with marked, central, transverse ridge (also present in females).

External maxilliped. Internal margin of ischium concave; external margin straight. Merus with pronounced posteroexternal convexity.

First male pleopod slightly curved, with marked terminal and subterminal lobes, hair present on internal margin distally.

Dimensions of largest male examined (mm)

Carapace breadth = 21.25	Carapace length = 16.5
Length of propodus of chela = 15.0	Breadth of front = 2.9

Distribution. Philippines (Adams & White, 1848; Rathbun, 1910b).

Comments. The first record of this species from an area other than the Philippines.

2. *Macrophthalmus (Mareotis) abercrombiei* Barnes, 1966

Synonymy

Macrophthalmus abercrombiei Barnes, 1966a, pp. 43–47, Plate 8, Fig. 1.

Material examined. 3 ♂♂ (22.25–26.0 mm).

Queensland (South east Gulf of Carpentaria).

Comments. No further specimens have been discovered since the author described this species in 1966. One paratype has however been transferred from the Australian Museum to the Queensland Museum.

3. *Macrophthalmus (Mareotis) setosus* H. Milne Edwards, 1852

(Plate 2(a), Fig. 5)

Synonymy

Macrophthalmus setosus H. Milne Edwards, 1852, p. 159; Haswell, 1882a, p. 89; de Man, 1888a, p. 356, Plate 9, Figs 2, 2(a); Ortmann, 1897, p. 343; Tesch, 1915, p. 189; Etheridge & McCulloch, 1916, p. 12, Plates 5–6; Snelling, 1959, p. 70; McNeill, 1962, p. 42.

Macrophthalmus pacificus: Snelling, 1959, p. 70; *nec* Dana, 1851, p. 248.

Material examined. 133 ♂♂ (4.5–39.75 mm); 99 ♀♀ (7.75–38.0 mm).

Queensland (Port Curtis—New South Wales border); New South Wales (Queensland border—Sydney).

Description. Front deflexed; constricted between bases of ocular peduncles; with median furrow; smooth surface; almost straight anterior margin; and smooth margins.

Upper orbital border slightly curved and backwardly sloping; ‘beaded’ with small granules along margin. Lower orbital border serrated by tubercular granules.

Two distinct and one indistinct anterolateral teeth present. External orbital angle large, broad, rectangular; outer margin convex, both margins ‘beaded’ with small granules continuous with those on upper orbital border; separated from second lateral tooth by narrow fissure. Second lateral tooth similar in shape to preceding tooth but smaller than latter and projecting less outwardly; separated from third lateral tooth by narrow incision. Third lateral tooth small and completely hidden in thick hair.

Carapace surface with small granules, except over central regions, latter smooth; with variable amount of short hair, sometimes completely covering carapace; with shallow but distinct furrows; with transverse granular and hairy row extending from level of third lateral tooth across anterior branchial region; with short transverse row above insertion of fourth pereopod; with two longitudinal rows subparallel to each other and to posterolateral carapace margins, on branchial region. Greatest carapace breadth occurring between external orbital angles, behind which lateral margins convergent. Lateral margins with row of short hairs.

Ocular peduncles long and narrow; cornea extending to base of external orbital angle.

Male cheliped. (a) Merus. Inner and upper margins heavily hairy; outer margin more or less smooth. Lower surface and upper regions of inner and outer surfaces heavily granulated, lower regions of inner and outer surfaces smooth.

(b) Carpus. Upper margin hairy; lower margin feebly granular. Inner surface with large granules and row of tubercles near joint with palm; outer surface with sparse smaller granules.

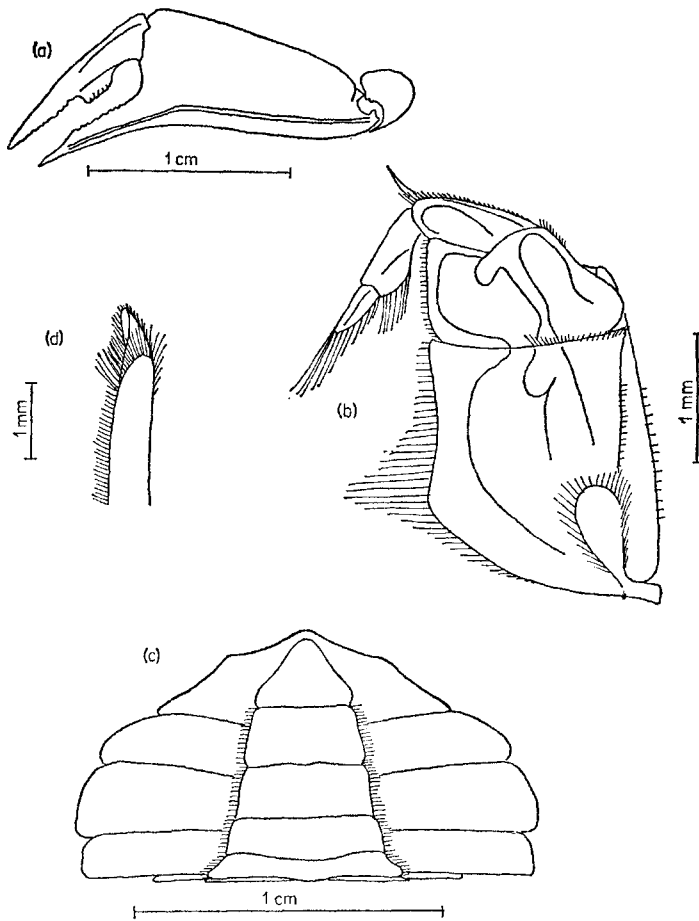


FIG. 5. *M. setosus*.

(a) Male chela (left), outer surface. (b) External maxilliped (left), outer surface. (c) Male abdomen and sternum. (d) 1st male pleopod (left), sternal surface.

(c) Palm. Upper margin with irregular granules; lower margin with few granules. Inner surface finely granular and heavily hairy; outer surface with granules near upper margin, with inconspicuous and feebly developed longitudinal ridge running close to and subparallel with lower margin, and with smooth central area.

(d) Immovable finger. Deflexed. Outer surface smooth, with faint continuation of longitudinal ridge near lower margin; inner surface heavily hairy. Lower

margin smooth; cutting margin with longitudinal series of similar granules, slightly raised proximally, but without distinct tooth.

(e) *Dactylus*. Outer surface smooth; inner surface heavily hairy. Cutting margin with large, long, crenulated tooth occupying proximal quarter of the margin, with series of granules distally.

Pereiopod meri and carpi heavily hairy; lower margins and surfaces of meri granular, subterminal spine on upper margins small.

Male abdomen. Lateral margins of fourth, fifth and sixth segments more or less straight, of terminal segment concave.

External maxilliped. Internal margin of ischium markedly concave; external margin straight. Internal margin of merus almost straight; external margin with marked postero-external convexity. Merus-ischium suture transverse.

First male pleopod slightly curved, with marked terminal lobe and with hair on internal margin distally.

Dimensions and relative proportions

Carapace breadth (mm)	5.0	10.0	15.0	20.0	25.0	30.0	35.0
$\frac{\text{Carapace breadth}}{\text{Carapace length}}$	1.43	1.59	1.66	1.67	1.68	1.69	1.71
$\left. \begin{array}{l} \text{Length of chela} \\ \text{Carapace breadth} \end{array} \right\}$	♂ 0.40	0.40	0.42	0.51	0.59	0.65	0.69
	♀ —	0.35	0.36	0.36	0.36	0.36	0.36
$\frac{\text{Carapace breadth}}{\text{Breadth of front}}$	5.15	7.41	8.77	9.76	10.16	10.42	10.64

Distribution. Eastern Australia (H. Milne Edwards, 1852; Haswell, 1882a).

Comments. Juveniles of about 7.5 mm carapace breadth and under, differ markedly from adults in two features of carapace shape. In these juveniles the carapace breadth is not so markedly greater than the length as it is in adults (see 'relative proportions') and the position of greatest breadth occurs posterior to the external orbital angles, between the second and third lateral teeth. (Thus in these characters the juveniles are more typical of the subgenus *Mareotis* than the adults.) It is these juvenile *M. setosus* that Snelling (1959) recorded from the Brisbane River as *M. pacificus*. This was first suggested by Dr J. C. Yaldwyn of the Australian Museum (pers. comm.), and then confirmed by examination of Snelling's identified material in the Australian Museum and the University of Queensland Department of Zoology.

4. *Macrophthalmus (Mareotis) pacificus* Dana, 1851

(Plate 2(b), Fig. 6)

Synonymy

Macrophthalmus pacificus Dana, 1851, p. 248; 1852, p. 314, Plate 19, Fig. 4; Stimpson, 1858, p. 97; de Man, 1890, p. 79, Plate 4, Fig. 10; 1895, p. 579; Ortmann, 1897, p. 342; Tesch, 1915, p. 190, Plate 8; Kemp, 1919, p. 391; Rathbun, 1924, p. 13; Sakai, 1939, p. 628; Chhappgar, 1957, p. 514, Plate 15; Tweedie, 1950, p. 359; *nec* Rathbun, 1910b, p. 307, Plate 1, Fig. 3; Snelling, 1959, p. 70.

? *Macrophthalmus bicarinotus* Heller, 1868, p. 36, Plate 4, Fig. 2; de Man, 1902, p. 496.

Macrophthalmus quadratus: Boone, 1934, pp. 204-6, Plate 107-9; *nec* A. Milne Edwards, 1873a, p. 280.

Material examined. 46 ♂♂ (5.4-18.75 mm); 25 ♀♀ (6.75-22.0 mm).

Queensland (Cooktown—Port Curtis); New Guinea (Kaimare & Daru Island); Solomon Islands (Ysabel Island).

Description. Front deflexed; slightly constricted between bases of ocular peduncles; with smooth margins; straight anterior margin; deep median furrow.

Upper orbital border slightly curved and transverse; margin studded with very small granules, appearing smooth to naked eye. Lower orbital border studded with large tubercular granules, which increase in size towards epistome, granules immediately nearest epistome, however, small.

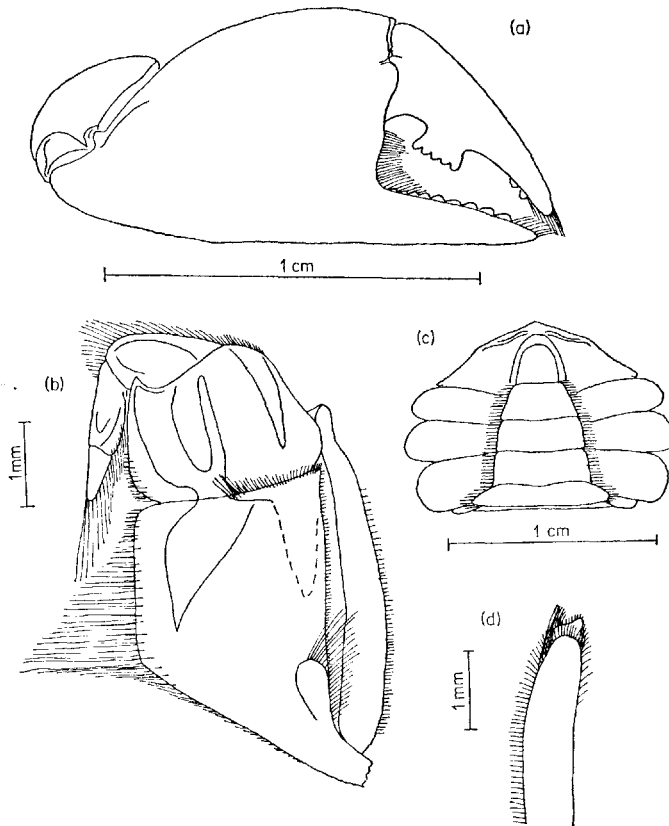


FIG. 6. *M. pacificus*.

(a) Male chela (right), outer surface. (b) External maxilliped (left), outer surface. (c) Male abdomen and sternum. (d) 1st male pleopod (left), sternal surface.

Two large and one small anterolateral teeth present. External orbital angle broad, rectangular; with outer margins divergent posteriorly and with 'beading' of small granules; separated from second lateral tooth by deep but narrow incision. Second lateral tooth very broad, subrectangular, projecting beyond former tooth; outer margins divergent posteriorly and with 'beading' of small granules; separated from third lateral tooth by small but distinct incision. Third lateral tooth small, pointed and projecting as far as, or beyond, second lateral tooth.

Carapace surface smooth to naked eye, but microscopically with small granules; with inconspicuous furrows, excepting circumgastric; with granular ridge extending transversely across anterior branchial region from level of third lateral tooth; with small, transverse, concave, row of granules above insertion of fourth pereopod; with two longitudinal rows, subparallel to each other and to posterolateral carapace margins, on each branchial region, outer row broken into two sections by gap near anterior end, small anterior row set at angle to larger posterior row. Greatest carapace breadth across third lateral teeth, behind which lateral margins parallel and with row of hairs.

Ocular peduncles long and narrow; cornea extending to base of external orbital angle.

Male cheliped. (a) Merus. Inner margin with row of long hairs; upper margin with row of large tubercular granules; outer margin with small granules proximally and large tubercular granules distally. Inner surface smooth, with curved line of hairs along lower and distal borders, scattered hairs over remainder; outer surface hairless with scattered small granules; lower surface with dense mat of hair.

(b) Carpus. Upper margin with a few large granules distally; lower margin with small scattered granules. Inner surface hairless, with small scattered granules; outer surface with scattered small granules and hairs.

(c) Palm. Upper and lower margins without distinct rows of granules. Outer surface smooth to naked eye, microscopically with small scattered granules, without longitudinal ridge near lower margin; inner surface with scattered granules just visible to naked eye, with dense patch of hair centrally near distal margin (continuous with hair on immovable finger).

(d) Immobile finger. Undeformed. Outer surface with small scattered granules; inner surface with dense mat of hair near cutting margin. Lower margin with small scattered granules; cutting margin with series of large rounded granules, but without differentiated tooth.

(e) Dactylus. Curved, hairless except for fine hairs around spoon-tip. Outer and inner surfaces and upper margin with small scattered granules; cutting margin with large, crenulated tooth, with base narrower than cutting surface, in proximal half.

Pereopod meri, carpi and propodi granular, with only sparse hair on upper margins.

Male abdomen. Lateral margins of fourth and fifth segment straight, of sixth segment slightly sinuous.

External maxilliped. Internal and external margins of ischium more or less straight. Internal margin of merus straight; external margin with small posteroexternal convexity.

First male pleopod curved, with short terminal lobe, and hairs on internal margin distally.

Dimensions and relative proportions

Carapace breadth (mm)	5.0	10.0	15.0	20.0
$\frac{\text{Carapace breadth}}{\text{Carapace length}}$	1.25	1.33	1.39	1.43
$\left. \begin{array}{l} \text{Length of chela} \\ \text{Carapace breadth} \end{array} \right\}$	♂	0.45	0.58	0.71
	♀	—	0.42	0.43
$\frac{\text{Carapace breadth}}{\text{Breadth of front}}$	5.55	6.45	7.04	7.14

Distribution. India (Chhapgar, 1957); Malaya (de Man, 1895); Borneo (Tweedie, 1950); Japan (Sakai, 1939); Australasia (Rathbun, 1924; Boone, 1934); Samoa (Dana, 1852).

Comments. The only previous record of this species from Australia is that of Rathbun (1924) who recorded a single male specimen from Broome, Western Australia.

The specimens from New Guinea and the Solomon Islands differed from those from Queensland in that they possessed more extensive pereopod hair and possessed a sparse covering of short hair over the carapace. Due, however, to the small number of specimens examined little significance can be placed on this.

5. *Macrophthalmus (Mareotis) crinitus* Rathbun, 1913

(Plate 2(c), Fig. 7)

Synonymy

Macrophthalmus crinitus Rathbun, 1913, p. 619, Plate 75, Fig. 3; Tesch, 1915, pp. 192-3; Kemp, 1919, p. 390, Plate 24, Fig. 7; Chhapgar, 1957, p. 515, Plate 15.

Macrophthalmus pacificus: Rathbun, 1910b, p. 307, Plate 1, Fig. 3; *nec* Dana, 1851, p. 248.

Macrophthalmus sp.: de Man, 1902, p. 495.

Material examined. 12 ♂♂ (3.1-13.5 mm); 1 ♀ (12.0 mm).

Northern Territory (Darwin).

Description. Front deflexed; slightly constricted between bases of ocular peduncles; with smooth margins; straight or faintly bilobed anterior margin; deep but narrow median furrow.

Upper orbital border curved and transverse; margin studded with small rounded granules. Lower orbital border studded along whole length with large tubercular granules, and with long hairs on outer quarter.

Two large and one small anterolateral teeth present. External orbital angle large, broad, subrectangular, with granules continuous with those on upper orbital border on anterior margin; outer margin convex, with rounded granules, margins of two teeth slightly divergent posteriorly; separated from second lateral tooth by wide V-shaped incision. Second lateral tooth large, very broad, directed outwards, projecting beyond former tooth; anterior margin straight, outer margin convex, studded with rounded granules; separated from third lateral tooth by very narrow incision. Third lateral tooth very small, pointed.

Carapace surface smooth centrally, with scattered granules on branchial and hepatic regions, and with variable short hair over whole surface, densest laterally; with distinct furrows but only circumgastric deep; with four rows of hairs on each branchial region, often obscured by carapace hair, indistinct transverse row extending across anterior branchial region from level of third lateral tooth; short, concave, transverse row above insertion of fourth pereopod; two longitudinal rows subparallel to each other and to posterolateral carapace margins; with prominent epigastric ridges. Greatest carapace breadth across second lateral teeth, behind which lateral margins subparallel and with row of hairs.

Ocular peduncles long and narrow; cornea extending to base of external orbital angles.

Male cheliped. (a) Merus. Inner margin with long hair and tubercular granules at distal angle; upper margin with long hair; outer margin with row of large pointed granules, largest distally. Inner surface with mat of hair distally and near inner margin; outer surface with granules proximally and near outer margin, hair near upper margin; lower surface with large rounded granules under mat of hair.

(b) Carpus. Upper and lower margins coarsely granular. Inner surface with small scattered granules and oblique row of large pointed tubercles; outer surface with small scattered granules.

(c) Palm. Upper and lower margins with scattered granules, largest on lower margin. Outer surface finely granular, granules largest and densest near upper margin, without longitudinal ridge near lower margin in adults, present in juveniles; inner surface heavily hairy distally and on upper half, with granules near lower margin.

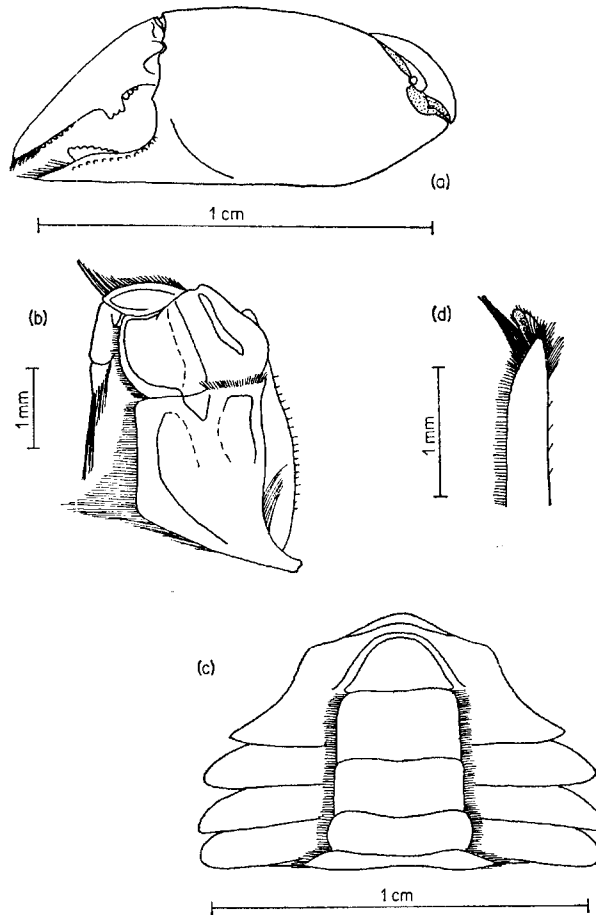


FIG. 7. *M. crinitus*.

(a) Male chela (left), outer surface. (b) External maxilliped (left), outer surface. (c) Male abdomen and sternum. (d) 1st male pleopod (left), sternal surface.

(d) Immovable finger. Straight or slightly deflexed. Outer surface finely granular, without continuation of longitudinal ridge except in juveniles; inner surface with mat of hair. Lower margin finely granular; cutting margin with large, long, crenulated tooth in centre of margin (in adults).

(e) Dactylus. Curved. Outer surface finely granular; inner surface heavily hairy. Upper margin with scattered granules; cutting margin with large quadrangular tooth, one third length of margin from base, (in adults), in juveniles long, low, crenulated tooth present near base (tooth of adult possibly developed from distal section of juvenile tooth), remainder of margin with medium-sized granules.

Pereiopod meri, carpi and propodi with thick hair on upper margins and upper surfaces, hair concealing subterminal spines on meri.

Male abdomen. Lateral margins of fourth segment slightly convex; of fifth and sixth segments straight and parallel.

External maxilliped. Internal and external margins of ischium straight. Internal margin of merus convex; external margin with pronounced posteroexternal convexity.

First male pleopod slightly curved; with well developed terminal lobe, and hair on internal margin distally.

Dimensions and relative proportions

Carapace breadth (mm)	3·0 (predicted)	5·0	7·5	10·0	13·0
$\frac{\text{Carapace breadth}}{\text{Carapace length}}$	1·20	1·25	1·30	1·38	1·42
$\frac{\text{Length of chela}}{\text{Carapace breadth}}$ ♂	0·37	0·45	0·51	0·60	0·77
$\frac{\text{Carapace breadth}}{\text{Breadth of front}}$	4·29	5·15	6·00	6·45	6·84

Distribution. India (Chhapgar, 1957); Mergui Archipelago (Kemp, 1919); Indonesia (Rathbun 1910b); Australia (present paper).

Comments. The Australian specimens differ from those described by Rathbun (1913) in details of the male chelae. The type male lacks a differentiated tooth on the immovable finger, and possesses a faint longitudinal ridge on the distal part of the outer surface of the palm, continued more distinctly onto the immovable finger. The juveniles examined by Rathbun possessed a much more distinct ridge on the palm than the type male. The juveniles from Darwin agree exactly with Rathbun's description, in that they lack the fore-mentioned tooth and possess the ridge. The largest Darwin specimen, however, although slightly smaller than Rathbun's type, has no ridge and possesses a tooth on the immovable finger. This largest specimen is similar to the type in the structure of the tooth on the dactylus, the juveniles however possess a much more elongate tooth (cf. adult *M. setosus*), although there are indications of a gradual reduction of the proximal section of the tooth with increase in size of the juveniles. The differences between Rathbun's specimens and the specimens from Darwin (both authors having only limited material at their disposal—Rathbun having only examined five specimens) would not appear to be basic differences in the nature of the chelae, but rather the attainment of adult characters at a slightly smaller size in the Australian specimens—Rathbun's type male then not being fully adult.

Tesch (1915), without having examined any material of *M. crinitus*, states that one of the characters of the species is a lack of longitudinal pubescent rows on the branchial region. Rathbun, however, in her original description (1913) makes no mention of the lack of

pubescent rows, but states instead that the species lacks distinct granular rows on the branchial region. In the Darwin specimens the longitudinal rows of hairs are clearly visible.

Rathbun indicated affinity between her species and *M. pacificus*. Tesch, however, and later Kemp (1919), denied close affinity of *M. crinitus* with *M. pacificus*, and placed its relationships with *M. boscii*. Although this species does bear a superficial resemblance to *M. boscii* (in shape of carapace and chelae), its basic structural features place it without doubt into the subgenus *Mareotis*, and in the opinion of the author within the subgenus its affinities are as Rathbun indicated (cf. *M. pacificus*).

6. *Macrophthalmus (Mareotis) japonicus* (de Haan, 1835)

(Plate 2(d), Fig. 8)

Synonymy

Ocypode japonica de Haan, 1835, p. 54, Plate 7, Fig. 1, Plate 15, Fig. 2.

Macrophthalmus japonicus: Gray, 1847, p. 38; Adams & White, 1848, p. 51; H. Milne Edwards, 1852, p. 158; Ortmann, 1894a, p. 746; 1897, p. 343; Tesch, 1915, p. 200, Plate 9; Parisi, 1918, p. 96; Balss, 1922, p. 145; Urita, 1926, p. 26; Yokoya, 1928, p. 779; Shen, 1932, p. 215, Plate 9, Figs 132 & 134; Sakai, 1934, p. 320; 1936, p. 215, Plate 60; 1939, p. 627, Plates 73 & 105, Fig. 98; 1965, p. 190, Plate 90.

Material examined. 4 ♂♂ (10.25–30.75 mm); 3 ♀♀ (21.5–29.25 mm).

Western Australia (Shark Bay).

Description. Front deflexed; constricted between bases of ocular peduncles; with smooth margins; granular surface; bilobed anterior margin; deep median furrow.

Upper orbital border curved, slightly backwardly sloping; margin studded with large tubercular granules along whole length. Lower orbital border studded with large tubercular granules similarly to upper border; inner four-fifths of border straight, outer fifth abruptly sloping.

Two large and one small anterolateral teeth present. External orbital angle large, broad, rectangular, pointed anteriorly, directed outwards and slightly forwards; outer margin with large tubercular granules; anterior margin with granules continuous with those of upper orbital border; separated from second lateral tooth by wide U-shaped incision. Second lateral tooth large, broad, rectangular, directed outwards, projecting beyond former tooth; both margins with tubercular granules, outer margin slightly convex; separated from third lateral tooth by small but distinct incision. Third lateral tooth small, conical, projecting outwards; outer margin with tubercular granules.

Carapace surface entirely covered by large granules, excepting over a small central area; with deep, wide, hair containing, furrows distinctly demarcating regions; with transverse granular and hairy row extending across anterior branchial region from level of third lateral tooth; with similar transverse row above insertion of fourth pereopod; with two longitudinal granular and hairy rows on branchial region, subparallel to each other and to posterolateral carapace margins. Greatest carapace breadth across second lateral teeth, behind which lateral margins slightly convergent or parallel. Lateral margins with large granules and row of hairs.

Ocular peduncles long and narrow; cornea extending to base of external orbital angle.

Male cheliped. (a) Merus. Elongate. Inner margin hairy; upper margin with distal row of tubercular granules; outer margin finely granular. Outer surface with few scattered granules; inner and lower surfaces heavily hairy near inner margin, and with scattered granules over remainder.

(b) Carpus. Hairless. Upper margin with row of large tubercles; lower margin finely granular. Outer surface granular towards margins, more or less smooth centrally; inner surface with scattered large tubercular granules.

(c) Palm. Elongate. Upper margin with longitudinal row of large tubercles; lower margin finely granular. Outer surface finely granular, granules increasing in size towards carpus, without longitudinal ridge near lower margin, with slight depression near base of immovable finger; inner surface heavily granular, with narrow longitudinal band of hair near upper margin.

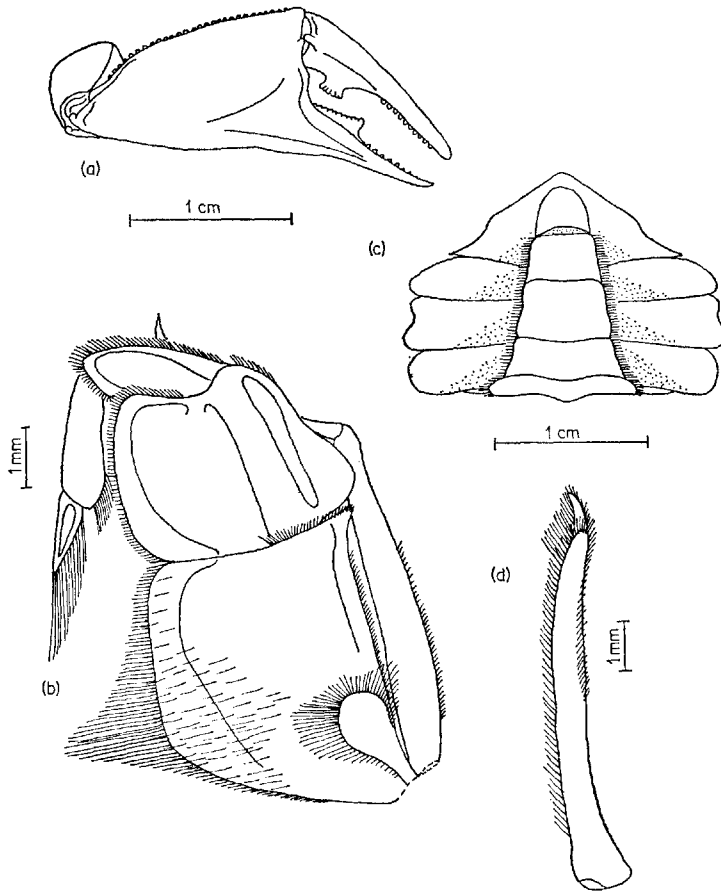


FIG. 8. *M. japonicus*.

(a) Male chela (right), outer surface. (b) External maxilliped (left), outer surface. (c) Male abdomen and sternum. (d) 1st male pleopod (left), sternal surface.

(d) Immovable finger. Deflexed, hairless. Outer surface granular near upper and lower margins; inner surface heavily granular. Lower margin slightly granular proximally, smooth distally; cutting margin with large, wedge-shaped, crenulated tooth occupying proximal half of margin, distally with few large and many small tubercular granules.

(e) *Dactylus*. Curved, hairless. Outer surface with granules near upper and lower margins; inner surface heavily granular. Upper margin granular; cutting margin with large quadrangular crenulated tooth, wider at tip than at base, near base, and distally row of tubercular granules.

Pereiopod meri elongate; parallel upper and lower margins with rows of large granules; lower surfaces granular; upper margins with few hairs. Carpi granular and with longitudinal ridges. Propodi granular and with faint longitudinal ridges. *Dactyli* lanceolate.

Male abdomen. Lateral margins of fourth, fifth and sixth segments almost straight. Proximal and posterior margins of sternal segments granular.

External maxilliped. Internal and external margins of ischium almost straight, and sub-parallel. Internal margin of merus slightly convex; external margin with marked postero-external convexity. Raised areas of merus and ischium pitted.

First male pleopod slightly curved; with well developed terminal lobe, and hair on internal margin distally.

Dimensions (mm)

	Carapace breadth	Carapace length	Breadth of front	Length of chela
Largest male	30.75	20.75	3.0	23.5
Smallest male	10.25	7.5	1.5	4.0
Largest female	29.0	20.25	3.0	11.5
Smallest female	21.5	14.5	2.5	8.5

Distribution. Japan (Sakai, 1965); North China (Sakai, 1939); Singapore (Sakai, 1939); Australia (present paper).

Comments. These specimens from Western Australia differ from Japanese specimens in two characters. Firstly the inner surface of the palm of the male chela is without hair in Japanese forms (Tesch, 1915; Sakai, 1939), whereas in the Australian forms there is a narrow band of hair on the upper portion of that surface. Secondly the inner longitudinal granular row on the branchial region is, in Japanese forms, divided into two rows by a break in the centre (de Haan, 1835, Plate 15; Tesch, 1915; Sakai, 1939, Plate 105), whereas in the Australian forms the row is undivided. These differences may be sufficient to distinguish a distinct Australian geographical race of *M. japonicus*, but a greater number of specimens of the Australian form must first be obtained and examined.

The chela figured (Fig. 8(a)) is that of the largest male examined, and its characters appear to lie between 'c' and 'd' in Fig. 98 (Sakai, 1939, p. 627), and thus none of the specimens would appear to be fully adult, not yet having developed the fully adult male chelae (Sakai, 1939, Fig. 98(d)).

(c) *Subgenus Mopsocarcinus*

KEY TO THE AUSTRALASIAN SPECIES OF THE SUBGENUS *MOPSOCARCINUS*

- | | | |
|---------|--|---------------------------|
| (1) (a) | Carapace surface granular. | ... <i>M. boscii</i> |
| | (b) Carapace surface without granules. | ... <i>M. punctulatus</i> |

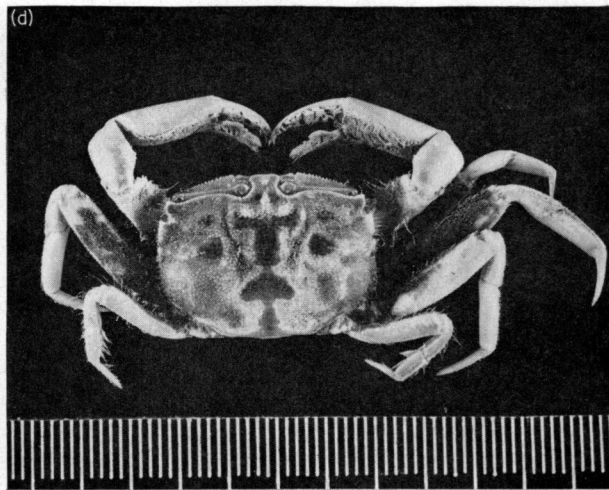
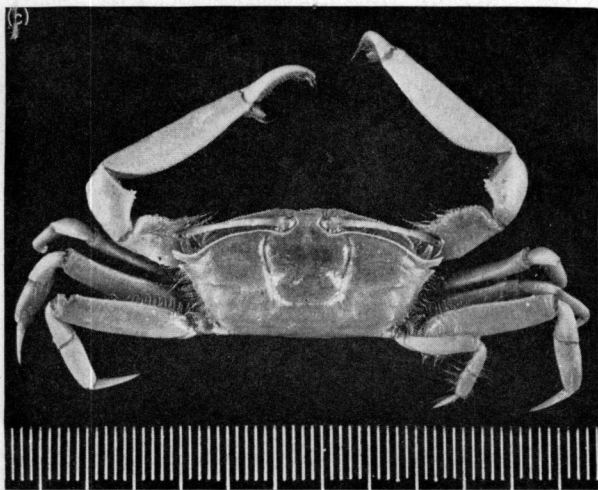
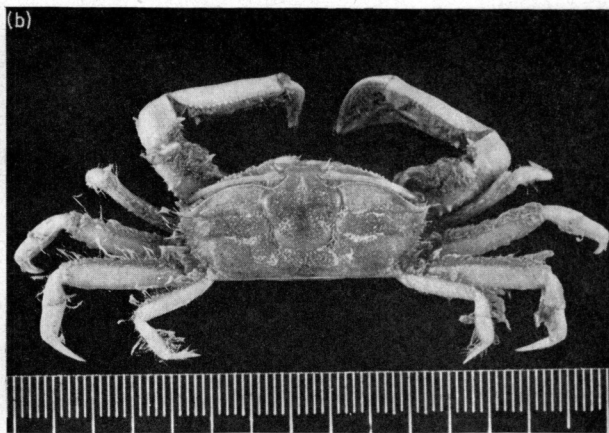
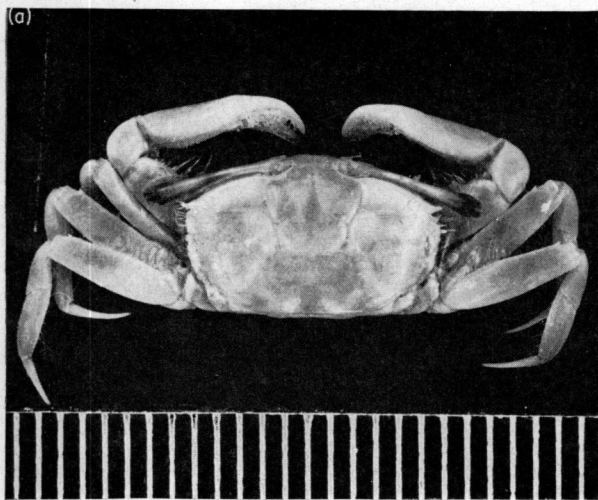


PLATE I. (a) *Macrophthalmus telescopicus* (A.M. No. P10408) ♂ dorsal surface.
(b) *Macrophthalmus crassipes* (Z.D.U.Q.) ♂ dorsal surface.
(c) *Macrophthalmus convexus* (Q.M. No. W1251) ♂ dorsal surface.
(d) *Macrophthalmus definitus* (A.M. No. P7663) ♂ dorsal surface.

A.M., Australian Museum; W.A.M. Western Australian Museum; Q.M., Queensland Museum; Z.D.U.Q., Zoology Department, University of Queensland. Scale lines 1 mm apart.