THE THALASSINIDEA (CRUSTACEA: DECAPODA) OF AUSTRALIA (1)

By

GARY C. B. POORE

Marine Studies Group
Ministry for Conservation, Melbourne

And

D. J. G. GRIFFIN

The Australian Museum, Sydney

SUMMARY

The mud shrimps, ghost shrimps, sponge shrimps, marine yabbies and related animals occurring in Australia are described and illustrated.

The number of Australian species is increased from 22 to 40 species by the addition of 12 new species and of six species not previously recorded from Australia. The 40 species are placed in 10 genera within six of the seven families currently considered to form the tribe Thalassinidea. The fauna is dominted by species of *Callianassa* and *Upogebia* which contain 13 and 11 species respectively.

Of the 40 species only 24 are known from more than 3 localities. The fauna contains a large element of 28 species (of which 12 are new) known only from Australia. Of the remaining 12 species only six have a geographic range extending beyond Indonesia.

The distribution patterns of the species within Australia are similar to those of other families of decapods, the bulk of the species being northern or southern with a few being essentially eastern or western. The northern (tropical) fauna contains those few species with ranges extending beyond Australia.

The fauna is amongst the richest of any area so far studied, although many areas are so far poorly known.

CONTENTS

---

(1) Paper No. 159 in the Ministry for Conservation, Victoria, Environmental Studies Series.
Records of the Australian Museum, 1979, **Vol. 32. No. 6,** 217-321, Figures 1-56.

INTRODUCTION

The tribe Thalassinidea includes loosely built lobster-like crustaceans which burrow in sand or mud or which live in cavities in reefs or in sessile animals such as sponges, corals and so on.

In Australia they are commonly called mud shrimps, ghost shrimps, yabbies, sponge shrimps and probably other more local names.

The tribe is characterized by a reasonably well calcified, compressed carapace; a symmetrical, extended, often feebly calcified abdomen terminating in a well developed tail fan; the chelate or subchelate first pair of legs; chelate, subchelate or simple second legs; and, always, non-chelate third legs (Wear & Yaldwyn, 1966).

The systematic postiton of the Thalassinidea, the subject of some controversy, is beyond the scope of this study. They have been variously placed as a tribe in the Section Anomura along with the Galatheidea (squat lobsters), Paguridea (hermit crabs) and Hippidea (mole crabs) (Borradaile, 1907; Calman, 1909; Barnard, 1950; Balss, 1957) and more recently as a tribe within the Section Macrura, along with the Homaridea and Palinura (lobsters) (Bouvier, 1940; Zariquiey Alvarez, 1968; Wear & Yaldwyn, 1966). Gurney (1938) discussed the relationships of the Thalassinidea to both groups. In the two most recent classifications of the Decapoda this difference of opinion persists. Waterman & Chace (1960) placed the Thalassinidea in the Section Macrura; Glaessner (1969) placed the superfamily Thalassinidea in the infraorder Anomura.

The Thalassinidea comprise seven families: Callianassidae, Axiidae, Callianideidae, Upogebiidae, Laomediidae, Axianassidae and Thalassinidae (Gurney, 1938; Wear & Yaldwyn, 1966) but these have been reduced to four by inclusion of the Axianassidae in the Laomediidae and the Upogebiidae and Callianideidae as subfamilies of the Callianassidae (Balss, 1957). More recently de Saint Laurent (1973) revived the Upogebiidae, a decision followed by Le Loeuff & Intes (1974), and suggested the Callianideidae may be part of the Axiidae. Until these questions are resolved, we have placed our species in six separate families; *Axianassa* has not been recorded from Australia and we do not consider it further.

The group has received reasonable attention in recent years in South Africa (Barnard, 1950; Kensley, 1974), South America (Holthuis, 1952, 1959; Rodrigues, 1971; De Carvalho & Rodrigues, 1973), North America (Biffar, 1970, 1971a, 1971b; Thistle, 1973; Boesch & Smalley, 1972; Williams, 1974), the Pacific (Edmondson, 1944), Japan (Miyake & Sakai, 1967; Sakai, 1962, 1966, 1967a, 1967b, 1967c, 1968, 1969, 1970a, 1970b, 1970c, 1971), Gulf of Guinea (Bozic & de Saint Laurent, 1972; Le Loeuff & Intes, 1974), East Africa (Sakai, 1975), Pakistan (Tirmizi, 1970), India (Sankolli, 1970-72), the Mediterranean (Bouvier, 1940; de Gaillande & Lagardere, 1966; Holthuis & Gottlieb, 1958; Zariquiey Alvarez, 1968; de Saint Laurent, 1970) and the Gulf of Gascogne (de Saint Laurent, 1972).

In Australia, on the other hand, apart from recent studies on the biology of one species (Hailstone & Stephenson, 1961) and on one of the smaller families (Yaldwyn & Wear, 1970, 1972) there has been no recent treatment of the group. Notes on fossil species have been provided by Campbell & Woods (1970) and on some larval forms by Dakin & Colefax (1940).

The discovery of a number of new species in Port Phillip Bay, Victoria, during the course of a large scale survey of the soft-bottom benthic fauna (Poore, 1975) prompted a review of Australian species of the group. Up to the commencement of these studies a total of 20 species had been described from Australia (Haswell, 1881; Fulton & Grant, 1902, 1906; Baker, 1907; De Man, 1925a, 1925c, 1928a; Hale, 1927, 1941; Ward, 1945; Yaldwyn & Wear, 1970, 1972).

This report deals with all known species from the Australian continent and adjacent islands. Our aim in this work is to describe as fully as possible the Australian thalassinidean fauna and to present diagnoses to aid in the identification of the species. We make few comments on the familial and generic classification of the group which is currently in a state of flux. Collation of material from Australian museums revealed several new species most of which are described here. Some new species recognized by us, notably two species of *Callianassa* from Western Australia and four axiids of doubtful generic status from north-western Australia, have not been included because of the poor condition of the material. The deep burrowing habits of many thalassinideans means that they are poorly represented in many collections, especially deep water samples usually taken by dredge or grab. The paucity of specimens of many species indicates that many more remain to be described from this area. In order to make this account as complete as possible we have described some species from few specimens. The descriptions deal with the principal morphological features of taxonomic importance; however, they are brief and are meant to be used in conjunction with the figures. Most figures have been drawn without setae except where these are taxonomically important. All scales, or divisions of scales, on the figures equal 1 mm. Carapace length is abbreviated as cl. and total length tl. Unless otherwise indicated, new species names are derived from the names of localities near which the species have been collected.

Specimens dealt with come from: The Queensland Museum, Brisbane (QM) including specimens from the University of Queensland, Department of Zoology, benthic survey of Moreton Bay (QUBS); The Australian Museum, Sydney (AM), which includes collections of the Commonwealth Scientific and Industrial Research Organization (CSIRO) Division of Fisheries and Oceanography made for the Gulf of Carpentaria Prawn Survey and in other locations; the National Museum of Victoria, Melbourne (NMV), including collections made by the Victorian Ministry for Conservation, Fisheries and Wildlife Division, in its Crib Point Benthic Survey (CPBS) in Western Port and as part of the Port Phillip Bay Environmental Study (PPBES); the Tasmanian Museum, Hobart (TM); the South Australian Museum, Adelaide (SAM); and the Western Australian Museum, Perth (WAM).

KEY TO AUSTRALIAN THALASSINIDEA

1	Appendix interna (article or lobe on inner ramus of pleopods 3-5) present, but inconspicuous in Callianassidae (elongate, narrow shrimps with flattened eyestalks and small rostrum — Callianassidae and Callianideidae — or compact shrimps with reflexed abdomen, cylindrical eyestalks and spinose rostrum — most Axiidae)	2
—	Appendix interna absent (compact shrimps with reflexed abdomen, cylindrical eyestalks, rostrum variously spinose, setose or reduced — Upogebiidae)	27
2(1)	Without epipods on pereopods ..... Callianassidae	3
—	Epipods on pereopods	17

Family **Callianassidae**

3(2)	Large cheliped cylindrical and pectinate (fixed finger and dactyl armed along their cutting edges with numerous longer and shorter slender pointed teeth) ..... *Ctenocheles collini* (p 277)	
—	Large cheliped laterally flattened and not so armed	4

4(3) Propod and dactyl of small cheliped strongly tapering; exopod of uropod distally notched ..... *Gourretia coolibah* (p 278)

— Propod and dactyl of small cheliped not tapering; exopod of uropod not distally notched ..... *Callianassa* 5

5(4) Maxilliped 3 with long epipod reaching beyond ischium of exopod; merus of large cheliped with a strong unarmed lobe along entire ventral edge, merus almost as broad as carpus; dactyl of small cheliped twice as long as fixed finger ..... *C. tooradin* (p 275)

— Maxilliped 3 without epipod (or if present minute); merus of cheliped with hooks or complexly dentate but not ventrally lobed, merus narrower than carpus; dactyl and fixed finger of small cheliped subequal 6

6(5) Chelipeds subequal (presumed so in *C. bulimba*); rostrum short, obtuse; telson much shorter than uropods 7

— Chelipeds unequal; rostrum short or a spine; telson as long as or shorter than uropods 8

7(6) Telson concave posteriorly, widest at midpoint and bearing a transverse ridge; propod of maxilliped 3 unarmed ..... *C. aequimana* (p 245)

— Telson straight posteriorly, widest proximally and without a transverse ridge; propod of maxilliped 3 with small teeth on medial margin *C. bulimba* (p257)

8(6) Rostrum, and sometimes lateral projections also, spinose 9

— Neither rostrum nor lateral projections spinose, at most broadly acute but usually obsolete 12

9(8) Rostrum and lateral projections spinose 10

— Rostrum only spinose, lateral projections obsolete 11

10(9) Telson subovate, widest at midpoint; rostral spine directed anteriorly in line with gastric region; cheliped coxae with a strong medial hook ..... *C. collaroy* (p260)

— Telson tapering, widest proximally; rostral spine directed upwards from slope of gastric region; cheliped coxae without a hook ..... *C. haswelli* (p263)

11(9) Large cheliped merus with a single strong ventral hook; uropod endopod ovate, widest in distal half; maxilliped 3 without epipod ... *C. joculatrix* (p266)

— Large cheliped merus denticulate ventrally but lacking a strong hook; uropod endopod lanceolate, widest in proximal half; maxilliped 3 with small epipod ..... *C. karumba* (p266)

12(8) Peduncle of antenna 1 twice as long as that of antenna 2, bearing dense rows of long setae ventrally; maxilliped 3 merus strongly expanded distally beyond articulation with carpus ..... *C. australiensis* (p250)

— Peduncles of antennae of similar length, without dense long setae; maxilliped 3 merus not expanded distally 13

13(12) Merus of large cheliped with a strong ventral hook, often secondarily dentate 14

— Merus of large cheliped with no ventral hook, finely denticulate 16

14(13) Propod of maxilliped 3 almost as long as broad, three times wider than dactyl, lobed ventrally; eyes reduced .....*C. limosa* (p270)

— Propod of maxilliped 3 much longer than broad, about twice as wide as dactyl, scarcely lobed ventrally; eyes normal 15

15(14) Telson subquadrate, shorter than uropod endopod; cheliped merus with at most a denticulate ridge distal to its hok; male pleopod 2 absent..... .....*C. arenosa* (p 250)

— Telson tapering slightly distally, as long as uropod endopod: cheliped merus with strongly dentate ridge distal to its hook; male pleopod 2 present .....*C. ceramica* (p 257)

16(13) Telson as long as uropod endopod; maxilliped 3 ischium much broader than long, propod much narrower than ischium .....*C. amboinensis (p*248)

— Telson shorter than uropod endopod; maxilliped 3 ischium narrower than long, propod as broad as ischium .....*C. mucronata* (p 273)

Family **Callianideidae**

17(2) Pleopods with branchial filaments (numerous articles on the margins of both rami).....Callianideidae
Branchial filaments ovate .....*Callianidea leura* (p281)

— Pleopods without branchial filaments .....Axiidae 18

Family **Axiidae**

18(17) Exopod of uropod with transverse suture .....*Axiopsis* 19

— Exopod of uropod without suture 23

19(18) Rostrum extending forward at same level as gastric region; scaphocerite and dorsal spine on article 2 of antenna 2 long; telson without movable spines .....Subgenus *Axiopsis* 20

— Rostrum arising at lower level than gastric region; scaphocerite and dorsal spine short; telson with movable spines distolaterally ....Subgenus *Paraxiopsis* 22

20(19) Submedian carinae unarmed in gastric region; median carina not extending on to base of rostrum but ending anteriorly as 1-3 teeth .....*A. werribee* (p232)

— Submedian carinae dentate; median carina extending on to rostrum as a tuberculate ridge 21

21(20) Submedian carinae coarsely tuberculate, ending simply anteriorly; anterolateral margin of carapace with an antennal tooth..*A. consobrina* (p230)

— Submedian carina finely tuberculate, recurving anteriorly as a deep U; anterolateral margin of carapace unarmed .....*A. australiensis* (p226)

22(19) Cheliped tuberculate or spinose; rostrum strongly toothed laterally; anterolateral margin of carapace with a small tooth near eye ..... *A. brocki* (p228)

— Cheliped smooth; rostrum simply trilobed, scarcely dentate; anterolateral margin of carapace unarmed ..... *A. appendiculis* (p224)

23(18) Anterior region of carapace sloping down steeply; scaphocerite minute ..... *Scytoleptus serripes* (p243)

— Anterior region of carapace continuous with rostrum; scaphorcerite and antennal spine prominent ..... *Axius*
Rostrum more or less notched or emarginate anteriorly (often obscurely) ..... Subgenus *Neaxius* 24

24(23) Exopod of uropod finely denticulate laterally; ischium and merus of cheliped with only a few denticles 25

— Exopod of uropod strongly spinose laterally; ischium and merus of cheliped strongly spinose ventrally 26

25(24) Rostrum strongly spinose, spines of medial lobe distinct from those of lateral lobes; exopod of uropod U-shaped, widest at midpoint; carapace up to 23 mm long ..... *A. plectrorhynchus* (p238)

— Spination of rostrum usually obsolete, if not so spines of lateral lobes of rostrum not distinct from those of medial lobe; exopod of uropod subtriangular, widest distally; carapace not more than 13 mm long ..... *A. waroona* (p240)

26(24) Spines laterally along cervical groove; dorsal ridge and spine of antenna 2 bearing 1 medial and 2-5 lateral spines ..... *A. acanthus* (p235)

— Cervical groove smooth; dorsal ridge and spine of antenna 2 unarmed ..... *A. glyptocerus* (p236)

Family **Upogebiidae**

27(1) Without epipods on pereopods ..... Upogebiidae
..... single genus *Upogebia* 28

— With epipods on pereopods 38

28(27) Pereopod 1 subchelate, dactyl and fixed finger not equal .....
..... Subgenus *Upogebia* 29

— Pereopod 1 chelate, dactyl and fixed finger equal or subequal .....
..... Subgenus *Calliadne* 34

29(28) Lateral lobes of rostrum about half as long as medial lobes and separated from it by a deep U 30

— Lateral lobes of rostrum obsolete or at most about ⅛th as long as medial lobe 32

30(29) Medial and lateral lobes of rostrum ventrally spinose, dorsally smooth ..... *U. spinifrons* (p305)

— Lobes of rostrum not ventrally spinose, with marginal dorsal spines 31

31(30) Anterior margin of carapace with spine beside eye; dorsolateral margins of carapace strongly converging anteriorly .....*U. neglecta* (p301)

— Anterior margin of carapace without spine; dorsolateral margins of carapace not strongly converging anteriorly .....*U. simsoni* (p301)

32(29) Telson with 2 transverse carinae, more or less parallel-sided .*U. dromana* (p295)

— Telson smooth or with 1 transverse carina, more or less tapering 33

33(32) Propod of pereopod 1 dorsally spinose, an accessory spine in the gape of the chela; rostrum broadly rounded with 3-4 blunt spines each side; telson smooth .....*U. giralia* (p297)

— Propod of pereopod 1 dorsally smooth, with no spine in gape of chela; medial lobe of rostrum with 4 spiniform teeth; telson with transverse carinae .....*U. carinicauda* (p292)

34(28) Eyestalks exceeding rostrum; medial and lateral lobes of rostrum separated by a broad concavity .....*U. tractabilis* (p307)

— Eyestalks not longer than rostrum; rostrum trilobed or with strong tubercles laterally 35

35(34) Rostrum without lateral lobes, medial lobe twice as wide as long, with 4 small spines; telson with a barely spinulous transverse ridge ....*U. darwinii* (p292)

— Rostrum with small lateral lobes, about 0.1 length of medial lobe; telson with spinulous transverse and longitudinal ridges 36

36(35) Medial lobe of rostrum broadly curved, with about 12 short, equal, closely spaced spines; distal mesial edge of propod of pereopod 1 with 2 strong spines; posterior margin of telson concave .....*U. bowerbankii* (p289)

— Medial lobe of rostrum triangular, unevenly spinose; distal mesial edge of propod of pereopod 1 with minute denticles; posterior margin of telson convex 37

37(36) Medial lobe of rostrum with 2-3 spines each side; lateral lobes reaching less than halfway towards most posterior spine of medial lobe; merus of pereopod 1 with ventral denticles .....*U. hexaceras* (p299)

— Medial lobe of rostrum with about 6 tubercles each side; the most posterior tubercle level with end of the lateral lobe; merus of pereopod 1 ventrally smooth .....*U. australiensis* (p287)

Family **Thalassinidae**

38(27) Both rami of uropod with suture .....Laomediidae
First pereopod chelate; peduncles of antennae short .....*Laomedia* 39

– Rami of uropod without suture.....Thalassinidae
Antenna 2 with movable triangular scaphocerite; ventral transverse ridge between pleopods 2-5 medially emarginate, laterally tuberculate..... .....*Thalassina squamifera* (p285)

Family **Laomediidae**

39(38) Anterior edge of carapace with antennal and orbital spines; 3-6 teeth beside terminal rostral tooth .....*L. healyi* (p 284)

— Anterior edge of carapace without spines; 1 small tooth beside terminal rostral tooth .....*Laomedia* "n.s.p." Yaldwyn & Wear, 1972 (p 284)

SYSTEMATIC ACCOUNT

Family **Axiidae** Borradaile, 1903

Axiopsis Borradaile, 1903

REMARKS: We cannot at this stage present a diagnosis for this genus. It has been noted by others (Boesch & Smalley, 1972; Miyake & Sakai, 1967; Williams, 1974; de Saint Laurent, 1972) that the genera of the Axiidae require redefinition. In particular, there is a poor separation between *Axiopsis, Calocaris* and *Calastacus* used as subgenera by De Man (1925a). Characters separating the last two, elevated to generic rank, were tabulated by de Saint Laurent (1972) but the status of *Axiopsis* is still unclear. All the Australian species dealt with here key out clearly through De Man's (1925a) key to *Axiopsis,* that is, none possess a dorsal carina running the length of the carapace.

We use *Axiopsis* here for species with a spinose rostrum, a transverse suture on the uropod exopod, and pleopods 2-5 similar. The subgenus *Axiopsis,* characterized by a long scaphocerite and dorsal spine on antenna 2 and continuous gastric region and rostrum, is represented by *A. australiensis, A. consobrina* and *A. werribee;* the subgenus *Paraxiopsis,* in which the spines are reduced and the gastric region and rostrum not continuous, by *A. appendiculis* and *A. brocki.*

Axiopsis (Paraxiopsis) appendiculis n. sp.
Fig. 1

MATERIAL EXAMINED: 18 females, 16 males; cl. 7-17 mm.

HOLOTYPE: AM P.9359, female cl. 14 mm.

TYPE LOCALITY. *New South Wales:* Shellharbour, under stones between tide marks, coll. G. McAndrew, 1926.

PARATYPES. *New South Wales:* Minnie Waters, Grafton (AM P.24674) 1 spec.; (AM P.24687) 1 spec. — Long Reef, Collaroy (AM P.9063) 1 spec.; (AM P.9365) 1 spec.; (AM P.18557) 1 spec.; (AM P.7474) 2 specs.; (AM P.8624) 1 spec.; (AM P.24688) 6 specs. — Port Jackson (AM P.8694) 1 spec.; (AM P.15037) 3 specs.; (AM P.265) 5 specs. — Watsons Bay, Port Jackson (AM P.5768) 1 spec.; (AM P.1511-4) 4 specs. — Bottle and Glass Rocks, Port Jackson (AM P.24673) 1 spec. — Camp Cove, Port Jackson (AM P.21116) 1 spec. — Bass Point (AM P.24672) 1 spec. — Shellharbour (AM P.20827) 2 specs.

DESCRIPTION: Rostrum trilobed, median lobe narrow, upturned, blunt, about twice as long as width at base, 0-3 small teeth on lateral margin; lateral lobes ⅓ length of median lobe. Gastric region falling steeply to rostrum. Five carinae on anterior half of carapace; median carina ending anteriorly just beyond base of rostrum, bearing a tooth midway along; a pair of submedian carinae ending anteriorly as blunt projections at level of tooth of median carina; lateral carinae shorter, arising halfway along submedian carinae, unarmed, running to lateral lobes of rostrum; anterolateral margin of carapace smooth. Antenna 1 peduncle reaching to halfway along article 4 of antenna 2, stylocerite a bluntly

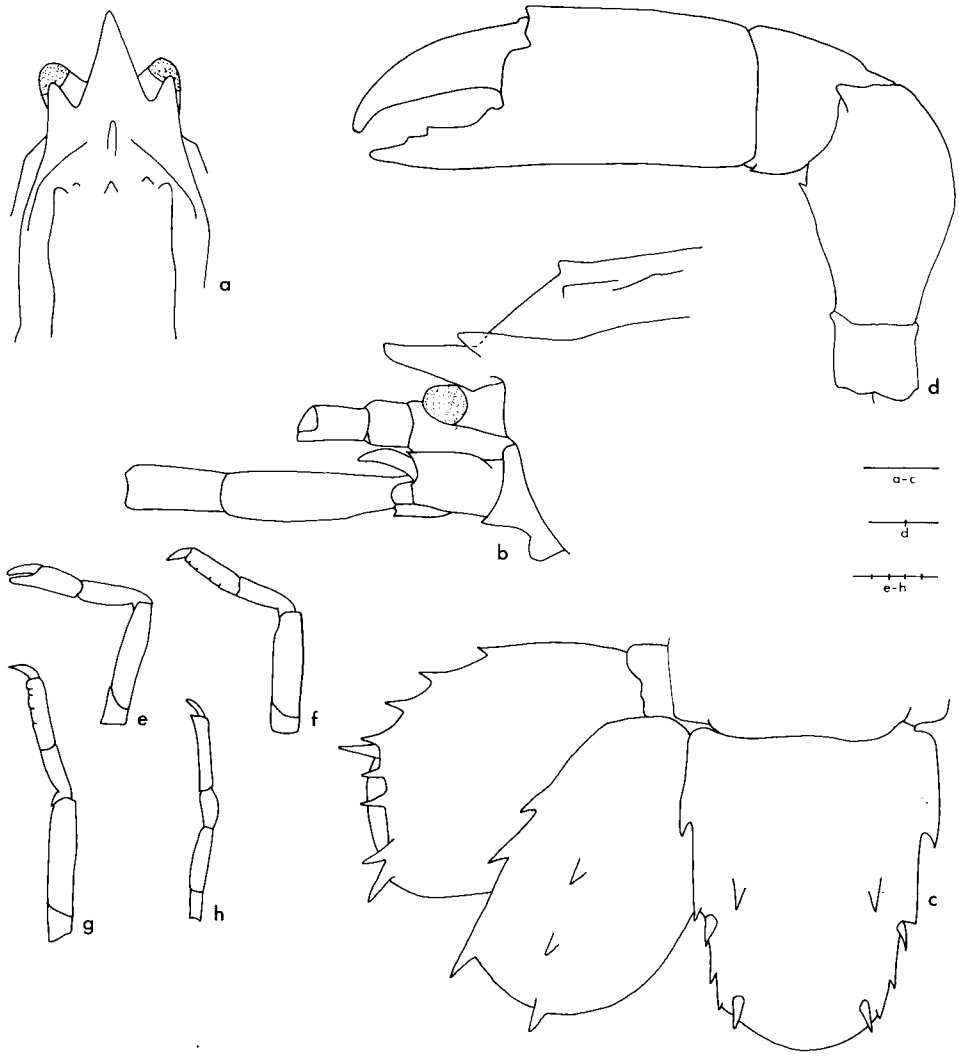

Fig. 1. *Axiopsis appendiculis* (AM P.9359, female, 13 mm): *a, b,* dorsal and lateral views of anterior region; *c,* telson and uropod; *d,* cheliped; *e-h,* pereopods 2-5.

ended ridge. Antenna 2 article 2 dorsally carinate with a small distal spine; scaphocerite a curved spine ¼ as long as article 4; article 3 with a ventral spine. Eyestalks about half length of rostrum. Maxilliped 3 ischium with a mesial toothed ridge; merus with 2 large medial spines; carpus with a small lateral spine on distal edge; propod unarmed. Chelipeds unequal but similar, not sexually dimorphic, extremely robust. Cheliped coxa and ischium smooth; merus inflated with a ventral spine and a flat triangular projection laterally at suture with carpus; carpus with a ventral spine; propod unarmed, dorsally and ventrally pubescent; fixed finger with 1-2 broad blunt teeth on distal half of cutting edge; dactyl as long as fixed finger, with a strong curved tip, its cutting edge with a proximal tooth, otherwise minutely dentate; ratio of dorsal lengths — merus: carpus: propod — 1:0.5:1. Pereopods 2-5 smooth. Pleopod 1 (female) uniramous, the multiarticulate flagellum about twice as long as the first article. Pleopod 1 (male) absent. Telson longer than wide, narrowing slightly distally, lateral margins with 2-4 fixed spines and 2 movable spines, one near base of second fixed spine and one distally; posterior margin semicircular, unarmed; 4 spines in a curved row about midway along dorsal surface. Uropod endopod lateral margin ending in a spine, with 2 spines in distal half, posterior and medial margins continuous, dorsal longitudinal ridge with 3-4 spines, the last on the margin; exopod 2-articulate, lateral margin of first article with 4-5 spines, ending in a long movable spine, 3 spines on lateral dorsal longitudinal ridge, medial ridge terminating in a bifid spine; 2 other spines on distal margin; second article 0.1 total length of exopod.

DISTRIBUTION: Intertidal to 5 m; central New South Wales.

REMARKS: *Axiopsis appendiculis* is similar to *A. brocki,* a species from north and western Australia, with which it shares a short scaphocerite and dorsal spine on antenna 2, and sloping anterior carapace. It differs most noticeably in possessing a trilobed rostrum instead of the strongly spinose lateral carinae characteristic of *A. brocki.* The chelipeds of *A. appendiculis* are smooth, but tuberculate or spinose in *A. brocki.*

This species was first recognized by Dr. T. Hailstone in collections in the Australian Museum in about 1964. We are very grateful to Dr. Hailstone for allowing us to use the MS name he gave it then. The species name was suggested by Dr. Hailstone because of "the presence of an appendix interna on each endopodite of pleopods 2-4" (pers. comm.).

Axiopsis (Axiopsis) australiensis De Man

Fig. 2.

Axiopsis australiensis De Man, 1925c: 127-132, fig. 4 (type locality: Port Jackson); 1925a: 5, 69.

MATERIAL EXAMINED: 32 males, 33 females; cl. 7-22 mm.

New South Wales: Angourie, Clarence R. (AM P.11360) 1 spec. — Woody Head, Clarence R. (AM P.24676) 1 spec. — Long Reef, Collaroy (AM P.15034) 3 specs; (AM P.15035) 1 spec.; (AM P.8623) 1 spec.; (AM P.13164) 1 spec.; (AM P.24675) 3 specs; (AM P.24697) 3 specs; (AM P.24698) 1 spec.; (AM P.24699) 2 specs; (AM P.13184) 2 specs; (AM P.20825) 1 spec.; (AM P.20826) 2 specs; (AM P.7472) 3 specs. — Bottle and Glass Rocks, Port Jackson (AM P.8618) 1 spec.; (AM P.9228) 1 spec. — Watsons Bay, Port Jackson (AM P.15036) 3 specs. — North Head, Sydney (AM P.24689) 1 spec. — Shellharbour (AM P.6310) 2 specs; (AM P.7167,8) 2 specs; (AM P.7239) 8 specs; (AM P.7954) 2 specs; (AM P.9360) 4 specs; (AM P.7414) 6 specs; (AM P.8439) 2 specs; (AM P.7900) 1 spec.; (AM P.9334) 5 specs.

Victoria: Shoreham (AM P.1757) 2 specs.

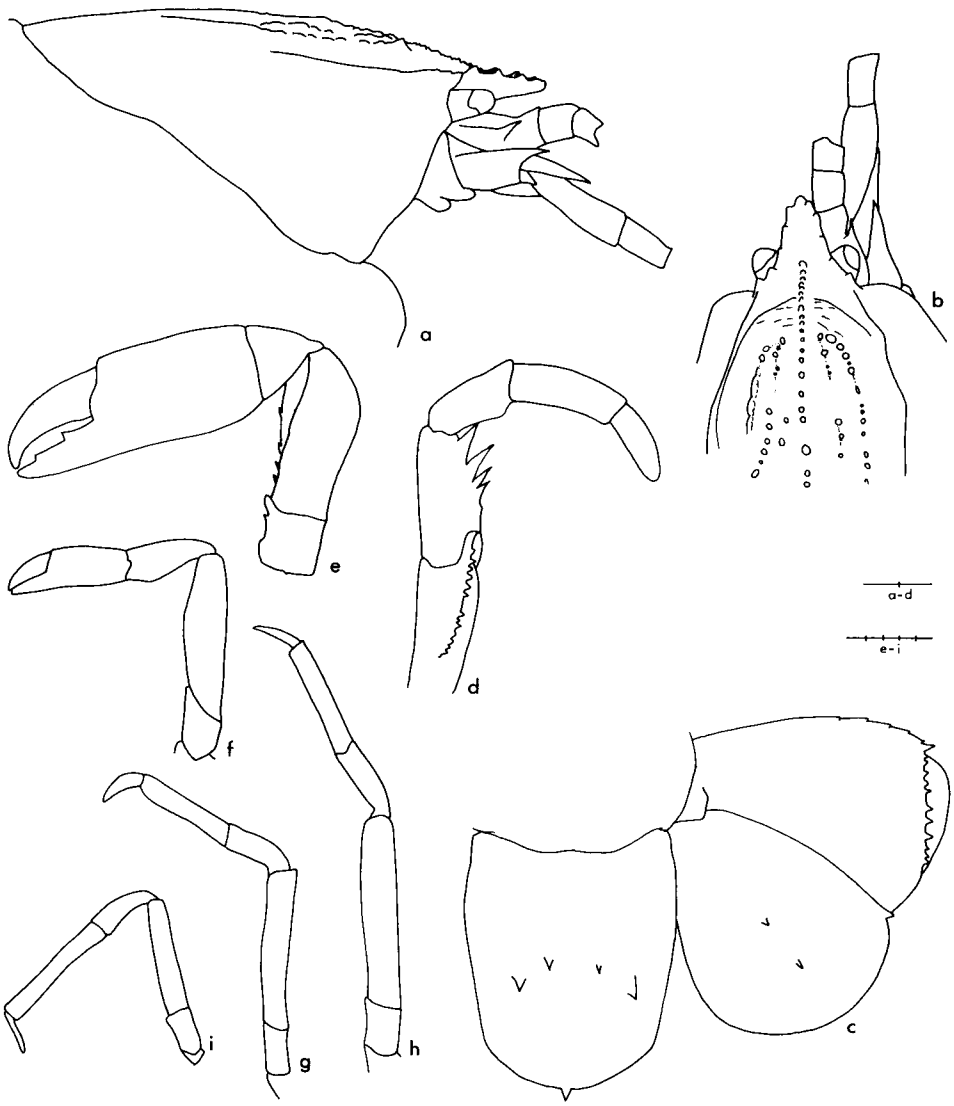

Fig. 2. *Axiopsis australiensis* (AM P.7954, female, 23 mm): *a, b,* dorsal and lateral views of anterior region; *c,* telson and uropod; *d,* maxilliped 3 endopod; *e,* cheliped; *f-i,* pereopods 2-5.

DESCRIPTION: Rostrum moderately weakly upturned, blunt, slightly longer than basal width, lateral edges of rostrum bearing 5-6 upwardly directed blunt spines on each side. Gastric region with 2 longitudinal submedian tuberculate ridges, curving together anteriorly about midway along tuberculate median carina to form a deep inverted U; median carina continuing to base of rostrum; posterior part of gastric region smooth; anterolateral margin of carapace smooth. Antenna 1 peduncle reaching to middle of article 4 of antenna 2, stylocerite a strong spine. Antenna 2 article 2 with a distolateral spine; scaphocerite a single long spine reaching to about midpoint of article 4; article 3 smooth. Eyestalks half length of rostrum. Maxilliped 3 ischium with a mesial ridge of strong teeth, merus with 3-4 large medial spines distally. Chelipeds subequal, not sexually dimorphic. Cheliped ischium with dentate ventral edge; merus with ventral dentate ridge laterally and 4-5 strong spines medially, smooth dorsally; carpus and propod smooth; fixed finger cutting edge with a strong tooth at proximal third and another near end; dactyl as long as fixed finger, strong curved tip, cutting edge with a low projection proximally; ratio of dorsal lengths — merus: carpus: propod — 1:0.5:1. Pereopods 2-5 unarmed. Pleopod 1 (female) uniramous, the multiarticulate flagellum about twice as long as the first article. Pleopod 1 (male) absent. Telson longer than wide, lateral margins tapering; posterior margin convex with a short medial spine; surface with 2 pairs of spines centrally, medial pair further forward than lateral pair. Uropod endopod lateral margin ending in a small spine, sometimes bearing 1-2 additional spines, posterior and medial margins continuous, dorsal longitudinal ridge with 3-4 spines; exopod 2-articulate, lateral margin of first article with 3-4 small spines; 2 dorsal longitudinal ridges, 3-4 spines on lateral ridge, medial ridge smooth, 9-10 spines along distal margin; second article 0.1 total length of exopod.

DISTRIBUTION: Intertidal; central New South Wales and central Victoria.

REMARKS: De Man's (1925c) figures adequately characterized this species which is distinguished particularly by the low recurved, beaded submedian carinae on the carapace.

Axiopsis (Paraxiopsis) brocki (De Man)
Fig. 3

Axius Brocki De Man, 1887: 475-480, pl. 20 fig. 3 (type locality: Indonesia — Ambon and near Jakarta).

Axiopsis (Paraxiopsis) Brocki. — De Man, 1905: 597; 1925a: 7, 71, 101-109, pl. 8 fig. 19.

MATERIAL EX(AMINED: 13 males, 6 females; cl. 13-17 mm.

Northern Territory: Waigait Reef, Darwin (AM P. 20357) 1 spec. — Rail Pier, Darwin (AM P.6824) 1 spec.

Western Australia: Burns Beach, Broome (WAM 16-75) 2 specs. — Point Peron (WAM 8-75) 1 spec. — near Geraldton (WAM 18-75) 1 spec. — Mullaloo Beach (WAM 77-75) 1 spec. — Rottnest Is. (WAM 50-75) 1 spec.; (WAM 1047-32) 1 spec.; (WAM 34-75) 1 spec. — Cockburn Sound, near Fremantle (WAM 36-75) 1 spec. — Garden Is. (WAM 24-75) 1 spec.; (WAM 9014) 2 specs; (WAM 8751) 3 specs. — Safety Bay (WAM 68-75) 1 spec. — Augusta (WAM 110-49) 1 spec.

DESCRIPTION: Rostrum narrow, upturned, acute, about 3 times a long as width at base. Gastric region falling gradually down to rostrum, sometimes rugose anteriorly; median carina ending anteriorly at base of rostrum; a pair of submedian carinae ending anteriorly variously as a blunt or rounded projection or as a spine; and lateral carinae running as strongly spinose ridges on to sides of rostrum, 4-6 spines on each side, anterior

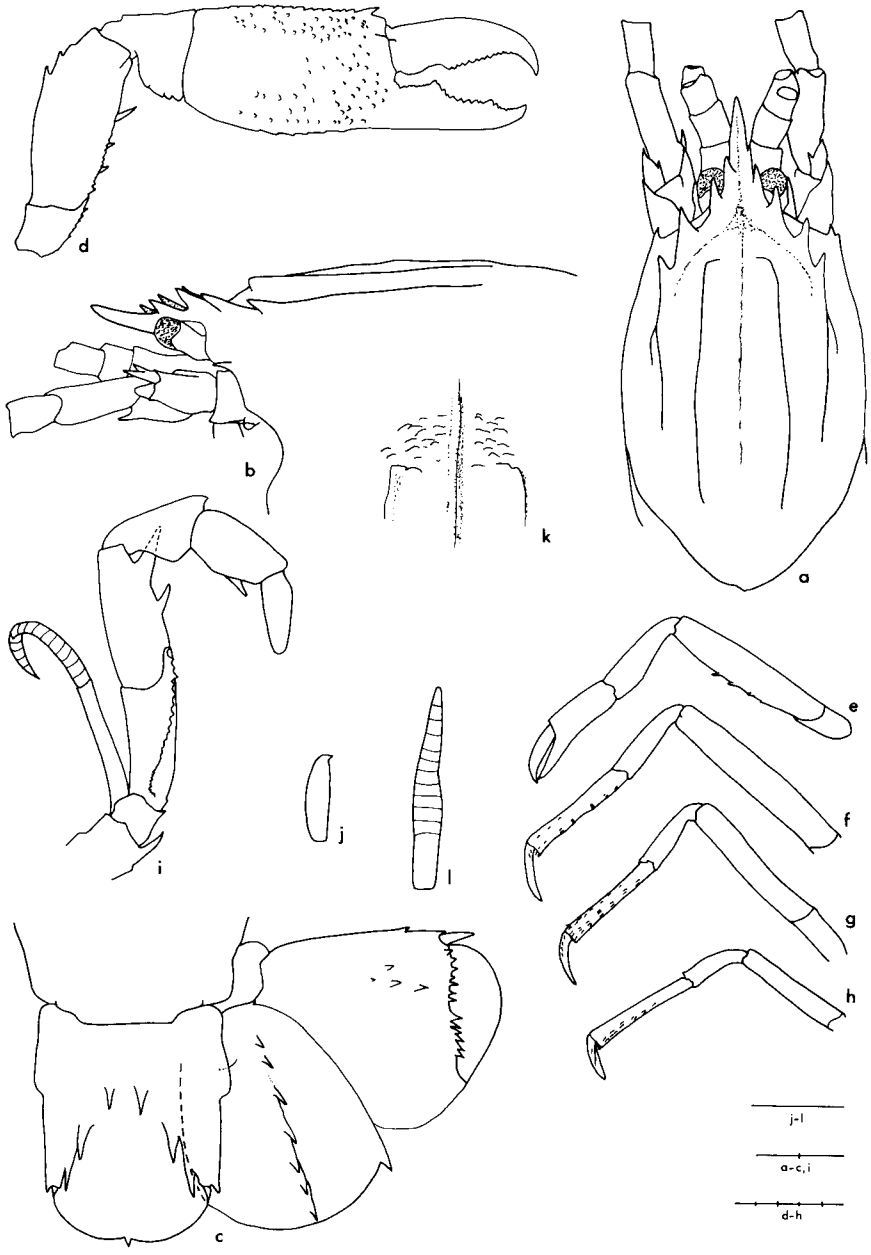

Fig. 3. *Axiopsis brocki* (WAM 24-75, male, 17 mm): *a, b,* dorsal and lateral views of anterior region; *c,* telson and uropod; *d-h,* pereopods 1-5; *i,* maxilliped 3; *j,* pleopod 1. (WAM 16-75, female, 17 mm): *k,* gastric region of carapace; *l,* pleopod 1.

ones often asymmetrical; anterolateral margin of carapace with a strong spine just above antenna 2. Antenna 1 peduncle reaching to end of article 4 of antenna 2, stylocerite a small spine. Antenna 2 article 2 with a distolateral spine; scaphocerite a double-spined plate, stronger spine laterally; article 3 with a ventral spine. Eyestalks less than half length of rostrum. Maxilliped 3 ischium with a mesial toothed ridge, merus with 2-3 large medial spines plus several smaller spines, propod with a medial spine. Chelipeds subequal, not sexually dimorphic. Cheliped coxa minutely spinose; ischium ventrally spinose; merus with dentate ventral margin and 4-7 submarginal spines, 2-4 dorsal spines distally; carpus and propod tuberculate on ventral, lateral, dorsal and most of medial surfaces; propod with a dorsal spine distally; fixed finger cutting edge strongly dentate, a very strong tooth ⅓ way along and often a less prominent one about ¾ way along; dactyl as long as fixed finger, strong curved tip, cutting edge concave proximally, ratio of dorsal lengths — merus: carpus: propod — 1:0.5:1. Pereopod 2 ischium spinose ventrally, pereopods 3-5 with numerous small articulating spines on propod and dactyl. Pleopod 1 (female) uniramous, the multiarticulate flagellum about 3 times as long as the first article. Pleopod 1 (male) a single small ovate article with a minute terminal hook. Telson longer than wide, parallel-sided but abruptly narrowed ⅓ way from base, lateral margins with 0-2 spines along length and ending posteriorly in 1 fixed and 1 (sometimes 2) movable spines; posterior margin semicircular with a short medial spine; 2 dorsal diagonal ridges with 3-4 strong spines running down to articulating spines. Uropod endopod lateral margin ending in a small spine, sometimes with 1-4 spines, posterior and medial margins continuous, dorsal longitudinal ridge with 5-8 spines; exopod 2-articulate, lateral margin of first article with 1-2 small spines, ending in a long articulating spine, 3-4 spines on dorsal longitudinal ridges, 13-20 spines along distal margin; second article 0.2 total length of exopod.

DISTRIBUTION: Intertidal to shallow reef; various localities in Indonesia (De Man, 1925a), Northern Territory and Western Australia. The present specimens represent the first records from Australia.

REMARKS: Our specimens agree in general with De Man's description and figures but the submedian carina on the carapace was never found to be interrupted as occasionally noted by De Man nor was its anterior end ever toothed. One incomplete specimen from Cockatoo Island, Western Australia, (WAM 29-75) closely resembled this species but differed in having 5-6 spines in place of the submedian carinae. We are unsure of the systematic postion of this specimen.

The species is characterized by the reduced scaphocerite and antennal spine (characteristic of species of subgenus *Paraxiopsis)* and by the complex ornamentation of the telson.

Axiopsis (Axiopsis) consobrina De Man
Fig. 4.

Axiopsis consobrina De Man, 1905: 595-596 (type localities: Philippine Is. — Sulu Archipelago; Indonesia — Buton Strait and Solor Strait); 1925a: 5, 69, 80-84, fig. 13.

MATERIAL EXAMINED: 1 male, 1 female; cl. 19, 24 mm.

Queensland: Gulf of Carpentaria, CSIRO stn 363 (AM P.16308) 1 spec.; CSIRO stn 557 (AM P.24677) 1 spec.

DESCRIPTION: Rostrum narrow, downwardly deflexed, acute, almost twice as long as width at base, about 7 spines on each edge, tip of rostrum horizontal. Gastric region falling very gradually down to rostrum; 5 longitudinal, spinose carinae arising near cervical

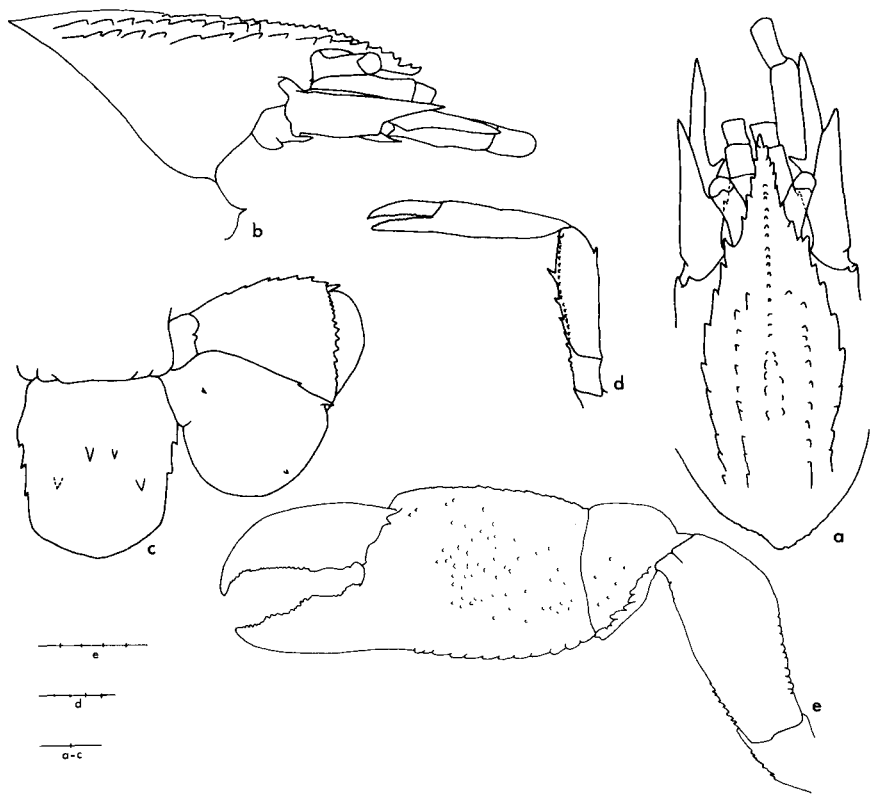

Fig. 4. *Axiopsis consobrina* (AM P.16308, male, 19 mm): *a, b,* dorsal and lateral views of anterior region; *c,* telson and uropod; *d,* small cheliped. (AM P.24677, female, 24 mm): e, pereopod 1.

groove; median carina extending forwards halfway along rostrum, existing as a double row of spines in part of posterior third; a pair of submedian carinae extending anteriorly to just over halfway along median carina; and lateral carinae running on to sides of rostrum; anterolateral margin of carapace with a small spine just above antenna 2. Antenna 1 peduncle reaching to proximal third of article 4 of antenna 2, stylocerite a small spine. Antenna 2 article 2 with a strong dorsal ridge and spine; scaphocerite a strong spine as long as or nearly as long as article 4 and bearing a basal medial spine; article 3 with a ventral spine. Eyestalks slender, half length of rostrum. Maxilliped 3 ischium with a mesial toothed ridge; merus with 4 medial spines, increasing in length distally; propod unarmed. Chelipeds unequal. Large cheliped coxa without spines; ischium spinose ventrally; merus with 4 ventral spines, its ventro-and dorsolateral edges dentate; carpus with a smooth dorsal ridge and dentate ventral ridge; propod with serrate dorsal and ventral ridges, surfaces minutely spinose, cutting edges of fingers dentate; dactyl as long as fixed finger; ratio of dorsal lengths — merus: carpus: propod — 1:0.3:0.8. Small cheliped similar to other but more slender and with a strong dorsal spine on the merus. Pereopod 2 ischium and merus spinose ventrally, pereopods 2-4 meri ventrally spinose. Pleopod 1 (female) uniramous, 2-articulate, second article bluntly lanceolate. Pleopod 1 (male) a single small ovate article with a minute terminal hook. Telson and uropods terminally setose. Telson

longer than wide, almost parallel-sided, lateral margins with 2 or 3 spines; posterior margin semicircular, with a median spine; a pair of submedial spines on dorsal surface at proximal third and 2 larger spines closer to edges halfway along. Uropod endopod lateral margin with a terminal spine and sometimes others, posterior and medial margins continuous, dorsal longitudinal ridge with 5 spines; exopod 2-articulate, lateral margin of first article with 5-7 small spines, dorsal longitudinal ridge sometimes spinose, 1 articulating plus 12 fixed spines along distal margin; second article 0.2 total length of exopod.

DISTRIBUTION: Shallow reef down to 27 m; various localities in Indonesia (De Man, 1925a), northern Queensland. The present specimens represent the first records from Australia.

REMARKS: De Man (1925a) figured and described this species well and our specimens agree with his remarks. This species is one of a number of thalassinideans previously known from Indonesian islands which have now been discovered in north Australian waters. The species is related to *A. serratifrons* known throughout the Pacific (De Man, 1925a).

Axiopsis (Axiopsis) werribee n. sp.
Figs 5, 6

MATERIAL EXAMINED: 38 specs.; tl. 11-29 mm.

HOLOTYPE: NMV J.280, female, tl. 29 mm.

TYPE LOCALITY: *Victoria:* 15 km E. of St Leonards, Port Phillip Bay (PPBES stn 956); clay sediment; 24 m; 14th February, 1970.

PARATYPES: *Victoria:* Port Phillip Bay PPBES stn 909 (NMV J.281) 1 spec.; stn 911 (NMV J.282) 1 spec., (AM P.25276) 1 spec.; stn 917 (NMV J.283) 2 specs, (AM P.25277,8) 4 specs; stn 923 (NMV J.284) 1 spec.; stn 925 (NMV J.285) 1 spec.; stn 930 (NMV J.286) 1 spec.; stn 931 (NMV J.287) 1 spec., (AM P.25279,80) 3 specs; stn 932 (NMV J.288) 1 spec.; stn 933 (NMV J.289) 1 spec.; stn 936 (NMV J.290) 1 spec., (AM P.25281) 1 spec.; stn 937 (NMV J.291) 1 spec.; stn 938 (NMV J.292) 1 spec., (AM P.25282,3) 2 specs; stn 949 (NMV J.293) 1 spec.; stn 954 (NMV J.294) 1 spec., (AM P.25284) 1 spec.; stn 956 (NMV J.295) 1 spec.; stn 957 (NMV J.296) 1 spec.; stn 969 (NMV J.297) 2 specs, (AM P.25285) 1 spec.; stn 976 (NMV J.298) 1 spec.; stn 977 (NMV J.299) 1 spec.; stn 983 (NMV J.300) 1 spec., (AM P.25286) 1 spec.

OTHER MATERIAL: *Tasmania:* Isthmus Bay, Bruny Is. (J. Lim colln).

DESCRIPTION: Rostrum evenly tapering to a terminal, upturned point, laterally 4-6 asymetrically placed teeth; median dorsal carina ending anteriorly at base of rostrum as 1-3 strong teeth; 2 pairs of low submedian carinae without teeth. Antenna 1 peduncle as long as first 4 articles of antenna 2, with a dorsolateral spine on distal margin of article 1. Antenna 2 with 1 ventral and 2 short medial spines on distal margin of article 1, a strong dorsal ridge and spine on article 2, a ventral spine on distal margin of article 3, scaphocerite shorter than article 4 and with a mesial spine proximally. Eyestalks about half length of rostrum. Maxilliped 3 ischium with pronounced curved toothed ridge on mesial surface; merus about as long as ischium with 3-5 medial spines. Chelipeds unequal, not sexually dimorphic. Large cheliped coxa with 2 ventral spines; ischium with 0-4 (usually 1) minute ventral teeth; merus with 4-6 hooked teeth ventrally and sometimes 1 dorsally; propod 0.7 times as wide as long, often with 1 distal dorsal tooth and sometimes 1-2 minute ventral teeth; fixed finger cutting edge variable, usually with a tooth or serrate blade at the midpoint; dactyl curved, ridged laterally; ratio of dorsal lengths — merus: carpus: propod — 1: 0.5: 0.6-1.2. Small cheliped with similar arrangement of spines as large cheliped, fixed

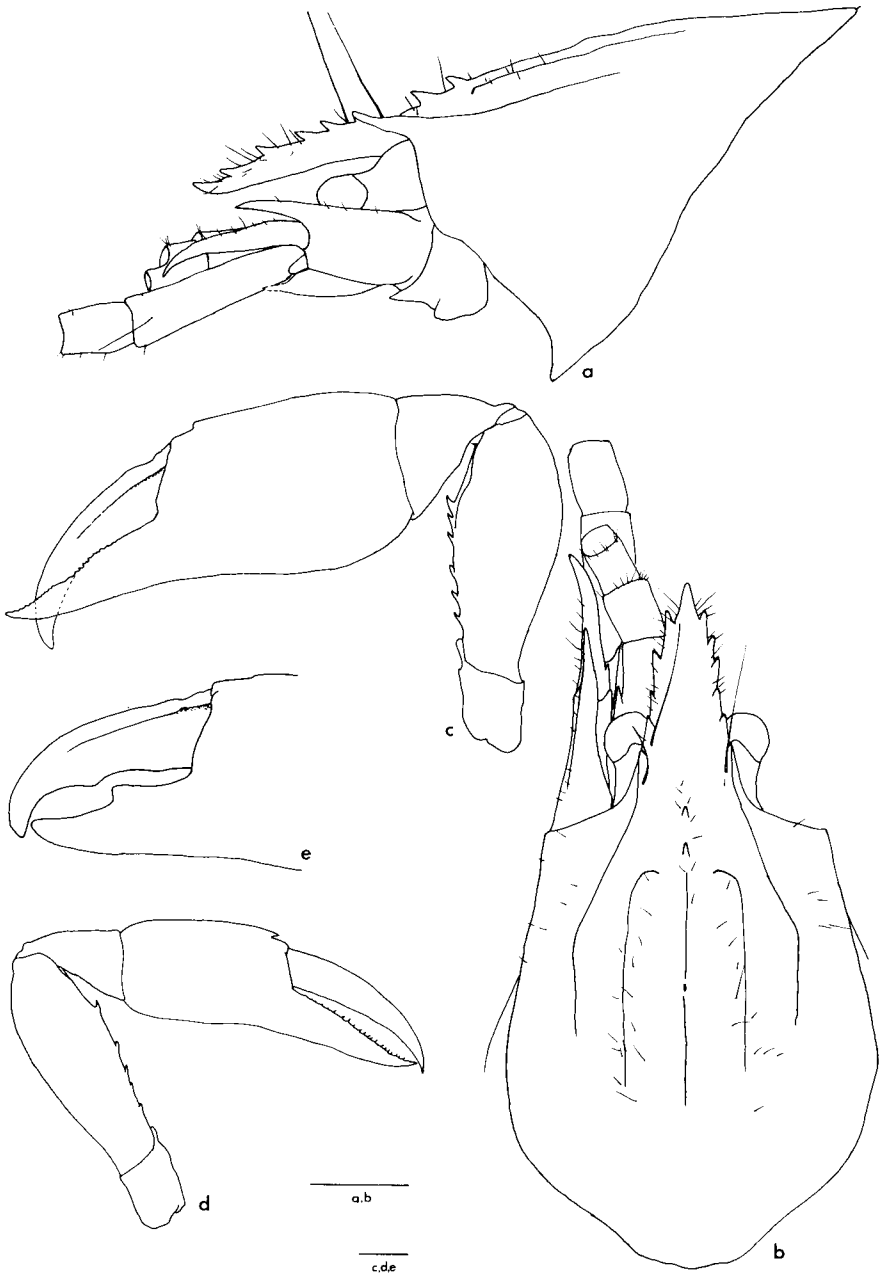

Fig. 5. *Axiopsis werribee* (NMV J.280, female, 21 mm): *a*, *b*, dorsal and lateral views of anterior region; *c*, large cheliped; *d*, small cheliped. (NMV J.298, female, 24 mm): *e*, large cheliped.

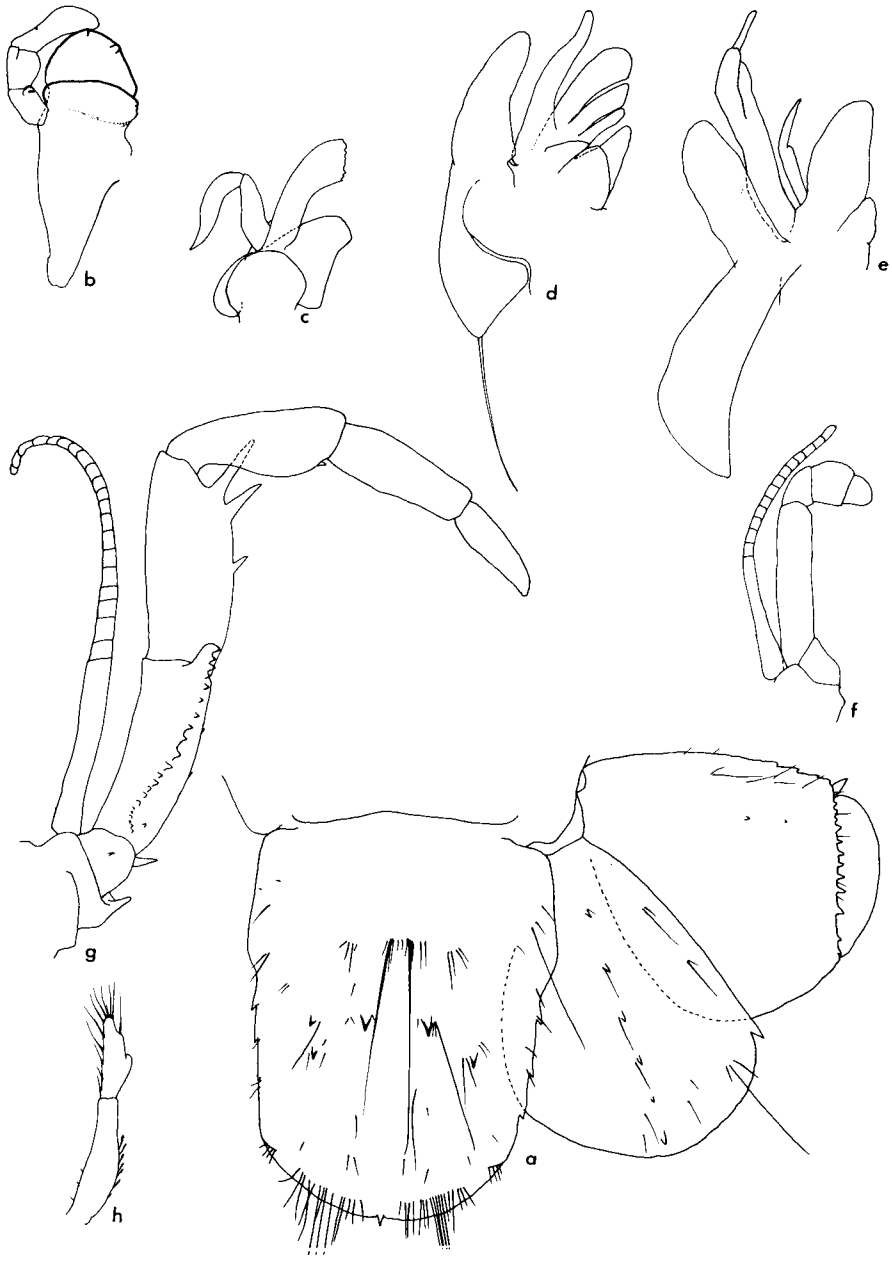

Fig. 6. *Axiopsis werribee* (NMV J.280, female, 21 mm): *a*, telson and uropod; *b*, mandible; *c*, *d*, maxillae 1, 2; *e-g*, maxillipeds 1-3; *h*, pleopod 1.

finger cutting edge with many fine erect teeth. Pereopod 2 coxa with ventral hook; pereopods 3-5 unarmed. Pleopod 1 (female) uniramous, 2-articulate, second article smaller, medially lobed. Pleopod 1 (male) absent. Telson longer than broad, with at least 2 pairs of dorsal spines and 1-3 lateral spines. Uropod endopod shorter than telson, a strong laterodistal spine and a spinose median rib; exopod first article with medial margin strongly convex, lateral margin serrate; row of minute spines on dorsal surface, articulating spine on laterodistal corner; distal edge spinose; second article about 0.15 total length of exopod.

DISTRIBUTION: Clay sediments 10-25 m; Victoria (Port Phillip Bay), Tasmania.

REMARKS: *Axiopsis werribee* is a small species with restricted distribution. It shares with *A. spinulicauda* Rathbun from the northwest coast of North America an absence of dorsal spines except on the median carina, a feature not common in the genus.

This species is described from quantitative benthic samples from the PPBES (Poore, 1975). Smith-McIntyre grab samples (0.1 m^2) indicate a mean density at stations where it was taken of 3.6 individuals per square metre, with highest densities and a maximum of 12 per square metre on the coarsest (sandy-silt) sediments of its range.

Axius Leach, 1815

REMARKS: A modern clear diagnosis has not been presented for this genus but among Australian axiids, species of *Axius* are recognized by both rami of the uropods being of one article, cylindrical eyestalks and the gastric region not falling steeply to the rostrum. De Man (1925a) recognized two subgenera: *Axius* with pleurobranchs on pereopods 2-4 and a pointed rostrum, and *Neaxius* lacking pleurobranchs on pereopods 2-4 and with a terminally notched rostrum. The four Australian species listed here fall within the subgenus *Neaxius* but in *A. plectrorhynchus* and *A. waroona* the terminal notch on the rostrum is often obscure.

Axius (Neaxius) acanthus A. Milne-Edwards
Fig. 7.

Axia acantha A. Milne-Edwards, 1879: 110 (type locality: New Caledonia).

Eiconaxius acanthus. — De Man, 1896: 491-497; 1898: pl. 34 figs 57, 57a.

Axius acanthus. — De Man, 1925a: 3, 14; 1925b: 50-56.

Axius acanthus var. *mauritianus* Bouvier, 1915: 196-198, fig. 7. — Fourmanoir, 1955: 31, fig. 4.

MATERIAL EXAMINED: 2 specimens, both without abdomens.

Queensland: Murray Is., Torres Strait (AM P.7451) 1 spec.; (AM P.7551) 1 spec.

DISTRIBUTION: Mauritius, New Britain, New Caledonia, Indonesia (Sulawesi), northern Australia (Torres Strait).

REMARKS: This species is very similar to the following, *A. glyptocercus*, which we have illustrated in more detail. The most consistent differences are: (1) *A. glyptocercus* bears a spine on the anterior border of the carapace between the rostrum and the suprantennal spine (missing in *A. acanthus*); (2) *A. acanthus* bears 2-4 spines along the cervical groove (missing in *A. glyptocercus*); (3) the dorsal ridge and spine on article 2 of antenna 2 of *A. acanthus* is armed near its base, mesially with 1 spine and laterally with 2-5 spines (*A.*

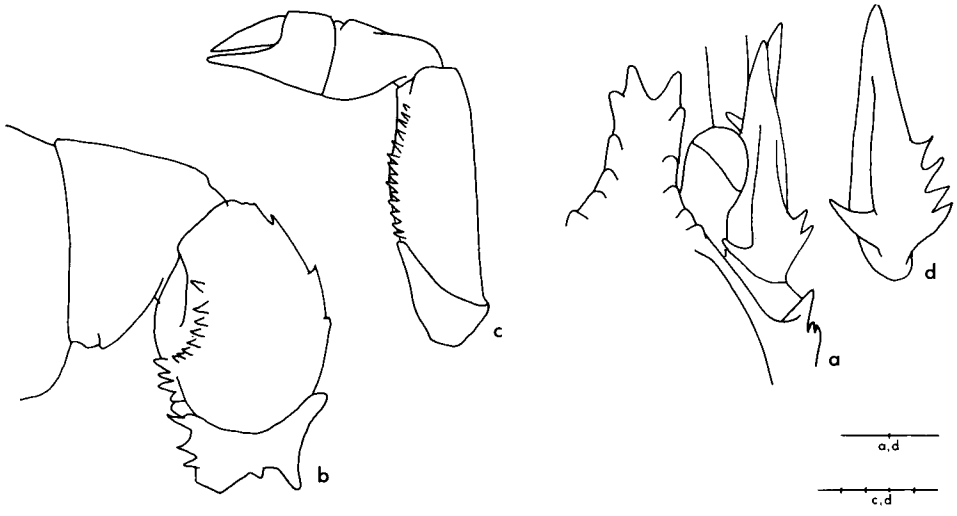

Fig. 7. *Axius acanthus* (AM P.7551, male, 23 mm): *a*, dorsal view of anterior region; *b*, proximal articles of large cheliped; *c*, pereopod 2. (AM P.7451): *d*, article 2 of antenna 2.

glyptocercus is unarmed here); and (4) lateral spination on the merus of pereopods 1 and 2 is much more pronounced in *A. acanthus* than in *A. glyptocercus*. De Man (1925b) misused the term stylocerite for the dorsal antennal spine. Figure 7 illustrates the differences (1), (3) and (4) above. Our material of *A. acanthus* and *A. glyptocercus* reaffirms De Man's distinction between the two species but some of the differences noted by him are not real. For example, the number of spines on the median carina is variable and not a distinguishing feature.

Axius (Neaxius) glyptocercus von Martens
Fig. 8.

Axius glyptocercus von Martens, 1868: 613 (type locality: Cape York). — De Man, 1925a: 4, 13; 1925b: 50-56, fig. 1.

MATERIAL EXAMINED: 21 specimens; cl. 22-38 mm.

Northern Territory: Darwin (AM P.15030) 1 spec., (AM P.18842) 1 spec., (AM P.20358) 1 spec.

Queensland: Fly Point, Cape York (AM P.24813) 2 specs. — Magnetic Is. (QM W.3748) 2 specs. — Townsville (QM W.4533) 1 spec.; (AM P.16176) 1 spec. — Bowen (AM P.16177) 1 spec. — Norwest Is., Capricorn Group (AM P.11829) 1 spec.; (AM P.10060) 1 spec. — Moreton Bay (QM W.1219) 1 spec.; (QM W.1434) 2 spec; (QM W.1072) 1 spec.; (QM W. 3649) 1 spec. — Amity Point (QM W.4532) 2 specs. — Dunwich, Stradbroke Is. (AM P.13723) 1 spec.

DESCRIPTION: Rostrum a little longer than basal width, tapering only near base; lateral margins each with 6-7 spines, strongest terminally, most distal pair anteriorly directed and dominating end of rostrum. Anterolateral edge of carapace with a large spine between the eyestalk and antenna 2, another of similar size at the base of the antenna 2 and 4-5 smaller spines between antenna 2 and cervical groove; 2-3 small spines on anterior

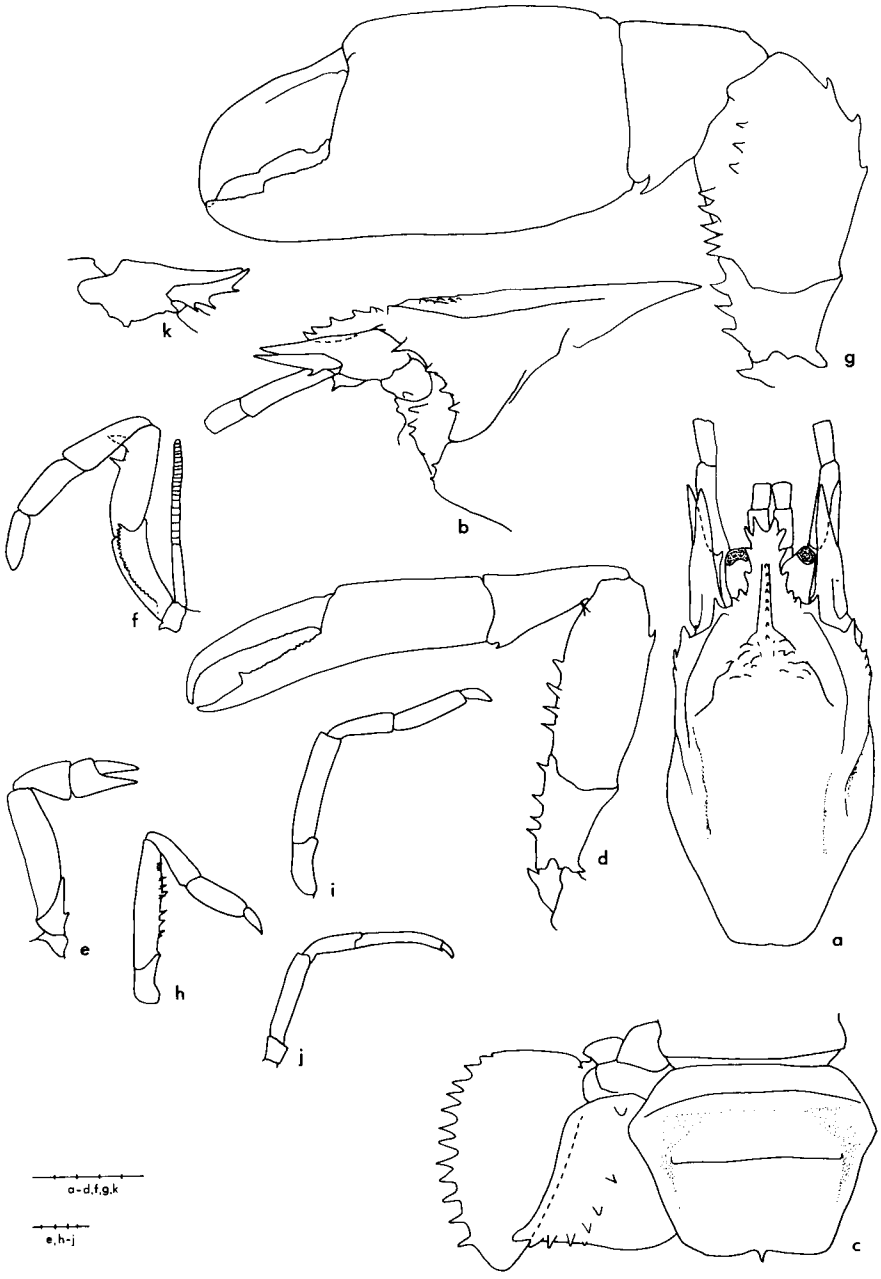

Fig. 8. *Axius glyptocercus* (QM W.4533, female, 27 mm): *a, b,* dorsal and lateral views of anterior region; *c,* telson and uropod; *d,* pereopod 1 (small cheliped form); *e,* pereopod 2; *f,* maxilliped 3. (QM W.4532, female, 27 mm): *g,* large cheliped; *h-j,* pereopods 3-5. (QM W.3748, female, 31 mm): *k,* antenna 2, article 2 and scaphocerite.

margin of branchial region of carapace. Frontal region of the carapace depressed except for a median carina bearing 4-7 spines, running back to rugose anterior part of gastric region; dorsolateral margins of carapace smooth. Preoral area spinose. Antenna 2 peduncle longer than that of antenna 1 by more than last article; article 2 dorsally produced to level of end of scaphocerite, dorsal ridge smooth; scaphocerite acute, reaching 0.7 length of article 4, with a median spine near end of eyestalks and 1-3 strong ventral spines; article 3 with a ventral spine; articles 4, 5 unarmed. Eyestalks 0.7 length of rostrum. Maxilliped 3 ischium with curved toothed ridge on mesial surface; merus longer than ischium and with 2-4 medial spines. Chelipeds unequal, not sexually dimorphic. Large cheliped coxa with 2 ventral spines; basis with 2 ventral and 1 mesial spines and a flat distolateral triangular projection; ischium with 3-5 ventral spines and often 1 proximal dorsal spine; merus with 1-4 spines on dorsal margin, 4-5 ventrally and 1-5 laterally near articulation with carpus (the number of spines depending on age); carpus with 1 ventral spine; propod dorsally and ventrally smooth; fixed finger stout, with an obsolete tooth near midpoint; dactyl equal to fixed finger, its cutting edge with a proximal tooth and a very broad projection at the midpoint. Small cheliped similar to the large except in size (e.g., fig. 8d) and in having an acute tooth on cutting edge of fixed finger and a terminally curved dactyl. Pereopod 2 with ventral spines on coxa, basis and ischium; pereopod 3 with ventral spines on coxa and merus (except small specimens); pereopod 4 with ventral spines on coxa; pereopod 5 unarmed. Pleopod 1 (female) 2-articulate, second article the longest, lanceolate. Pleopod 1 (male) absent. Telson wider than long, widest point ⅓ way along then strongly tapering posteriorly; posterior margin weakly emarginate, with a small spine at its midpoint; 2 strong smooth transverse ridges dorsally. Uropod endopod lateral margin concave distally, a flat spine between this margin and posterior margin, dorsal ridge with 1 proximal and 3-7 distal spines; exopod with a short straight lateral margin; posterior margin curved with 12-14 strong spines.

DISTRIBUTION: Northern Territory (Darwin) through Queensland to Moreton Bay.

REMARKS: *A. glyptocercus* and *A. acanthus* are clearly recognizable among Australian axiids by the emarginate rostrum bearing blunt lateral tubercles and the characteristic ornamentation of the uropods. The differences between *A. glyptocercus* from north-eastern Australia, and the closely related *A. acanthus* from islands north of Australia and Torres Strait, have been discussed by De Man (1925b) and again by us in remarks on the previous species.

Axius (Neaxius) plectrorhynchus Strahl
Fig. 9.

Axius plectrorhynchus Strahl, 1861: 1060-1062, figs 2-4, 11 (type locality: Luzon); 1862: 387. — Miers, 1884: 282-283. — De Man, 1887: 463-464, pl. 19 fig. 5; 1925a: 4, 13.

Axius plectorhynchus (sic). — Hale, 1927: 84-85, fig. 81.

Axius plectrohynchus (sic). — Coleman, 1977: 135, colour plate.

MATERIAL EXAMINED: 19 males, 25 females; cl. 6-23 mm.

Queensland: Fly Point, Cape York (AM P.24810, 1) 2 specs. — Hayman Is., Whitsunday Group (AM P.7304) 2 specs. — Norwest Islet, Capricorn Group (AM P.8676) 1 spec. — Heron Is. (AM P.20832) 1 spec. — Port Curtis (AM P.25294) 2 specs.

South Australia: no locality (AM P.149) 1 spec.; (AM P.2345, 6) 2 specs.; (AM P.25290) 1 spec. — Sellicks Beach (SAM C.1968) 1 spec. — Petrel Bay, Great Francis Is. (AM P.20966) 1 spec. — Kingscote (AM P.4826) 4 specs.

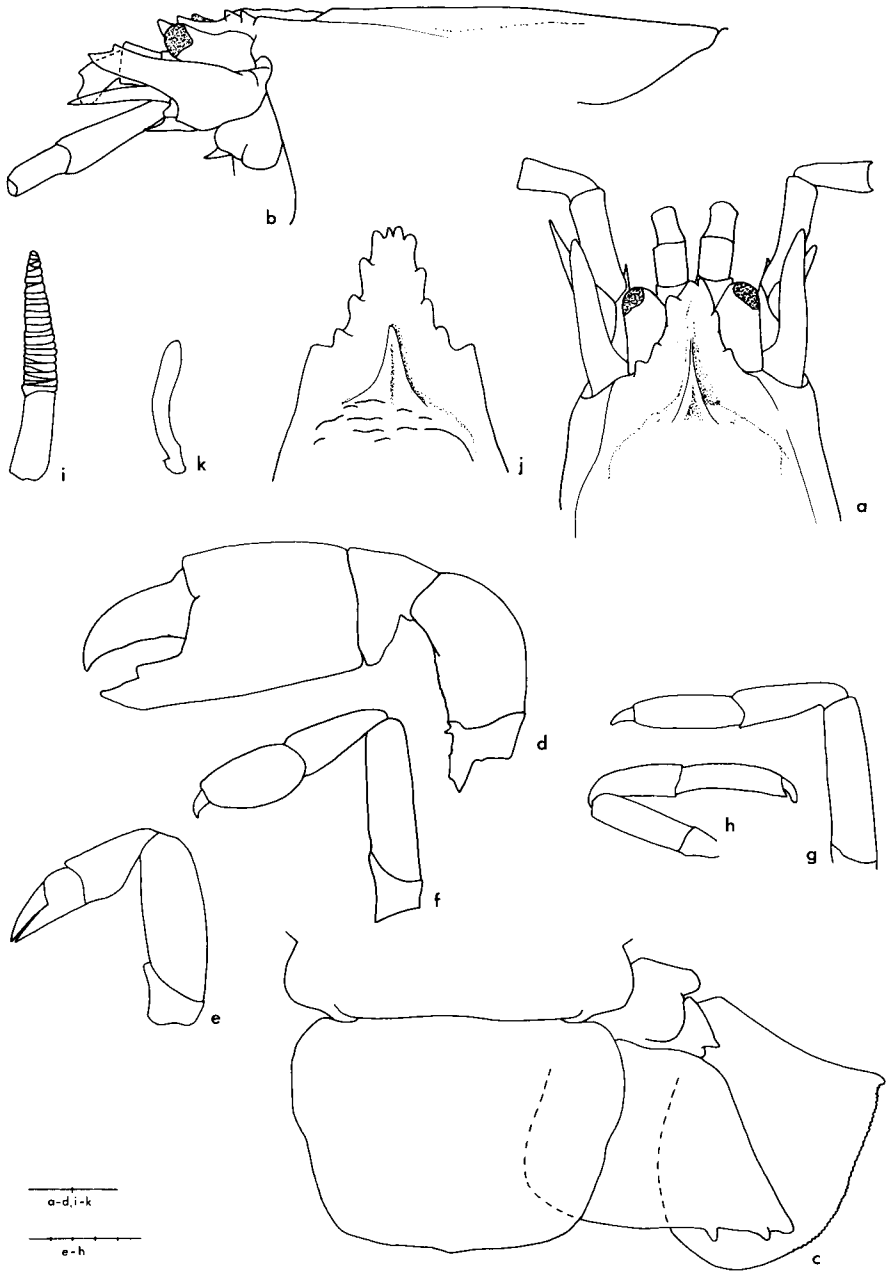

Fig. 9. *Axius plectrorhynchus* (WAM 23-75, female, 19 mm): *a, b,* dorsal and lateral views of anterior region; *c,* telson and uropod; *d-h,* pereopods 1-5; *i,* pleopod 1. (WAM 167-60, female, 22 mm): *j,* dorsal view of anterior. (WAM 167-60, male, 17 mm): *k,* pleopod 1.

Western Australia: Point Peron (WAM 23-75) 1 spec.; (WAM 105-56) 1 spec.; (WAM 19-75) 4 specs.; (WAM 273-65) 1 spec.; (WAM 166-60) 1 spec.; (WAM 67-75) 4 specs. — Cape Naturaliste (WAM 167-60) 2 specs.; (WAM 55-75) 2 specs. — Carnac Is. (WAM 11-75) 5 specs. — Gordie Bay, Rottnest Is. (WAM 303-65) 2 specs. — Hamelin Bay (WAM 21-75) 2 specs. — no locality (WAM 224) 1 spec.

DESCRIPTION: Rostrum little longer than width at base, lateral margin concave, dentition asymmetrical, 4-6 strong, blunt teeth on each side. Gastric region rugose, sloping gradually down to rostrum; a prominent triangular median carina in front of the gastric region narrows and slopes down, usually steeply, at the base of the rostrum, sometimes acute anteriorly; lateral carinae end anteriorly at base of rostrum as blunt teeth distinctly out of line of rostral teeth. Antenna 1 peduncle not reaching to end of article 4 of antenna 2, stylocerite a minute spine. Antenna 2 with a ventral spine on article 1; a dorsal ridge on article 2 extending forward as a strong spine (a blade sometimes); scaphocerite a prominent spine almost reaching to end of article 4; article 3 with a medioventral spine. Eyestalks reaching almost to end of rostrum and clearly visible dorsally. Maxilliped 3 merus with 2 spines medially. Chelipeds equal, not sexually dimorphic. Cheliped coxa with 2 spines and basis with 1 spine on posteromedial edge; ischium with a distal spine on the ventral margin; merus minutely ventrally serrate; propod stout, unarmed; fixed finger cutting edge with a prominent blunt tooth midway along; dactyl equal to fixed finger, cutting edge smooth; ratio of dorsal lengths — merus: carpus: propod — 1:0.6:1. Pereopods 2-4 with spines on coxae, otherwise pereopods unarmed. Pleopod 1 (female) uniramous, multiarticulate flagellum 1.5 times as long as first article. Pleopod 1 (male) a single curved article. Telson 1.5 times as wide as long, broadest about ⅓ way along, posterior to which lateral margins constrict and then taper to be continuous with posterior margin; sometimes a medial spine on posterior margin; dorsally smooth or with 2 obsolete spines. Uropod endopod with broad anterior free margin, lateral margin slightly concave and ending posteriorly in a squamiform spine; posterior margin slightly convex with 2 (rarely 3) additional spines, the most medial one, ending the dorsal rib, often acute, dorsal ridge sometimes with 1-3 spines; exopod 1.2 times as wide as long, widest at midpoint, lateral margin concave, ending posteriorly in a squamiform spine, posterior and medial margins continuous, minutely crenulate distally, free proximal margin parallel to posterior margin.

DISTRIBUTION: Intertidal — 13 m, reef and coral; Indonesia (Seram), Queensland, South Australia and Western Australia.

REMARKS: *Axius plectrorhynchus* is one of the more widespread and common axiids in Australia but taxonomically one of the most poorly known. It is easily confused with the smaller *A. waroona* whose range it overlaps. The two species are compared following the description of the latter species. De Man's (1925a) key allows identification of the species but it has not been adequately described or figured previously. Hale (1927) and Coleman (1977) misspelt the specific name.

Axius (Neaxius) waroona n. sp.
Fig. 10.

Axius plectrorhynchus. — Fulton & Grant, 1902: 60-61, pl. 5 figs 7,8. (Not *Axius plectrorhynchus* Strahl, 1861.)

Axius plectorchynchus (sic) "small variety". — Hale, 1927: 84.

MATERIAL EXAMINED: 12 males, 12 females, 4 others; cl. 6-13 mm.

HOLOTYPE: WAM 20-75, ovigerous female, cl. 8 mm.

Fig. 10. *Axius waroona* (WAM 20-75, female, 8 mm): *a, b,* dorsal and lateral views of anterior region; *c,* telson and uropod; *d,* cheliped. (WAM 151-76, male, 7 mm): *e,* rostrum.

TYPE LOCALITY: *Western Australia:* N. side of Cape Naturaliste, "below lighthouse, building mud tubes under intertidal stones", coll. B. R. Wilson and S. Slack-Smith, 9th December, 1965.

PARATYPES: *Queensland:* Murray Is., Torres Strait (AM P.24662) 1 spec. — Masthead Is. (AM G.5757) 1 spec.

Victoria: (localities in doubt) Beaumaris (SAM C.880) 4 specs. — Flinders (AM P.25291) 5 specs.

Tasmania: Jacobs Boat Harbour (TM G.1638) 1 spec.

South Australia: Kingscote, Kangaroo Is. (AM P.4841) 2 specs.

Western Australia: Edward Is., Lancelin (AM P.24664) 3 specs. — Bathurst Pt., Rottnest Is. (WAM 174-31) 1 spec.; (WAM 130-75) 1 spec. — Garden Is. (WAM 432-73) 2 specs. — Cowaramup Bay (WAM 9-75) 2 specs. — Cape Nauraliste (WAM 151-76) 2 specs. — Albany (WAM 73-75) 2 specs.

DESCRIPTION: Rostrum little over half as long as width at base, somewhat depressed, lateral margins convex, marginal ornamentation varying from an obsolete tuberculate ridge to sometimes 4-6 small acute spines per side. Gastric region usually somewhat rugose, sloping down to rostrum; a triangular median carina in front of the gastric region ends indefinitely anteriorly; Lateral carinae run into margins of rostrum without disruption. Antenna 1 peduncle reaching to about end of article 4 of antenna 2. Antenna 2 with a small ventral spine on article 1; a dorsal ridge on article 2 extending forward as a stong spine; scaphocerite a prominent downcurved spine; article 3 with a small medioventral spine. Eyestalks not reaching end of rostrum, largely obscured dorsally. Chelipeds equal, not sexually dimorphic. Cheliped ischium with a distal spine on the ventral margin; merus irregularly dentate ventrally; propod, stout, unarmed; fixed finger cutting edge with a prominent sharp tooth midway along; dactyl subequal to fixed finger, cutting edge smooth; ratio of dorsal lengths — merus: carpus: propod — 1:0.5:1. Pereopods 2-4 with spines on coxae, otherwise pereopods unarmed. Pleopods as in *A. plectrorhynchus*. Telson about 1.3 times as wide as long, broadest near proximal margin, lateral margins tapering to be continuous with posterior margin; sometimes a medial spine on posterior margin; dorsally smooth or with 2 obsolete spines. Uropod endopod with little anterior free margin, lateral margin slightly concave proximally, straight distally and ending in small spine; posteror margin weakly convex with small acute spine at the end of the dorsal ridge (rarely a third intermediate marginal spine); dorsal ridge usually smooth, rarely bearing a small spine; exopod little longer than wide, widest about ⅔ way along, lateral margin straight-concave, ending in a minute spine, posterior and medial margins continuous.

DISTRIBUTION: Intertidal, under rocks; Queensland, Victoria, Tasmania, South Australia and Western Australia.

REMARKS: *Axius waroona* is most closely related to the previous species, *A. plectrorhynchus*. Hale (1927) noted a "small variety" in specimens of *A. plectrorhynchus* from South Australia. *A. waroona* differs in several subtle characters as well as its smaller size, notably the spination of the rostrum (usually obsolete in *A. waroona),* the lateral lobes of the rostrum not being distinct, and especially the uropod rami being more triangular in *A. waroona*. The form of the rami of the uropods is propably the clearest feature distinguishing the two species.

Scytoleptus Gerstaecker, 1856

DIAGNOSIS: Uropod rami without sutures; eyestalks cylindrical; dorsum falling steeply to rostrum; scaphocerite minute.

Scytoleptus serripes Gerstaecker
Fig. 11.

Scytoleptus serripes Gerstaecker, 1856: 158, pl. 6 figs 1-4 (type locality: South Africa). — Strahl, 1861: 1055. — Hilgendorf, 1878: 827. — Lenz, 1905: 379. — Bouvier, 1915: 198-200, figs. 8, 9. — De Man, 1925a: 5, 49-53, fig. 9. — Barnard, 1950: 499. — Fourmanoir, 1955: 30-31.
Evaxius tricarinatus Kingsley, 1882: 130-131, pl. 1 fig. 1.

MATERIAL EXAMINED: 13 females, 6 males; cl. 5-46 mm.

Northern Territory: Cape Wessel (QM W.4531) 3 specs. — West Point, Darwin (WAM 68-77) 2 specs. — Fannie Bay, Darwin (AM P.24670) 1 spec.

Western Australia: Cockatoo Is. (WAM 125-75) 1 spec. — Quongdong Reef, Broome (WAM 58-75) 2 specs. — Port Hedland (WAM 78-75) 1 spec. — Dampier Archipelago: Kendrew Is., (WAM 6-75) 1 spec.; (WAM 15-75) 1 spec.; Bezont Is. (WAM 74-75) 1 spec.; Delambre Is. (WAM 283-65) 3 specs.; Angel Is. (WAM 47-75) 2 specs. — Exmouth Gulf (WAM 280-65) 1 spec.

DESCRIPTION: Rostrum broad basally with 1 pair of blunt lateral spines, tapering abruptly to narrow tip, dorsally concave. Gastric region falling steeply to rostrum, its median carina obsolete dorsally and ending anteriorly in a blunt corner or sometimes a sharp spine; the anterior vertical ridge with 1 or 2 more or less acute, short spines midway down; single pair of obsolete lateral carinae ending anteriorly in sharp or rounded corners; cervical groove and linea thalassinica indistinct. Antenna 1 peduncle reaching about a third along length of article 4 of antenna 2, unarmed. Antenna 2 with a small ventral spine on article 1; article 2 unarmed, scaphocerite a small triangular plate; article 4 elongate, 4 times as long as article 2. Eyestalks about half length of rostrum. Maxilliped 3 ischium with a prounced curved toothed ridge on mesial surface; merus with a strong medial terminal spine. Chelipeds unequal, not sexually dimorphic. Large cheliped usually unarmed, but sometimes an irregular dentate ridge on ventral margin of merus; fixed finger stout, cutting edge irregular and slightly toothed; dactyl little longer than fixed finger, stout, curved, unarmed; ratio of dorsal lengths — merus: carpus: propod — 1:0.5:1.3. Small cheliped narrow, unarmed except sometimes a blunt spine ventrally on merus; fixed finger irregularly dentate. Pereopods 2-5 without fixed armature but propod and dactyl of pereopods 3, 4 bear numerous short black articulating spines laterally and ventrally. Pleopod 1 (female) uniramous, first article as long as multiarticulate flagellum. Pleopod 1 (male) a single narrow curved article. Telson longer than broad, lateral margins with a small proximal spine, a small spine at midpoint of convex posterior edge; strongly convex dorsally, spinose and setose. Uropod endopod little shorter than telson, with a spinose longitudinal ridge and 2 spines on posterior margin; exopod with convex, continuous lateral and posterior margins, spinose dorsally and on posterior margin.

DISTRIBUTION: Intertidal reefs; Mauritius, Madagascar, Aldabra Is., South Africa, Mozambique, Zanzibar Is., Indonesia, northern and northwestern Australia. The present specimens represent the first records from Australia.

REMARKS: This distinctive species is the sole representative of its genus. The steeply falling gastric region above the short dished rostrum easily distinguishes it from all other

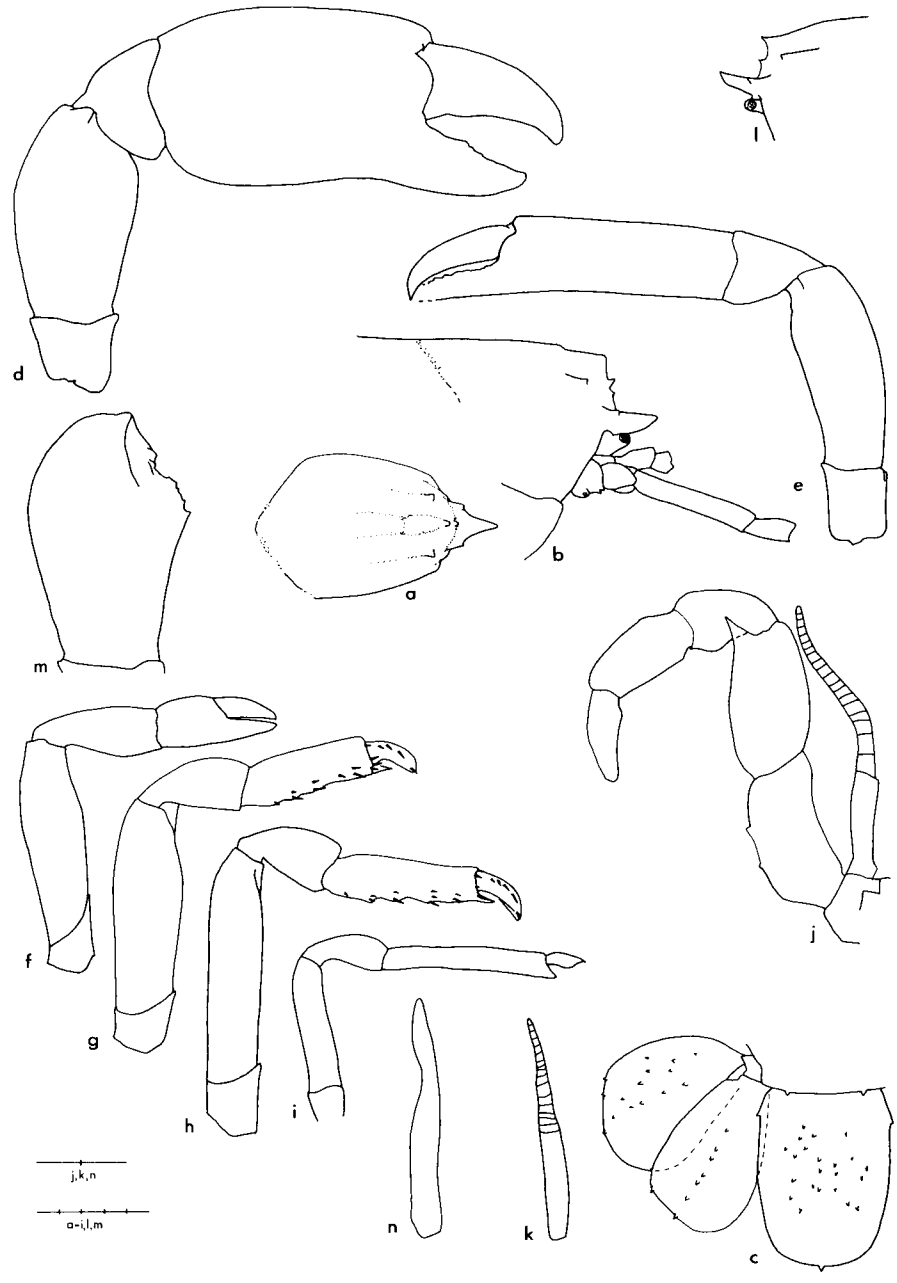

Fig. 11. *Scytoleptus serripes* (QM W.4531, female, 20 mm): *a, b,* dorsal and lateral views of anterior region; *c,* telson and uropod; *d,* large cheliped; *e,* small cheliped; *f-i,* pereopods 2-5; *j,* maxilliped 3; *k,* pleopod 1. (QM W.4531, female, 16 mm): *l,* lateral view of anterior. (WAM 74-75, female, 18 mm): *m,* merus of large cheliped. (WAM 47-75, male, 21 mm): *n,* pleopod 1.

thalassinideans. *Scytoleptus serripes* is the only Australian thalassinidean found also in southern Africa.

Family **Callianassidae** Dana, 1852

Callianassa Leach, 1814

DIAGNOSIS: Dorsal oval of the carapace, the area delimited by the cervical groove, obvious and longer than the cardiac region behind it; well developed linea thalassinica; rostrum flattened, triangular and short or spinous or lacking. Eyestalks flat, eye on dorsal surface. Maxilliped 3 usually lacking exopod, operculiform or pediform. Chelipeds usually unequal.

REMARKS: The above diagnosis serves to distinguish *Callianassa senso latu* from the two other genera known from Australia, *Ctenocheles* and *Gourretia*. Biffar (1971a) has given a more extensive description. We have had some difficulty in placing some of the Australian callianassid species in the new genera erected by de Saint Laurent (1973) (see also Poore, 1975) and therefore prefer not to follow her arrangement. The exception is her new genus *Gourretia* which forms a relatively homogeneous group of species clearly distinct from the remainder of the family.

Callianassa aequimana Baker
Figs 12, 13

Callianassa aequimana Baker, 1907: 182-185, pl. 24 figs 1-8 (type locality: South Australia, Kingston). — Hale, 1927: 87, fig. 83. — De Man, 1928a: 28, 114: 1928b: 48-51.

MATERIAL EXAMINED: 16 males, 18 females; tl. 9-84 mm.

Queensland: Northwest Islet, Capricorn Group (AM P.10356) 1 spec.

New South Wales: Balmoral Beach, (AM P.3636) 1 spec.

Victoria: Shoreham (AM G.5776) 1 spec.; (AM G.5769) 1 spec. — Port Phillip Bay (PPBES stn 953) 4 specs. — Crib Point, Western Port (CPBS stn 00) 2 specs.

South Australia: Kingston (AM P. 148) 1 spec.; (SAM C. 902, paratypes) 2 specs. — Port McDonnell (NMV) 1 spec.

Western Australia: Houtman Abrolhos Is. (WAM 253-65) 1 spec. — Dalkeith, Swan River (WAM 10842) 1 spec. — Fremantle Harbour (WAM 71-75) 1 spec. — Garden Is. (WAM 46-75) 2 specs; (WAM 9544) 1 spec.; (WAM 14-75) 1 spec. — Rockingham, Cockburn Sound (WAM 12-75) 1 spec. — Mandurah (AM P.11887) 1 spec.; (WAM 17-75) 1 spec. — Peel Inlet (WAM 7-75) 2 specs. — Bunbury (AM P.13717) 1 spec.; (WAM 199-34) 1 spec.; (WAM 70-75) 1 spec.; (WAM 31-75) 1 spec. — Leschenault Estuary, Bunbury (WAM 26-75) 1 spec. — Albany (WAM 35-75) 1 spec.; (WAM 116-52) 1 spec. — Cheyne Beach (WAM 27-75) 1 spec.

DESCRIPTION: Dorsal oval 0.6 length of dorsal carapace. Rostrum variable, usually very short, broad, triangular, anteriorly blunt, less than 0.2 length of eyestalks; lateral projections as long as rostrum, blunt; postrostral area gently sloping anteriorly, often with 3 broad obsolete ridges running on to rostrum and anterior margin. Eyestalks extending as far as distal edge of first article of antenna 1, anteromedial angle subacute; pigmented area subdistal, circular. Peduncle of antenna 1 reaching just beyond article 4 of antenna 2. Maxilliped 3 merus width 0.6-0.7 length of ischium and merus together, merus little shorter than ischium; ischium with row of about 24 spines along midline of inner surface; carpus articulating terminally on merus, subovate; propod subovate, lateral edge weakly curved,

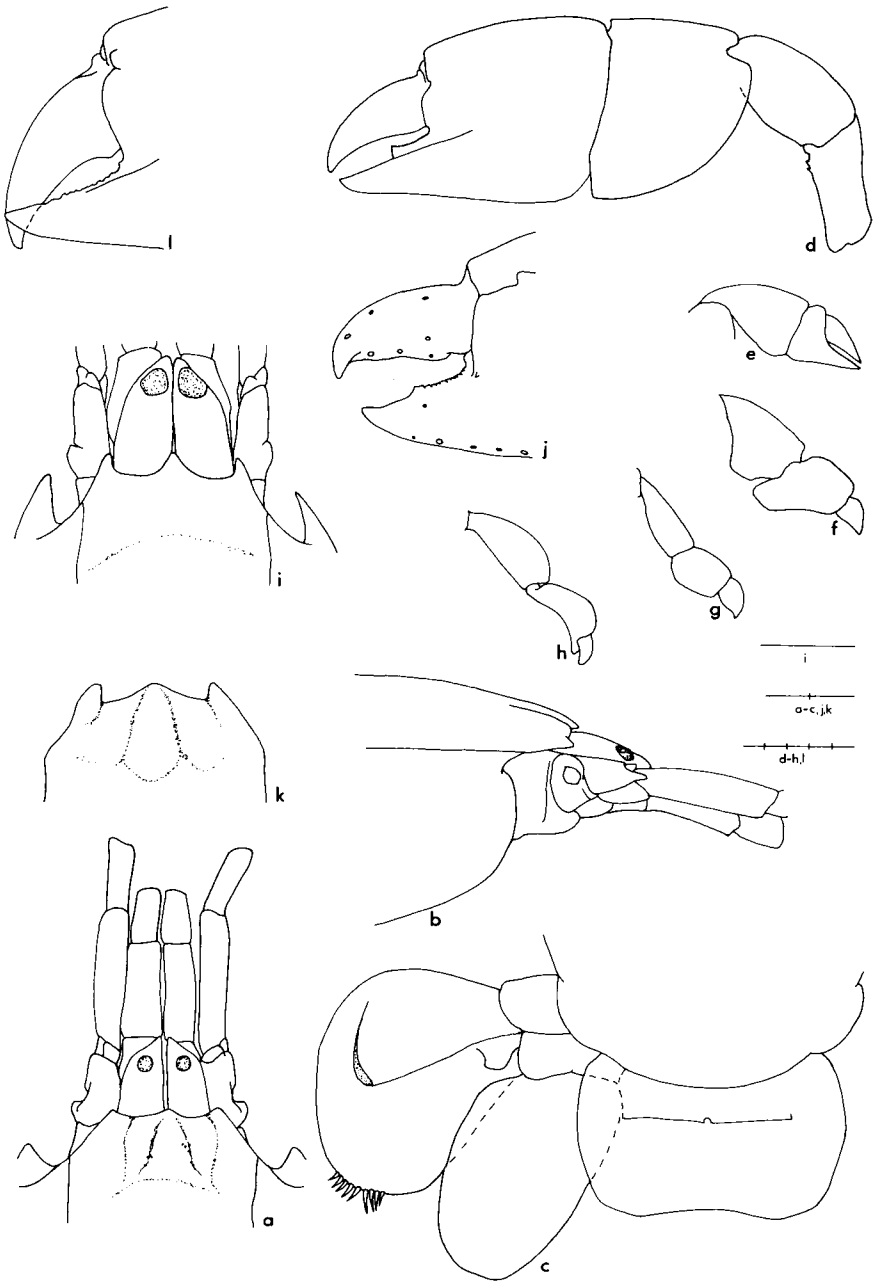

Fig. 12. *Callianassa aequimana* (AM P.148, female, 56 mm): *a*, *b*, dorsal and lateral views of anterior region; *c*, telson and uropod; *d*, cheliped; *e-h*, pereopods 2-5 (terminal articles only). (AM P.10356, female, 37 mm): *i*, anterior; *j*, chela (medial view). (AM P.3636, male, 81 mm): *k*, anterior of carapace, *l*, chela (medial view).

Fig. 13. *Callianassa aequimana* (AM P.148, female, 56 mm): *a*, mandible (with detail); *b, c*, maxillae 1, 2; *d-f*, maxillipeds 1-3; *g, h*, pleopods 1, 2. (AM P.3636, male, 37 mm): *i, j*, pleopods 1, 2.

medially lobed, width twice length; dactyl subovate, width half that of propod. Chelipeds equal and similar in both sexes; ischium weakly serrate ventrally, 2 or 3 strong spines distally; merus unarmed, dorsally carinate; carpus about 1.5 times as wide as long; propod carinate dorsally and ventrally, dorsal edge sometimes produced distally; fixed finger tapering to end, a variably sized tooth at proximal third, proximal half generally denticulate; dactyl about as long as fixed finger, tapering to downcurved end; cutting edge usually smooth but sometimes with obsolete proximal teeth; ratio of dorsal lengths — merus: carpus: propod — 1:0.85 — 0.95:0.9. Pleopod 1 (female) uniramous, 2-articulate second article curved. Pleopod 2 (female) biramous, exopod straight, subequal to distal lobe of first article of 2-articulate endopod. Pleopod 1 (male) uniramous, 2-articulate, distal article medially lobed. Pleopod 2 (male) biramous, endopod 3-articulate, first and second articles distally lobed, lobes of equal length, third article small. Telson with weakly concave posterior edge, sides weakly convex, length just over half greatest width; surface with a transverse ridge close to base, a tuft of setae arising from notch at centre of ridge. Uropod endopod ovate, greatest width midway along, almost twice as long as wide, 1.5 times as long as telson, margin barely setose; exopod slightly shorter than endopod, length 1.3 times width, greatest width midway along, setae and few spines on posterior edge.

DISTRIBUTION: Intertidal and subtidal mudflats down to 9 m, often in estuaries;

southern Queensland through N.S.W., Victoria, South Australia, to south Western Australia.

REMARKS: There is good agreement between this material and that described by Baker (1907), but we have noted considerable variation especially with size. The postrostal area can be smooth or, in larger specimens, have broad obsolete longitudinal ridges. The rostrum varies from almost absent to quite prominent and the rami of the uropods become more elongate with increasing size. We cannot confidently place this species in any of de Saint Laurent's (1973) genera of the Callianassidae.

Callianassa amboinensis De Man
Fig. 14.

Callianassa amboinensis De Man, 1887: 480-482, pl. 20 fig. 4 (type locality: Indonesia, Ambon); 1928a: 27, 107, 165-170, pl. 18 fig. 28. — Zehntner, 1894: 194. — Borradaile, 1903: 545.

MATERIAL EXAMINED: 2 females, tl. 44 mm.

Western Australia: 3-4 mi (4.8-6.4 km) off E. end of Delambre Is. Dampier Archipelago, 18 m (WAM 119-75) 1 spec.; (WAM 120-75) 1 carapace.

DESCRIPTION: Dorsal oval 0.75 length of dorsal carapace. Rostrum flat, very broad, obtuse, less than 0.2 length of eyestalks; lateral projections obsolete. Eyestalks extending just beyond end of first article of antenna 1, with a long, broad, rounded mesiodistal lobe beyond the large lateral eyes. Peduncle of antenna 1 reaching beyond end of peduncle of antenna 2; neither antenna very setose. Maxilliped 3 merus width 0.8 length of ischium and merus together, merus shorter then ischium; ischium with curved row of 25 small teeth on mesial surface; carpus articulating distally on merus, subovate; propod tapering; dactyl narrow, tapering. Large cheliped (female) ischium dentate ventrally; merus with evenly curved minutely dentate ventral margin, dorsal margin convex; carpus about 1.3 times as wide as long, dorsally and ventrally smooth; propod dorsally and ventrally smooth; fixed finger stout, cutting edge minutely serrate; dactyl equal to fixed finger, strongly curved at end, minutely serrate; ratio of dorsal lengths — merus: carpus: propod — 1:0.8:1.5. Large cheliped (male) unknown. Small cheliped of similar proportions to large cheliped, about 0.7 times its length. Pleopod 1 (female) 2-articulate. Pleopod 2 (female) biramous, both rami 2-articulate, endopod longer than exopod. Pleopods (male) unknown. Telson little wider than long, lateral edges strongly curved and continuous with weakly concave posterior edge, a minute spine at midpoint of posterior edge; long setae terminally. Uropod endopod subovate, little longer than telson, with setose margin; exopod about as long as endopod, lateral margin almost straight, distal and medial margins convex, continous, wider than long, greatest width at midpoint, with setose margin.

DISTRIBUTION: Reef to 18 m; Indonesia, north Western Australia. The present specimens represent the first records from Australia.

REMARKS: Without seeing the types or other specimens of *C. amboinensis* it is difficult to separate the two specimens from north Western Australia from De Man's (1887, 1928a) descriptions and figures. There is close resemblance in the antennae, tail fan, maxilliped 3 and propod of pereopod 3. Features where our specimens differ are the absence of acute ends on the eyestalks, a blunter rostrum, and some dentition on the ischium and merus of the large cheliped — all characteristics which can vary with age, sex or size. Given the geographical proximity of the collecting sites we feel confident in assigning these specimens to *C. amboinensis*.

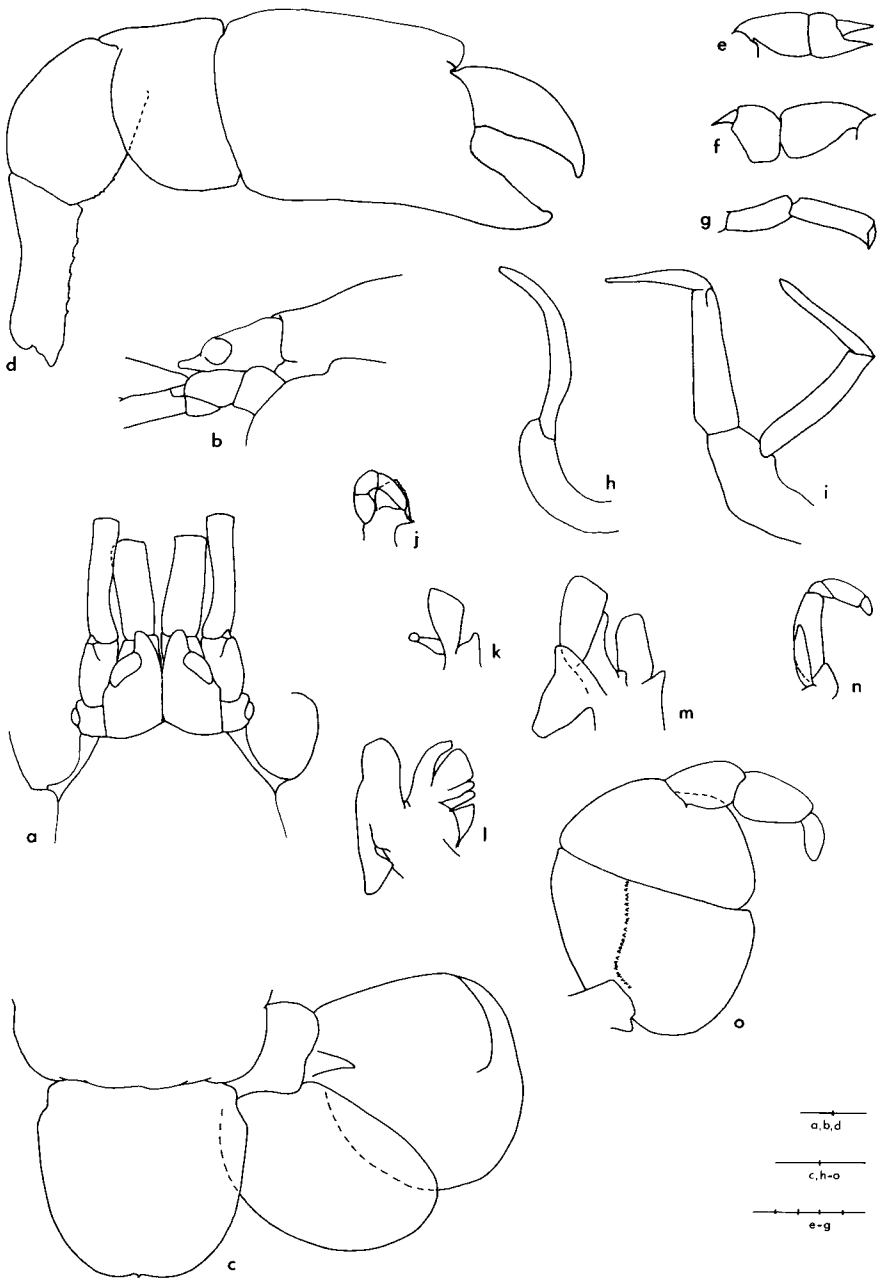

Fig. 14. *Callianassa amboinensis* (WAM 119-75, female, 44 mm): *a, b,* dorsal and lateral views of anterior region; *c,* telson and uropod; *d,* large cheliped; *e, f, g,* pereopods 2, 3, 5 (terminal articles); *h, i,* pleopods 1, 2; *j,* mandible; *k, l,* maxillae 1, 2; *m-o* maxillipeds 1-3.

Callianassa arenosa Poore
Figs 15-17

Callianassa arenosa Poore, 1975: 197-201, figs 1-2 (type locality: Victoria, Port Phillip Bay).

MATERIAL EXAMINED: 63 specs. tl. 10-43 mm.

Queensland: Moreton Bay (QUBS) 16 specs. — Pelican Banks, Moreton Bay (CSIRO) 2 specs. — Bird Is., Moreton Bay (QM W.832) 3 specs. — 1 mile S. of Southwest Rocks, Moreton Bay (QM W.3977) 1 spec.; (QM W.3978) 2 specs. — Dunwich (QM W.2037) 2 specs.

New South Wales: Careel Bay (AM P.20797) 1 spec.; (AM P.20796) 1 spec.; (AM P.19961) 1 spec.; (AM P.19960) 1 spec.; (AM P.15694) 1 spec.; (AM P.24667) 1 spec.; (AM P.24668) 1 spec.; (AM P.24669) 1 spec. — Mort Bay (AM P.16240) 1 spec. — Sailors Bay, Sydney Harbour (AM P.24665) 3 specs; (AM P.24666) 2 specs. — Mosman Bay (AM G.5775) 2 specs. — Gunnamatta Bay (CSIRO) 1 spec. — Tuross R. (AM P.24690) 1 spec. — Merimbula (NMV Kudenov colln) 4 specs.

Victoria: Raymond Is., Gippsland Lakes(NMV) 2 specs. — Seaport (AM P.8700) 1 spec. — French Is. (NM V) 1 spec. — Warrnambool, Hopkins R. (NM V Kudenov colln) 1 spec.

Tasmania: Margate (TM G.395) 2 specs. — Midway Point (TM G.1583) 8 specs.

DISTRIBUTION: Intertidal to shallow subtidal sand and mudflats, often in estuarine situations; southern Queensland, N.S.W., Victoria and Tasmania.

REMARKS: This species was originally described from survey material from Port Phillip Bay and Western Port in Victoria. The range of this species is here extended south to Tasmania and north through N.S.W. to southern Queensland. A large male (43 mm) is illustrated (fig. 17) to show more pronounced dentition of the dactyl of the cheliped than noted in the previous description. Figures 15 and 16 are from Poore (1975).

Callianassa australiensis (Dana)
Figs 18-20

Trypaea australiensis Dana, 1852: 573, pl. 32 fig. 4 (type locality: New South Wales, Illawarra district). — Fulton & Grant, 1906: 14-15.

Trypaea porcellana Kinahan, 1858: 130, pl. 4 fig. 2.

Callianassa (Trypaea) australiensis. — De Man, 1928a: 27, 104. — Stephenson et al., 1931: 56. — Dakin & Colefax, 1940: 182-184, figs 270, 271 (larvae). — Gurney, 1944: figs 8, 9. — Dakin et al., 1952: 199, pl. 44. — Hailstone & Stephenson, 1961: 259-285, figs 1-15, pls 1-3. — Hailstone, 1962: 29-31, 2 figs. — McNeill, 1968: 26. — Healy & Yaldwyn, 1970: pl. 30.

MATERIAL EXAMINED: more than 409 specs; tl. 16-63 mm.

Queensland: Townsville Harbour (AM P.16236) 13 specs. — Bowen Harbour (AM P.5193) 1 spec.; (AM P.5982) 4 specs. — Mackay (QM W.75) 1 spec. — Boyne River (AM P.17338) 9 specs; (AM P.17403) 136 specs; (AM P.16875) 9 specs. — Brisbane (WAM 10-75) 1 spec. — Amity, Moreton Bay (QM W.241) 2 specs. — Bird Is., Moreton Bay (QM W.832) 1 spec. — Beenleigh (QM W.86) 1 spec. — Nerang River, Southport (NMV) several specs.

New South Wales: Richmond River (near Ballina) (AM P.12941) 2 specs. — Trial Bay (AM P.4603) 1 spec. — Red Bank River (N. of Coffs Harbour) (AM P.12120) 3 specs. — Bellinger River (AM P.4743) 2 specs. — Patonga Creek (AM P.16237) 1 spec. — Sirius Cove (AM

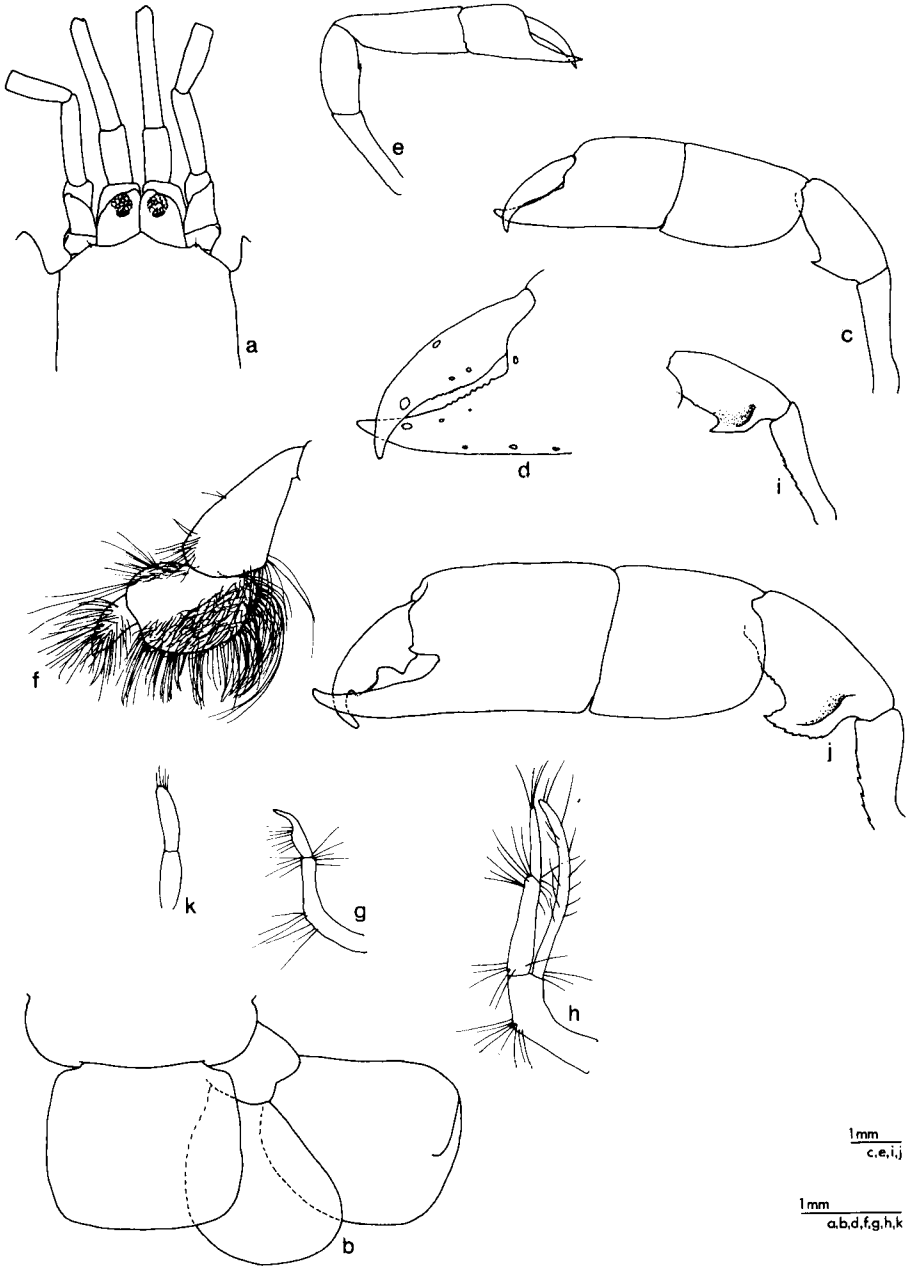

Fig. 15. *Callianassa arenosa* (NMV J.271, female, 24 mm (holotype)): *a*, front; *b*, tail fan; *c*, *d*, large cheliped (left); *e*, small cheliped (right); *f*, pereopod 3; *g*, *h*, pleopods 1, 2. (PPBES stn 982, female, 20 mm): *i*, large cheliped ischium and merus. (NMV J.272, male, 22 mm (allotype)): *j*, large cheliped (left); *k*, pleopod 1.

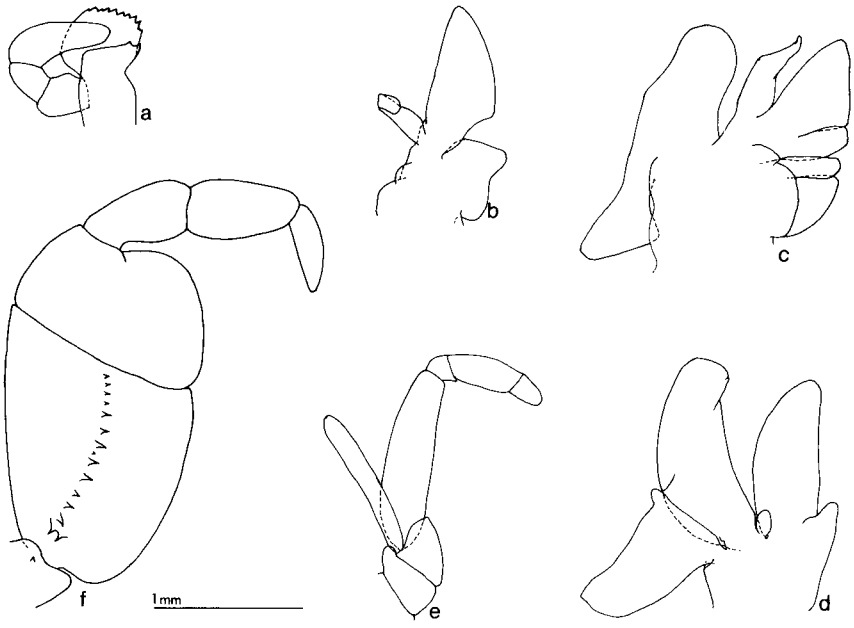

Fig. 16. *Callianassa arenosa* (NMV J.271, female, 24 mm (holotype)): *a*, mandible; *b, c*, maxillae 1, 2; *d, e-f*, maxillipeds 1-2-3.

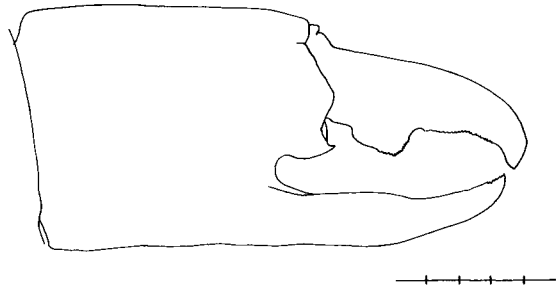

Fig. 17. *Callianassa arenosa* (AM P.16239, male, 43 mm): chela.

G.5690) 1 spec. — Off Sow and Pigs Shoal, Port Jackson (AM P.9402) 17 specs. — Sydney foreshore (AM P.12940) 6 specs. — near Roseville Bridge (AM P.15904) 5 specs. — Towra Point, Botany Bay (AM P.4744) 1 spec. — Hacking River (AM P.9385) 5 specs. — Port Kembla (AM G.5771) 2 specs. — 'Illawarra' (AM G.5673) 2 specs. — Batemans Bay (AM P.4674) 3 specs. — Murrah Lake (AM P.4745) 1 spec. — Merimbula (NMV Kudenov colln) 1 spec.

Victoria: Port Welshpool (NMV) several specs. — Mallacoota Inlet (NMV) 3 specs; (NMV Kudenov colln) 1 spec. — Western Port (NMV) 1 spec; (NMV Fulton colln) several specs; (NMV) many specs. — (AM P.4061) 2 specs. — French Is., Western Port (NMV) 3 specs. — Crib Point, Western Port (CPBS stns A2, C6, 24N, 25N, 31E, 34S) 159 specs. — Stony Point, Western Port (AM G.5774) 5 specs. — Port Phillip Bay (AM G.5672) 4 specs; (PPBES stn 955) 1 spec. — Sandridge, Port Melbourne (NMV) several specs.

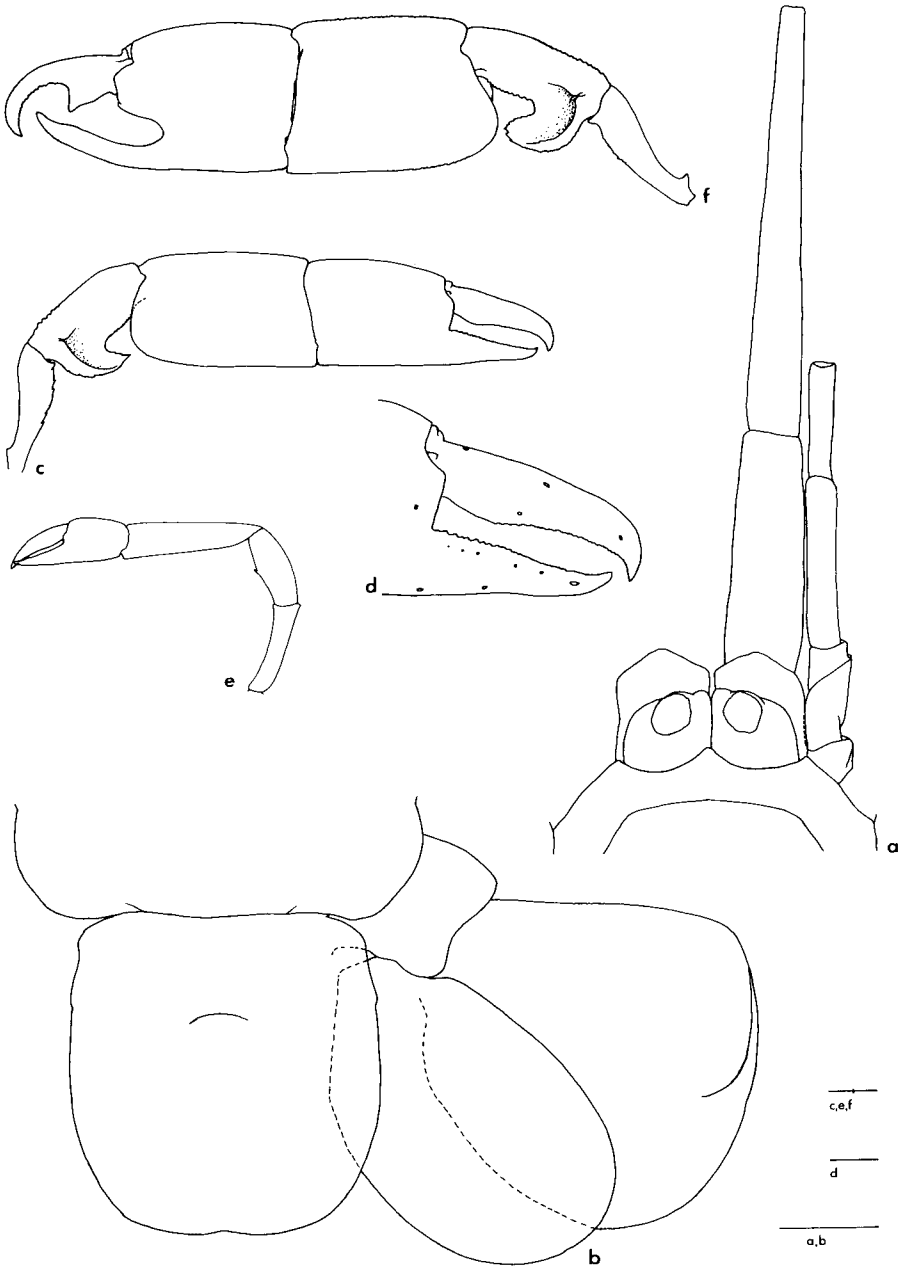

Fig. 18. *Callianassa australiensis* (CPBS stn 25N, female, 32 mm): *a*, dorsal view of anterior region; *b*, telson and uropod; *c*, *d*, large cheliped and detail; *e*, small cheliped. (CPBS stn 25N, male, 36 mm): *f*, large cheliped.

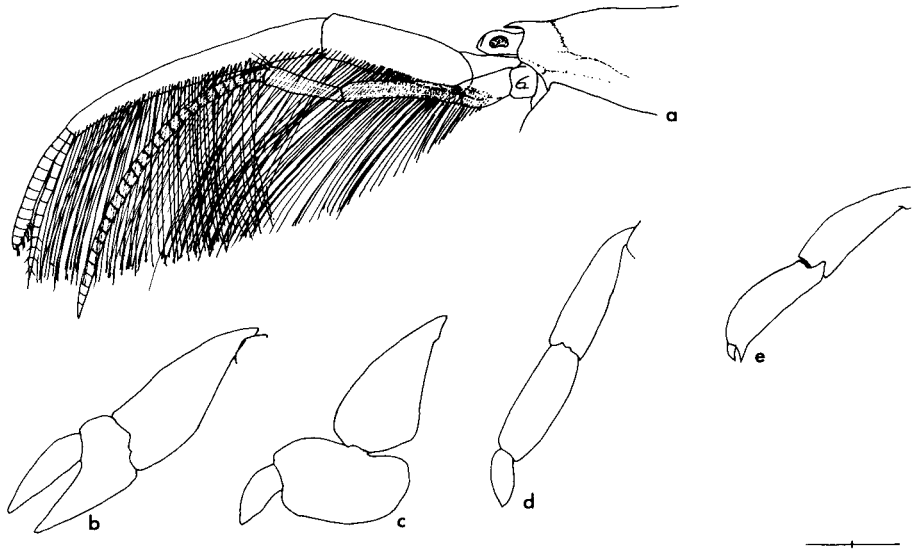

Fig. 19. *Callianassa australiensis* (CPBS stn 25N, female, 32 mm): *a*, lateral view of anterior region; *b-e*, pereopods 2-5 (terminal articles only).

DESCRIPTION: Dorsal oval 0.6-0.7 length of dorsal carapace. Rostrum dorsally convex, a very broad triangle, obtuse, 0.2 length of eyestalks; lateral projections broadly obtuse, little shorter than rostrum. Eyestalks broader than long, not reaching distal edge of first article of antenna 1, with broad mesiodistal lobe; pigmented area distal. Peduncle of antenna 1 almost twice as long as that of antenna 2, with a dense curtain of long setae ventrally. Maxilliped 3 merus width 0.6-0.7 length of ischium and merus together, merus as long as ischium; ischium without teeth on inner surface; carpus articulating laterally on merus, distal ⅔ of merus produced beyond articulation, carpus slender, length 4 times width; propod as long as carpus; dactyl almost half length of propod, tapering. Large cheliped (female) ischium strongly serrate ventrally on distal half, a tooth on dorsal surface proximally; merus with strong ventral serrate hook proximally and serrate ridge on dorsal edge; carpus 0.6-0.7 as wide as long; propod smooth ventrally, fixed finger tapering to upturned end; dactyl barely exceeding fixed finger, tapering to curved end; inner edges of both fingers evenly and coarsely toothed; ratio of dorsal lengths — merus: carpus: propod — 1:0.85-0.95:0.9. Large cheliped (male) carpus 0.8-1.2 times as wide as long; propod as wide as long, deeply incised at gape, a minute mesial denticle close to base of dactyl; dactyl slender, exceeding fixed finger, with a triangular tooth proximally, cutting edge with small teeth, tip strongly curved; ratio of dorsal lengths — merus: carpus: propod — 1:0.7-0.75:1.0-1.1. Small cheliped ischium smooth; merus usually with a minute ventral tubercle; carpus and propod elongate; dactyl and fixed finger subequal, inner edges minutely toothed. Pleopod 1 (female) uniramous, 2-articulate, second article with small lobe midway along. Pleopod 2 (female) biramous, exopod curved, shorter than 2-articulate endopod. Pleopod 1 (male) uniramous, 2-articulate, distal article apically rounded. Pleopod 2 (male) absent. Telson as wide as long, laterally convex, posterior edge weakly concave medially, setae along posterior margin and in tuft on dorsal surface. Uropod endopod oval, greatest width just beyond midpoint, 1.5 times as long as wide, slightly

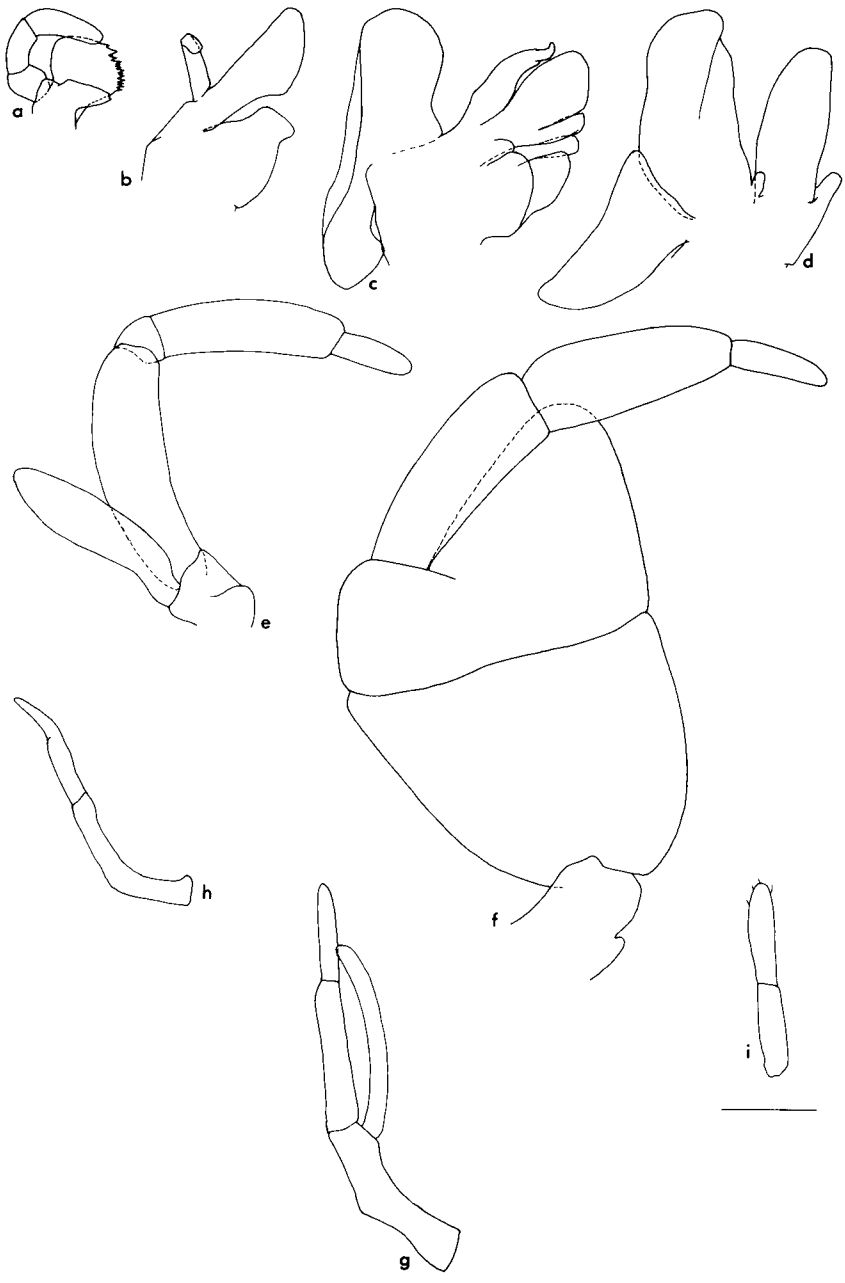

Fig. 20. *Callianassa australiensis* (CPBS stn 25N, female, 32 mm): *a*, mandible; *b*, *c*, maxillae 1, 2; *d-f*, maxillipeds 1-3; *g*, *h*, pleopods 1, 2. (CPBS stn 25N, male, 36 mm): *i*, pleopod 1.

longer than telson, setose margin; exopod slightly longer than endopod, little shorter than wide, greatest width subdistally, densely setose margin.

DISTRIBUTION: Intertidal sand and mudflats, often in estuarine situations; northern Queensland (Townsville) through N.S.W. and Victoria as far west as Port Phillip Bay.

REMARKS: This species is by far the most abundant thalassinidean in eastern Australia and it is curious that it was omitted from Haswell's (1882) catalogue. It is most easily recognized by the dense setation of the antenna 1 and maxillipeds. In suitable habitats its density reaches many hundreds of individuals per square metre. The ecology of this species was examined by Hailstone & Stephenson (1961). *C. australiensis* is included in *Callianassa s.s.* of de Saint Laurent (1973), but the size of the peduncle of antenna 1 and the shape of maxilliped 3 separate this species from others in the genus. The specimens recorded by Stephenson et al. (1931) from Low Isles, North Queensland (BM(NH) Reg. No. 1937.9.21.405-406) have been re-examined at our request by Dr Ray Ingle (BM(NH)) and confirmed as *C. australiensis*.

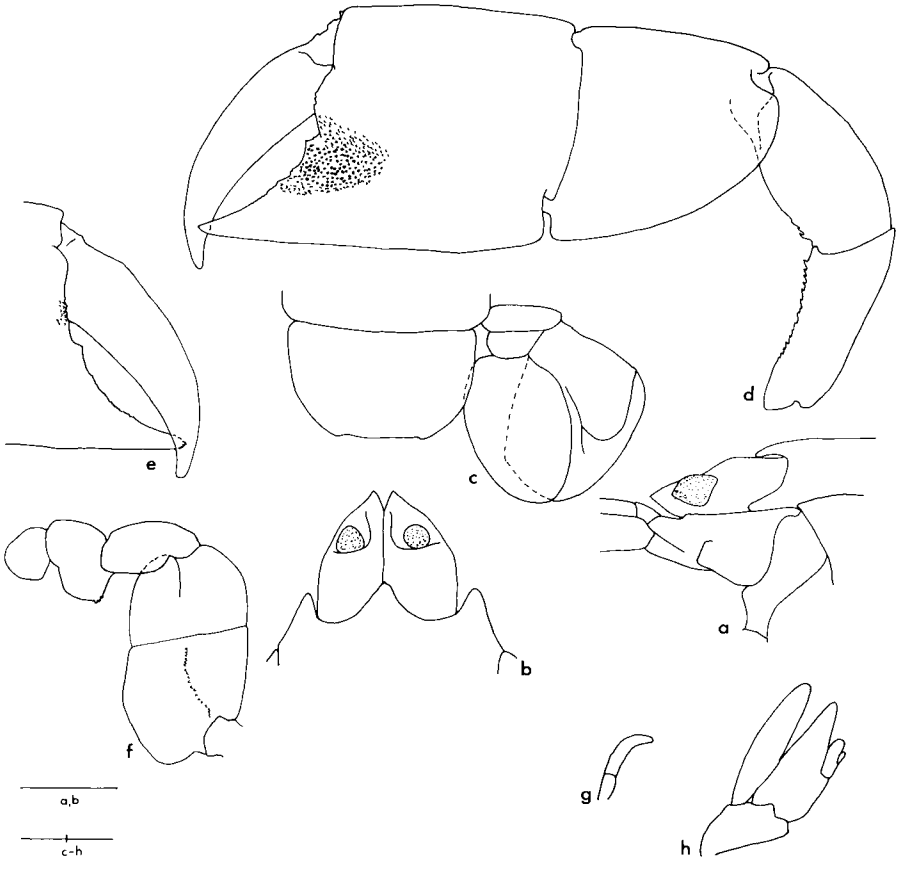

Fig. 21. *Callianassa bulimba* (QM W.1525, male, 36 mm): *a, b,* lateral and dorsal views of anterior region; *c,* telson and uropod; *d,* cheliped (lateral); *e,* chela (medial); *f,* maxilliped 3; *g, h,* pleopods 1, 2.

Callianassa bulimba n. sp.
Fig. 21.

MATERIAL EXAMINED: 1 spec.

HOLOTYPE: QM W.1525, male, tl. 36 mm.

TYPE LOCALITY: *Queensland:* Mud Is., Moreton Bay, collected V. F. Collin, 6th October, 1942.

DESCRIPTION: Dorsal oval 0.8 length of dorsal carapace. Rostrum not depressed, as long as broad, triangular, sharp, one third length of eyestalks; lateral projections strong, equal to rostrum; postrostral area smooth. Eyestalks about as long as first article of antenna 1, anteromedial angle sharp; eye subterminal. Peduncle of antenna 1 reaching to midpoint of last article of antenna 2. Maxilliped 3 merus width half length of ischium and merus together, merus shorter than ischium; ischium with mesial row of many small teeth; carpus articulating terminally on merus; propod medially lobed, lobe with 3 proximal teeth on medial margin, width almost twice length; dactyl width half that of propod, ovate. Chelipeds (presumed) equal; ischium serrate ventrally, teeth stronger distally; merus with curved ventral margin bearing a small proximal spine; carpus little wider than long; propod fixed finger stout with a strong granulate depression proximally on the lateral surface, a small tooth on cutting edge adjacent to dactyl; dactyl longer than fixed finger, unarmed; ratio of dorsal lengths — merus: carpus: propod — 1:1:1.2. Pleopod 1 (male) uniramous, 2-articulate. Pleopod 2 (male) biramous, exopod equal to endopod; endopod 3-articulate, first and second articles lobed, first greatly exceeding second, third article small. Telson widest on proximal margin, distal margin with few setae laterally, dorsally smooth except for few setae at midpoint, length 0.6 greatest width. Uropod endopod ovate, 1.5 times as long as wide, more than 1.5 times as long as telson, sparsely setose marginally; exopod equal to endopod, length 1.3 times width.

DISTRIBUTION: Southern Queensland.

REMARKS: This species is closely related to *C. aequimana* common in southern Australia. Although the general form of the antennae, rostrum, maxilliped 3, chelae and male pleopods are similar in the two species, sufficient differences exist, especially in the eyes, propod of the maxilliped 3, telson and male pleopod 2 to separate this specimen from *C. aequimana*.

Callianassa ceramica Fulton & Grant
Figs 22, 23

Callianassa ceramica Fulton & Grant, 1906: 12-14, pl. 5 (type locality: Port Phillip and Western Port, Victoria). — Hale, 1927: 86. — De Man, 1928a: 27, 104. — Poore, 1975: 205.

MATERIAL EXAMINED: 80 specs; tl. 16-80 mm.

Victoria: Williamstown (NMV Kane colln) 3 specs. — Shoreham, (NMV Fulton collns) 24 specs; (AM P.20163) 2 specs; (AM G.5779) 4 specs; (AM P.25296) 3 specs. — Queenscliff (NMV Batchelor colln) 1 spec.; (NMV Flatow colln) 1 spec. — Sorrento (NMV) 3 specs. — Altona (NMV Brazenor colln) 3 specs. — Point Lonsdale (NMV) 1 spec. — Point Addis (AM P.13155) 1 spec. — San Remo Ocean Beach (NMV Blackwood colln) 4 specs. — Portland (NMV Buther colln) 8 specs. — Port Phillip Bay or Western Port mudflats — cotype (AM G.5666) 1 spec. — Tidal R., Wilsons Promontory (NMV Kudenov colln) 1 spec.

Tasmania: Koonya, Tasman Peninsula (TM G.1582) 2 specs. — Cowry Pt (TM G.393) 2

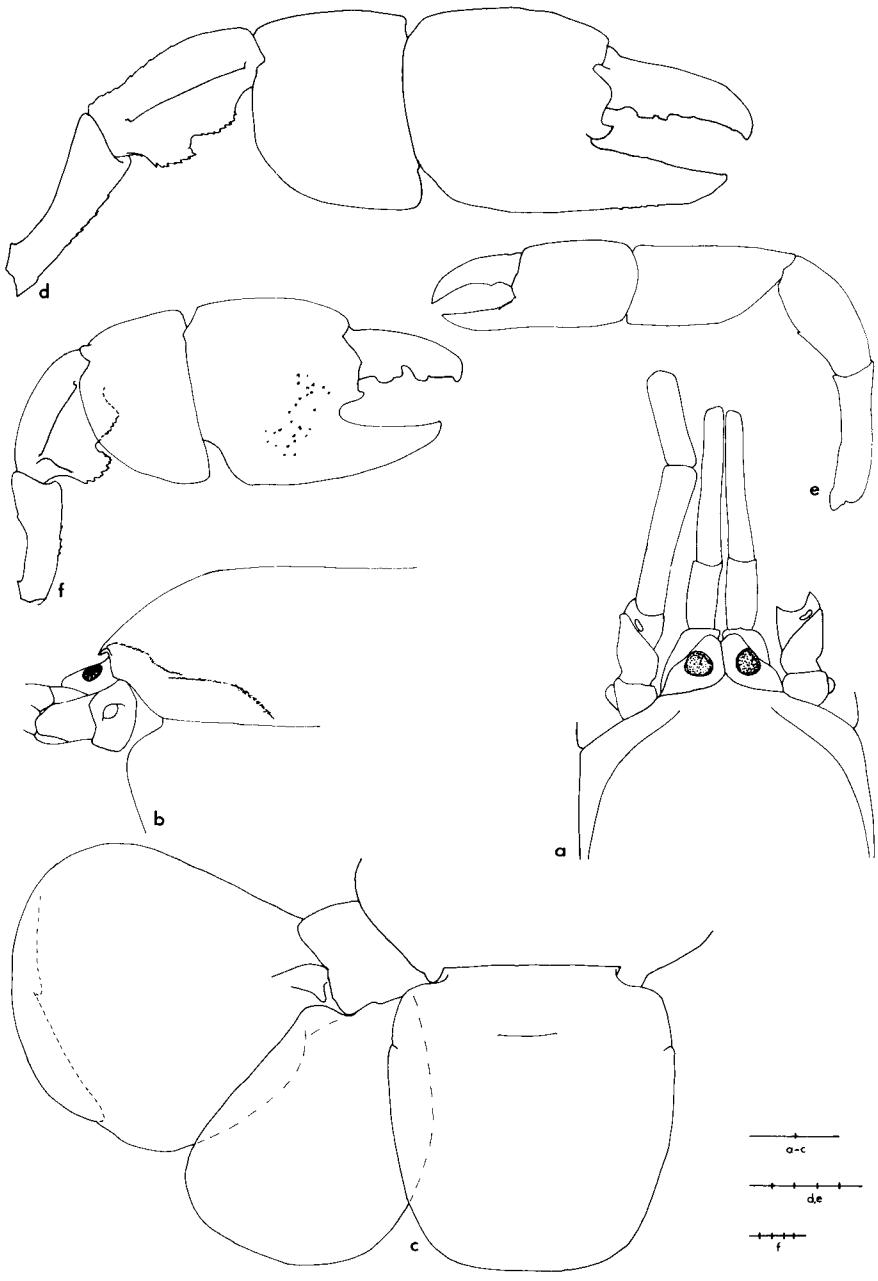

Fig. 22. *Callianassa ceramica* (NMV Fulton colln, female, 63 mm): *a*, *b*, dorsal and lateral views of anterior region; *c*, telson and uropod; *d*, large cheliped; *e*, small cheliped. (NMV Fulton colln, male, 60 mm): *f*, large cheliped.

specs.; (TM G.394) 10 specs. — Triabunna (TM G.1298) 1 spec.

South Australia: Kangaroo Is. (AM P.5778) 1 spec.

Western Australia: Miami Beach, Mandurah (WAM 33-75) 1 spec. — Esperance (WAM 64-75) 1 spec. — Peaceful Bay (WAM 13-75) 2 specs.

DESCRIPTION: Dorsal oval 0.8-0.9 length of dorsal carapace. Rostrum strongly downturned, broad to very obtuse, apically slender and pointed, less than 0.2 length of eyestalks; lateral projections obsolete. Eyestalks extending almost to end of first article of antenna 1, with minute, often sharp, mesiodistal spine; pigmented area large, subcircular, central. Peduncle of antenna 1 reaching midway along last article of antenna 2; neither antenna very setose. Maxilliped 3 merus width 0.6-0.7 length of ischium and merus together, merus little shorter than ischium; ischium with curved row of 12-22 spines along midline of inner surface; carpus articulating distolaterally on merus, broadened distally; propod tapering, without lobe, half as wide as long; dactyl narrow, half as wide as propod, tapering. Large cheliped (female) ischium serrate midventrally and with proximal dorsal

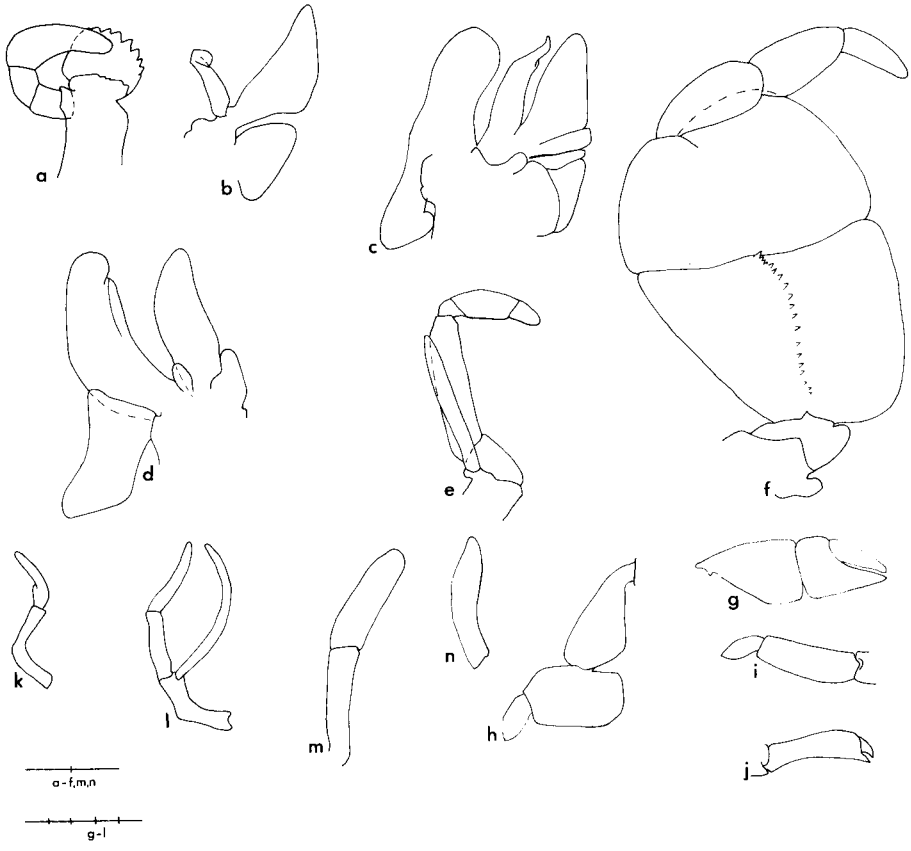

Fig. 23. *Callianassa ceramica* (NMV Fulton colln, female, 63 mm): *a*, mandible; *b*, *c*, maxillae 1, 2; *d-f*, maxillipeds 1-3; *g-j*, pereopods 2-5 (terminal articles only); *k*, *l*, pleopods 1, 2. (NMV Fulton colln, male, 60 mm): *m*, *n*, pleopods 1, 2.

tooth; merus bilobed ventrally, lobes strongly serrate, dorsal ridge also serrate, a longitudinal ridge laterally; carpus about 1.3 times as wide as long, dorsally and ventrally smooth; propod finely crenulate ventrally; gape with strong serrate tooth; fixed finger tapering to upturned end, cutting edge minutely serrate proximally; dactyl equal to fixed finger, tapering to curved end, a prominent, truncate serrate tooth close to base and sometimes another midway along, middle third to distal half of cutting edge denticulate; ratio of dorsal lengths — merus: carpus: propod — 1:1.2-1.3:0.8-1.0. Large cheliped (male) of similar form to that of female except that carpus and propod are shorter, chela more gaping and cutting edge of dactyl with pronounced notch at midpoint. Small cheliped ischium smooth; merus usually with small ventral spine or hook; carpus elongate; dactyl slightly over-reaching fixed finger, ventral edge with blunt triangular tooth proximally. Pleopod 1 (female) uniramous, 2-articulate, second article with lobe midway along, distal portion flat and curved posteriorly. Pleopod 2 (female) biramous, exopod curved, subequal to 2-articulate endopod. Pleopod 1 (male) uniramous, 2-articulate. Pleopod 2 (male) uniramous, narrow, but often absent. Telson as wide as long, lateral edges weakly convex, posterior edge weakly convex; long setae along posterior edge and in tuft on dorsal surface. Uropod endopod subovate, lateral margin straight, medial and distal edges weakly convex, continuous, greatest width at distal third, almost as wide as long, a little longer than telson, with setose margin; exopod longer than endopod, width slightly exceeding length, widest distally, with setose margin.

DISTRIBUTION: Intertidal and shallow subtidal mudflats and sandy beaches; Tasmania, Victoria, South Australia, south Western Australia.

REMARKS: Fulton & Grant (1906) did not note any sexual differentiation in their material. Their illustration is of a female and consequently their description misses some points on the dentition of the male cheliped. The species is fairly consistent and is often best recognized by the subquadrate propod on pereopod 3. *C. ceramica* could be included in *Callianassa s.s.* of de Saint Laurent (1973) except that the male pleopods are scarcely rudimentary.

Callianassa collaroy n. sp.
Figs 24, 25

MATERIAL EXAMINED: 2 males, 1 female; tl. 45-123 mm.

HOLOTYPE: AM P.16305, male, 45 mm.

TYPE LOCALITY: *New South Wales:* Long Reef, Collaroy, in sand among boulders, coll. I. Bennett, 9th December, 1946.

PARATYPES: *New South Wales:* Long Reef, Collaroy (AM P.13163) 1 spec. — Shellharbour (AM P.8869) 1 spec.

DESCRIPTION: Dorsal oval 0.8 length of dorsal carapace. Rostrum an anteriorly-directed, acute spine as long as eyestalk, articulating in smaller specimens. Lateral projections acute, half as long as rostrum. Eyestalks shorter than first article of antenna 1; eyes large, terminal. Peduncle of antenna 1 reaching to about midpoint of peduncle of antenna 2. Antenna 2 with dorsal spine on distal edge of article 3. Maxilliped 3 merus width about 0.75 length of ischium and merus together, merus little shorter than ischium; ischium with 13-17 stout teeth mesially; with a small tooth on distal margin, carpus articulating distolaterally on merus; propod as wide as long, subquadrate; dactyl a quarter as wide as propod, half as long. Large cheliped (both sexes) coxa with strong medial ventrally-directed hook; ischium with 4-5 strong ventral spines; merus with 3-5 sharp ventral spines; carpus 0.8 times as wide as long; propod smooth

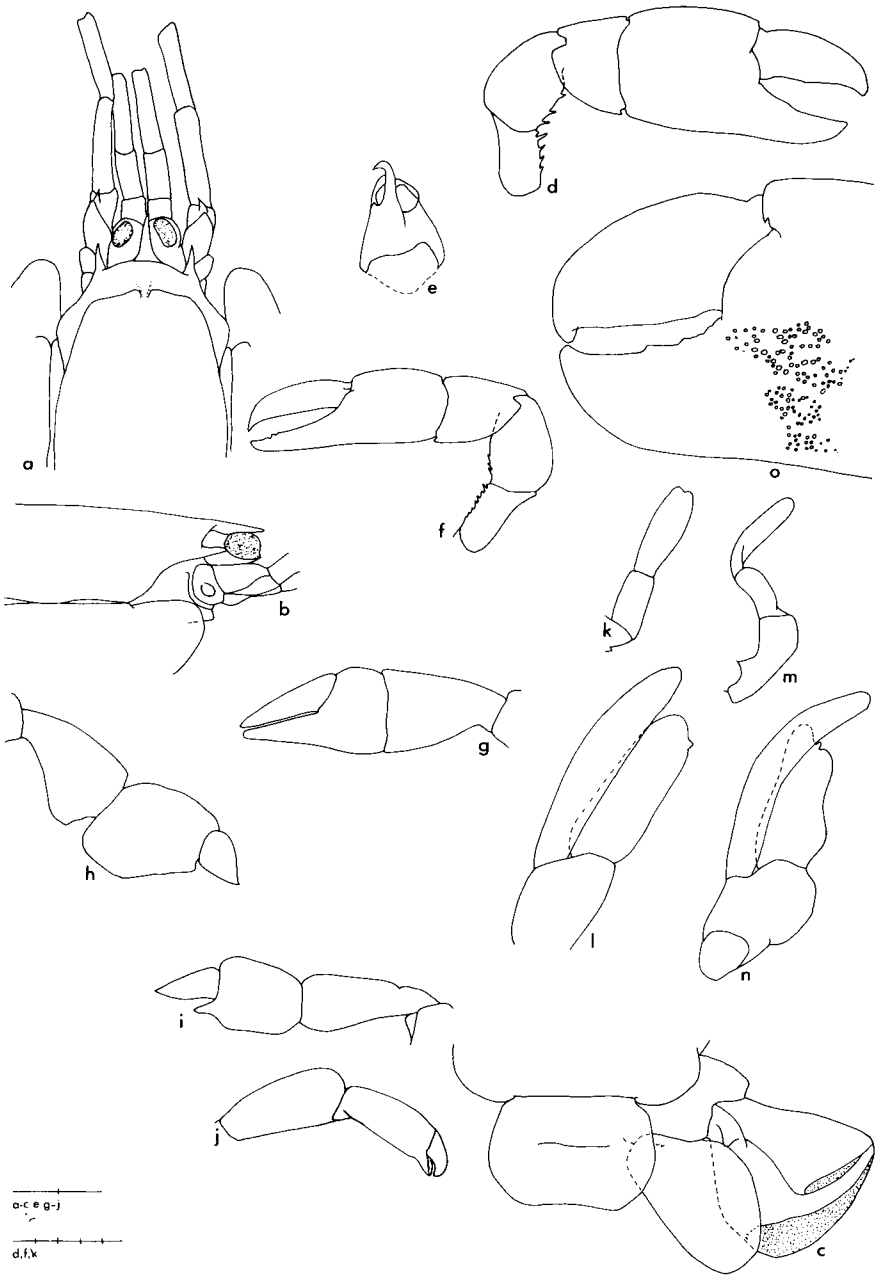

Fig. 24. *Callianassa collaroy* (AM P.16305, male, 52 mm): *a, b,* dorsal and lateral views of anterior region; *c,* telson and uropod; *d,* large cheliped; *e,* medial view of coxa of left cheliped; *f,* small cheliped; *g-j,* pereopods 2-5 (terminal articles only); *k, l,* pleopods 1, 2. (AM P.13163, female, 123 mm): *m, n,* pleopods 1, 2. (AM P.8869, female, 101 mm): *o,* chela.

dorsally and ventrally but minutely denticulate near gape on medial and lateral surfaces of large specimen; fixed finger with obsolete irregularly-toothed ridge on proximal half of cutting edge; dactyl stout, little longer than fixed finger, with a sharply-curved terminal tooth, and cutting edge slightly concave; ratio of dorsal lengths — merus: carpus: propod — 1:0.9:1.2. Small cheliped ischium and merus with ventral spines; carpus and propod elongate; fixed finger with small subterminal tooth. Pleopod 1 (female) uniramous, 2-articulate, second article medially-lobed, distal portion curved posteriorly. Pleopod 2 (female) biramous, exopod longer than broad, terminally notched endopod. Pleopod 1 (male) uniramous, 2-articulate, distal article broad, notched terminally. Pleopod 2 (male) biramous, exopod longer than broad endopod. Telson 1.5 times as wide as long, apically excavate; laterally convex; a transverse row of short spines with longer setae near midpoint of the dorsal surface; small groups of long setae at distolateral corners. Uropod endopod with inner margin almost straight, greatest width near midpoint and tapering to a broadly rounded apex, extending almost twice length of telson, setae only near apex and in two small groups on dorsal surface; exopod as long as endopod, subtriangular, wider than long, terminally very setose.

DISTRIBUTION: Intertidal, in sand among boulders; central New South Wales.

REMARKS: This species is particularly close to the Hawaiian *Callianassa articulata* Rathbun, 1906, but comparison with the original figures and Edmondson's (1944) illustrations reveal several distinguishing features. The two species share a trispined front, a terminal spine on article 3 of antenna 2, a terminal hook on the merus of maxilliped 3 and a short telson broadest at its midpoint. *C. collaroy* differs in having a straight rather than

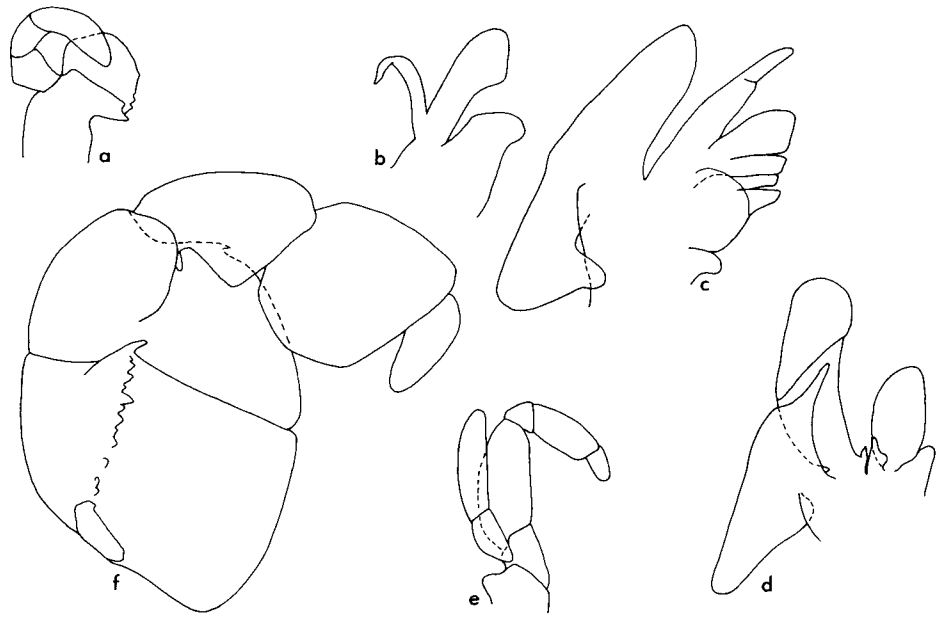

Fig. 25. *Callianassa collaroy* (AM P.16305, male, 52 mm): *a*, mandible; *b*, *c*, maxillae 1, 2; *d-f*, maxillipeds 1-3.

curved rostrum, a broader and larger propod on maxilliped 3, a tooth on the fixed finger of the small cheliped and more ovate rami on the uropods. The largest specimen of *C. articulata* known (33 mm) is less than a third the size of the largest *C. collaroy* in our collection.

Callianassa collaroy is most easily separated from the only other trispined species from Australia *(C. haswelli)* by the form of the telson and uropods.

Callianassa haswelli n. sp.
Figs 26, 27

Callianassa sp. Haswell, 1882: 167-168.

MATERIAL EXAMINED: 2 males, 3 females; tl. 32-65 mm.

HOLOTYPE: AM P.11453, female, tl. 65 mm.

TYPE LOCALITY: *Queensland:* Whitsunday Group, coll. Mrs R. Hallam.

PARATYPES: *Queensland:* Yam Is., Torres Strait (AM P.24814) 1 spec. — Molle Is., Whitsunday Passage (AM P.274) 1 spec. (the specimen referred to by Haswell, 1882). — Masthead Is., Capricorn Group (NMV Kershaw colln) 1 spec. — Langford Is., Cumberland Group (AM P.20833) 1 spec.

DESCRIPTION: Dorsal oval 0.8 length of dorsal carapace. Rostrum a broadly-based upturned acute spine about as long as eyestalk, non-articulating. Lateral projections also upwardly-directed, acute spines, less than half length of rostrum. Eyestalks shorter than first article of antenna 1; eyes large, terminal. Peduncle of antenna 1 just exceeding article 4 of antenna 2. Maxilliped 3 merus width half length of ischium and merus together, merus little shorter than ischium; ischium with 12-16 uneven teeth mesially; carpus articulating distolaterally on merus; propod as wide as long, bigger than merus, free distal margin transverse and excavate; dactyl one third as wide as propod and as long. Large cheliped (both sexes) ischium with a few blunt ventral teeth; merus with a ventral ridge of blunt spines, more definite proximally; carpus 1.3 times as wide as long; propod smooth dorsally and ventrally; fixed finger with an obsolete basal tooth; dactyl stout, longer than fixed finger, with sharply curved terminal tooth and obsolete basal tooth; ratio of dorsal lengths — merus: carpus: propod — 1:0.75:1.3. Small cheliped ischium and merus without ventral spines; carpus and propod elongate; fixed finger with small, blunt tooth at midpoint of cutting edge. Pleopod 1 (female) uniramous, second article medially lobed. Pleopod 2 (female) biramous, exopod longer than endopod which is notched terminally. Pleopod 1 (male) 2-articulate, second article broad, with strong terminal hook. Pleopod 2 (male) biramous, exopod little longer than endopod. Telson 1.7 times as wide as long; widest basally and tapering to sinuate posterior margin; dorsal surface convex, with one pair of tufts of long setae; small groups of setae on distolateral corners. Uropod endopod lanceolate, more than twice length of telson, setae only in small groups on dorsal surface; exopod almost twice length of endopod, medial edge concave, produced.

DISTRIBUTION: Islands off north and central Queensland coast.

REMARKS: *C. haswelli* is superficially similar to *C. collaroy* from N.S.W. in having a trispined front to the carapace but is readily distinguished by the upturned rostral spine and the different form of the telson and uropods. Of other trispined species it resembles *C. longiventris* most closely (Biffar, 1971a), differing in the absence of strong spines on the chelipeds and form of the telson and uropod. It is also similar to *C. lanceolata* Edmondson, 1944, from Hawaii, and *C. nakesonei* Sakai, 1967, from Okinawa, Ryukyu Islands, differing

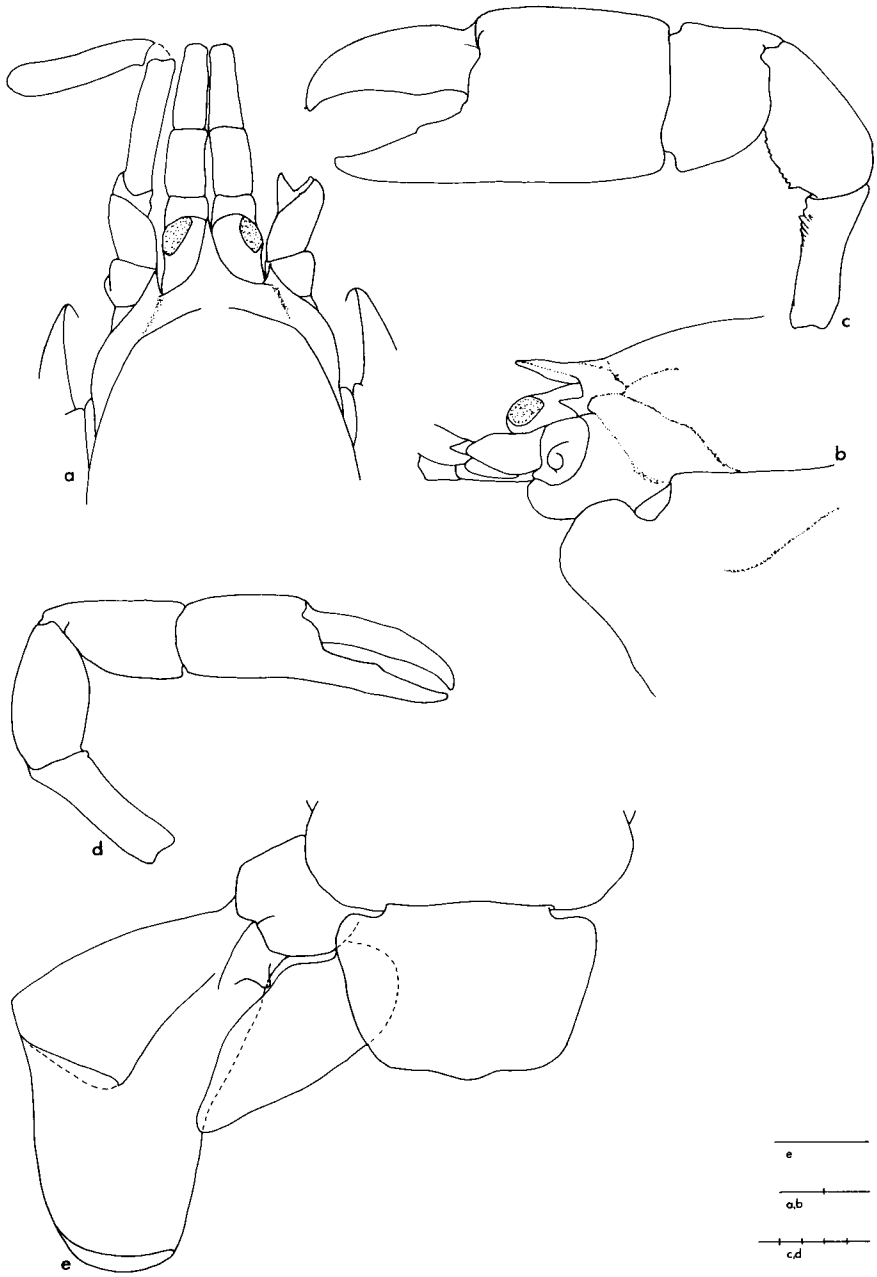

Fig. 26. *Callianassa haswelli* (AM P.11453, female, 65 mm): *a*, *b*, dorsal and lateral views of anterior region; *c*, large cheliped; *d*, small cheliped. (NMV Kershaw colln, female, 32 mm): *e*, telson and uropod.

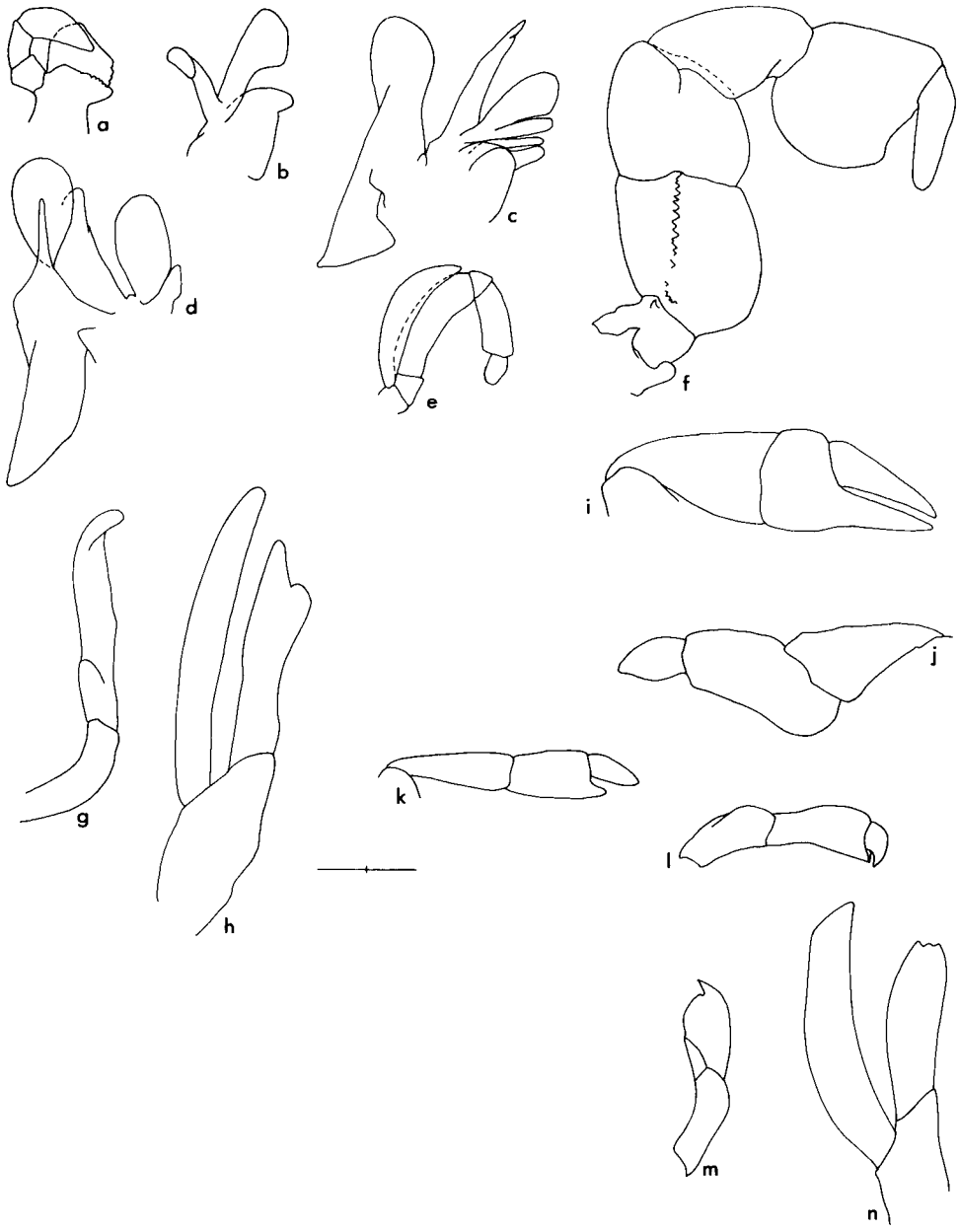

Fig. 27. *Callianassa haswelli* (AM P.11453, female, 65 mm): *a*, mandible; *b*, *c*, maxillae 1, 2; *d-f*, maxillipeds 1-3; *g*, *h*, pleopods 1, 2. (AM P.274, female): *i*, *j*, pereopods 2, 3 (terminal articles only). (NMV Kershaw colln, female, 32 mm): *k*, *l*, pereopods 4, 5 (terminal articles only). (AM P.20833, male, 65 mm): *m*, *n*, pleopods 1, 2.

in the uropods and maxilliped 3 among other features. This species is named for W. A. Haswell (1854-1925), a pioneer in the study of Australian Crustacea.

Callianassa joculatrix De Man
Figs 28, 29

Callianassa joculatrix De Man, 1905: 610 (type localities: Indonesia: Java, Lombok, Sumbawa, Flores Strait, Sulawesi, Kai Islands); 1928a: 26, 98, 130-137, pl. 12 fig. 19b, c, pl. 13 figs 19a, d-m. — McNeill, 1968:26.

MATERIAL EXAMINED: 4 males, 2 females; tl. 14 mm, all with chelipeds detached.

Queensland: W. of Low Isles (British Great Barrier Reef Expedition 1928-29) (AM P.15009) 6 specs.

DESCRIPTION: Dorsal oval 0.8 length of dorsal carapace. Rostrum a narrow acute forward-directed spine, about half length of eyestalks. Lateral projections obscure. Eyestalks just exceeding first article of antenna 1; dorsoventrally tapering from basal eye, distal half broad, but with an acute distal spine medially. Peduncle of antenna 1 longer than that of antenna 2. Maxilliped 3 merus width ¼ length of merus and ischium together, merus shorter than slightly tapering ischium; ischium with a row of 8-10 teeth mesially; carpus articulating terminally on merus; propod little broader than carpus, tapering; dactyl half as wide as propod, tapering. Large cheliped (female) ischium with a few ventral spines; merus with a straight dorsal margin bearing 1-2 small proximal hooks or spines, a strong sharp spine opposite on the straight ventral margin; carpus 0.75 times as wide as long; propod smooth dorsally and ventrally; fixed finger and dactyl equal, evenly tapered, cutting edges minutely serrate; dactyl curved distally; ratio of dorsal lengths — merus: carpus: propod — 1:1:0.8. Large cheliped (male) ischium and merus as for female; carpus 1.5 times as broad as long; propod with a dorsal ridge; fixed finger short and stout, cutting edge sinuate, gape a little excavate; dactyl stout, strongly curved with a subterminal tooth on cutting edge; ratio of dorsal lengths — merus: carpus: propod — 1:0.7:1.2. Small cheliped extremely fine and elongate, ischium with 1-2 ventral teeth. Pleopod 1 (female) uniramous, second article broad. Pleopod 2 (female) biramous, exopod 2-articulate. Pleopod 1 (male) a prominent conical lobe. Pleopod 2 (male) absent. Telson 1.5 times as wide as long; widest ⅓ way along and tapering to nearly straight posterior margin. Uropod endopod longer than telson, lateral and medial margins diverging to evenly rounded end; exopod longer than endopod, with straight lateral margin, long curved posterior margin continuous with convex medial margin.

DISTRIBUTION: Mud, 15-350 m; Indonesia, northern Queensland.

REMARKS: This species has been well described and illustrated previously by De Man (1928a) and our specimens agree.

Callianassa karumba n. sp.
Figs 30, 31

MATERIAL EXAMINED: 1 spec.

HOLOTYPE: AM P.24678, male, tl. 34 mm.

TYPE LOCALITY: *Queensland:* Norman River, Karumba; CSIRO Gulf of Carpentaria Prawn Survey, beam trawl collection, 10th February, 1964.

DESCRIPTION: Dorsal oval 0.7 length of carapace. Rostrum a slightly upturned acute spine, about half length of eyestalks; lateral projections obsolete. Eyestalks extending

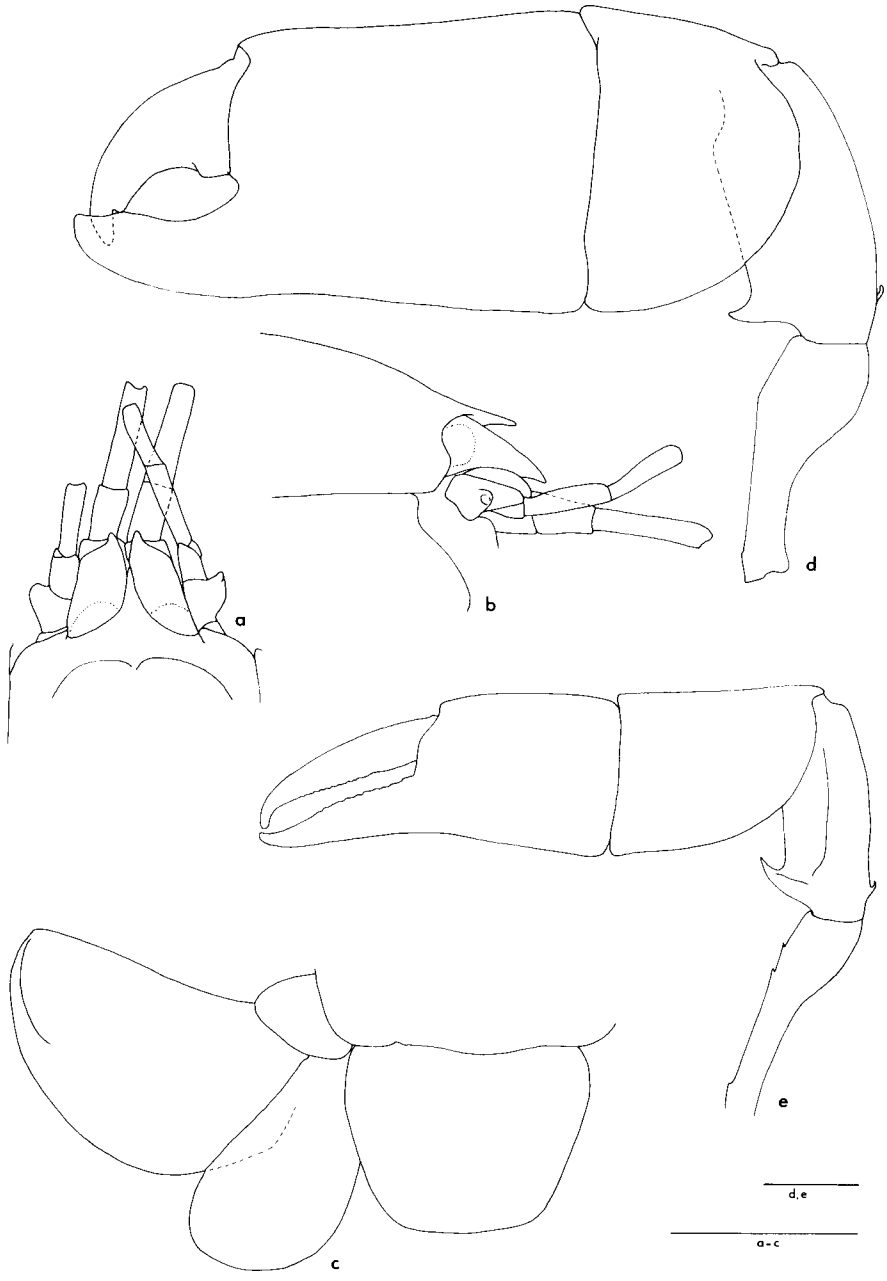

Fig. 28. *Callianassa joculatrix* (AM P.15009, male, 14 mm): *a, b,* dorsal and lateral views of anterior region; *c,* telson and uropod; *d,* large cheliped. (AM P.15009, female, 14 mm): *e,* large cheliped.

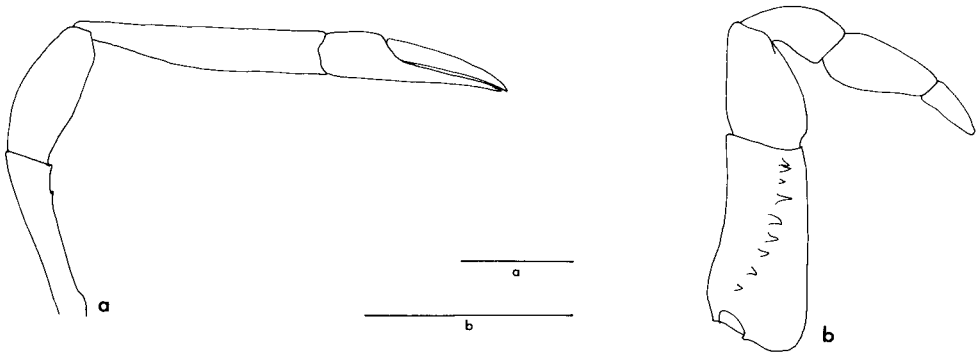

Fig. 29. *Callianassa joculatrix* (AM P.15009, male, 14 mm): *a*, small cheliped; *b*, maxilliped 3.

beyond end of first article of antenna 1, a rounded lobe mediodistally; eyes large central-subdistal. Peduncle of antenna 1 reaching almost to end of that of antenna 2; neither antenna particularly setose. Maxilliped 3 with a minute exopod, about 0.2 length of ischium of endopod; merus width about half of length of ischium and merus together, merus 0.7 length of ischium; ischium with few minute denticles proximally on inner surface; carpus articulating distally on merus; propod strongly lobed mesially, as wide as long; dactyl narrow, 0.3 width of propod and reaching back almost to base of ischium. Large cheliped (male) ischium denticulate ventrally; merus irregularly spinose ventrally; carpus about 1.3 times as wide as long, dorsally and ventrally smooth; propod obscurely denticulate ventrally; gape with a double blunt accessory tooth; fixed finger unarmed; dactyl equal to fixed finger, tapering to a curved end, cutting edge smooth; ratio of dorsal lengths — merus: carpus: propod — 1:0.8:1.0. Large cheliped (female) unknown. Small cheliped with elongate carpus; dactyl slightly over-reaching fixed finger which bears minute spines on cutting edge. Pleopod 1 (male) 2-articulate, second article terminally notched. Pleopod 2 (male) biramous; endopod 2-articulate, shorter than exopod, second article small and with a mesiodistal digitate lobe. Pleopods (female) unknown. Telson length 0.7 times width, lateral and posterior margins convex. Uropod endopod lanceolate, greatest width at proximal third, width half length, almost twice length of telson; exopod longer than endopod, width almost twice length, widest at midpoint.

DISTRIBUTION: Queensland (Norman River, Karumba, Gulf of Carpentaria).

REMARKS: This species is distinguished by the presence of a minute exopod on maxilliped 3, a feature noted for, *C. tooradin*, *C. novaebritanniae* (see Sakai, 1966) and *C. latispina* (see Biffar, 1971a) in all of which the exopod is a much larger ramus. *C. karumba* bears little resemblance in other features to these species except *C. novaebritanniae* from which it is easily distinguished by the rostrum, telson and uropods. *C. karumba* is most similar to two species, *C. mucronata* Strahl, 1861, from Australia and *C. placida* De Man, 1905, from Indonesia resembling them in general form of the uropods, telson and chelipeds. It differs, however, in the single spined rostrum, lanceolate uropod endopod and very long exopod among many other features.

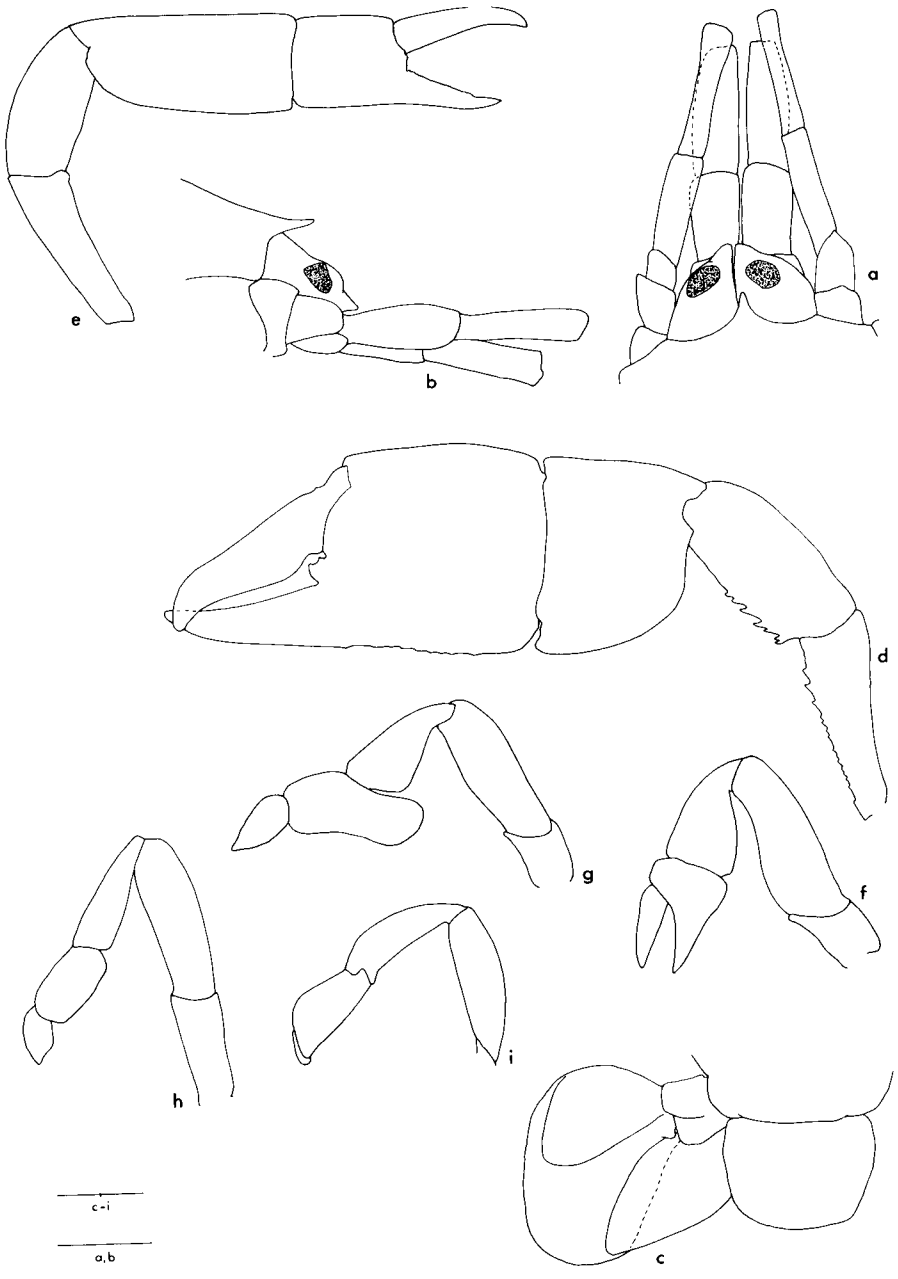

Fig. 30. *Callianassa karumba* (AM P.24678, male, 34 mm): *a, b,* dorsal and lateral views of anterior region; *c,* telson and uropod; *d,* large cheliped; *e,* small cheliped; *f-i,* pereopod 2-5.

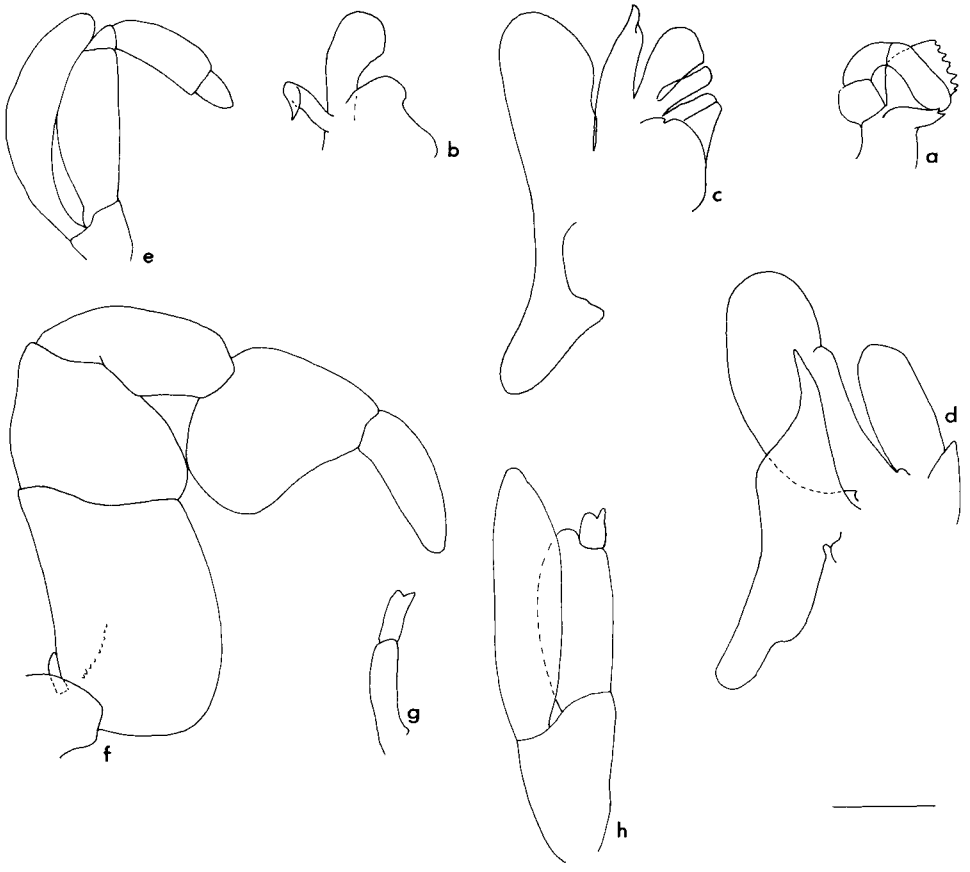

Fig. 31. *Callianassa karumba* (AM P.24678, male, 34 mm): *a*, mandible; *b*, *c*, maxillae 1, 2; *d-f*, maxillipeds 1-3; *g*, *h*, pleopods 1, 2.

Callianassa limosa Poore
Figs 32, 33

Callianassa limosa Poore, 1975: 201-205, figs 4, 5 (type locality: Victoria, Port Phillip Bay).

MATERIAL EXAMINED: 27 specs, tl. 12-19 mm.

New South Wales: 4.5 km E. of North Head, 66 m (AM P.20160) 1 spec.; (AM P.20159) 1 spec.; (AM P.20161) 1 spec.; (AM P.20157) 1 spec. — 2.3 km E. of Malabar, 66 m (AM P.20162) 3 specs; (AM P.20156) 7 specs. — Off Malabar, 75 m (AM P.20158) 2 specs. — Off Cronulla, 73 m (AM P.16257) 1 spec. — ?'Illawarra' district (AM P.20165) 7 specs.

Victoria: Hobsons Bay, Port Phillip Bay (NMV) 1 spec.

Tasmania: 5½ m (8.8 km) off Burnie (TM G.1479) 1 spec.

DISTRIBUTION: Deeper (well below low water down to 100 m) muddy shelf and bay sediments; central N.S.W. through central coastal Victoria to Tasmania.

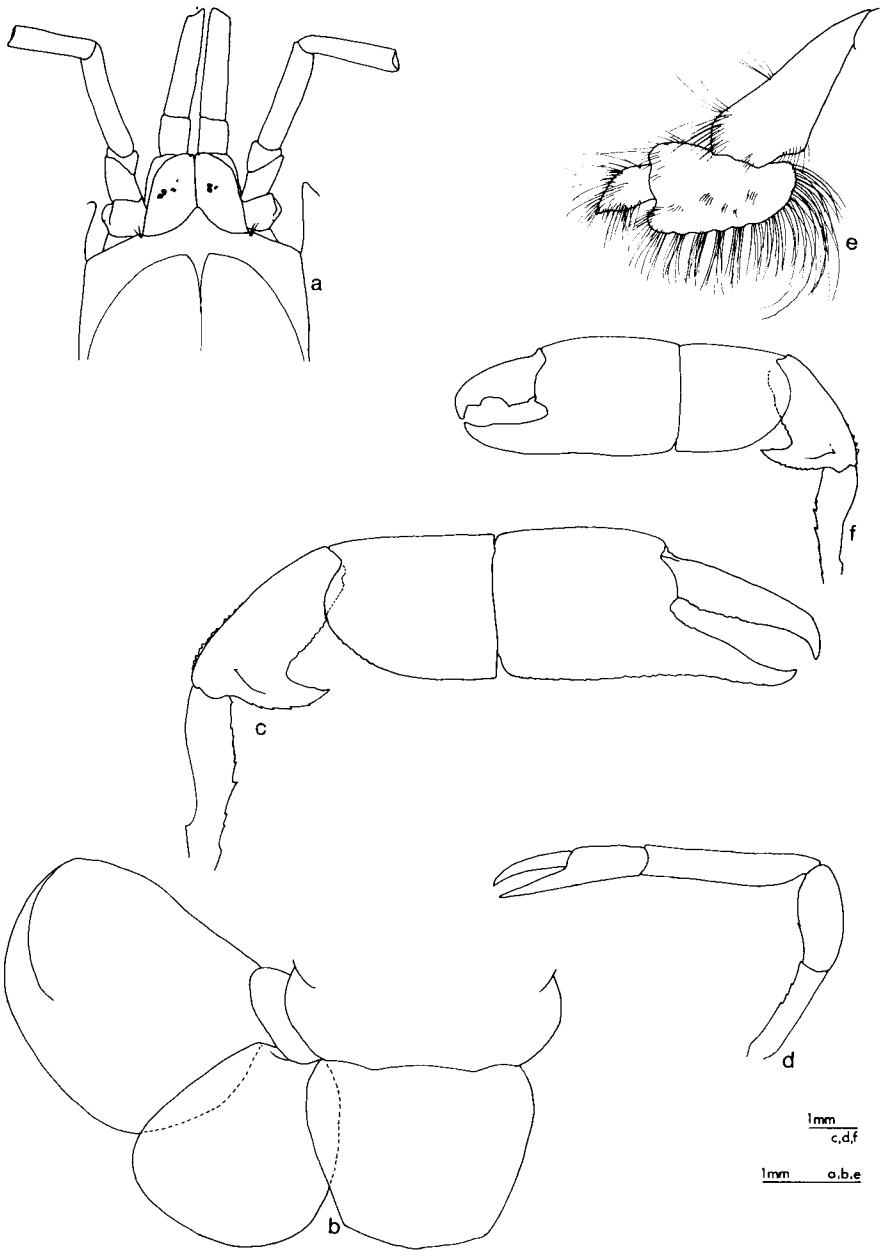

Fig. 32. *Callianassa limosa* (NMV J.274, female, 23 mm (holotype)): *a*, front; *b*, tail fan; *c*, large cheliped (right); *d*, small cheliped (left); *e*, pereopod 3. (NMV J.275, male, 14 mm (allotype)): *f*, large cheliped (left).

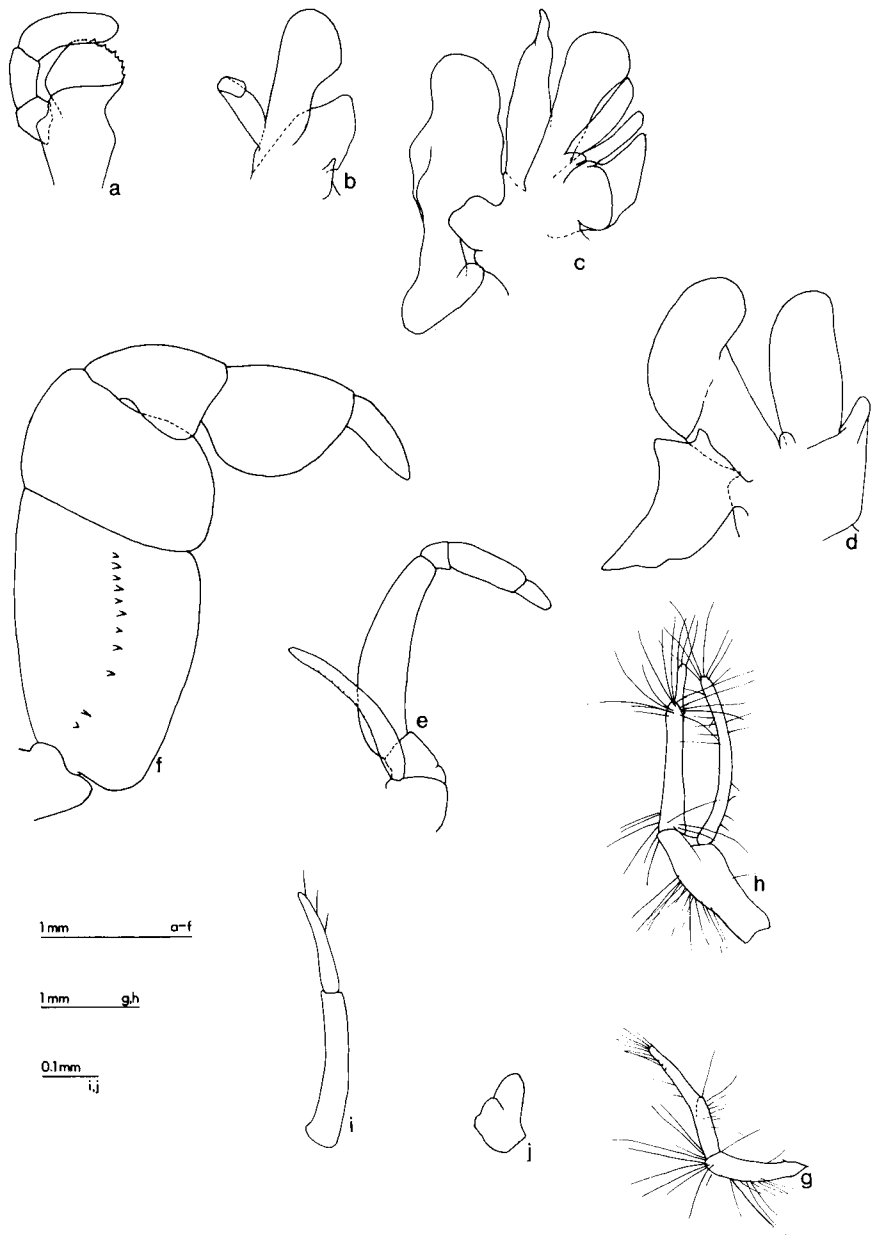

Fig. 33. *Callianassa limosa* (NMV J.274, female, 23 mm (holotype)): *a*, mandible; *b*, *c*, maxillae 1, 2; *d-f*, maxillipeds 1-2-3; *g*, *h*, pleopods 1, 2. (NMV J.275, male, 14 mm (allotype)): *i*, *j*, pleopods 1, 2.

REMARKS: In a previous paper (Poore, 1975) the distribution of this species in Port Phillip Bay was discussed and its preference for fine muddy sediments noted. The additional collections reported on here are morphologically similar to the Port Phillip Bay material and extend its distribution through muddy sediments of Bass Strait and the southeastern Australian shelf.

The species is recognized by its small adult size, rudimentary eyes and strongly lobed propod on maxilliped 3. The figures are from Poore (1975).

Callianassa mucronata Strahl
Figs 34, 35

Callianassa mucronata Strahl, 1861: 1056 (type locality: Luzon, Philippine Is.). — De Man, 1887: 484-485, pl. 21 fig. 2; 1928a: 29, 112, 175-179, pl. 19 fig. 30 (for complete synonymy). — Tirmizi, 1977: 21-26, figs 1-3.

Callianassa novaeguineae Thallwitz, 1891: 31.

MATERIAL EXAMINED: 1 male, 1 female; tl. 33-37 mm.

Queensland: Palm Is. (AM P.5194) 1 spec. — Rat Is., Port Curtis (AM P.2010) 1 spec.

DESCRIPTION: Dorsal oval 0.8 length of dorsal carapace. Rostrum a broadly-based, downturned acute triangle less than half length of eyestalks. Lateral projections obsolete angles. Eyestalks little shorter than first article of antenna 1, basally thick and terminally a flat rounded-acute lobe; eye at midpoint. Peduncle of antenna 1 reaching to midpoint of article 5 of antenna 2. Maxilliped 3 merus width 0.4 length of ischium and merus together, merus shorter than ischium; ischium with a row of about 20 teeth mesially; carpus triangular, articulating terminally on merus; propod as wide as long, medial margin evenly curved; dactyl ⅓ as wide as propod, ovate. Large cheliped (both sexes) ischium with irregular spines on ventral margin; merus with an irregularly serrate ventral margin, convex dorsal margin; carpus little wider than long, ventral margin ending distally with a small tooth; propod smooth dorsally and ventrally; fixed finger stout, with blunt tooth at midpoint; dactyl as long or longer than fixed finger, cutting edge with strong notch near midpoint, hooked terminally; ratio of dorsal lengths — merus: carpus: propod — 1:0.8:1.5. Small cheliped ischium and merus unarmed; carpus, propod and fingers elongate. Pleopod 1 (female) uniramous, second article longer, curved. Pleopod 2 (female) biramous, exopod longer than 2-articulate endopod, second article small, articulating laterally. Pleopod 1 (male) a single flat elongate article, unevenly notched distally. Pleopod 2 (male) biramous, exopod shorter than broad, terminally notched endopod. Telson 1.5 times as wide as long; widest proximally and tapering to evenly convex posterior margin; dorsal surface and posterior margin with a few tufts of setae. Uropod endopod ovate-lanceolate, almost twice length of telson; exopod as long as endopod, broadly ovate.

DISTRIBUTION: Coral reef; various localities in Indonesia, Papua New Guinea and northern Queensland. The present specimens represent the first records of this species from Australia.

REMARKS: Our specimens agree substantially with earlier descriptions of this species except that De Man (1887, 1928a) has described and figured the rostrum as spiniform. This character is variable in other species and not sufficient to distinguish Australian material. We believe De Man (1928a: fig. 30d) was in error in describing the male pleopod 1 as 2-articulate. *C. mucronata* is distinguished from other Australian callianassids by the combination of tapering telson and short rostrum and by its characteristic maxilliped 3 and chela.

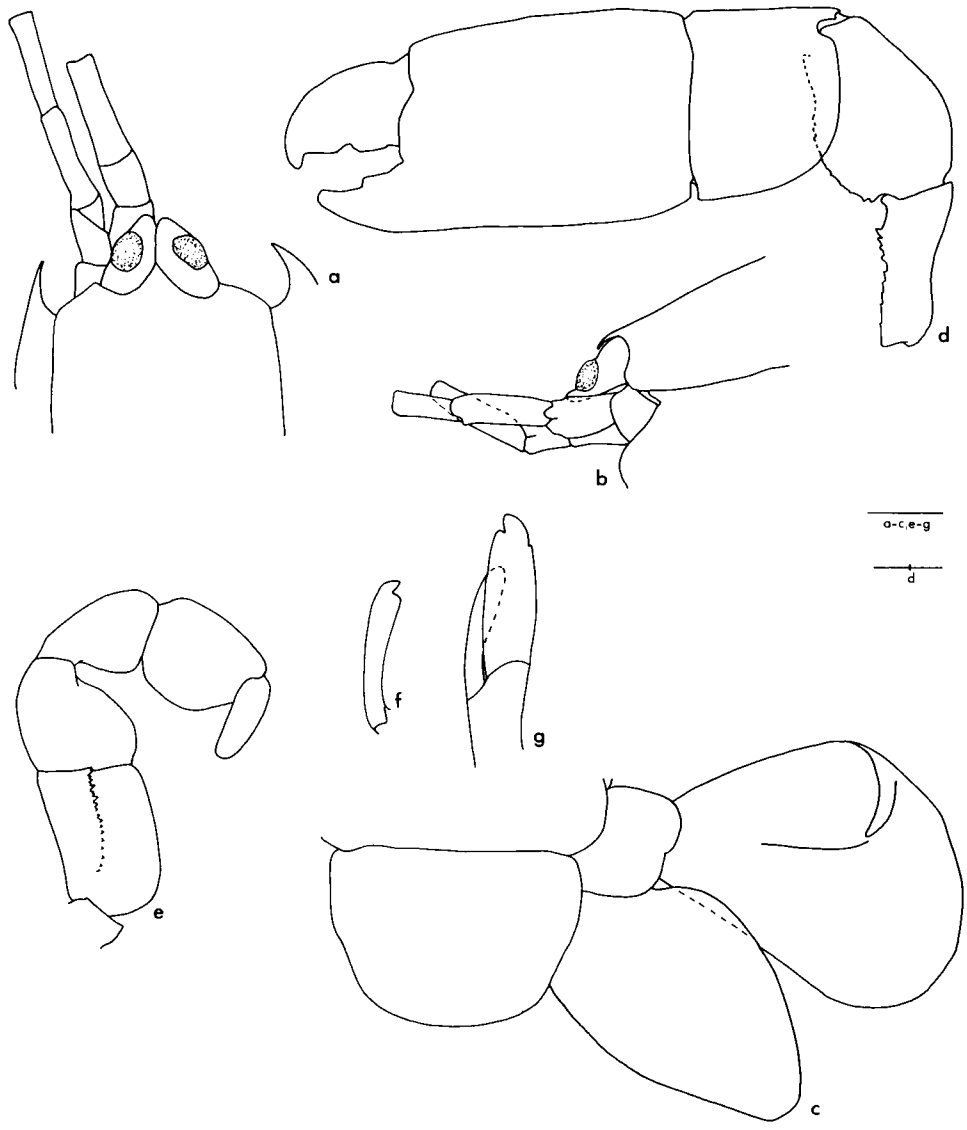

Fig. 34. *Callianassa mucronata* (AM P.2010, male, 33 mm): *a, b,* dorsal and lateral views of anterior region; *c,* telson and uropod; *d,* large cheliped; *e,* maxilliped 3; *f, g,* pleopods 1, 2.

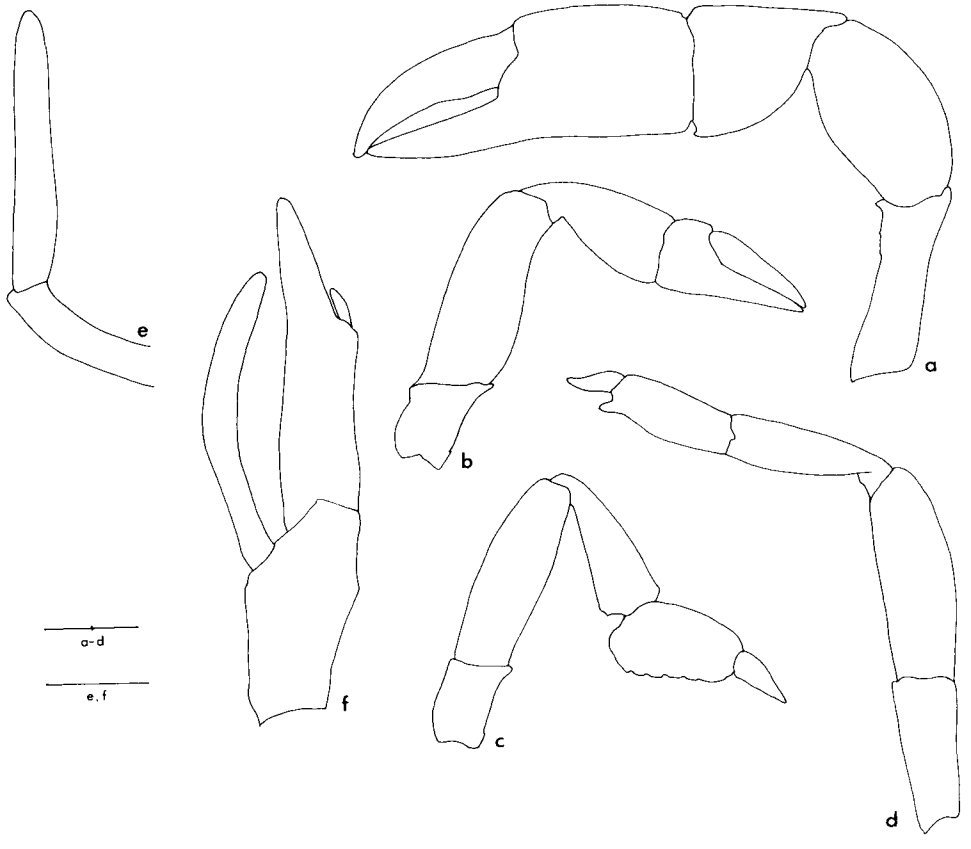

Fig. 35. *Callianassa mucronata* (AM P.2010, male, 33 mm): *a*, small cheliped; *b-d*, pereopods 2-4. (AM P.5194, female, 40 mm): *e, f*, pleopods 1, 2.

Callianassa tooradin n. sp.
Fig. 36

MATERIAL EXAMINED: 2 males, 2 females; tl. 7-24 mm.

HOLOTYPE: NMV. J. 301, female, 19 mm.

TYPE LOCALITY: *Victoria:* Crib Point, Western Port, CPBS stn 11N, fine sand sediment, 5 m, 31st March, 1965.

PARATYPES: Victoria: Crib Point, Western Port, CPBS stn 11N (NMV J. 302) 2 specs.; CPBS stn 00 (NMV J.303) 1 spec.

DESCRIPTION: Dorsal oval 0.7 length of carapace, clearly delimited. Rostrum a very broad triangular projection about 0.2 length of eyestalks; lateral projections obsolete. Eyestalks extending to end of first article of antenna 1, tapering distally; pigmented area small, compact. Peduncle of antenna 1 reaching to end of article 4 of antenna 2. Antenna 2

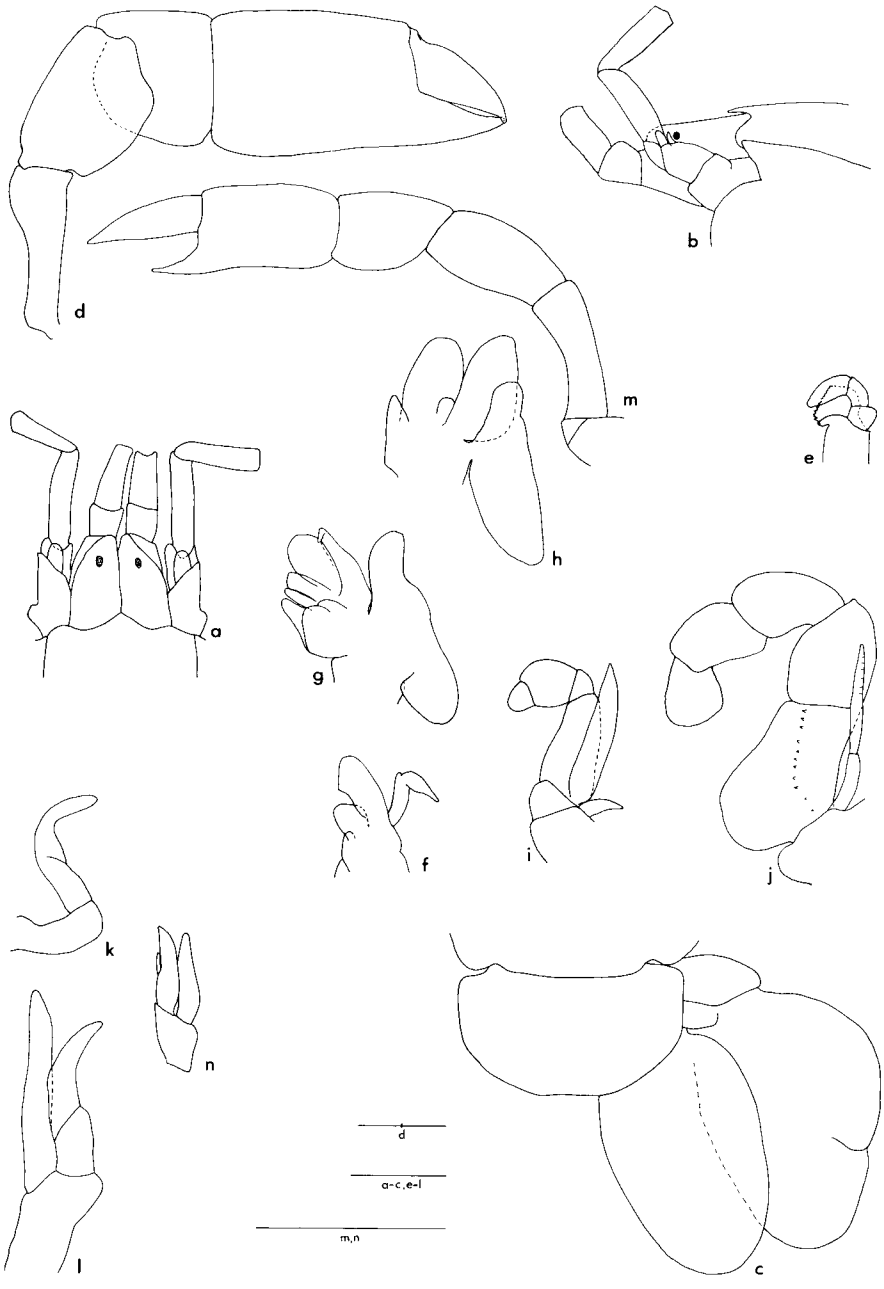

Fig. 36. *Callianassa tooradin* (NMV J.301, female, 19 mm): *a, b,* dorsal and lateral views of anterior region; *c,* telson and uropod; *d,* cheliped; *e,* mandible; *f, g,* maxillae, 1, 2; h-j maxillipeds 1-3; *k, l,* pleopods 1, 2. (NMV J.302, male, 7 mm): *m,* small cheliped; *n,* pleopod 2.

with a small scaphocerite, ovate distally. Maxilliped 3 with exopod reaching more than half way along merus; ischium with a proximal medial lobe and with about 11 small spines on inner surface; merus narrower than greatest width of ischium, shorter than ischium; carpus articulating distomedially on merus, curved, broadened distally; propod tapering; dactyl subovate, widest distally, as wide as propod, and reaching back as far as midpoint of ischium. Large cheliped (female) ischium unarmed, dorsally concave; merus strongly lobed ventrally, the lobe unarmed; carpus wider than long, smooth; propod slightly tapering; fixed finger short, tapered; dactyl equal to fixed finger, cutting edge smooth. Large cheliped (male) unknown. Small cheliped unarmed, dactyl twice length of fixed finger. Pleopod 1 (female) 2-articulate. Pleopod 2 (female) biramous, endopod 2-articulate. Pleopod 1 (male) absent. Pleopod 2 (male) biramous, endopod with a medially articulated article. Telson half as long as wide, widest proximally, lateral and posterior margins continuously convex; 2 dorsal tufts of setae and 2 on posterior margin. Uropod endopod ovate, about three times as long as telson; exopod little shorter than endopod, broadly ovate, longer than wide.

DISTRIBUTION: Subtidal (5 m) on fine sand sediments; Victoria (Western Port).

REMARKS: *Callianassa tooradin* is the only species of this genus known from Australia with a substantial exopod on maxilliped 3. This feature is known in only three other *Callianassa* species: *C. novaebritanniae* Borradaile (see De Man (1928a, b) and Sakai (1966)); sometimes in *C. latispina* Dawson (see Biffar (1971a)); and as a very small appendage in *C. karumba,* species which are otherwise little related to each other or to *C. tooradin*. A second feature peculiar to *C. tooradin* is the moderately well developed scaphocerite on antenna 2, an article usually vestigial in species of *Callianassa*. *Callianassa tooradin* is similar in some features to *C. lobata* de Gaillande & Lagardere, 1966, type species of de Saint Laurent's (1973) new genus *Calliax,* notably in the unequal fingers of the smaller cheliped. Species of *Calliax* may possess a third maxillipedal exopod such as occurs in *C. tooradin* but *C. tooradin* cannot easily be placed in this genus because the dorsal oval is well delimited and the chelipeds are unequal. Clearly, more study of relationships within the callianassids is needed before a workable generic subdivision of the many species can be put forward. Our material of *C. tooradin* was a small collection of poorly preserved specimens but their unique position in the Australian fauna made them worth describing at this stage.

Ctenocheles Kishinouye, 1926

DIAGNOSIS: Dorsal oval of the carapace not well delimited, with a median carina on the rostrum and a dorsal projection in the cardiac region. Maxilliped 1 epipod with a short anterior lobe. Maxilliped 3 with or without an exopod, according to species; endopod pediform. Uropod exopod without an anterodorsal lobe, but with a distal indentation. Fingers of the large cheliped very elongate and bearing a comb of fine teeth. (Translated from de Saint Laurent, 1973).

Ctenocheles collini Ward

Fig. 37

Ctenocheles collini Ward, 1945: 134-135, pl.13 (type locality: Queensland, Moreton Bay). — Holthuis, 1967:377-378.

MATERIAL EXAMINED: 7 specs.

Queensland: Mud Is., Moreton Bay (QM W.3536, paratypes) 3 specs; (QM W.5951-3) 3 specs; (QM W.3184) chela. — no locality (QM W.1670) 1 spec.

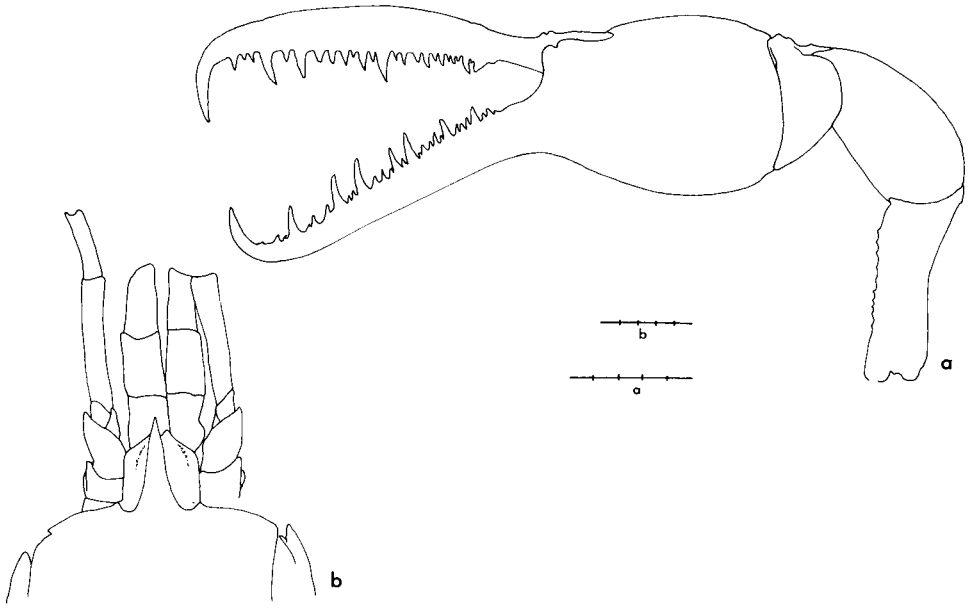

Fig. 37. *Ctenocheles collini* (QM W.1670): *a*, cheliped; *b*, dorsal view of anterior region.

DISTRIBUTION: 15-40 m; southern Queensland.

REMARKS: *Ctenocheles* is represented in Australia by a single species, *C. collini*, easily distinguished from all other thalassinideans by the form of the large cheliped. We have not examined a wide range of material of this species and therefore offer no new description.

Gourretia de Saint Laurent, 1973

DIAGNOSIS: Dorsal oval of the carapace not well delimited, with a fine median carina on the rostrum and a slight cardiac protuberance. Maxilliped 1 epipod with a well developed posterior lobe and the anterior lobe truncate towards the front. Maxilliped 3 always with an exopod, endopod pediform. Uropod exopod not lobed, sometimes with a distal indentation. Small cheliped elongate, tapered. (Translated from de Saint Laurent, 1973).

REMARKS: *Gourretia* is possibly the most distinct of de Saint Laurent's (1973) new genera of the Callianassidae and we use it rather than *Callianassa* for the following new species.

Gourretia coolibah n. sp.
Figs 38, 39

MATERIAL EXAMINED: 1 specimen.

HOLOTYPE: WAM 66-75, female, tl. 43mm.

TYPE LOCALITY: *Western Australia:* ca, 215 mi (350 km) ENE. of Troughton Is., Joseph Bonaparte Gulf, 32 fm (58 m), mud, coll. R. W. George on "Dorothea", 23 October 1962.

DESCRIPTION: Dorsal oval 0.7 length of dorsal carapace. Rostrum downturned, an acute triangle as long as broad, half length of eyestalks; lateral projections broad lobes. Eyestalks not reaching to end of first article of peduncle of antenna 1, tapering to a broad mesiodistal lobe; few minute pigment spots subdistally. Peduncle of antenna 1 reaching beyond that of antenna 2; neither antenna very setose. Maxilliped 3 with exopod reaching to end of ischium; merus width 0.2 length of ischium and merus together, merus 0.6 length of ischium; ischium with prominent ridge of 14 teeth on inner surface; carpus articulating

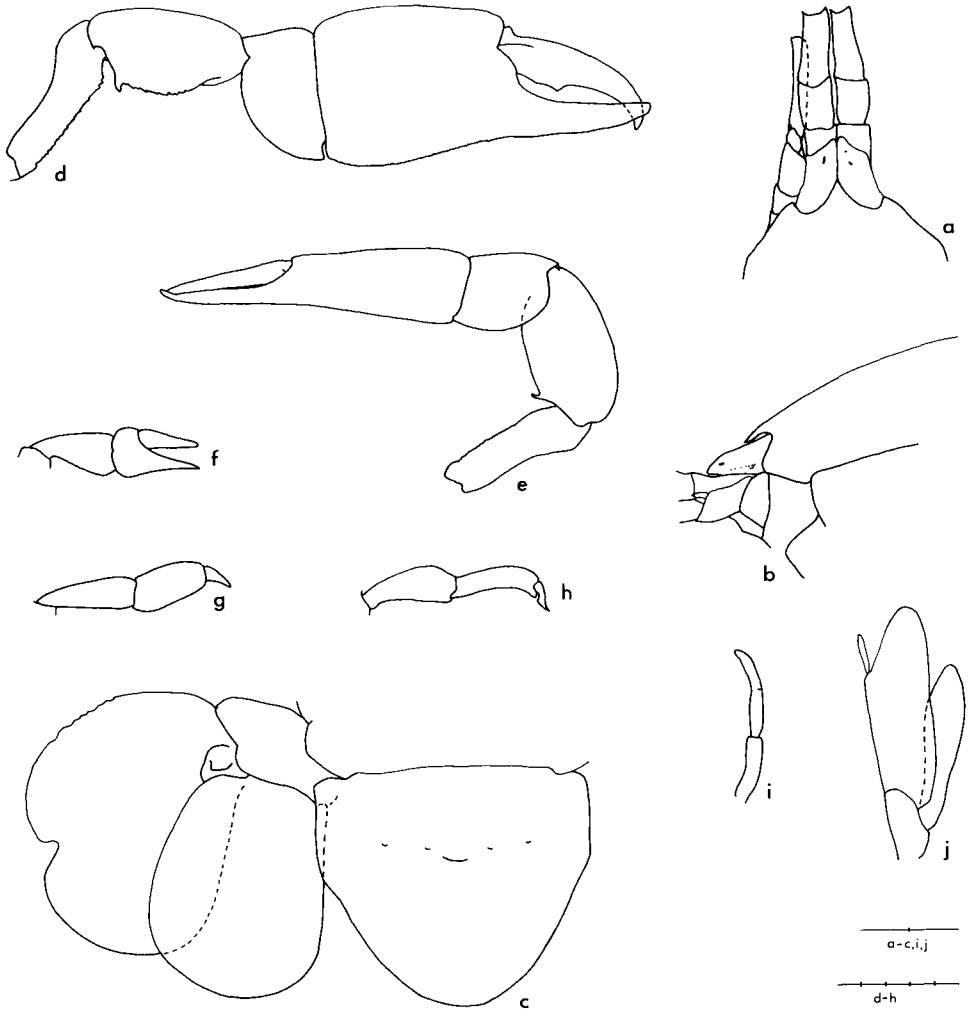

Fig. 38. *Gourretia coolibah* (WAM 66-75, female, 48 mm): *a, b,* dorsal and lateral views of anterior region; *c,* telson and uropod; *d,* large cheliped; *e,* small cheliped; *f, g, h,* pereopods 2, 4, 5; *i, j,* pleopods 1, 2.

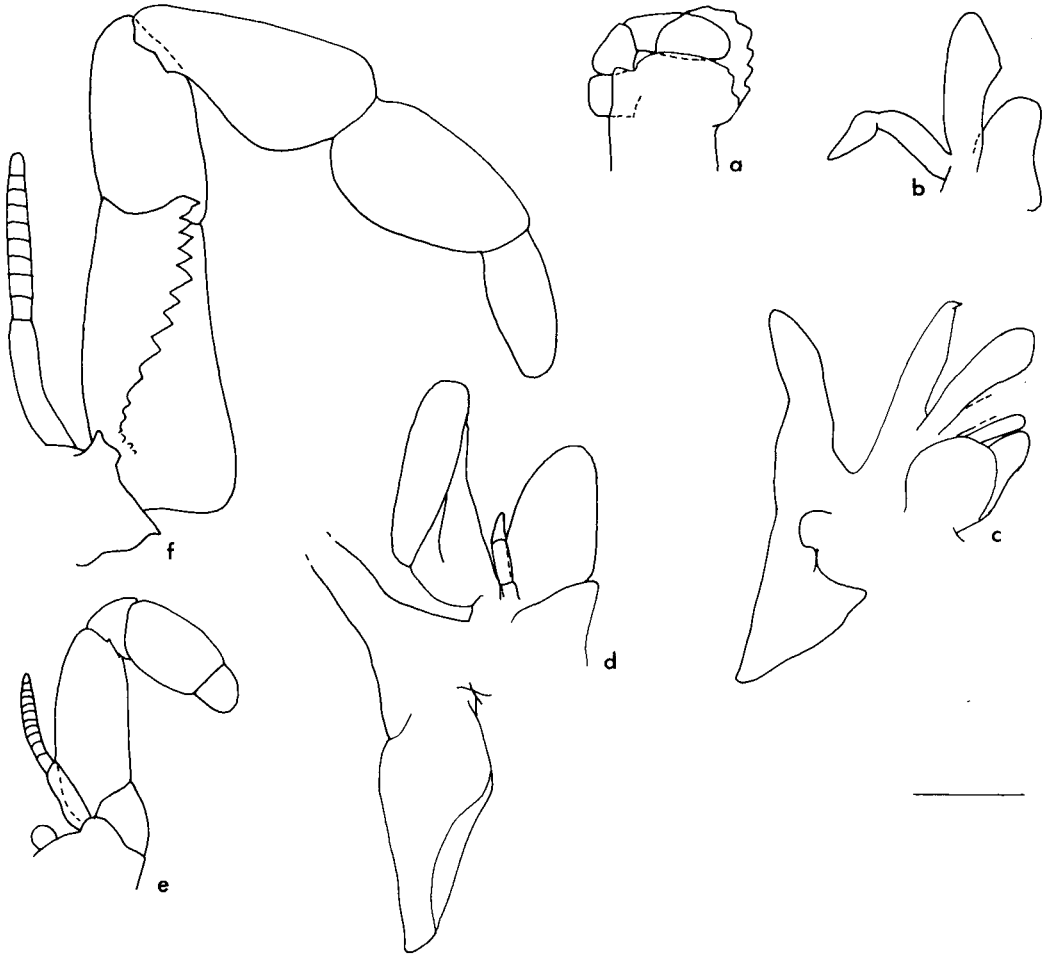

Fig. 39. *Gourretia coolibah* (WAM 66-75, female, 48 mm): *a*, mandible; *b*, *c*, maxillae 1, 2; *d-f*, maxillipeds 1-3.

terminally on merus, longer than merus, subtriangular; propod subovate, convex medially and tapering; dactyl 0.7 times length of propod, narrower. Large cheliped (female) ischium dentate ventrally; merus with dentate, convex ventral margin with a curved proximal tooth; carpus twice as wide as long; propod smooth dorsally, crenulate ventrally; fixed finger smooth and evenly tapering to blunt tip; dactyl equal to fixed finger, strongly curved, a blunt double tooth on cutting edge; ratio of dorsal lengths — merus: carpus: propod — 1:0.5:1.2. Large cheliped (male) unknown. Small cheliped ischium minutely dentate; merus with ventral spine proximally; carpus longer than wide; propod uniformly tapering; fixed finger and dactyl equal, curved terminally, cutting edges irregular. Pleopod 1 (female) uniramous, 2-articulate, second article with lobe midway along. Pleopod 2 (female) biramous, exopod broad, shorter than 2-articulate endopod, second article of endopod small and articulating on medial edge of first. Pleopods (male) unknown. Telson little wider than long, proximal half parallel-sided then tapering to broadly rounded end,

setose terminal margin and scattered setae dorsally. Uropod endopod longer than wide, subequal to telson, lateral and distal margins convex, continuous; exopod strongly convex laterally, distal margin notched and strongly convex medially of notch, setose marginally.

DISTRIBUTION: Deep mud; north Western Australia.

REMARKS: This is the first record of this genus from Australia. The species is distinguished superficially from all other Australian callianassids by the narrow, tapering small cheliped and the notched uropod exopod.

G. coolibah is distinguished from other species of this genus (see Le Loeuff & Intes, 1974) by the poor dentition of the chelipeds among other features and by the notch on the distal margin of the uropod exopod. It most closely resembles *G. lahouensis* Le Loeuff & Intes, 1974.

Family **Callianideidae** De Man, 1928

Callianidea Milne-Edwards, 1837

DIAGNOSIS: Carapace smooth, cervical groove poorly marked, rostrum short, not carinate. Eyestalks contiguous, cornea subdistal. Maxilliped 3 with an exopod, endopod pediform, epipod short. Pereopods 1 unequal or equal, carpus much wider than merus. Pleopods 2-5 bordered by branchial filaments.

REMARKS: This diagnosis is translated from de Saint Laurent (1973) with the exception of the remark on the inequality of the first pereopods. The following new species has equal pereopods 1 and the diagnosis has been expanded to include it. Stephenson et al. (1931) noted a species of *Callianidea* from sandy areas on Low Isles, north Queensland. Dr Ray Ingle tried to locate this specimen for us, but it is not in the thalassinid material at the BM(NH) with the other specimens from this expedition, so we are unable to confirm the record.

Callianidea leura n. sp.

Figs 40, 41

MATERIAL EXAMINED: 2 females; tl. 25 mm.

HOLOTYPE: AM P.25294, ovigerous female, tl. 25 mm.

TYPE LOCALITY: *Queensland:* Masthead Is., Capricorn Group.

PARATYPE: *Queensland:* Holbourne Is. (AM P.5574) 1 spec.

DESCRIPTION: Cervical groove indistinct. Rostrum flat, slightly depressed distally, as long as broad, end bluntly rounded, 0.4 length of eyestalks; front deeply excavate at base of eyestalks, with a short longitudinal row of setae behind; dorsolateral anterior margin of carapace broadly rounded. Eyestalks reaching to midpoint of second article of antenna 2, somewhat flattened, broadly rounded terminally; eyes subdistal. Peduncles of antenna 1 and 2 of about equal length. Article 1 of antenna 1 extremely elongate, more than 3 times as long as last 2 articles together, strongly tapering to its midpoint and dilating slightly distally. Antenna 2 with an acute scaphocerite, article 4 about 3 times as long as article 2. Maxilliped 3 with exopod reaching almost to end of merus; merus width 0.2 length of ischium and merus together, merus longer than ischium; ischium with a mesial row of about 10 small denticles; merus with a strong medial spine subdistally; carpus, propod and dactyl all about as wide as end of merus, together longer than previous two articles. Chelipeds

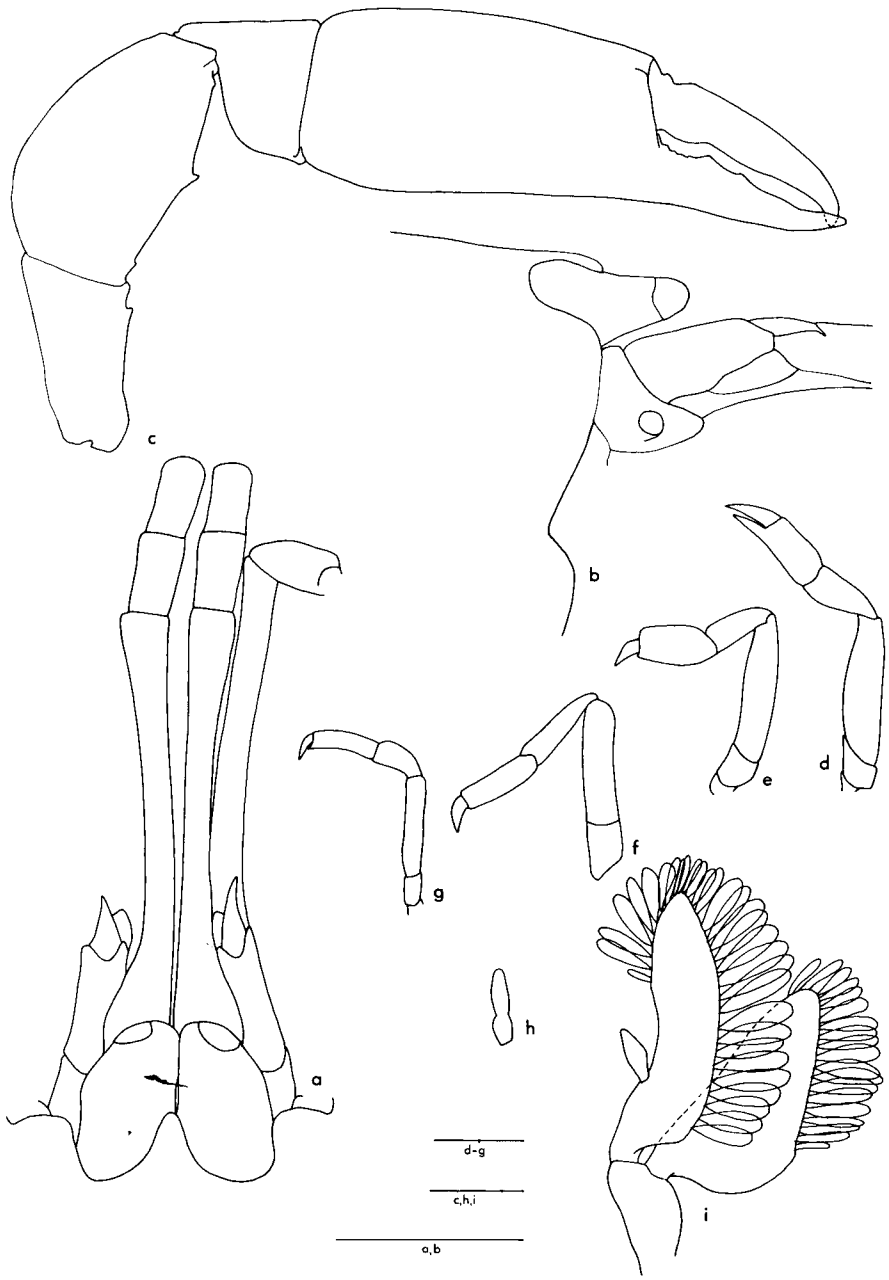

Fig. 40. *Callianidea leura* (AM P.25294, female, 25 mm): *a, b,* dorsal and lateral views of anterior region; *c,* cheliped; *d-g,* pereopods 2-5; *h, i,* pleopods 1, 2.

equal; ischium with a small medial tooth; merus strongly convex dorsally, its ventral margin with a small tooth near midpoint; margins of carpus and propod smooth; fixed finger tapering, cutting edge with 2 low teeth proximally; dactyl equal to fixed finger, sinuate cutting edge, curved end; ratio of dorsal lengths — merus: carpus: propod — 1:0.6:1.3. Pleopod 1 (female) a single small article, constricted near the midpoint. Pleopod 1 (male) unknown. Pleopods 2-5 similar, both rami bearing simple narrowly-ovate branchial filaments. Telson length 0.8 width, proximal half parallel-sided then tapering to broadly rounded end. Uropod endopod 1.5 times as long as telson, ovate, length 1.2 times width, bearing a minute terminal tooth; exopod about as long as endopod, broadly ovate, length 1.5 times width.

DISTRIBUTION: Central Queensland.

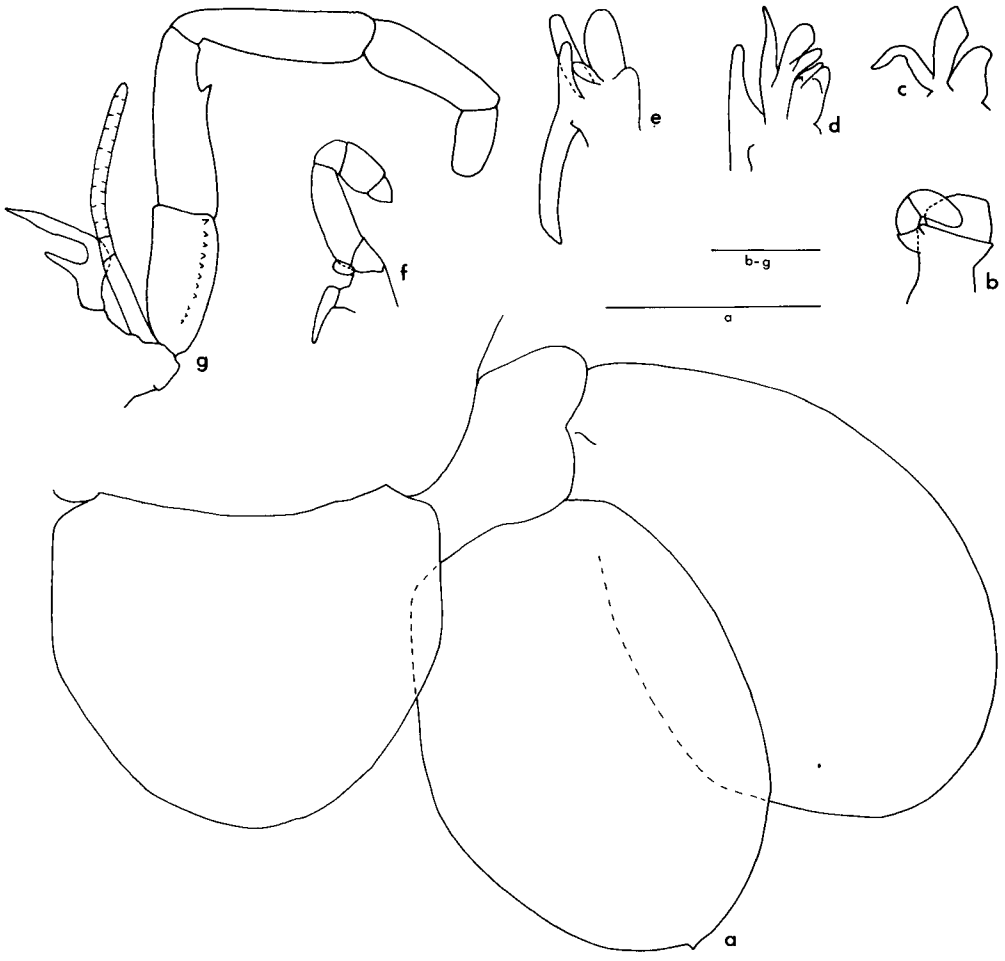

Fig. 41. *Callianidea leura* (AM P.25294, female, 25 mm): *a*, telson and uropod; *b*, mandible; *c*, *d*, maxillae 1, 2; *e-g*, maxillipeds 1-3.

REMARKS: This species is similar in general form to species of *Callianassa* but in Australia is distinguished from these by the branchial filaments on pleopods 2-5. *Callianidea leura* differs from other species of *Callianidea* in a number of important features which might be considered of generic status. The pleopodal branchial filaments which characterize the genus are simple in *C. leura* but branched or multiarticulate in other species (De Man, 1928a), pereopods 1 are equal in *C. leura*, unequal in others, and article 2 of antenna 1 is extremely elongate in this species but of a more normal length (about equal to the eyestalks) in others.

Family **Laomediidae** Borradaile, 1903

Laomedia De Haan, 1841

DIAGNOSIS: Pereopods 1 subequal; pereopods 2 subchelate or simple; uropods with transverse suture on both endopod and exopod; pleopod 1 (male) absent; pleopod 1 (female) reduced and uniramous; pleopods 2-5 similar, bearing appendix interna.

REMARKS: Yaldwyn & Wear (1972) have given a more complete diagnosis and Le Loeuff & Intes (1974) discussed the relationships of the genus *Laomedia*.

Laomedia healyi Yaldwyn & Wear

Laomedia healyi Yaldwyn & Wear, 1970:384-385, fig. 1 (type locality: New South Wales, Careel Bay); 1972: 126-141 figs 1-12, pls 6-7. — Healy & Yaldwyn, 1970: frontispiece.

MATERIAL EXAMINED: 10 specimens; cl. 18-26 mm.

Queensland: Hayman Is., Whitsunday Group (AM P.7306) 1 spec. — Russell Is., Moreton Bay (QM W.1974) 1 spec. — Southport (QM W.4538) 1 spec.

New South Wales: Woy Woy (AM P.4027) 1 spec. — Port Jackson (AM P.4673) 1 spec. — Figtree, Lane Cove (AM P.7079) 1 spec. — Back Creek, Tuross Lake (AM P.25016) 1 spec.

Victoria: Hastings, Western Port (NMV, Ahsanullah colln) 3 specs.

DISTRIBUTION: Intertidal, often in mangroves; northern Queensland to central Victoria.

REMARKS: This species has been described and illustrated in detail previously (Yaldwyn & Wear, 1970, 1972) and is therefore not dealt with here. It is most easily distinguished from other thalassinideans by both rami of the uropod being 2-articulate. The range of the species is extended here down to central Victoria by the discovery of material from intertidal mangroves in Western Port.

Laomedia sp.

Laomedia n. sp. (Barron River) Yaldwyn & Wear, 1972: 126, 129-31.

REMARKS: This, as yet undescribed, species is known only from the Queensland material noted by Yaldwyn & Wear (1972). It is separated from *L. healyi* by a number of features, the most notable being the presence of only one small tooth beside the terminal rostral tooth (rather than 3-6) and the absence of orbital and antennal spines on the anterior margin of the carapace (Yaldwyn & Wear, 1972).

Family **Thalassinidae** Dana

The family is monogeneric.

Thalassina Latreille, 1806

DIAGNOSIS: Thalassinidea with linea thalassinica present; rostrum small and triangular; pereopods 1 unequal, subchelate, dactyl greatly exceeding fixed finger; pereopods 2 subchelate; pleopods lacking appendix interna; uropod rami each of a single, linear curved article.

Thalassina squamifera De Man
Fig. 42

Thalassina anomala var. *squamifera* De Man, 1915: 445, pl.29 fig. 16 (type locality: Karakelong, Indonesia); 1928a: 12-14, pl. 1 fig. 1.

Thalassina anomala. — De Man, 1928a: 4-12 (part). — Bennett, 1968: 22-25, figs (part). — Stephenson et al., 1931: 40-42. — McNeill, 1968: 26.

Thalassina maxima Hess, 1865: 163, pl.7 fig.18. — Haswell, 1882: 166-167.

Thalassina sp. — Haswell, 1882: 167.

Thalassina squamifera. — Campbell & Woods, 1970: 41-42.

MATERIAL EXAMINED: 7 males, 4 females, 21 others; cl. 35-60 mm.

Queensland: Weipa (WAM 186-62) 1 spec. — Silver Plains Station, Cape York (AM P.16154) 1 spec. — Palm Is. (AM P.5210,1) 2 specs. — Port Curtis (AM P.16155) 2 specs; (AM P. 17423) 1 spec.; (AM P.16780) 5 specs. — Gladstone (AM P.14978,9) 2 specs.

Northern Territory: Darwin (AM P.12519) 1 spec.; (AM P.14980) 1 spec.; (WAM 42-75) 1 spec. — Cape Don (WAM 39-75) 1 spec. — Napier Bay, Melville Is. (AM P.18776) 1 spec.

Western Australia: North coast of W.A. (WAM 187-62) 1 spec. — Wyndham (WAM 43-75) 1 spec. — Broome (AM P.15055) 1 spec.; (WAM 168-60) 1 spec. — 27 km SE. of Broome (WAM 38-75) 1 spec. — Port Hedland (WAM 9302) 1 spec.; (WAM 37-75) 1 spec.; (WAM 44-75) 1 spec.; (WAM 169-60) 1 spec. — Roeburne (WAM 188-62) 1 spec. — Learmonth (WAM 181-60) 1 spec. — north of Perth (AM P.14982) 1 spec.

Philippines: Laguio Point, Lopez Bay (WAM 45-75) 1 spec.

DISTRIBUTION: Intertidal mangrove mudflats and down to 13 m; Philippines; Irian Jaya and Karakelong, Indonesia (De Man 1928a); north Western Australia, Northern Territory and north Queensland.

REMARKS: *Thalassina squamifera* was first described from specimens from Indonesia as a variety of the widespread species *T. anomala*. Campbell & Woods (1970) first elevated the variety to specific rank after an examination of Australian material and our material confirms their determination. The ranges of the two species overlap in Indonesia and the Philippines.

Thalassina anomala and *T. squamifera* are very close species, differing in three characters already noted by De Man (1928a).

1. In *T. squamifera* the transverse sternal ridge between the pleopods on pleonites 2-5 is medially emarginate and laterally tuberculate; in *T. anomala* this ridge bears a single prominent tubercle medially.

2. *T. squamifera* bears a small, variously sized, scaphocerite; *T. anomala* lacks this feature although Sankolli (1970) noted its presence on two out of 70 specimens from India.

3. *T. squamifera* lacks the oblique tuberculate ridge which runs on the lateral surface

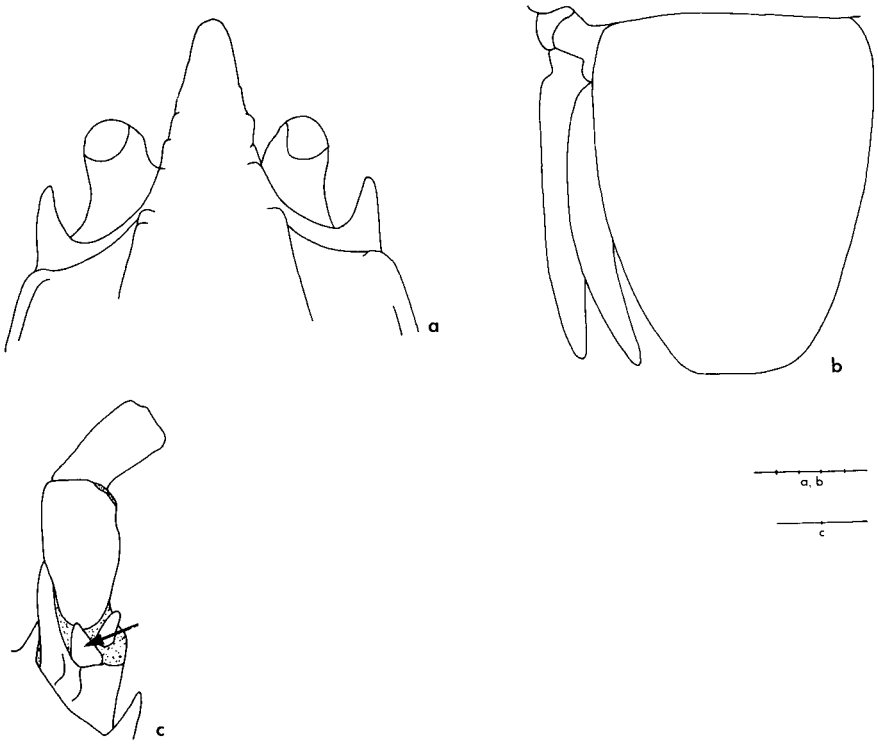

Fig. 42. *Thalassina squamifera* (WAM 186-62, female, 54 mm): *a,* rostrum; *b,* telson and uropod; *c,* right antenna 2 and anterior margin of carapace (dorsal view, scaphocerite arrowed).

parallel to the promixal cutting edge of the fixed finger of the large cheliped in *T. anomala*. Sankolli (1970) noted that Indian specimens of *T. anomala* also lacked this ridge but in his material the chelipeds differed little in size but not at all in form. Our examination of material of *T. anomala* in the Australian Museum from Samoa, the Solomon Is., New Guinea, Fiji and the New Hebrides confirmed De Man's (1928a) observation that the tuberculate ridge occurs on the larger cheliped only when its propod is strongly expanded distally. In spite of some of Sankolli's material being sexually mature this condition was not met. We also note from our examination of Australian material that *T. squamifera* is a smaller species than *T. anomala,* its maximum carapace length being 60 mm, compared with about 100 mm for *T. anomala*.

The species *Thalassina maxima* was described by Hess (1865) from Sydney (Haswell, 1882; De Man, 1928a). Considering the present-day distribution of Australian *Thalassina* this is a most unlikely locality record. Observations on the burrowing behaviour of *Thalassina* in northern Queensland mangrove forests were made by Macnae (1966).

Family **Upogebiidae** Borradaile, 1903

Upogebia Leach, 1814

DIAGNOSIS: Carapace with a well-developed rostrum, spinous; cervical groove

separating essentially equal anterior and posterior regions. Linea thalassinica present. Pleurobranchs absent; pereopod epipods absent. Eyestalks cylindrical with terminal eyes. Scaphocerite reduced. Maxilliped 1 exopod slender, with a terminal flagellum; endopod short and epipod rudimentary or absent. Maxilliped 3 with an exopod; endopod pediform, usually without *crista dentata* (mesial crest of teeth on ischium); epipod vestigial or absent. Pereopods 1 equal, chelate, subchelate or simple. Pereopods 2, 3, 4 simple. Pereopod 5 subchelate or chelate. Pleopod 1 present in female only. Pleopods 2-5 similar, foliaceous, without appendix interna. Uropod exopod not lobed. (Modified from a translation of the family diagnosis given by de Saint Laurent (1973)). The family is monogeneric.

Upogebia (Calliadne) australiensis De Man
Fig. 43

Gebia hirtifrons. – Haswell, 1882: 164-165 (type locality: Port Jackson, N.S.W.). (Not *Gebia hirtifrons* White, 1847.)

Upogebia octoceras australiensis De Man, 1927: 14-17; pl. 2 fig. 7; 1928a: 24, 49.

Upogebia (Calliadne) australiensis. – Hale, 1941: 273-274, fig. 9.

MATERIAL EXAMINED: 53 specs; cl. 4-15 mm.

Queensland: Port Molle (AM P.260) 1 spec.
New South Wales: Broughton Is. (AM P.263) 1 spec. — Avalon (AM P.24679) 1 spec. — Collaroy (AM P.13505) 1 spec. — Balmoral Beach (AM P.1696) 7 specs. — Port Jackson (AM P.262 syntypes) 3 specs; (AM P.24701) 9 specs; (AM P. 25529) 1 spec.; (AM P.5184) 5 specs.; (AM P.6747) 1 spec.; (AM P.6760) 2 specs. — Dobroyd Pt, Sydney (AM P. 20835) 1 spec. — Syney area (AM P. 16206) 2 specs. — Bondi Beach (AM P.5653) 1 spec.; (AM P.5652) 2 specs.

Western Australia: Bunbury (AM P.2454) 15 specs.

DESCRIPTION: Rostrum weakly trilobed, lateral lobes 0.1 length of medial lobe, hiatus between lobes a shallow broad U, total length about equal to width at base; surface of medial lobe tuberculate, without spines, its lateral edge with about 6 blunt tubercles, lateral lobes with up to 15 close-set blunt tubercles along lateral edges extending back to cervical groove; setae on dorsal surface of medial lobe of rostrum and along lateral edges of lateral lobes; without ventral teeth. No spine on anterolateral border of carapace, nor on lateral border of cervical groove. Eyestalk about 0.8 length of rostrum. Maxilliped 3 exopod exceeding merus; ischium without hook; ischium and merus together about as long as last 3 articles; dactyl 1.5 times length of propod. Pereopods 1 equal, not sexually dimorphic; coxa unarmed, double ventral setal row on ischium and merus, single dense row on proximal half of propod; merus smooth; distal margin of carpus with dorsal denticles, a mesial and a ventral spine, dorsal patch of dense setae subdistally; fixed finger of propod almost as long as dactyl, cutting edge strongly toothed, a small slender spine on both lateral and mesial surface of propod distally at junction with dactyl; dactyl with a proximal tooth on cutting edge, a short longitudinal row of tubercles on mesial surface; ratio of dorsal lengths — merus: carpus: propod — 1:0.3:1. Pereopods 2-5 unarmed. Pleopod 1 (female) 2-articulate, second article longer. Pleopod 1 (male) absent (or if present of form of female). Telson quadrate, length equal to width, a strong tranverse ridge close to base and longitudinal ridge near each lateral edge, ridges and area immediately behind transverse ridge with small spines, those on lateral ridges generally in pairs. Posterior edge of sixth abdominal segment with small spines. Uropod endopod no longer than telson, lateral edge straight, distal margin very weakly convex, with single longitudinal ridge; exopod longer than endopod, distal edge evenly curved, surface with double ridge, minute denticles on distal edges of both exopod and endopod.

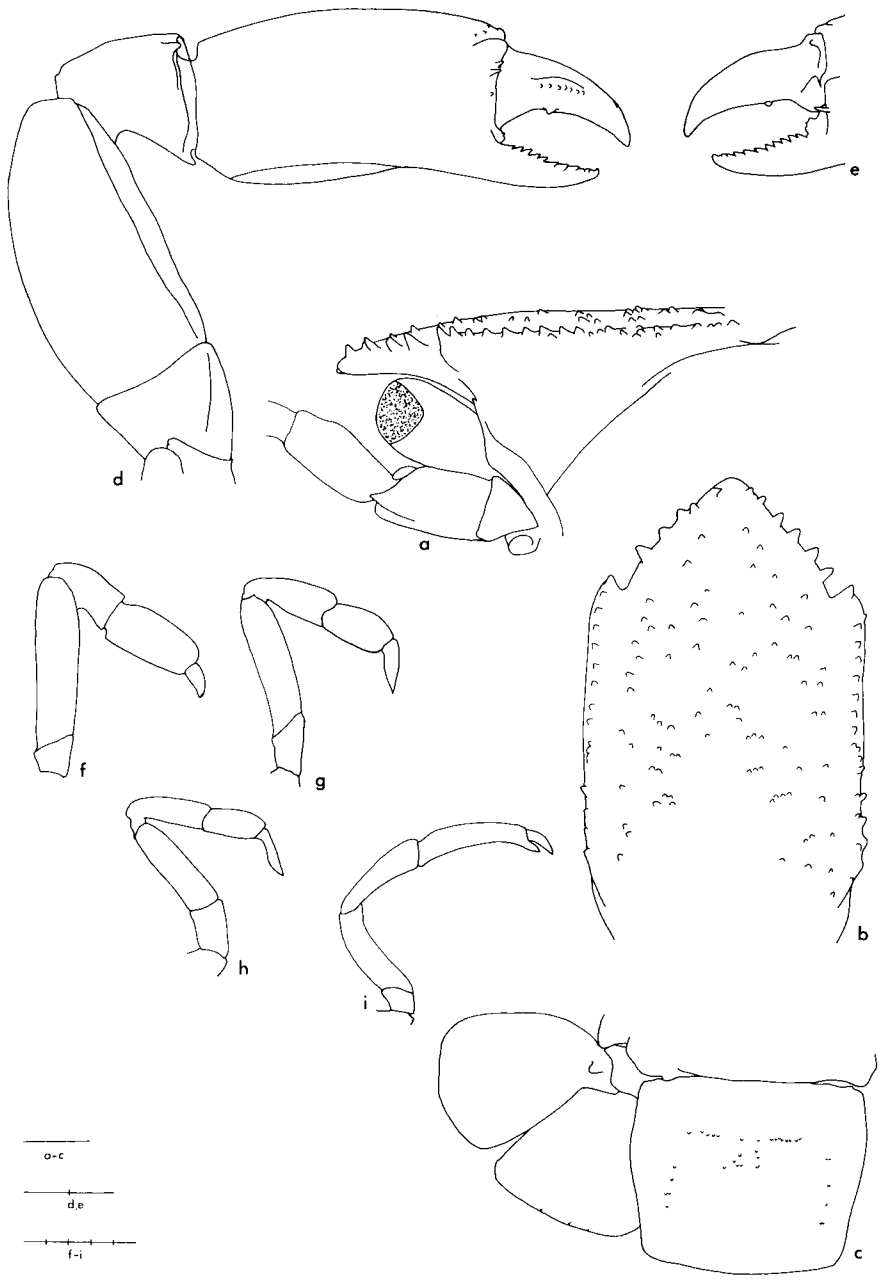

Fig. 43. *Upogebia australiensis* (AM P.25529, female, 14 mm): *a, b,* dorsal and lateral views of anterior region; *c,* telson and uropod; *d,* pereopod 1 (medial view); *e,* chela (lateral view); *f-i,* pereopods 2-5.

DISTRIBUTION: Often recorded from within sponges, from intertidal down to 62 m (Hale, 1941); northern Queensland to central N.S.W., and Western Australia. Not yet recorded from Victoria or South Australian waters.

REMARKS: This species was first described as a variety of the Red Sea species *U. octoceras* Nobili. Hale was the first to elevate it to full specific status. It has been adequately dealt with by De Man and by Hale. Our specimens agree in all major respects. However, our specimens possess on the distal edge of the propod of pereopod 1, a single mesial spine and a small spinule plus a single lateral spine and spinule. Hale figured the propod with 2 spines mesially and 2 laterally. The species is superficially similar to *U. hexaceras* from which it differs in the broader and more tuberculate rostrum. The lateral lobes of the rostrum are short in both species.

Upogebia (Calliadne) bowerbankii (Miers)
Figs 44, 45

Gebiopsis bowerbankii Miers, 1884: 282 (type locality: Fremantle, W.A.).

Upogebia bowerbankii. — Hale, 1924: 69; 1927: 85; 1941: 274-276, fig. 10. — De Man, 1927: 9-12, pl. 1 fig. 4; 1928a: 24, 48.

Upogebia (Calliadne) bowerbankii. — Sakai, 1975: 13-17, fig. 3.

MATERIAL EXAMINED: 25 males, 23 females; cl. 4-17 mm.

South Australia: Decres Bay (WAM 63-75) 5 specs. — Backstairs Passage (SAM C.891) 2 specs. — Spencer Gulf (AM P.24671) 2 specs.

Western Australia: Lancelin Is. (WAM 54-75) 6 specs. — Cottesloe (WAM 374-377-31) 4 specs; (WAM 3-75) 1 spec; (WAM 10767) 1 spec; (WAM 10365-10373) 8 specs; (WAM 10148) 2 specs. — near Perth (WAM 56-75) 1 spec. — 8.8 km NE. of Rottnest Is. (WAM 72-65) 1 spec. — Fremantle (BM (NH) 61-97 holotype) 1 spec. — 1 km W. of Garden Is. (WAM 68-72) 6 specs; (WAM 60-75) 1 spec; (WAM 66-72) 2 specs. — Esperance (WAM 122-75) 2 specs. — Green Is., Oyster Harbour (WAM 52-75) 2 specs. — 96-128 km W. of Eucla (AM P.25288) 1 spec.

DESCRIPTION: Rostrum trilobed, lateral lobes about one quarter length of medial lobe; medial lobe evenly rounded and slightly depressed distally, about half as long as wide, with 5-6 strong, dorsally-directed, equal marginal spines on each side; lateral lobe an acute spine ending a row of about 20 shorter spines on dorsolateral margin of carapace. Dorsal surface of carapace, particularly of rostrum, spinose; densely setose only near margin of medial lobe of rostrum; carapace otherwise unarmed. Eyestalk reaching midway between ends of lateral and medial lobes of rostrum. Maxilliped 3 exopod reaching beyond midpoint of merus; ischium with small mesial spine proximally; merus shorter than ischium, together longer than last 3 articles; dactyl as long as propod. Pereopods 1 subequal, double ventral setal row on ischium and merus, single row on proximal half of propod; carpus with a strong mesiodistal spine and 3-4 minute mesial spines; propod with several minute dorsal spines distally, 2 mesial, 1 dorsal and 1 lateral spines on distal margin of propod at base of dactyl; fixed finger regularly (rarely irregularly) toothed on cutting edge; dactyl and fixed finger subequal, dactyl with a proximal dorsal tubercle, a mesial row of denticles, and a blunt proximal tooth near uneven cutting edge; ratio of dorsal lengths-merus: carpus: propod — 1:0.4:0.8. Pereopods 2-5 unarmed. Pleopod 1 (female) 2 — articulate. Pleopod 1 (male) absent. Telson as long as wide, scarcely tapering, posterior edge concave, sometimes scarcely; with a proximal spinulose transverse ridge, a pair of spinulose domes posterior to this, and longitudinal submarginal ridges; uropod endopod

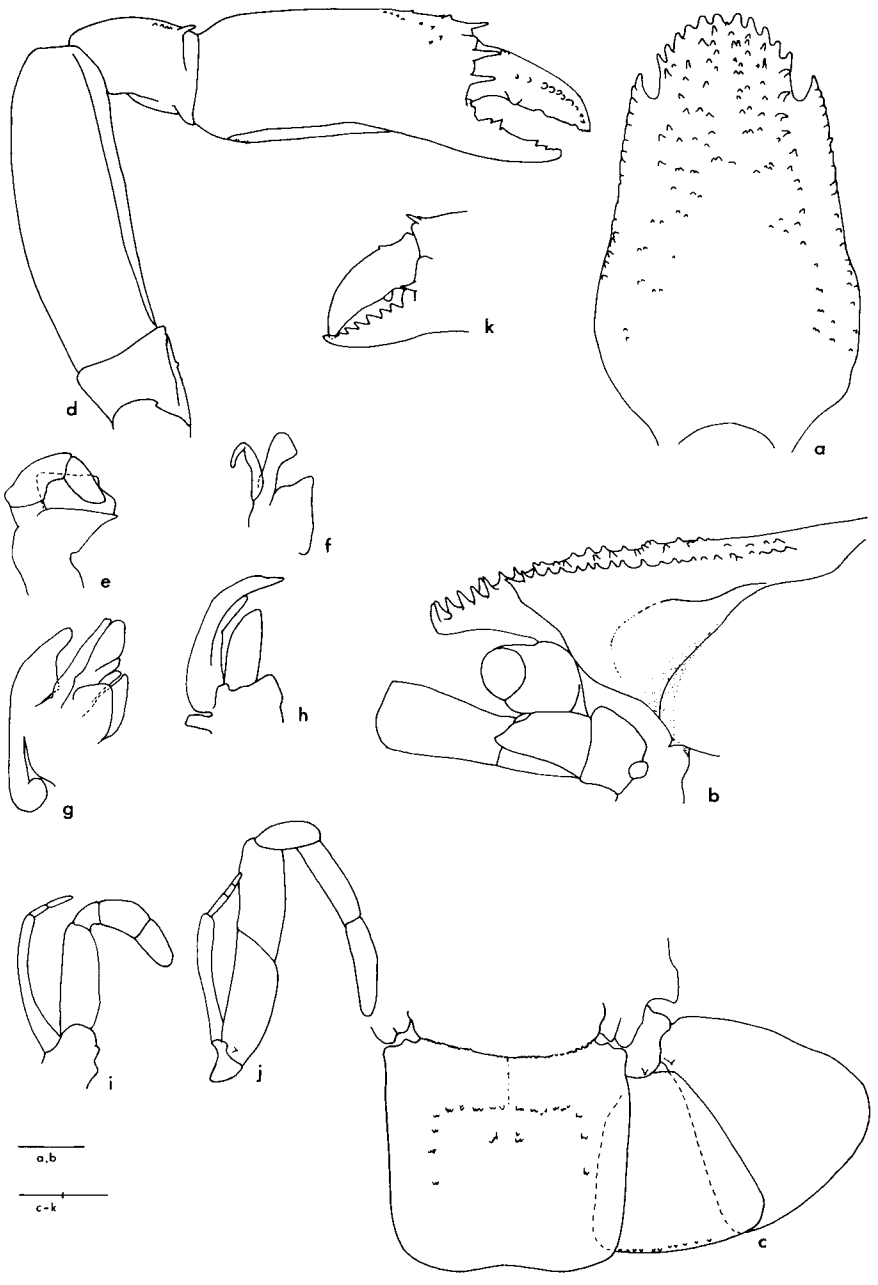

Fig. 44. *Upogebia bowerbankii* (AM P.25288, female, 13 mm): *a, b,* dorsal and lateral views of anterior region; *c,* telson and uropod; *d,* pereopod 1; *e,* mandible; *f, g,* maxillae 1, 2; *h-j,* maxillipeds 1-3. (WAM 54-75, male, 13 mm): *k,* chela (lateral).

as long as telson, with a longitudinal ridge, distal margin weakly convex and with submarginal denticles; exopod equal to endopod, distal and lateral margins convex.

DISTRIBUTION: Often taken in sponges, 6-200 m; South Australia and southern Western Australia.

REMARKS: The holotype of this species was obtained on loan from the British Museum (Natural History) as De Man's (1927) illustration of it could not be reconciled with Hale's (1941) figure and description, nor with the large series of specimens from the Western Australian Museum. The rostrum of the holotype proved to have been damaged at some stage in the life of the animal resulting in a transverse line of non-calcification at the level of the second most distal pair of spines. The terminal pair of spines are a little more elongate than usual, the second pair quite soft and slender and the whole of the rostrum excessively depressed. Otherwise the specimen cannot be distinguished from the WAM material. The fixed finger of the cheliped illustrated (fig. 44d) is not typical of the species; fig. 44k is more representative.

U. bowerbankii is distinguished from other Australian *Upogebia* by the evenly curved, broad rostrum bearing 5-6 equal spines on each side. Having the fixed finger and dactyl subequal, it belongs in the subgenus *Calliadne*.

Sakai (1975) assigned four specimens from Kenya to this species noting some differences from De Man's (1927) redescription of the type specimen. Our examination of a wider range of Australian material leads us to suspect that the Kenyan material is not *U. bowerbankii*. Sakai's (1975) illustration and description of the medial lobe of the rostrum differ in having fewer marginal spines (7-9 vs 10-12), being longer and more tapered, and in barely exceeding the eyestalks (twice as long in our material). The lateral lobes of the rostrum are more prominent and the fixed finger bears more teeth in Australian specimens. Sakai found the spination of the propod of the first pereopod to be variable; our material was constant although it fell within the range given by Sakai.

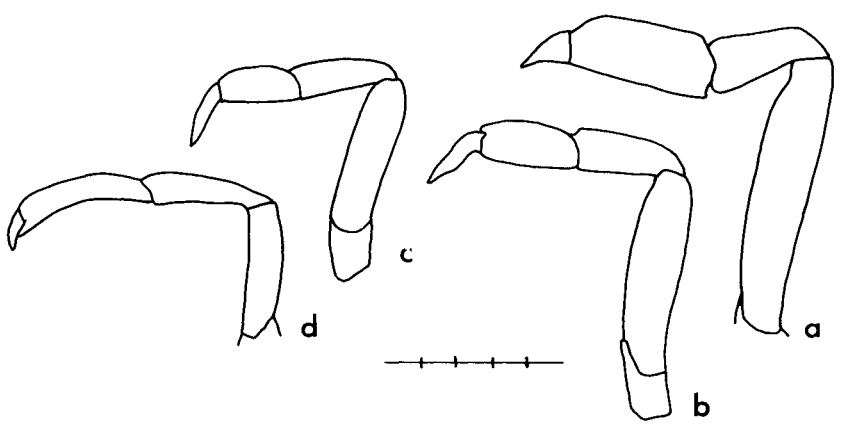

Fig. 45. *Upogebia bowerbankii* (WAM 54-75, male, 13 mm): *a-d*, pereopods 2-5.

Upogebia (Upogebia) carinicauda (Stimpson)

Gebia carinicauda Stimpson, 1860: 23 (type locality: Hong Kong). — Miers, 1884: 280.

Gebia barbata Strahl, 1861: 1062, figs 7-9.

Upogebia carinicauda. — De Man, 1928a: 22, 44, 60-65, pls 3, 4 figs 6-6n (includes complete synonymy).

DISTRIBUTION: Hong Kong through southeast Asia, Samoa and Solomon Islands and including Thursday Island in Torres Strait. See De Man (1928a) for details of localities.

REMARKS: The specimens recorded by Miers (1884) are from Thursday Island, north of Cape York, Australia, and De Man (1928a) confirmed their identification.

No material of this species exists in Australian museums but De Man's (1928a) description and figures are probably adequate to recognize the species. The fixed finger is shorter than the dactyl (subgenus *Upogebia);* the rostrum short, rounded anteriorly and bearing 4 spiniform teeth; the telson distinctly broader than long and bearing a sharp transverse carina anteriorly which is continuous with the lateral carinae. The absence of spinules on these carine distinguish *U. carinicauda* from many other Australian species.

Upogebia (Calliadne) darwinii (Miers)
Fig. 46

Gebiopsis darwinii Miers, 1884: 281-282, pl. 32 fig. A (type locality: Darwin, N.T.).

Gebiopsis intermedia D Man, 1888: 256, pl. 16 fig. 2.

Upogebia darwinii. — Hale, 1927: fig. 82. — De Man, 1928a: 24, 50, 84-86, pls 8,9, figs 12-12f (includes complete synonomy).

Upogebia darwini. — Ngoc-Ho, 1977: 439-464, figs. 1-13.

MATERIAL EXAMINED: 5 females, 5 males; cl. 5-8 mm.

Western Australia: Cockatoo Is. (WAM 32-75) 1 spec.

Northern Territory: Fannie Bay, Darwin (AM P.24663) 1 spec.

Queensland: Cape York, Somerset Beach (AM P.24812) 4 specs; (AM P.24808) 1 spec. — Thursday Is. (AM P.24809) 1 spec. — Prince of Wales Is. (AM P.24815) 2 specs.

DESCRIPTION: Rostrum trilobed; medial lobe as long as wide, depressed, with a subterminal and lateral spine on each side; lateral lobes about ⅛ as long as medial lobe and separated from it by a sharp V, with a subterminal dorsal spine and numerous small spines along the dorsolateral margin of the carapace. Dorsum with few spines laterally in gastric region, densely setose on medial lobe. Minute spine on anterolateral margin of carapace (right side only in (WAM 32-75)); no spines on cervical groove. Eyestalk more than half length of rostrum. Maxilliped 3 exopod longer than ischium; ischium with hook on mesial face; merus about as long as ischium and together about as long as last 3 articles. Pereopods 1 equal; double ventral setal row on ischium and merus; coxa with posterodistal hook; ischium with 1 ventral spine; merus with up to 10 short ventral spines and 1 strong distal dorsal spine; carpus with 1 ventral, 1 dorsal and 1 medial spine on distal margin, propod smooth dorsally and ventrally; fixed finger ⅔ length of dactyl, cutting edge irregularly serrate; dactyl scarcely curved, cutting edge irregularly serrate; ratio of dorsal lengths — merus: carpus: propod — 1:0.6:1. Pereopod 2 with dorsal spine on merus; pereopods 3-5 unarmed. Pleopod 1 (female) 2-articulate, second article shorter than first.

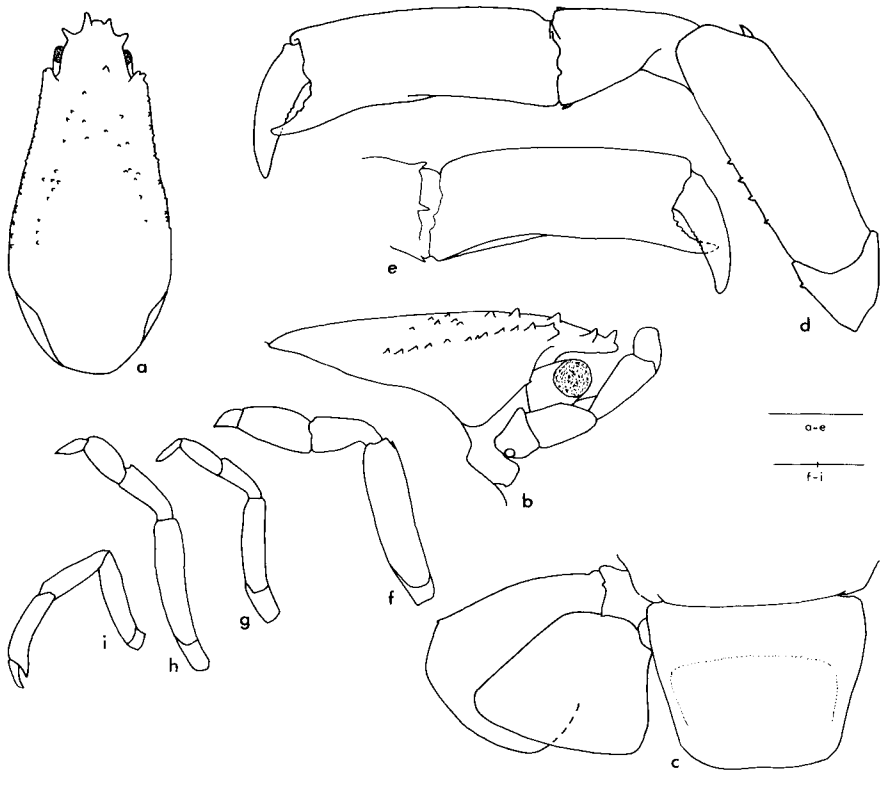

Fig. 46. *Upogebia darwinii* (WAM 32-75, female, 5.7 mm): *a, b,* dorsal and lateral views of anterior region; *c,* telson and uropod; *d,* pereopod 1 (lateral); *e,* pereopod 1 (medial view of terminal articles); *f-i,* pereopods 2-5.

Telson wider than long, lateral margins tapering, distal margin broadly curved but slightly concave medially; a strong dorsal transverse ridge ⅓ way along, passing into 2 submarginal longitudinal ridges. Uropod endopod with straight lateral margin, slightly convex distal margin; exopod lateral margin convex and ending with a small spine, distal margin strongly convex and continuous with medial margin.

DISTRIBUTION: Intertidal to shallow water, in coral cracks, sponges and sandy mud; Red Sea, southeast Asia, northern Australia. See De Man (1928a) for list of localities.

REMARKS: Until recently *Upogebia darwinii* was poorly described but Ngoc-Ho (1977) has given a good description of this rather variable species. The spination of the rostrum and relative lengths of the fingers on pereopod 1 is variable. *U. darwinii* is a small species similar to *U. carinicauda* from which it differs in spination of the rostrum. Ngoc-Ho (1977) discussed variation in this species particularly in the spines of the rostrum and cheliped.

We obtained types of this species from the British Museum (Natural History); three specimens from Darwin (number 82.7) and two syntypes from Singapore (number 82.24).

These could be confused with *U. hexaceras* but are distinguished by much smaller size (cl. about 5 mm), the very broad obtuse medial lobe of the rostrum bearing four blunt teeth and the obsolete lateral lobes of the rostrum. De Man's (1928a) figure of the rostrum of a specimen from the Mergui Archipelago is not consistent with the type specimens.

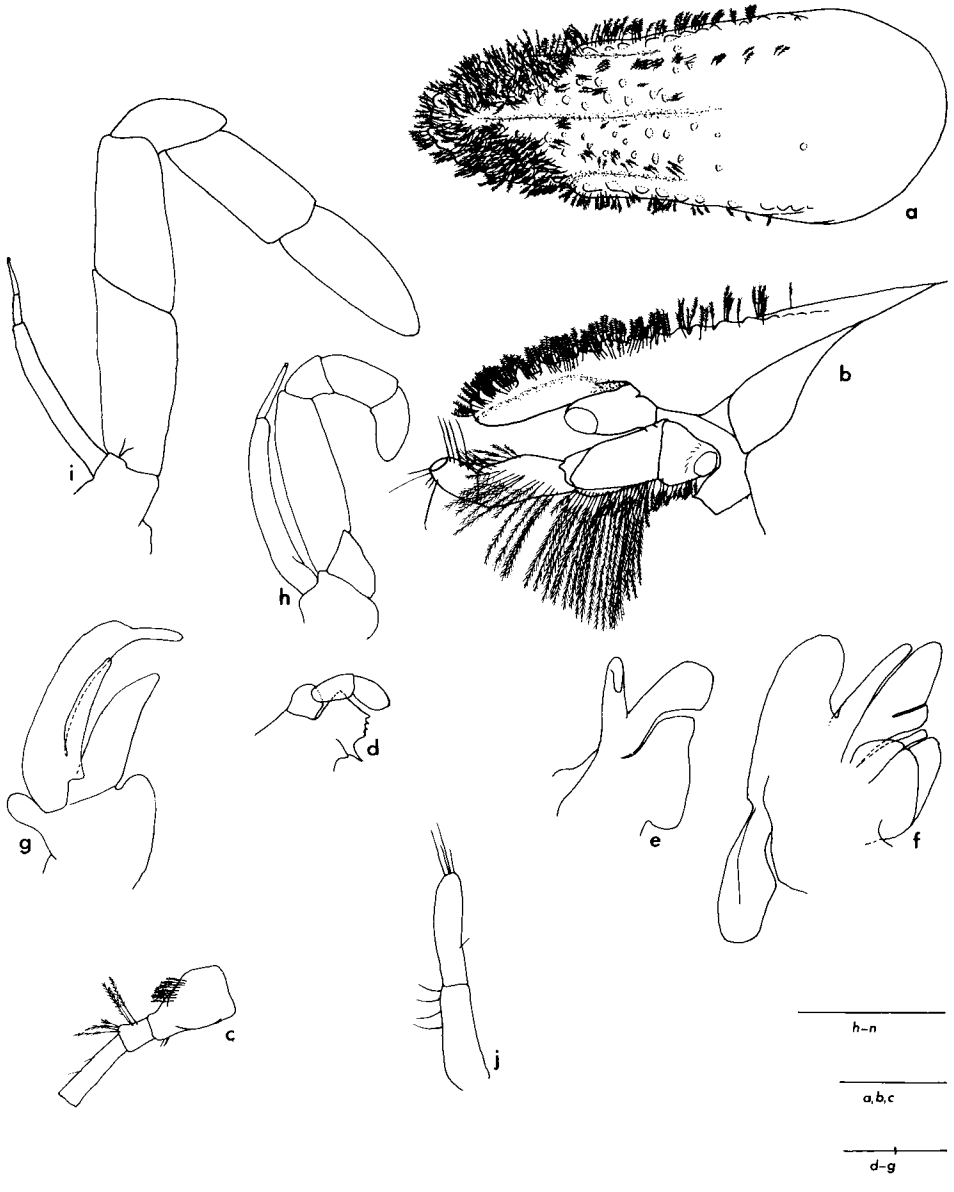

Fig. 47. *Upogebia dromana* (NMV J.304, female, 7.2 mm): *a, b,* dorsal and lateral views of anterior region; *c,* antenna 1; *d,* mandible; *e, f,* maxillae 1, 2; *g-i,* maxillipeds 1-3; *j,* pleopod 1.

Upogebia (Upogebia) dromana n. sp.
Figs 47, 48

MATERIAL EXAMINED: 33 specimens; cl. 5-9 mm.

HOLOTYPE: NMV J.304, female, cl. 7.2 mm.

TYPE LOCALITY: *Victoria:* 2 km W. of Fisherman Point, Mornington, Port Phillip Bay (PPBES stn 972); sandy silt sediment; 19 m; 11 October, 1971.

PARATYPES: *New South Wales:* Off Malabar, Shelf Benthic Survey stations: stn II (AM P.24680) 1 spec.; stn 35 (AM P.24691) 1 spec.

Victoria: Port Phillip Bay PPBES stn 906 (NMV J.305) 2 specs; stn 914 (NMV J.306) 2 specs; stn 938 (NMV J.307) 1 spec.; stn 969 (NMV J.308) 2 specs; (AM P.25269) 2 specs; stn 972 (NMV J.309) 2 specs; stn 977 (NMV J.310) 1 spec., (AM P.25270, 1) 3 specs; stn 982 (NMV J.311) 1 spec., (AM P.25272,3) 5 specs; stn 983 (NMV J.312) 2 specs, (AM P.25274,5) 2 specs. — Crib Point, Western Port, CPBS stn 31S (NMV J.313, J.314) 2 specs; CPBS stn 300 (NMV J.315) 2 specs.

Tasmania: 8 mi (12.8 km) off Burnie (TM G.1477) 1 spec.

DESCRIPTION: Rostrum not trilobed, depressed distally, as long as wide at base; 4-7 (usually 5 or 6) vertically directed stout spines on each side; sides often not symmetrical; a thick fur of setae on the dorsal surface of the rostrum except near the median groove; without ventral teeth. Dorsolateral margins of the carapace with 10-12 blunt teeth, largest anteriorly, separated from rostral teeth by a distinct but short hiatus. Dorsum tuberculate, posteriorly 2 rows of obsolete tubercles on each side separated by a median groove, more pronounced anteriorly on basal half of rostrum where rows coalesce. Spine on anterolateral border of carapace near eye present, though sometimes minute, but without spines on lateral portion of cervical groove. Eyestalk about half length of rostrum. Maxilliped 3 exopod longer than ischium; ischium with proximally directed hook on mesial face; merus shorter than ischium, together about as long as last 3 articles; dactyl 1.2 times as long as propod. Pereopods 1 equal, not sexually dimorphic; coxa with small distal spine, double ventral setal row on ischium and merus, merus with 4-9 irregularly spaced, perpendicular ventral spines; distal margin of carpus with minute dorsal spine, large mesiodorsal spine and smaller mesial spine; propod without spines; fixed finger 0.2 length of dactyl, minute accessory tooth; dactyl evenly curved, cutting edge irregular; ratio of dorsal lengths — merus: carpus: propod — 1:0.5:0.8. Pereopod 2 carpus with a small dorsal hook; pereopods 3-5 unarmed. Pleopod 1 (female) 2-articulate, second article longer. Pleopod 1(male) absent. Telson quadrate, length 0.8-0.85 width, with 2 strong curved, transverse ridges on proximal half and fine medial longitudinal groove posteriorly, sometimes crossing second ridge. Uropod endopod triangular with lateral and distal margins straight; exopod longer than endopod, distal margin convex.

Colour yellowish-orange with small widely-spaced red chromatophores.

DISTRIBUTION: Silty-sand to sandy sediments, 10-20 m; New South Wales shelf; Port Phillip Bay and Western Port, Victoria, and north coast of Tasmania.

REMARKS: *U. dromana* is most closely similar to *U. hirtifrons* from New Zealand from which it differs most especially in having two (rather than a single) transverse ridges on the telson. Other minor features shown only by *U. hirtifrons* are a dorsal spine on the ischium of pereopod 1, tubercles on the posterior margin of the cervical groove and more than one dorsal spine on the carpus of pereopod 2.

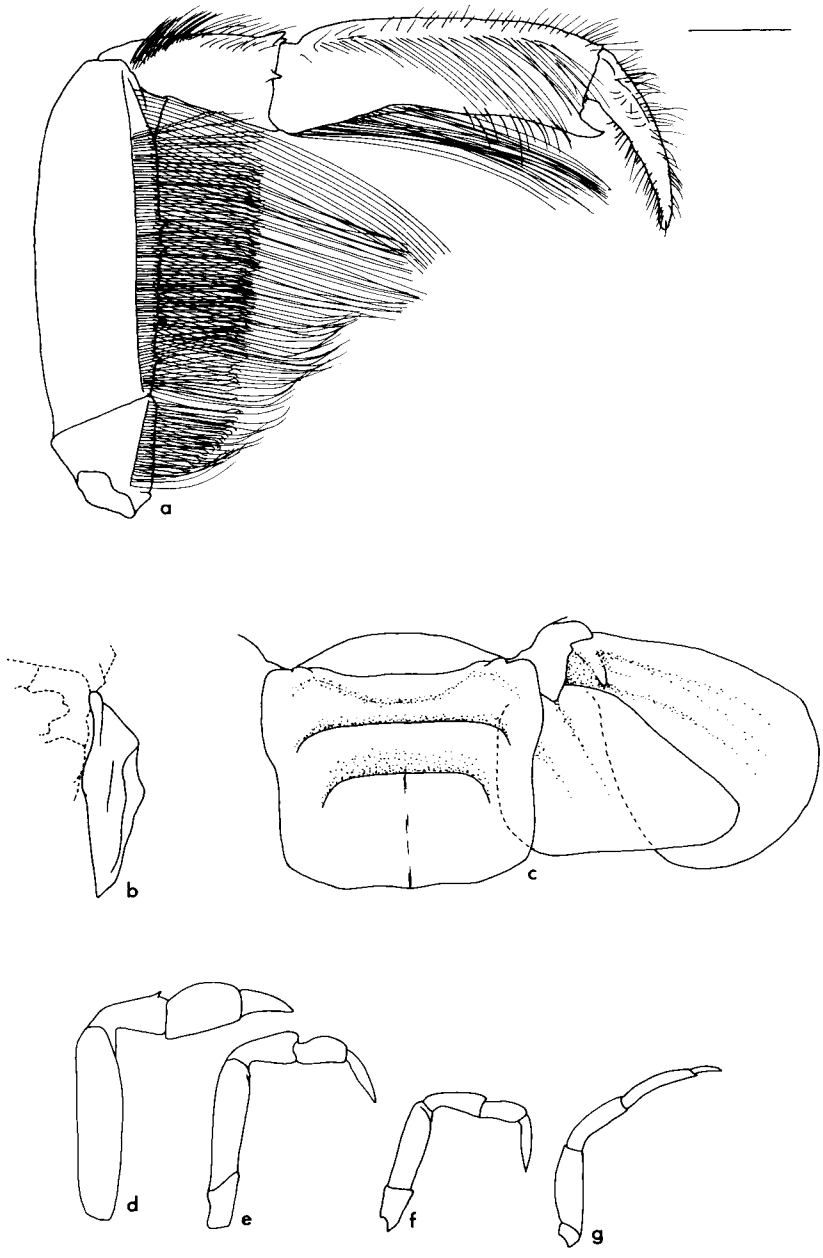

Fig. 48. *Upogebia dromana* (NMV J.304, female, 7.2 mm): *a*, *d-g*, pereopods 1-5; *b*, lateral view of telson; *c*, telson and uropod.

This species is described largely from quantitative benthic samples from the PPBES (Poore, 1975). Smith-McIntyre grab samples (0.1 m^2) indicate a density of up to 16 specimens per square metre.

Upogebia (Upogebia) giralia n. sp.
Fig. 49

MATERIAL EXAMINED: 3 males, 6 females; cl. 6-14 mm.

HOLOTYPE: WAM 123-75, male, cl. 14 mm.

TYPE LOCALITY: *Western Australia:* Learmonth, mangroves; coll: A. M. Douglas and G. F. Mees, 20 May 1960.

PARATYPES: *Western Australia:* Learmonth, collected with holotype (WAM 124-75) 1 spec.

Northern Territory: Tinganoo Creek, Melville Is. (AM P.24806) 6 specs. —Andranangoo Creek, Melville Is. (AM P.24807) 1 spec.

DESCRIPTION: Rostrum barely trilobed, lateral lobes scarcely distinct from medial lobe; medial lobe 0.6 times as long as wide, broadly rounded anteriorly, with 3-4 stout blunt marginal spines distally; dorsolateral margins of carapace with irregular row of blunt spines, terminal one (lateral lobe) separate from more posterior ones, and clearly separate from spines of medial lobe by a short hiatus. Dorsum domed and with a pair of short spines between ends of dorsolateral ridges, setae in two rows of dense tufts and around bases of anterior spines. No spines on anterolateral edge of carapace or on cervical groove. Eyestalk less than half length of rostrum. Maxilliped 3 exopod longer than ischium; ischium with a hook on mesial face, merus about as long as ischium and together about as long as last 3 articles. Pereopods 1 equal; double ventral setal row on ischium and merus; ischium with 1 ventral spine; merus with 2-3 (none in small specimen) ventral and 1 distal dorsal spine; carpus with 2 distal dorsal spines and 1 distal medial spine; propod serrate dorsally, proximally denticulate ventrally, with a strong medial spine at the base of the fixed finger and another laterally in the gape; fixed finger 0.4-0.6 length of dactyl, stout, cutting edge irregularly serrate; dactyl evenly curved, cutting edge irregularly dentate, with a medial row of tubercles; ratio of dorsal lengths — merus: carpus: propod — 1:0.6:1. Pereopod 2 merus with a dorsal spine; pereopods 3-5 unarmed. Pleopod 1 (female) 2-articulate, second article shorter than first. Pleopod 1 (male) absent. Telson wider than long, widest at about ¼ length and tapering, posterior margin concave, dorsally smooth. Uropod endopod strongly expanded distally, shorter than telson, lateral margin straight, distal and medial margins convex and continuous; exopod longer than endopod, lateral margin slightly convex, distal margin strongly convex.

DISTRIBUTION: Intertidal in mangroves; north and western Australia.

REMARKS: *U. giralia* is one of only two species of this genus known from Australia in which the lateral lobes of the rostrum are obsolete. The other is *U. dromana* from southeastern states which differs in having a more tapered rostrum, transverse carinae on the telson and in a number of other features. The form of the rostrum of *U. giralia* is similar to that of *U. osiridis* Nobili from the Red Sea (De Man, 1927) but they differ in detail and in the dentition of pereopod 1. *U. giralia* is most clearly recognized and distinguished from other species of the genus by the concentration of setae into dense tufts on the dorsum of the carapace and along the margin of the rostrum.

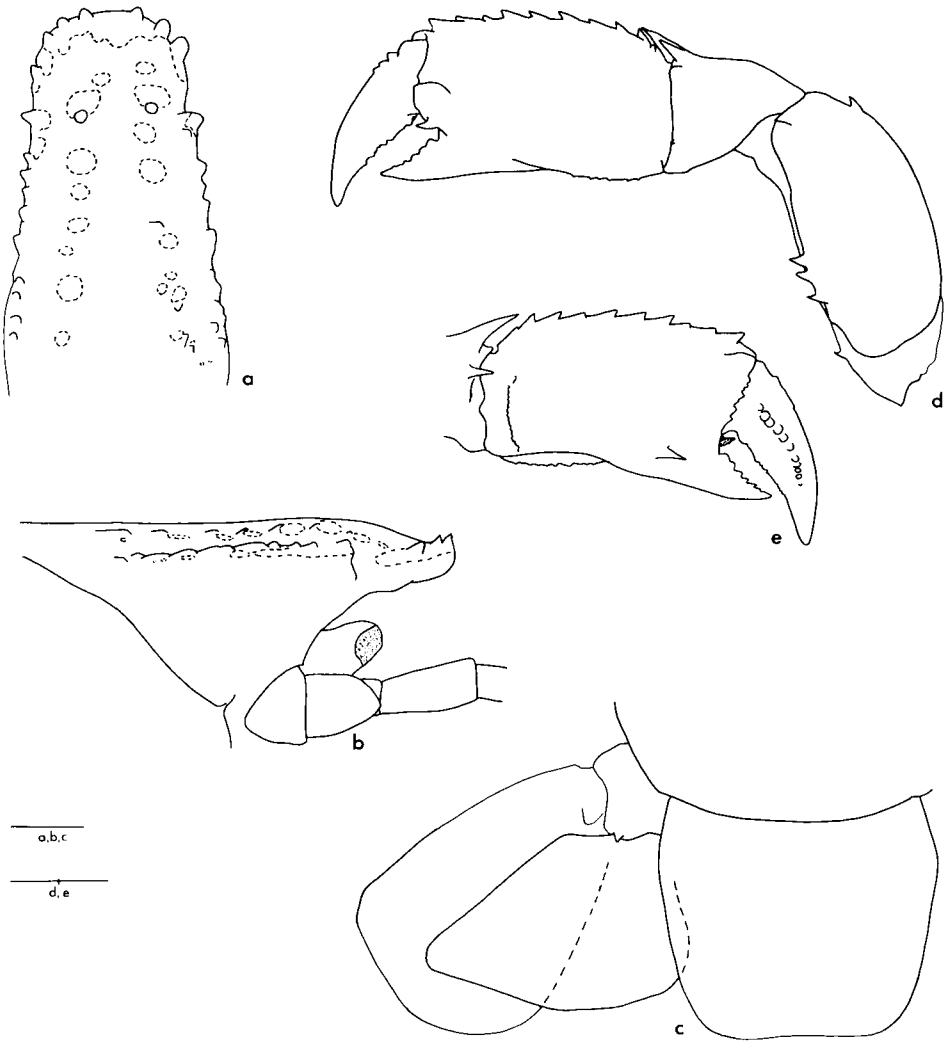

Fig. 49. *Upogebia giralia* (WAM 123-75, male, 14 mm): *a, b,* dorsal and lateral views of anterior region (dashed areas denote limits of dorsal tufts of setae); *c,* telson and uropod; *d,* pereopod 1 (lateral); *e,* terminal articles of pereopod 1 (medial).

Upogebia (Calliadne) hexaceras (Ortmann)
Fig. 50

Gebia (Gebiopsis) hexaceras Ortmann, 1894: 23, pl. 3 fig. 1 (type locality: Thursday Island, Queensland).

Upogebia (Calliadne) hexaceras. — Nobili, 1906: 60. — De Man 1928a: 24, 49, 81-84, pl. 7 figs 11-11f.

MATERIAL EXAMINED: 7 males, 6 females; cl. 8-15 mm.

Northern Territory: Darwin (AM P.6823) 2 specs.

Queensland: Gulf of Carpentaria, CSIRO Prawn Survey (AM P.24681) 1 spec.

Western Australia: 4.8-7.2 km E. of Pilambri Is., Dampier Archipelago (WAM 121-75) 1 spec. — between Gridley and Rosemary Is., Dampier Archipelago (WAM 156-65) 1 spec. — Exmouth Gulf (WAM 28-75) 1 spec. — Cottesloe (WAM 10573) 1 spec. — Bunbury (AM P.24685) 2 specs. — locality unknown (WAM 65-75) 2 specs. — locality unknown (WAM 87-53) 2 specs.

DESCRIPTION: Rostrum trilobed, hiatus a broad V, lateral lobes ¼ length of medial lobe, reaching forward less than halfway to most posterior of tubercles of the medial lobe; total length ⅔ of width at base; surface of medial lobe weakly tuberculate except along grooved midline, lateral edge of medial lobe with 2 or 3 tubercles; lateral lobes with tubercles on edge extending back almost to cervical groove, tubercles getting smaller posteriorly; a dense fur of setae covering medial lobe, scattered setae along edges of lateral lobes; without ventral teeth. No spine on anterolateral border of carapace; posterior border of cervical groove smooth. Eyestalk about 0.6 length of rostrum. Maxilliped 3 exopod reaching forward to midway along merus of endopod; ischium without hook, ischium and merus together about as long as last 3 articles; dactyl almost as long as propod. Pereopods 1 equal, not sexually dimorphic; double ventral setal row on merus; single ventral row of setae on propod; ischium with 1-2 ventral denticles on larger specimens; merus with denticles along entire length of ventral mesial edge, otherwise smooth or rarely with obsolete dorsal spine; distal edge of carpus with 4-5 short mesial denticles and several short dorsal spines; propod with few small denticles ventrally, mesial surface with 2-3 small denticles and lateral surface with 1-2 denticles near base of fixed finger. Fixed finger and dactyl subequal; fixed finger cutting edge finely toothed especially proximally; dactyl strongly curved, cutting edge with strong tooth proximally, dorsal surface with obsolete proximal tubercles; ratio of dorsal lengths — merus: carpus: propod — 1:0.2:1. Pereopods 2-5 unarmed. Pleopod 1 (female) 2-articulate, articles subequal. Pleopod 1 (male) absent. Posterior edge of sixth abdominal segment denticulate. Telson subquadrate, 1.3 times as wide as long, lateral edges straight, slightly tapering, distal edge convex but weakly concave at midline, surface with a weakly spinulous, transverse ridge close to base, spinulous domes posterior to this, longitudinal ridge near each lateral edge. Uropod endopod shorter than telson, lateral edge weakly convex, minutely denticulate, distal edge straight, surface with single longitudinal ridge; exopod little longer than endopod, distal edge weakly convex, minutely denticulate, surface with 2 longitudinal ridges.

DISTRIBUTION: Intertidal — 20 m, associated with sponges; north Queensland, Northern Territory, Western Australia; Persian Gulf (Nobili, 1906), Salawati Is., Indonesia (De Man, 1928a).

REMARKS: The two specimens from north of Australia described by De Man (1928a) have 3 spines on each side of the medial lobe of the rostrum. In our collection specimens

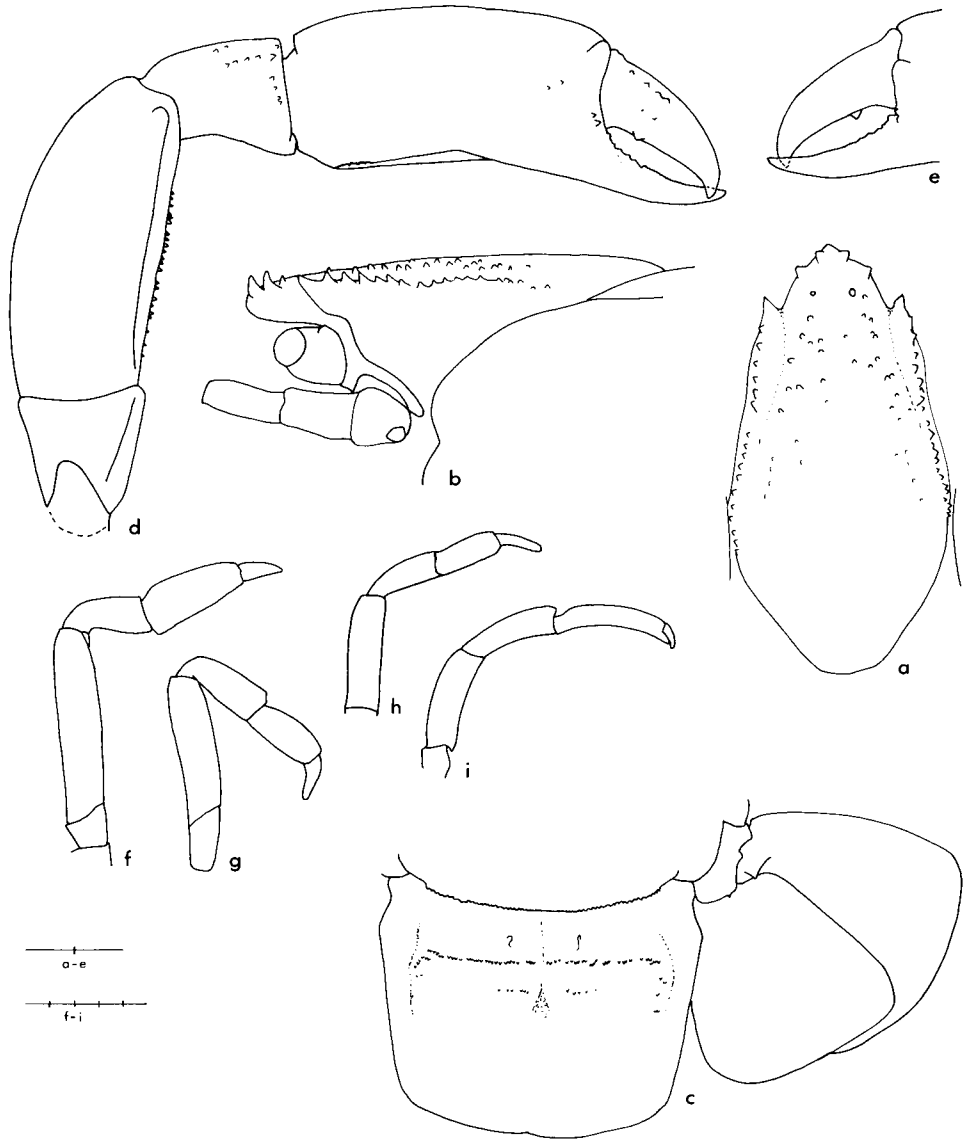

Fig. 50. *Upogebia hexaceras* (WAM 10573, female, 14 mm): *a, b,* dorsal and lateral views of anterior; *c,* telson and uropod; *d,* pereopod 1; *e,* chela (lateral); *f-i,* pereopods 2-5.

with 2 spines were equally common. De Man (1928a) did not note the small medial tubercles on the distal margin of the propod of pereopod 1, consistent in our material. *U. hexaceras* is distinguished from similar Australian species with short lateral lobes by the prominent tubercles on the triangular medial rostrum lobe and the spination of pereopod 1.

Upogebia (Upogebia) neglecta De Man
Fig. 51

Upogebia neglecta De Man, 1927: 34-36, fig. 13 (type locality: Port Stephens, N.S.W.); 1928a: 23, 42.

MATERIAL EXAMINED: 1 female; cl. 15 mm.

New South Wales: Port Stephens (AM P.1545 holotype) 1 spec.

DESCRIPTION: Rostrum trilobed, lateral lobes slender, 0.3 length of medial lobe, hiatus between lobes a narrow V, total length 1.4 times width at base; medial lobe tuberculate except anteriorly along shallow medial groove; lateral lobes with closely spaced tubercles along lateral edge; surfaces very sparsely setose; without ventral teeth. A spine on anterolateral border of carapace near eye. Posterior border of cervical groove tuberculate towards dorsal surface. Eyestalk about half length of rostrum. Maxilliped 3 exopod reaching halfway along merus; ischium with a proximally-directed hook on mesial face and medial row of short tubercles; merus as long as ischium, merus and ischium together about as long as last 3 articles; dactyl 1.2 times as long as propod. Pereopods 1 equal, double ventral setal row on ischium and merus; ischium with 3 ventral spines; merus with 4-6 irregularly-spaced, ventral spines and a subdistal dorsal spine; distal margin of carpus with a strong, curved ventral spine, a slightly shorter dorsal spine and 2 smaller subdorsal lateral spines; propod with ventral denticles proximally, a subdistal dorsal spine, 2 mesial distal spines and 1 lateral distal spine; fixed finger 0.2 length of dactyl, with minute teeth proximally on cutting edge; dactyl slender, dorsally denticulate, with a lateral ridge, cutting edge weakly denticulate; ratio of dorsal lengths — merus: carpus: propod — 1:0.5:0.9. Pereopods 2, 3 with spines on merus and carpus; pereopods 4, 5 unarmed. Pleopod 1 (female) 2-articulate, second article longer. Telson quadrate, length 0.8 width, surface smooth. Uropod endopod with single longitudinal ridge, lateral and distal margins straight; exopod with double ridge, longer than endopod, distal edge evenly convex; distal edges of endopod and exopod minutely denticulate.

DISTRIBUTION: New South Wales.

REMARKS: This specimen, the only one known of the species, was extensively described by De Man (1927). The species is similar to *U. simsoni,* whose distribution includes the only known locality of *U. neglecta,* in having prominent lateral lobes on the rostrum. They also share a mesial row of teeth, less pronounced in this species, on the ischium of maxilliped 3, (see comments under *U. simsoni*). The two species can be distinguished by the spination of the pereopod 1, and shape of the telson and rostrum.

Upogebia (Upogebia) simsoni (Thomson)
Fig. 52

Gebia simsoni Thomson, 1893: 49-50, pl. 1 figs 3-5 (type locality: Tasmania).

Upogebia simsoni. — Fulton & Grant, 1902: 61-64, pl. 5 figs 5, 6 — Hale, 1927: 85. — De Man, 1927: 24-25; 1928a: 23, 40.

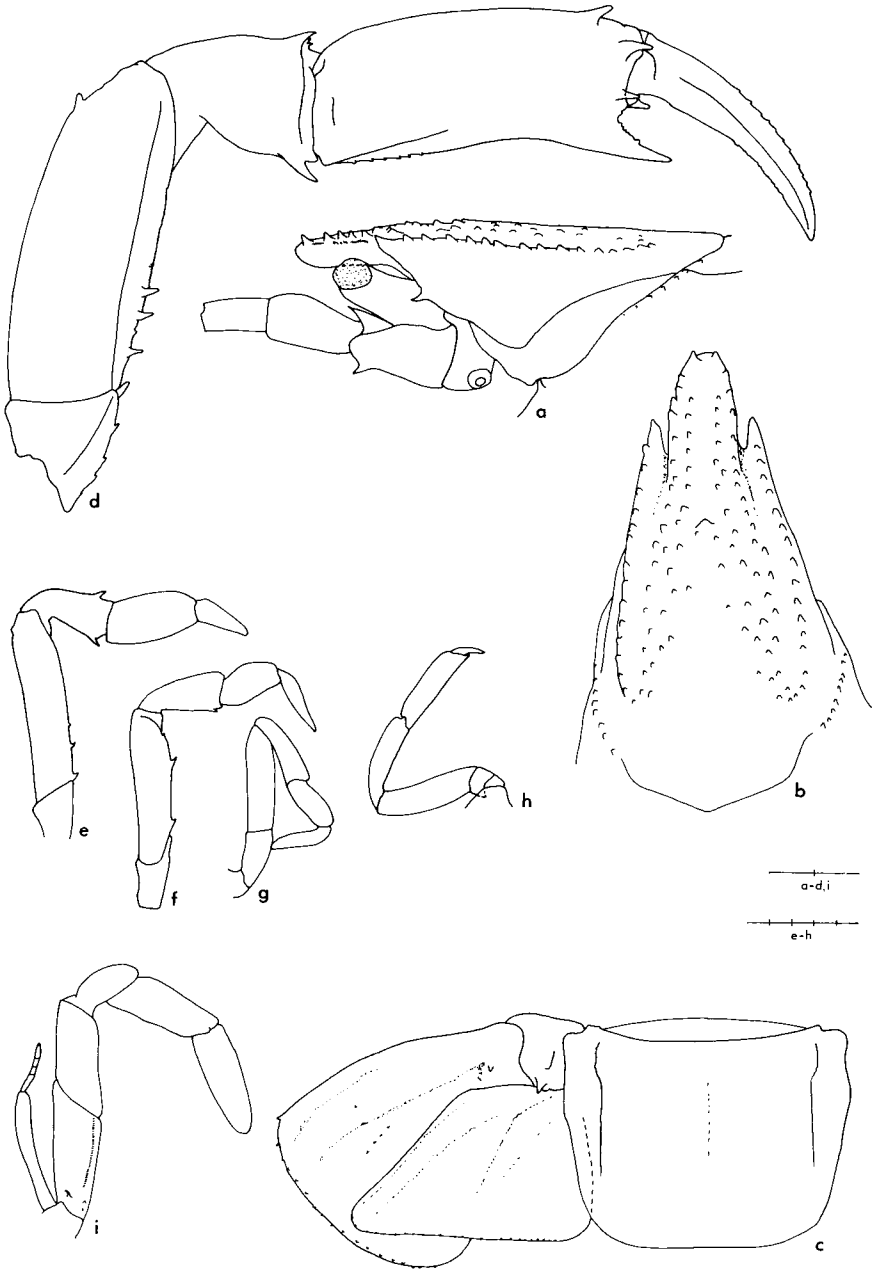

Fig. 51. *Upogebia neglecta* (AM P.1545, female, 16 mm): *a, b,* dorsal and lateral views of anterior region; *c,* telson and uropod; *d-h,* pereopods 1-5; *i,* maxilliped 3.

MATERIAL EXAMINED: 47 specs; cl. 11-40 mm.

Northern Territory: Port Darwin (AM P.9478) 1 spec.

Queensland: Northwest Island, Capricorn Group (NMV) 1 spec.; (AM P.8678) 1 spec.

New South Wales: Long Reef, Collaroy (AM P.7473) 1 spec. — Port Jackson (AM P.1407) 2 specs. — Bottle and Glass Rocks, Port Jackson (AM P.9417) 1 spec.; (AM P.8696) 1 spec. — Kurnell, Botany Bay (AM P.9055) 11 specs; (AM P.8943) 14 specs. — Shellharbour (AM P.9361) 1 spec.; (AM P.7901) 2 specs.

Victoria: Flinders (NMV) 1 spec.; (NMV, Kane colln) 1 spec.

Tasmania: No locality (AM P.5970) 2 specs. — Fisher Is., Furneaux Group (TM G.1638) 1 spec. — Margate (T. M. Walker colln) 1 spec.

South Australia: Kangaroo Island (AM P.150) 2 specs. — Kingscote, Kangaroo Island (AM P.4825) 2 specs; (AM P.4842) 1 spec.

DESCRIPTION: Rostrum strongly trilobed, lateral lobes reaching to midpoint of medial lobe, hiatus between lobes a broad U, all 3 lobes weakly upcurved apically, total length equal to width at base; up to 10 vertically directed stout spines along each side of medial lobe and up to 14 on lateral edge of lateral lobes, spines on rostrum continuing back to near cervical groove; a few stout setae on dorsal surface of the rostrum scattered among spines and arising in rows below lateral teeth; ventral teeth absent. Without a spine on anterolateral border of carapace; posterior border of cervical groove weakly tuberculate. Eyestalks narrow, about half length of rostrum. Maxilliped 3 exopod reaching to midway along merus of endopod; ischium of endopod with mesial row of slender spines on inner surface; merus almost as long as ischium, its medial edge with strong spines along central ⅔; ischium and merus together about as long as last 3 articles; dactyl almost as long as propod. Pereopods 1 equal, not sexually dimorphic, single sparse setal row on ischium and merus; ischium with 2-3 ventral spines; merus with 2-4 ventral spines proximally, a distal dorsal spine and lateroventral tuberculate ridge; distal margin of carpus with strong ventral spine and 2 mesiodorsal spines; propod with 3-7 spines ventrally near base of fixed finger and a small dorsal spine close to distal edge; fixed finger 0.2 length of dactyl, cutting edge serrate proximally; dactyl tapering, dorsally serrate; ratio of dorsal lengths — merus: carpus: propod — 1:0.6:1.2. Pereopods 2, 3 with small ventral denticles on the merus; pereopods 4, 5 unarmed. Pleopod 1 (female) 2-articulate, articles subequal in length. Pleopod 1 (male) absent. Telson subquadrate, proximal half of equal width throughout, distal half narrowing somewhat, length about 0.8 width, surface smooth, distal edge weakly concave. Uropod endopod with single longitudinal ridge, lateral edge straight, distal edge weakly convex, minutely spinose; exopod with double ridge, longer than endopod, distal edge convex, minutely spinose.

DISTRIBUTION: Intertidal to high subtidal; Northern Territory, eastern Australian coast, Tasmania, through to eastern South Australia.

REMARKS: Thomson's original description was extremely brief mentioning only the general features of the rostrum, antennae and first pereopods. Fulton & Grant (1902) extensively redescribed the species on the basis of material from Western Port with which our specimens agree well.

This species is notable among *Upogebia* in having a mesial row of teeth on the ischium of maxilliped 3. This feature is generally present in species of *Callianassa* and axiids, being replaced in *Upogebia* most commonly by a single proximal hook. The absence of this

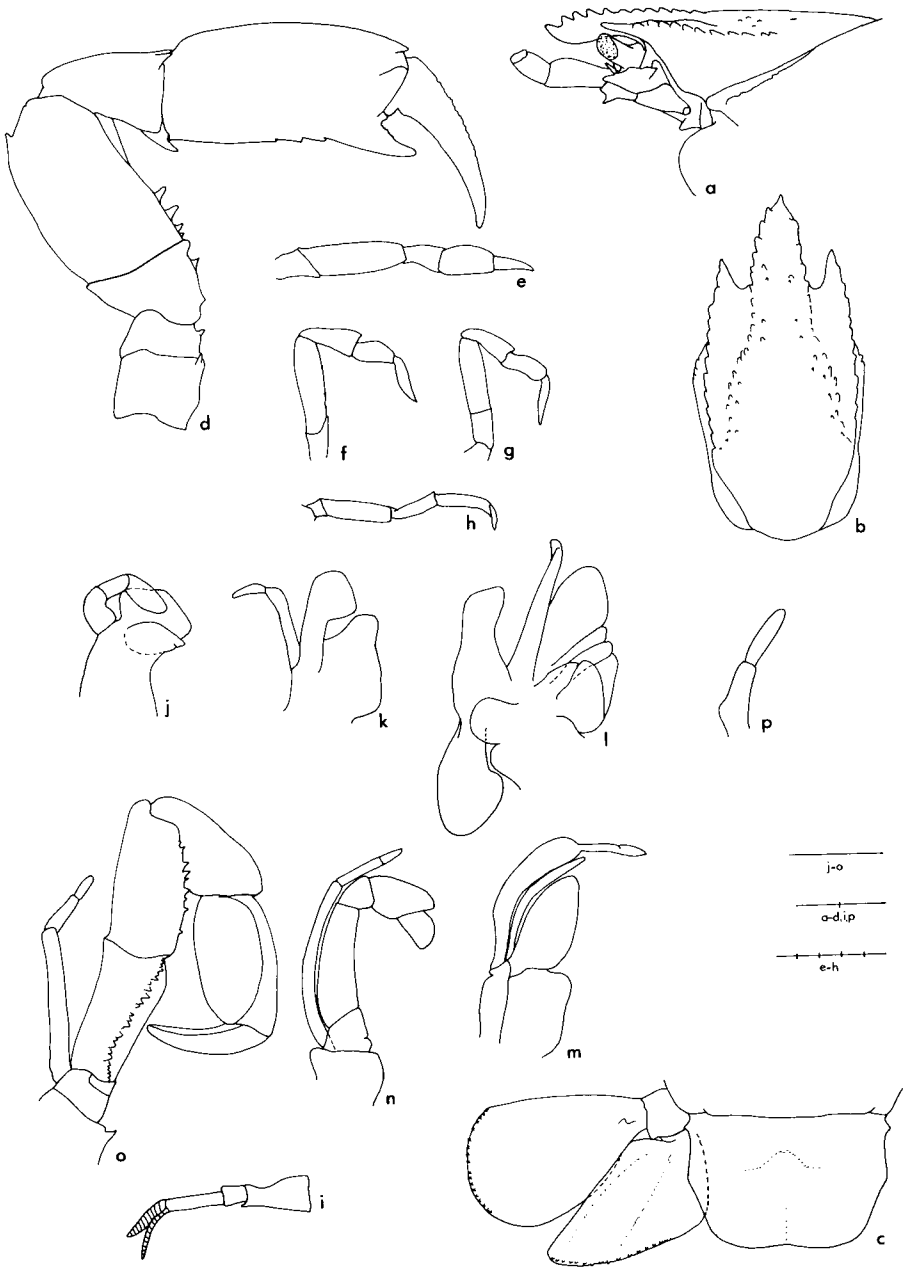

Fig. 52. *Upogebia simsoni* (AM P.8943, female, 11 mm): *a*, *b*, dorsal and lateral views of anterior region; *c*, telson and uropod; *d-h*, pereopods 1-5; *i*, antenna 1; *j*, mandible; *k*, *l*, maxillae 1, 2; *m-o*, maxillipeds 1-3. (AM P.8943, female, 13 mm): *p*, pleopod 1.

toothed ridge, the *crista dentata*, was used by de Saint Laurent (1973) in the diagnosis of the family Upogebiidae but we cannot remove *U. simsoni* from the family on the basis of this character alone.

Upogebia (Upogebia) spinifrons (Haswell)
Figs 53, 54

Gebia spinifrons Haswell, 1881: 762 (type locality: Port Stephens, N.S.W.); 1882: 165, pl. 3 fig. 5.

Upogebia spinifrons. — De Man, 1927: 53-56, pl. 6 fig. 20; 1928a: 23, 46.

MATERIAL EXAMINED: 25 specs; cl. 9-25 mm.

Queensland: Gulf of Carpentaria, CSIRO Prawn Survey stn 29 (AM P.24682) 1 specs.; stn 558 (AMP.24683) 2 spec; stn 13 (AMP.24684) 1 specs. — Mud Island, Moreton Bay (QM W.1218) 2 specs; (QM W.1234) 1 spec.; (QM W.1435) 3 specs. — Moreton Bay (QM W.1071) 1 spec.; (QM W.2585) 1 spec.; (QM W.2765) 1 spec. — ½ mi SE. of Southwest Rocks, Moreton Bay (QM W.3968) 1 spec.; (QM W.3969) 1 spec. — Macleay Is., Moreton Bay (QM W.2892) 1 spec.

New South Wales: Port Stephens (AM P.261) 2 specs; (AM P.1544) 1 spec. — Hawkesbury River, near Brooklyn (AM P.12943) 1 spec. — Port Jackson (AM P.11448) 1 spec. — Potts Point, Port Jackson (QM W.1535) 4 specs.

DESCRIPTION: Rostrum strongly trilobed, lateral lobes reaching to midpoint of medial lobe, hiatus a narrow U, as long as width at base, dorsally with a few marginal tubercles on medial lobe, ventral surface of medial lobe with 4 strong slender spines, ventral surface of lateral lobes each with 1 spine and a terminal spine; a thick fur of setae on dorsal surface of the rostrum except posteriorly. Anterolateral border of carapace with 5 strong spines, 3 above and 2 below antenna 2, 1-2 spines laterally behind eye and 2-3 spines and 3-4 spinules on posterior border of cervical groove. Eyestalks about half length of rostrum. Maxilliped 3 exopod hardly surpassing ischium; ischium with 3 hooks proximally on mesial face and row of short spines medially; merus little shorter than ischium, merus and ischium together about as long as last 3 articles; dactyl slightly longer than propod. Pereopods 1 equal, not sexually dimorphic; coxa with small distal hook; double ventral setal row on ischium and carpus, single row on proximal half of propod; ischium with 4 strong ventral spines; merus with about 8 regularly spaced, strong, ventral spines and one dorsal spine distally; distal margin of carpus with strong, hooked ventral spine, 6-8 large mesiodorsal spines and a large mesial spine; propod with up to 10 strong dorsal spines and 1-2 mesial spines and 1 lateral spine on distal edge; fixed finger 0.1-0.5 length of dactyl, smooth or with accessory lateral tooth; dactyl with proximal tooth on cutting edge, dorsally denticulate proximally; ratio of dorsal lengths — merus: carpus: propod — 1:0.4:0.8. Pereopod 2 with strong hooks on coxa, merus and carpus; pereopod 3 with hooks on merus; pereopods 4, 5 not armed. Pleopod 1 (female) 2-articulate, articles equal in length. Pleopod 1 (male) absent. Telson quadrate, length 0.7 width, with longitudinal groove in midline. Uropod endopod with single longitudinal ridge, lateral and distal edges almost straight, lateral edge with small lobe near base; exopod longer than endopod with double ridge, distal edge convex.

DISTRIBUTION: 12-25 m; northern Queensland to central New South Wales.

REMARKS: The extremely spinous rostrum, carapace, antennae and chelipeds distinguish this species from others of the genus in Australia. It has been well described and illustrated by De Man.

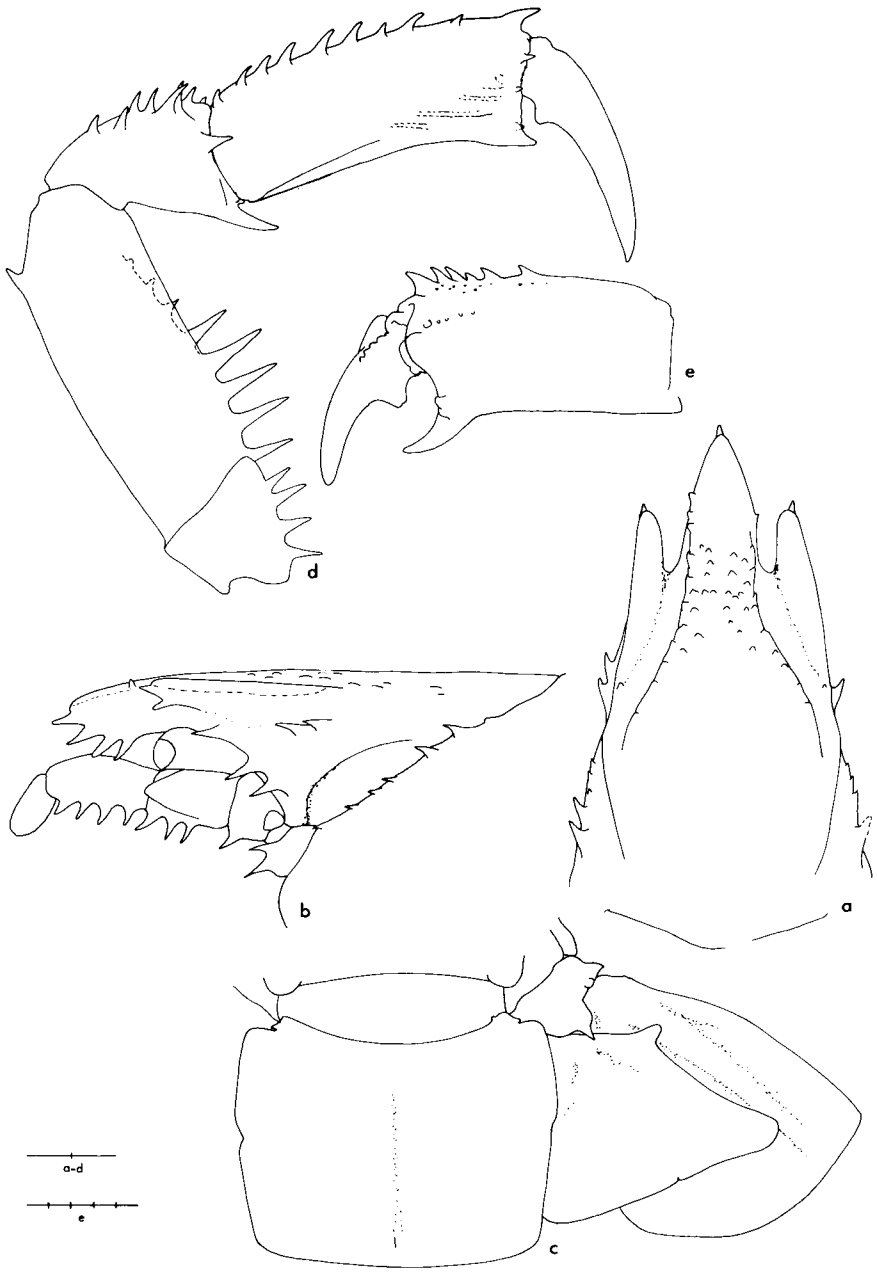

Fig. 53. *Upogebia spinifrons* (AM P.12943, female, 19 mm): *a, b,* dorsal and lateral views of anterior region; *c,* telson and uropod; *d,* pereopod 1. (QM W.1435, female, 24 mm): *e,* propod and dactyl of pereopod 1 (lateral).

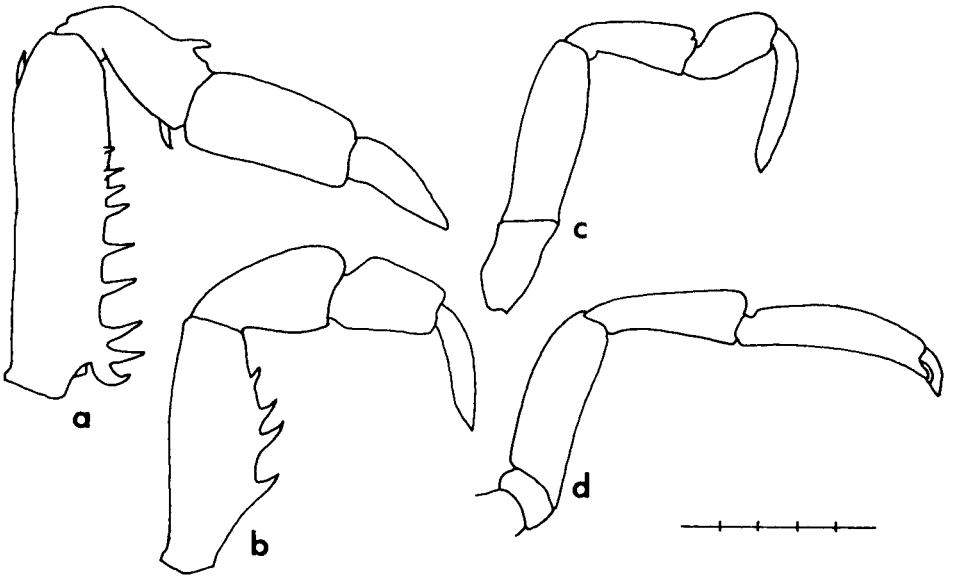

Fig. 54. *Upogebia spinifrons* (AM P.12943, female, 19 mm): *a-d,* pereopods 2-5.

Upogebia (Calliadne) tractabilis Hale
Fig. 55

Upogebia (Calliadne) tractabilis Hale, 1941: 276-277, fig. 11 (type locality: St Vincent Gulf, S.A.).

MATERIAL EXAMINED: 9 males, 12 females; cl. 3-8 mm.

South Australia: St Vincent Gulf, 57 m (SAM C887 paratypes) 7 specs. — Spencer Gulf (AM P.25289) 2 specs.

Western Australia: Cottesloe (WAM 9992) 1 spec.; (WAM 10639) 2 specs. — NW. of W. end of Rottnest Island, 67 m (WAM 53-75) 3 specs. — Bunbury (AM P.24686) 6 specs.

DESCRIPTION: Rostrum trilobed; medial lobe 3 times as broad as long, bluntly rounded and depressed anteriorly, with 5-7 small submarginal spines on anterior 2/3 of each side, usually vertical but most distal pairs sometimes projecting forwards; lateral lobe about 0.2 length of medial lobe and separated from it by a very shallow smooth U, with a small terminal, somewhat laterally-directed tooth and 4-5 widely spaced small spines along dorsolateral margins of carapace. Dorsum with sparse minute spines anteriorly except along midline; sparsely setose dorsally but dense along ventral edge of medial lobe of rostrum. No spine on anterolateral edge of carapace or on cervical groove. Eyestalk 1.3 times as long as rostrum and clearly visible from dorsal view. Maxilliped 3 exopod longer than ischium; ischium with hook on mesial face; merus about as long as ischium, together about as long as last 3 articles. Pereopods 1 equal, not sexually dimorphic; double ventral setal row on ischium and merus; merus with 5-8 ventral spines; carpus with distal ventral spines; propod with 2 ventral spines proximally and sometimes 1 dorsally; fixed finger

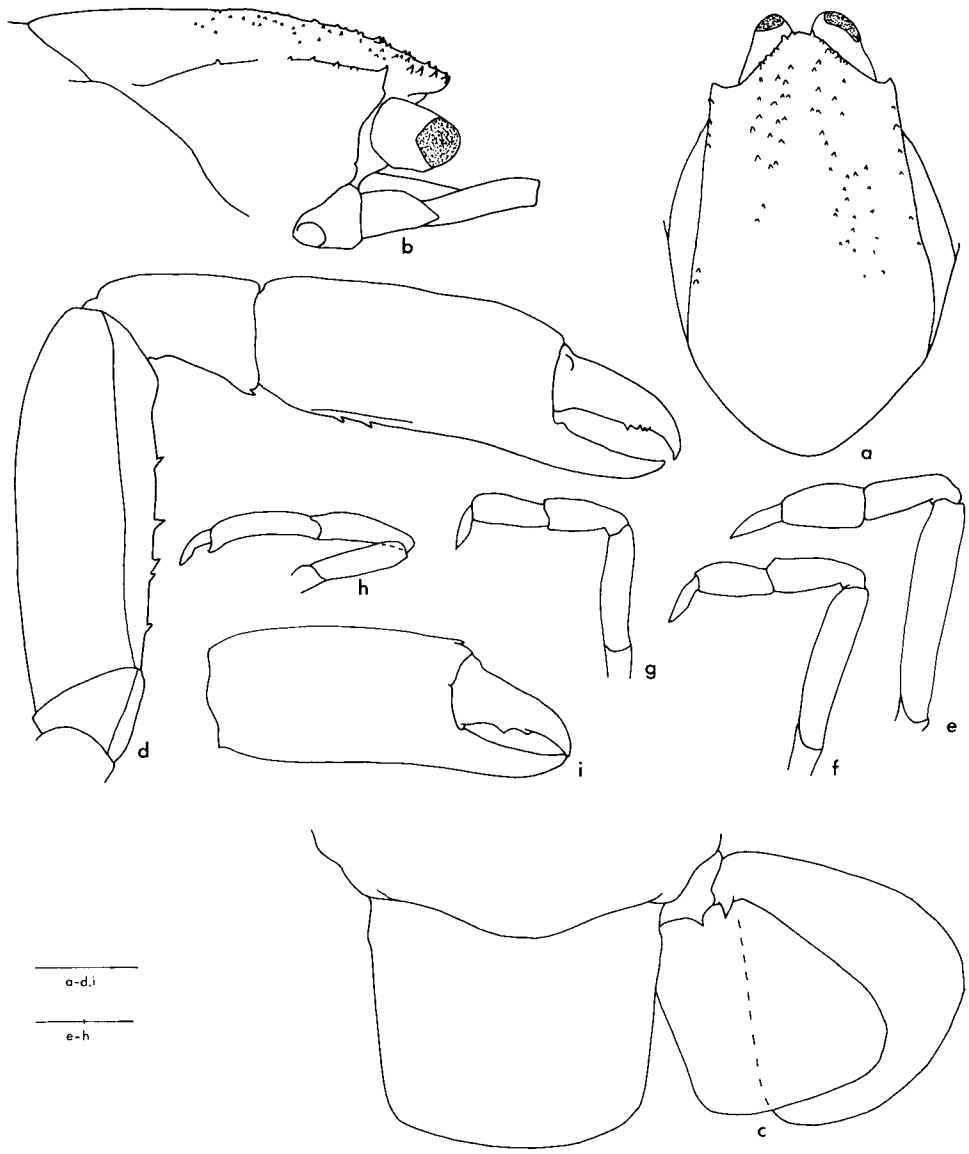

Fig. 55. *Upogebia tractabilis* (SAM C.887, female, 7 mm): *a, b,* dorsal and lateral views of anterior region; *c,* telson and uropod; *d-h,* pereopods 1-5. (SAM C.887, male, 6 mm): *i,* chela.

curved; dactyl little longer than fixed finger, strongly curved distally, cutting edge usually with 2 proximal teeth but teeth variable in number (up to 5) and position; ratio of dorsal lengths — merus: carpus: propod — 1:0.4:0.8. Pereopods 2-5 unarmed. Pleopod 1 (female) 2-articulate, second article shorter. Pleopod 1 (male) absent. Telson wider than long, lateral margins straight, slightly tapering, posterior margin weakly convex, dorsally smooth. Uropod endopod barely expanded distally, margins almost straight but corners broadly rounded; exopod with continuous, convex lateral and distal margins.

DISTRIBUTION: Often associated with sponges, down to 75 m; St Vincent Gulf (S.A.) to Rottnest Island (W.A.).

REMARKS: This species was adequately figured by Hale but we show here some of the variability of the chela and figure the tail fan for the first time. The species is most clearly recognized by its small size and very short rostrum with only minute spines. It is probably most easily confused with *U. australiensis* from which it differs in the absence of spines around the gape of the chela and the more rounded rostrum.

DISCUSSION

When these studies began a mere 20 species belonging to seven genera were known to occur in Australia. Two new species were described by Poore (1975) and the present report adds three genera new to Australia and a further 18 species of which 12 are new species and six are species previously unknown from Australia. In addition, one species, *Callianidea leura* n. sp., adds a new family to the fauna (table 1). A study of an essentially littoral or shelf decapod crustacean group which doubles the number of known species must be considered unusual. Recent studies of deep-water decapods off Australian coasts have increased the known fauna by a similar order of magnitude.

While extending our knowledge of the fauna the material available to us still leaves a large number of species poorly known. Only 25 of the 40 species are known from more than three localities; material of *Upogebia carinicauda* (Stimpson) from Thursday Island does not exist in Australia and a number of other species are known from only one or two specimens. Collections in the Australian Museum, Western Australian Museum and by the Ministry for Conservation, Victoria, have contributed significantly to the increase of knowledge of the thalassinidean fauna: they contain representatives of all but three of the 20 new species and new records.

Zoogeographic analysis of the Australian thalassinidean fauna is constrained by the paucity of knowledge concerning 15 species. The following discussion draws principally on the 25 better known species.

The fauna appears to be partitioned into five groups (fig. 56): a northern group extending south along the east coast (comprising three species), a northern group extending south along the west coast (five species), a southern group extending eastwards (six species including *Upogebia australiensis* with a disjunct distribution), and an eastern group (mainly southern) (10 species); in addition, 1 species —*Thalassina squamifera* — has a northern distribution extending southwards along both the east and west coasts.

Considering the total fauna the species must be considered rather localized in their distributions, 30 species being confined to either the northeast, southeast, southwest, northwest or north (Torres Strait and the Gulf of Carpentaria). Considering these regional faunas, that occurring in southeastern Australia appears particularly restricted, 11 of the 15 species occurring there being unknown elsewhere; this compares with the northeastern area with only five of the 14 species being so restricted and the southwestern area with four of the 11 being restricted. Again only four species of the Australian total have a wide

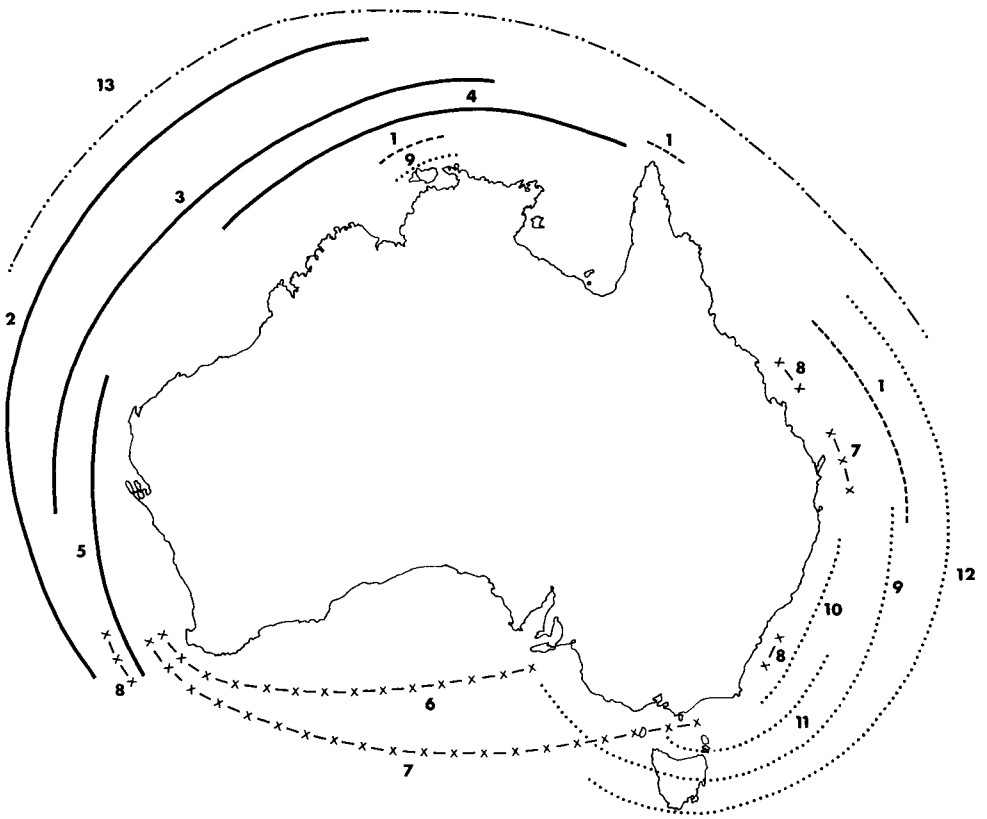

Fig. 56. Distribution patterns of selected Thalassinidea in Australia.
A NORTHERN group extending south along the EAST coast (— — — —)
1. *Callianassa haswelli; C.mucronata; Axius glyptocercus* (this species *only* also occurs off Cape York and Darwin).
A NORTHERN group extending south along the WEST coast (————).
2. *Axiopsis brocki.*
3. *Scytoleptus serripes; Upogebia giralia.*
4. *Upogebia darwinii.*
5. *Upogebia hexaceras* (occurs on west coast only).
A SOUTHERN group extending east (x — x — x).
6. *Upogebia bowerbankii; U. tractabilis.*
7. *Callianassa ceramica; Axius waroona; Axius plectrorhynchus* (this *only* also occurs in SE Qld) and possibly
8. *Upogebia australiensis* with a disjunct distribution.
An EASTERN group distributed mainly along the southeastern and eastern south coasts (.....).
9. *Axiopsis australiensis; Callianassa arenosa; C.aequimana; Laomedia healyi; Upogebia simsoni* (this species *only* also occurs off Darwin).
10. *Axiopsis appendiculis; Upogebia spinifrons.*
11. *Callianassa limosa; Upogebia dromana.*
12. *Callianassa australiensis.*
A NORTHERN species extending south along both west and east coasts (—..—..—..).
13. *Thalassina squamifera.*

distribution extending from some part of northeastern Australia south along the east coast to southwestern areas.

As to relationships with areas outside Australia a high degree of restriction again appears. Only 12 of the 40 species (30%) are known from outside Australia and six of those occur only in Indonesia. The affinities of the other six species are principally with the western Indian Ocean (four species). One species occurs in the Philippines and one in the Pacific (table 2). All these species are found in northern Australia.

No genus or family is confined to Australia.

Existing knowledge of the thalassinidean fauna appears to be weakest so far as coral reef, offshore and the northwestern Australian species are concerned.

It must be conceded that Australia's thalassinidean fauna as now known is rich. While it might at first appear that the faunas of other areas comprise a smaller number of species, this is not correct. It is clear that where research has recently been conducted many more species have been discovered. Areas such as the northeastern Atlantic and western Atlantic contain 53 and 49 species respectively. There are approximately 15 species in the Mediterranean (L.B. Holthuis, pers. comm.). As for the Indo-Pacific, 19 species are known from South Africa (B. Kensley, pers. comm.), and at least 44 species are known from Madagascar (M.de Saint Laurent, pers. comm.). Twenty species are known from the Red Sea (L.B. Holthuis, pers. comm.) and about 40 species are known from Japan (K. Sakai, pers. comm.). In general, however, our knowledge of the thalassinidean fauna is still so weak that really meaningful conclusions about the relationships of the Australian fauna with that of the Indo-West Pacific area as a whole or of the Indo-West Pacific fauna with the East Pacific or Atlantic cannot be drawn at this time. For instance, so far as the presently known species are concerned the principal relationships of the Australian fauna are with Indonesia; there are no species in common with New Zealand.

ACKNOWLEDGEMENTS

Many individuals around Australia and elsewhere kindly made material available: Mr Ron Monroe, Queensland Museum; Miss Alison Green, Tasmanian Museum; Mr Arturs Neboiss, National Museum of Victoria; Mr David Lee, South Australian Museum; Dr Ray George, Western Australian Museum; Dr John Yaldwyn, National Museum of New Zealand; Dr R.W. Ingle, British Museum (Natural History); Dr Jerry Kudenov, Marine Studies Group, Victoria. Their assistance is gratefully acknowledged.

We are indebted to Helen Flood, Marine Studies Group, who inked most of the illustrations and assisted GCBP by sorting material, and to Diane Brown and Helen Tranter of the Australian Museum, who assisted in sorting collections, checking literature and in many other ways.

Special thanks are due to Dr Tom Hailstone, Department of Zoology, University of Queensland, whose previous sorting and identification of much of the Australian Museum's collection made our task much easier. He also allowed us to use his manuscript name for a new species of *Axiopsis*.

We would also like to thank Michele de Saint Laurent, Drs L.B. Holthuis, B.F. Kensley and K. Sakai for information on the distribution of thalassinideans in other parts of the world.

Finally, we sincerely thank John Yaldwyn (National Museum of New Zealand) and Tom Biffar (Duxbury, Massachusetts, U.S.A.) for their helpful comments on the draft of this manuscript.

Table 1

SUMMARY DATA

Family	Genus	Number of Species: Previous Australian Records	New Australian Records	New Species	Total
Axiidae	Axiopsis	1	2	2	5
	Axius	3		1	4
	Scytoleptus		1		1
Callianassidae	Callianassa	5	3	5	13
	Ctenocheles	1			1
	Gourretia			1	1
Callianideidae	Callianidea			1	1
Laomediidae	Laomedia	2			2
Thalassinidae	Thalassina	1			1
Upogebiidae	Upogebia	9		2	11
TOTALS	*10* genera	*22*	*6*	*12*	*40*

Table 2

GEOGRAPHIC DISTRIBUTION OF AUSTRALIAN THALASSINIDEA

				Species occurring outside Australia						
Family	Genus	Species total	Species restricted to Aust.	Indonesia	Philippines	China Sea	W. Pacific Islands	E. Africa	Red Sea, Iranian Gulf	India
Axiidae	Axiopsis	5	3	2						
	Axius	4	2	2				1		
	Scytoleptus	1		1				1		
Callianassidae	Callianassa	13	10	3						
	Ctenocheles	1	1							
	Gourretia	1	1							
Callianideidae	Callianidea	1	1							
Laomediidae	Laomedia	2	2*							
Thalassinidae	Thalassina	1		1	1					
Upogebiidae	Upogebia	11	8	3	1	1	1		2	1
TOTALS	*10* genera	*40*	*28*	*12*	*2*	*1*	*1*	*2*	*2*	*1*

**Laomedia healyi*. Recent work shows that this species probably occurs in SE Asia (K. Sakai, personal communication).

REFERENCES

Baker, W.H., 1907. Notes on the South Australian decapod Crustacea. Part 5. *Trans. Proc. R. Soc. S. Aust.* 31: 173-191, pls 23-25.

Balss, H., 1957. Decapoda. VIII. Systematik. In: H.G. Bronns (ed.), *Klassen und Ordnungen das Tierreichs* 5 (1), 7 (12): 1505-1672, text-figs 1131-1199.

Barnard, K.H., 1950. Descriptive catalogue of South African decapod Crustacea (crabs and shrimps). *Ann. S. Afr. Mus.* 38: 1-837, 154 figs.

Bennett, I., 1968. The mud-lobster. *Aust. nat. Hist.* 16: 22-25, figs.

Biffar, T.A., 1970. Three new species of callianassid shrimp (Decapoda, Thalassinidea) from the Western Atlantic. *Proc. biol. Soc. Washington* 83: 35-50, 3 figs.

——— 1971a. The genus *Callianassa* (Crustacea, Decapoda, Thalassinidea) in south Florida, with keys to the Western Atlantic species. *Bull. mar. Sci.* 21: 637-715, 0 figs.

——— 1971b. New species of *Callianassa* (Decapoda, Thalassinidea) from the Western Atlantic. *Crustaceana* 21: 225-236, 3 figs.

Boesch, D.F. & Smalley, A.E., 1972. A new axiid (Decapoda, Thalassinidea) from northern Gulf of Mexico and tropical Atlantic. *Bull. mar. Sci.* 22: 45-52, 9 figs.

Borradaile, L.A., 1903. On the classification of the Thalassinidea. *Ann. Mag. nat. Hist.* (7) 12: 534-551, 638.

——— 1907. On the classification of the decapod crustaceans. *Ann. Mag. nat. Hist.* (7) 19: 457-486.

Bouvier, E.L., 1915. Décapodes marcheurs (Reptantia) et stomatopodes recueillis à l'île Maurice par M. Paul Carié. *Bull. Scient. Fr. Belg.* (7) 48: 178-318, 42 figs, pls 4-7.

——— 1940. Décapodes marcheurs. In: Faune de France, 37: 1-404, 222 figs, 14 pls. Lechevalier, Paris.

Bozic, B. & Saint Laurent, M. de, 1972. Description et position systématique d' *Upogebia contigua* sp. nov. du Golfe de Guinée (Crustacea Decapoda Callianassidae). *Bull. Mus. natn. Hist. nat., Paris, Zool.* 29: 339-346, 10 figs.

Calman, W. T., 1909. Crustacea. In: E. R. Lankester. (ed.) Treatise on Zoology by Adam & Charles Black, London. VII, 3, 1-346, 194 figs.

Campbell, B.N. & Woods, J.T., 1970. Palaeontological Papers 1967. Quaternary crustaceans from northern Australia in the collections of the Bureau of Mineral Resources, Canberra. *Bull. Bureau Min. Res.* 108: 41-42.

Coleman, N., 1977. A field guide to Australian marine life. Rigby, Adelaide. Pp 223, pls.

Dakin, W.J., Bennett, I. & Pope, E., 1952. Australian Seashores. Angus & Robertson, Sydney. Pp 372, 23 figs, 99 pls.

Dakin, W.J. & Colefax, A.N, 1940. The plankton of the Australian coastal waters off New South Wales. *Monogr. Dept Zool., Univ. Sydney* 1: 1-215, 4 pls, 303 figs.

Dana, J.D., 1852. Crustacea. In: United States Exploring Expedition during the years 1838-1842 under the command of Charles Wilkes, USNM. C. Sherman, Philadelphia. Vol. 13. Pp VIII, 1618; Atlas (1855), pp 27, 96 pls.

De Carvalho, H.A. & Rodrigues, S. de A., 1973. *Marcusiaxius lemoscastroi* g.n., sp.n., nova ocurrencia da familia Axiidae (Crustacea, Decapoda, Thalaesinidea) no Brasil. *Bol. Zool. Biol. Mar, N.S.* 30: 553-566. 21 figs.

Edmondson, C.H., 1944. Callianassidae of the central Pacific. *Occ. Pap. Bernice P. Bishop Mus.* 18: 35-61, 11 figs.

Fourmanoir, P., 1955. Notes sur la faune intercotidale des Comores 1. Crustacés macroures et anomoures stomatopodes. *Naturaliste malgache* 7 (1): 19-33, 5 figs.

Fulton, S.W. & Grant, F.E., 1902. Some little known Victorian decapod Crustacea with descriptions of new species. *Proc. R. Soc. Vict.* 14: 55-64, pl. 5.

——— 1906. Some little known Victorian decapod Crustacea with descriptions of new species — No. 3. *Proc. R. Soc. Vict.* 19: 5-15, pls 3-5.

Gaillande, D. de, & Lagardere, J.P., 1966. Description de *Callianassa (Callichirus) lobata,* nov. sp. (Crustacea Decapoda Callianassidae). *Rec Trav. Sta. mar. Endoume. Bull.* 40: 259-265, 4 figs.

Gerstaecker, A., 1856. Carcinologische Beiträge. *Arch. Naturgesch.* 22 (1): 101-162, pls 4-6.

Glaessner, M.F., 1969. Decapoda. in: R. C. Moore (ed), Treatise on Invertebrate Paleontology. R. Arthropoda 4 (2): 399-651. The University of Kansas and The Geological Society of America.

Gurney, R., 1938. Larvae of decapod Crustacea. Part V. Nephropsidea and Thalassinidea. *Discovery Rep.* 17: 293-344, text-figs 1-39.

——— 1944. The systematics of the crustacean genus *Callianassa. Proc. zool. Soc. Lond.* 114: 82-90, 19 figs.

Haan, W. De, 1833-1850. Crustacea. In: P.F. de Siebold, Fauna Japonica sive descriptio animalium, quae in itinere per Japoniam, jussu et auspiciis superiorum, qui summum in India Batava Imperium tenent, suscepte, annis 1823-1830 collegit, notis, observationibus et adumbrationibus illustravit. J. Muller, Amsterdam. Pp xvii, xxxi, 244, 70 pls.

Hailstone, T.S., 1962. They're good bait. *Aust. nat. Hist.* 14: 29-31, 2 figs.

Hailstone, T.S. & Stephenson, W., 1961. The biology of *Callianassa (Trypaea) australiensis* Dana, 1852 (Crustacea, Thalassinidea). *Univ. Qd Papers. Dept Zool.* 1 (12): 259-185, 15 figs, 3 pls.

Hale, H.M., 1924. The flora and fauna of the Nuyts Archipelago and the Investigator Group. No. 16. *Trans. R. Soc. S. Aust.* 48: 67-73, pls 4, 5.

——— 1927. The Crustaceans of South Australia. Part 1. Govt Printer, Adelaide. Pp 201, 202 figs.

——— 1941. Decapod Crustacea. *Rep. B.A.N.Z. Antarct. Res. Exped.* 1929-1931 Ser. B, 4 (9): 257-285, 16 figs, pl. 3.

Haswell, W.A., 1881. Description of some new species of Australian Decapoda. *Proc. Linn. Soc. N.S.W.* 6: 750-763.

——— 1882. Catalogue of the Australian stalk and sessile-eyed Crustacea. Australian Museum, Sydney. Pp XXIV, 326, 4 pls.

Healy, A. & Yaldwyn, J.C., 1970. Australian Crustaceans in Colour. A.H. & A.W. Reed, Sydney. Pp. 112, 57 figs, 52 pls.

Hess, W., 1865. Beiträge zur Kenntis der Decapoden-Krebse Ost-Australiens. *Arch. Naturgesch.* 31: 127-173, pls 6-7.

Hilgendorf, F., 1878. Die von Herrn Dr. W. Peters in Mocambique gesammelten Crustaceen. *Mb. Akad. Wiss. Berlin* 1878: 782-850, 4 pls.

Holthuis, L.B., 1952. Report of the Lund University Chile Expedition 1948-49. The Crustacea Decapoda Macrura of Chile. *Acta Univ. Lund.* (2) 47: 1-110, 19 figs.

——— 1959. The Crustacea Decapoda of Suriname (Dutch Guiana). *Zool. Verhandl.* 44: 1-296, 68 figs, 16 pls.

——— 1967. A survey of the genus *Ctenocheles* (Crustacea: Decapoda, Callianassidae), with a discussion of its zoogeography and its occurrence in the Atlantic Ocean. *Bull. mar. Sci.* 17: 376-385.

Holthuis, L.B. & Gottlieb, E., 1958. An annotated list of the decapod Crustacea of the Mediterranean coast of Israel, with an appendix listing the Decapoda of the eastern Mediterranean. *Bull. Res. Counc. Israel* 7B (1-2): 1-126, 3 tables, 15 figs, 3 pls.

Kensley, B., 1974. The genus *Callianassa* (Crustacea, Decapoda, Thalassinidea) from tte west coast of South Africa with a key to South African species. *Ann. S. Afr. Mus* 62: 267-278, 5 figs.

Kinahan, J.R., 1856. Remarks on the habits and distribution of marine Crustacea on the eastern shores of Port Phillip, Victoria, Australia; with descriptions of undescribed species and genera. *Jl R. Dublin Soc.* 1: 111-134, pls 3, 4.

Kingsley, J.S., 1882. Carcinological notes, no. 5. *Bull. Essex Institute* 14: 105-132, 2 pls.

Kishinouye, K., 1926. Two rare and remarkable forms of macrurous Crustacea from Japan. *Annot. Zool. jap.* 11: 63-70, 2 figs.

Latreille, P.A., 1806. Genera Crustaceorum et Insectorum secundum ordinem naturalem in familias disposita, iconibus exeplisque pluramis explicata. A. Koenig, Paris & Argentorati. 1. Pp xviii, 302, 16 pls.

Leach, W.E., 1815. A tabular view of the external characters of four classes of animals, which Linné arranged under Insecta; with the distribution of the genera composing three of these classes into orders. *Trans. Linn. Soc. London.* 11: 306-400.

Lenz, H., 1905. Ostafrikanische Dekapoden und Stomatopoden, gesammelt von Herrn Professor Dr. A. Voeltzkow. *Abh. Senckenb. naturf. Ges.* 27: 341-392, pls 47-48.

Le Loeuff, P. & Intes, A., 1974. Les Thalassinidea (Crustacea, Decapoda) du Golfe de Guinée. Systématique — Ecologie. *Cah. O.R.S. T.O.M. Oceanogr.* 12: 17-69, 5 tables, 22 figs.

Macnae, W., 1966. Mangroves in eastern and southern Australia. *Aust. J.Bot.* 14: 67-104, 9 figs, 3 pls.

McNeill, F.A., 1968. Crustacea, Decapoda & Stomatopoda. *Scient. Rep. Gt Barrier Reef Exped. 1928-29* 7 (1): 1-98, 2 figs, 2 pls.

Man, J.G. de, 1882-1888. Report on the podophthalmous Crustacea of the Megui Archipelago, collected for the Trustees of the Indian Museum, Calcutta, by Dr. John Anderson. *J. Linn. Soc. London (Zool.)* 22: 1-312, 19 pls.

——— 1887. Bericht über die im Indischen Archipel von Dr. J. Brock gesammelten Decapoden und Stomatopoden. *Arch. Naturgesch.* 53: 215-600, pls 7-22a.

——— 1896. Bericht über die von Herrn Schiffscapitän Storm zu Atjeh, an den westlichen Küsten von Malakka, Borneo und Celebes sowie in der Java-See gesammelten Decapoden und Stomatopode. *Zool. Jb. Syst.* 9: 459-514; 10: pl. 34 (1898).

——— 1905. Diagnoses of new species of macrurous decapod Crustacea from the 'Siboga Expedition'. *Tijdschr. Ned. Dierk. Vereeniging* (2) 9: 587-614.

——— 1915. Zur Fauna von Nord Neuguinea. Nach den Sammlungen von Dr. P.N. van Kampen und K. Gjellerup in der Jahren 1910-1911. Macrura. *Zool. Jb. Syst.* 38: 385-458, pls 27-29.

——— 1925a. The Decapoda of the Siboga-Expedition. Part vi. The Axiidae collected by the Siboga-Expedition. *Siboga-Exped. Monogr.* 39a (5): 1-127, 10 pls.

——— 1925b. Sur deux espèces encore imparfaitement connue du genre *Axius* Leach. *Bull. Soc. zool. Fr.* 50: 50-61, 2 figs.

——— 1925c. Uber neue oder wenig bekannte Axiidae. *Mitt. zool. Mus. Berlin* 12: 117-140, 7 figs.

——— 1927. A contribution to the knowledge of twenty-one species of the genus *Upogebia* Leach. *Capita Zool.* 2 (5): 1-58, 6 pls.

——— 1928a. The Decapoda of the Siboga-Expedition. Part vii. The Thalassinidae and Callianassidae collected by the Siboga-Expedition, with some remarks on the Laomediidae. *Siboga-Exped. Monogr.* 39a (6): 1-187, 20 pls.

——— 198b. A contribution to the knowledge of twenty-one species and three varieties of the genus *Callianasa* Leach. *Capita Zool.* 2 (6): 1-56, 12 pls.

Martens, E. C. von, 1868. *Über einige neue Crustaceen. MB Akad Wiss. Berlin* 1868: 608-615.

Miers, E. J., 1884. Crustacea. In: Report on the Zoological collections made in the Indo-Pacific Ocean during the Voyage of H.M.S. "Alert" 1881-2. British Museum, London. Pp 178-322, 513-575, pls 18-34, 46-52.

Milne-Edwards, A., 1879. Additions à la famille des thalassiniens. *Bull. Soc. Philom. Paris* (7) 3: 110-113.

Milne-Edwards, H., 1837. Histoire Naturelle des Crustacés, comprenant l'Anatomie, la Physiologie et la Classification de ces Animaux. Lib. Roret, Paris. Vol. 2 Pp 532. Atlas.

Miyake, S. & Sakai, K., 1967. Two new species of Axiidae (Thalassinidea, Crustacea) from the East China Sea. *J. Fac. Agric., Kyushu Univ.* 14: 303-309, pl. 4.

Ngoc-Ho, N., 1977. The larval development of *Upogebia darwini* (Crustacea, Thalassinidea) reared in the laboratory, with a redescription of the adult. *J. Zool. Lond.* 181: 439-464, 13 figs.

Nobili, G., 1906. Crustacés décapodes et stomatopodes. Mission J. Bonnier et Ch. Perez (Golfe Persique 1901). *Bull. scient. Fr. Belg.* 40: 13-159, pls 3-7.

Ortmann, A.E., 1894. Crustaceen. In: R. Semon (ed.), Zoologische Forschungsreisen in Australien und dem Malayischen Archipel. *Denkschr. med.-naturw. Ges. Jena* 8: 3-80, 3 pls.

Poore, G.C.B., 1975. Systematics and distribution of *Callianassa* (Crustacea: Decapoda: Macrura) from Port Phillip Bay, Australia, with descriptions of two new species. *Pacif. Sci.* 29: 197-209, 8 figs.

Rathbun, M.J., 1906. The Brachyura and Macrura of the Hawaiian Islands. *Bull. U.S. Fish. Comm.* 23: 827-930, 79 figs, 24 pls.

Rodrigues, S. de A., 1971. Mud shrimps of the genus *Callianassa* Leach from the Brazilian coast (Crustacea, Decapoda). *Arq. Zool. S. Paulo* 20: 191-223, 98 figs.

Saint Laurent, M. de, 1970. Capture, en Méditerranée, d'*Upogebia talismani* Bouvier, 1915 (Crustacea Decapoda Callianassidae). *Bull. Mus. natn. Hist. nat., Paris* 42: 1259-1262, 3 figs.

——— 1972. Un thalassinide nouveau du golfe de Gascogne, *Calastacus laevis* sp. nov. Remarques sur le genre *Calastacus* Faxon. (Crustacea Decapoda Axiidae). *Bull. Mus. natn. Hist. nat., Paris, Zool.* 29: 347-356, 10 figs.

——— 1973. Sur la systématique et la phylogénie des Thalassinidea: définition des familles des Callianassidae et des Upogebiidae et diagnose de cinq genres nouveaux (Crustacea Decapoda). *C.R. Acad. Sci. Paris* (Ser D), 277: 513-516.

Sakai, K., 1962. Systematic studies on Thalassinidea 1. *Laomedia astacina* de Haan. *Publ. Seto mar. biol. Lab.* 10: 27-34, pls 5-7.

——— 1966. On *Callianassa (Callichirus) novaebritanniae* Borradaile (Thalassinidea, Crustacea) from Japan. *J. Fac. Agr. Kyushu Univ.* 14: 161-171, 4 figs.

——— 1967a. Two new species of Axiidae (Thalassinidea, Crustacea) from the East China Sea. *J. Fac. Agr. Kyushu Univ.* 14: 303-309, 2 figs, pl. 4.

——— 1967b. Three new species of Thalassinidea (Decapod Crustacea) from southwest Japan. *Publ. Seto mar. biol. Lab.* 15: 319-328, 4 figs, pl. 11.

——— 1967c. Three new species of Thalassinidea (Decapoda, Crustacea) from Japan. *Researches on Crustacea* 3: 39-51, 3 figs.

——— 1968. Three species of the genus *Upogebia* (Decapoda, Crustacea) in Japan. *J. Seika Women's Junior Coll.* 1: 45-50, 1 fig.

——— 1969. Revision of Japanese callianassids based on the variations of larger cheliped in *Callianassa petalura* Stimpson and *C. japonica* Ortmann (Decapoda: Anomura). *Publ. Seto mar. biol. Lab.* 17: 209-252, pls 9-15, 8 text-figs.

——— 1970a. Supplementary description of *Callianassa (Callichirus) tridentata* von Martens (Crustacea, Thalassinidea). *Publ. Seto mar. biol. Lab.* 17: 393-401, 3 figs.

——— 1970b. A small collection of thalassinids from the waters around Tsushima Islands, including a new species of *Callianassa*. (Crustacea, Anomura). *Publ. Seto mar. biol. Lab.* 18: 37-47, 4 text-figs.

——— 1970c. A new coral burrower, *Upogebia trypeta* sp. nov. (Crustacea, Thalassinidea) collected from Amami-Oshima, Japan. *Publ. Seto mar. biol. Lab.* 18: 49-56, figs 1, 2A, 2B.

——— 1971. A new burrower, *Upogebia (Calliadne) kiiensis* sp. nov. (Crustacea, Thalassinidea) collected from Kii, Japan. *Publ. Seto mar. biol. Lab.* 19: 243-247, 2 text-figs.

——— 1975. Thalassinidea of Kenya collected by Dr. A.J. Bruce (Crustacea, Decapoda) 1. Family Upogebiidae Borradaile, 1903. *Veröff. Zool. Staatssamml. München* 18: 1-44, 1 table, 15 figs.

Sankolli, K.N., 1970-1972. The Thalassinoidea (Crustacea, Anomura) of Maharashtra. *J. Bombay nat. Hist. Soc.* 67: 235-249, 4 figs (1970); 68: 94-106, figs 5-8 (1971); 68: 671-682, figs 9, 10 (1972).

Stephenson, T.A., Stephenson, A., Tandy, G., & Spender, M., 1931. The structure and ecology of Low Isles and other reefs. *Scient. Rep. Gt Barrier Reef Exped.* 3: 17-112, 27 pls, 15 text-figs.

Stimpson, W., 1860. Prodromus descriptionis animalum evertebratorum, quae in expeditionae ad Oceanum Pacificum Septentrionalem, e Republica federata missa, C. Ringgold et J. Rodgers ducibus, observavit et descripsit. VIII Crustacea Macrura. *Proc. Acad. nat. Sci. Philad.* 1860: 22-47.

Strahl, C., 1861. Über einige neue von Hrn F. Jagor eingesandte Thalassinen und die systematische Stellung dieser Familie. *Mb. Akad. Wiss. Berlin* 1861: 1055-1072, 14 figs.

——— 1862. On some new Thalassinae sent from the Philippines by M. Jagor, and on the systematic position of that family. *Ann. Mag. nat. Hist.* (3) 9:383-396.

Thallwitz, J., 1891. Decapoden-Studien, insbesondere basiert auf A.B. Meyer's Sammlungen im Ostindischen Archipel, nebst einer Aufzählung der Decapoden und Stomatopoden des Dresdener Museums. *Abh. Ber. Zool. Mus. Dresden* 3: 1-55, 1 pl.

Thistle, D., 1973. A taxonomic comparison of the American *Upogebia* (Decapoda, Thalassinidea) including two new species from the Caribbean. *Breviora* 408: 1-23, 6 figs.

Thomson, G.M., 1893. Notes on Tasmanian Crustacea, with descriptions of new species. *Pap. Proc. R. Soc. Tas.* 1892: 45-76, 6 pls.

Tirmizi, N.M., 1970. A new species of *Callianassa* (Decapoda, Thalassinidea) from West Pakistan. *Crustaceana* 19: 245-250, 3 figs.

——— 1977. A redescription of the holotype of *Callianassa mucronata* Strahl, 1861 (Decapoda, Thalassinidea). *Crustaceana* 32: 21-26, 3 figs.

Ward, M., 1945. A new crustacean. *Mem. Qd Museum* 12: 134-135, 1 pl.

Waterman, T.H. & Chace, F.A., Jr, 1960. General crustacean biology. In: T. H. Waterman (ed), The Physiology of Crustacea. 1. Metabolism and Growth. Academic Press, New York & London. Pp xvii, 670.

Wear, R.G. & Yaldwyn, J.C., 1966. Studies on thalassinid Crustacea (Decapoda, Macrura Reptantia) with a description of a new *Jaxea* from New Zealand and an account of its larval development. *Zool. Publ. Victoria Univ. Wellington* 41: 1-27, 5 figs.

White, A., 1847. Descriptions of new or little-known decapod Crustacea in the collection at the British Museum. *Proc. zool. Soc. Lond.* 15: 118-124.

Williams, A.B., 1974. Two new axiids (Crustacea: Decapoda: Thalassinidea: *Calocaris)* from North Carolina and the Straits of Florida. *Proc. biol. Soc. Washington* 87: 451-464, 18 figs.

Yaldwyn, J.C. & Wear, R.G., 1970. Preliminary description of a new burrowing mud-shrimp from eastern Australia (Crustacea, Macrura Reptantia, Laomediidae). *Aust. Zool.* 15: 384-385, 1 fig.

——— 1972. The eastern Australian burrowing mud-shrimp *Laomedia healyi* (Crustacea, Macrura Reptantia, Laomediidae) with notes on larvae of the genus *Laomedia*. *Aust. Zool.* 17:126-141, pls 6-7, 20 figs.

Zairquiey Alvarez, R., 1968. Crustáceos decápodos Ibéricos. *Invest. Pesq., Barcelona* 32: I-XV, 1-510, 164 figs.

Zehntner, L., 1894. Crustacés de l'Archipel Malais. In: *Rev. Suisse Zool.* 2: 135-214, pls 7-9.

INDEX TO FAMILIES, GENERA, SUBGENERA AND SPECIES

Manuscript accepted for publication 27 October, 1977.