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NOTES ON THE TAXONOMY AND ZOOGEOGRAPHY OF THE TASMANIAN GRAPSID AND OCYPODID CRABS (CRUSTACEA, BRACHYURA)

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Figures 1-10

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ABSTRACT

Seven of the eleven species of shore crabs of the families Grapsidae and Ocypodidae occurring in Tasmania are considered; synonymies, detailed locality lists and comments on previous work are given; the remaining four species have been recently discussed in detail elsewhere by Campbell and Griffin (1966). The sesarminae *Paragrapsus laevis* (Dana) is recorded definitely from Tasmania for the first time. The status of this species and of *Leptograpsodes octodentatus* (H. Milne Edwards) is discussed. The zoogeographical relations of the Tasmanian grapsid and ocypodid fauna are considered.

INTRODUCTION

Until recently, ten species of shore crab belonging to the families Grapsidae and Ocypodidae were considered to be present in Tasmania. Except for two widespread species, the majority of these were described by the French carcinologist H. Milne Edwards around the middle of last century. Previous Australian monographs on Crustacea (Haswell, 1882b; Hale, 1927a) had dealt briefly with most of these, M. W. F. Tweedie (1942) had treated the Tasmanian species in more detail, whilst Guiler (1952a, 1956) gave additional distributional data. Recently, Campbell and Griffin (1966) have given detailed revisions of those species belonging to the subfamily Sesarminae. The included Tasmanian species were *Cyclograpsus granulatus*, *Helograpsus haswellianus*, *Paragrapsus quadridentatus*, and *P. gaimardii*. In the present paper the taxonomy of these species is not further considered. Another species dealt with by Campbell and Griffin was *Paragrapsus laevis*. The evidence they had available then suggested that this species probably does not occur in Tasmania, but in the present paper it is recorded from a few localities on the central east coast and one on the north coast; the taxonomic status of these populations is discussed.

As Campbell and Griffin (1966: 141) noted, the grapsid described by Jacquinot (in Jacquinot and Lucas, 1853) from "Hobart", *Cyclograpsus tasmanicus*, cannot be identified with any known species of *Cyclograpsus* or with any Tasmanian crab, and its status must remain uncertain for the present. During the course of the studies reported in part here, the status of two geographically widespread species, *Leptograpsus variegatus* and *Plagusia chabrus*, were investigated throughout their range. The results of these studies will be given in detail elsewhere and the two species are only briefly dealt with here.

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Dr R. W. George has recently completed a study of the species previously known as *Brachynotus octodentatus* and has considered that it should be placed in the genus *Leptograpsodes*. This placing is followed here, and George's studies are commented upon.

In the present paper, then, brief notes are given on five of the nine species of Tasmanian grapsids and the two species of ocypodid. Except in the case of the two widespread species mentioned above, and of *Paragrapsus laevis*, full synonymies are given. All Tasmanian localities at which each species is known to occur are listed and those important morphological features not previously mentioned in the literature are described. The taxonomic status of *Leptograpsodes octodentatus*, *Brachynotus spinosus*, and *Paragrapsus laevis* is discussed. Finally, the zoogeographical relations of the Tasmanian grapsid and ocypodid fauna are considered.

Terminology used here follows that used by Campbell and Griffin (1966) and by Rathbun in her various publications. Dimensions given are carapace widths in mm as measured with vernier or dial calipers.

The material on which this study was based has been deposited in the Tasmanian Museum, Hobart; Queen Victoria Museum, Launceston; Australian Museum, Sydney; Dominion Museum, Wellington; and U.S. National Museum, Washington.

TAXONOMY

Family **GRAPSIDAE**

Subfamily **GRAPSINAE**

Genus **Leptograpsus** H. Milne Edwards, 1853

Leptograpsus variegatus (Fabricius)

Restricted synonymy:

Cancer variegatus Fabricius, 1793: 450.

Leptograpsus variegatus; Tweedie, 1942: 14. Guiler, 1952a: 40. Guiler, in Guiler, Serventy and Willis, 1958: 182. Bennett, 1964: 80.

Material examined.—A total of 20 specimens (12 ♂♂, 8 ♀♀, 21–75 mm).

Localities.—Bass Strait: Citadel I., Glennie Gp.; Currie Harb., King I. Tasmania: Eddystone Pt.; Binnalong B.; Bicheno; Coles B.; C. Forestier; Maria I.; Pirates B. (see fig. 8).

Habitat.—On rocky coasts exposed to strong surf, sheltering in crevices around high tide mark and wandering over surface of the rocks and in pools.

Distribution.—Southern warm temperate Indian and Pacific Oceans from Shark Bay, Western Australia, through southern and eastern Australia and New Zealand to Chile in South America.

Remarks.—Bennett and Pope in their survey of intertidal zonation in Tasmania (Bennett and Pope, 1960) found this species along the east coast at Swan Island, Sleepy Bay, Fossil Island at Pirates Bay and the Remarkables Cave (Elizabeth C. Pope, pers. comm.). This species is found in quite large numbers in some localities in Tasmania but, apart from the mention of it given by Bennett and Pope, has not been previously recorded from Tasmania. Guiler (in Guiler, Serventy and Willis, 1958) recorded this species from Fisher Island, just to the south of Flinders Island.

As will be shown in a future paper, Western Australian, New Zealand, and South American populations form a single specific unit taxonomically, as previously reported by Rathbun (1918), Garth (1957), and Bennett (1964).

Genus **Leptograpsodes** Montgomery, 1931

Leptograpsodes octodentatus (H. Milne Edwards)

Figs. 1, 2a-c, 3a

Cyclograpsus octodentatus H. Milne Edwards, 1837: 80 (type locality: King I., Bass Strait; type in Muséum National d'Histoire Naturelle, Paris—*vide* Montgomery, 1931).

Heterograpsus octodentatus; H. Milne Edwards, 1853: 194. Kingsley, 1880: 209. Haswell, 1882b: 101.

Brachynotus octodentatus; Tesch, 1918: 106 (in key). Hale, 1924: 69; 1927a: 182, fig. 183; 1927b: 312. Balss, 1935: 142. Tweedie, 1942: 16, fig. 2. Guiler, 1952a: 40.

Grapsus inornatus Hess, 1865: 148, pl. vi fig. II (type locality: Sydney; type in Gottingen Museum—*vide* Montgomery, 1931). De Man, 1887: 699.

Leptograpsodes webbhysi Montgomery, 1931: 452, pl. 25 fig. 5, pl. 28 fig. 1, 1a, 1b (type locality: Long Island, Abrolhos Islands; types not extant, lost in transit—*vide* Montgomery, 1931).

Leptograpsodes octodentatus; George, 1962: 71.

Material examined.—A total of 59 specimens (30 ♂♂, 29 ♀♀, 11–35 mm).

Localities.—Bass Strait: King I.; Hunter I.; Goose I.; Chapel I. Tasmania: Just W. of Crayfish Ck.; Rocky C.; Hawley Beach, Devonport; Green's Beach; Low Head; Waterhouse I.; Pirates B.; C. Direction; Blackman's B.; Adventure B., Bruny I.; Conical Harb. (S. of Pieman R.); just S. of Interview R.; just N. of Arthur R. (see fig. 8).

Habitat.—On boulder beaches and rocky platforms exposed to moderate surf and in sheltered bays, above high tide level, under stones or in crevices, sometimes in burrows in earth, often near freshwater seepages.

Distribution.—Restricted to Australia, from the Abrolhos Islands in the west, through South Australia, Victoria, to northwestern, northern, and eastern coasts of Tasmania; not found on the east coast of the mainland north of Victoria (F. A. McNeill, personal communication to R. W. George). George (1962) reported a total of twenty-seven localities known at that time (see fig. 9).

Description.—A detailed description of this species was given by Montgomery (1931) and a shorter one by Tweedie (1942); the synonymous *Grapsus inornatus* Hess was redescribed by De Man (1887). Additional features are as follows:

Male abdomen.—Seven-segmented, widest at the middle of the laterally convex third segment, following segments narrowing uniformly, edges weakly concave, to distal edge of sixth; seventh segment laterally strongly concave basally.

Male first pleopod.—Long, quite slender, weakly curved outwards distally, sternal surface with a moderately long groove towards medial surface ending in distal flap; lateral surface sparsely setose, medial surface with numerous setae extending from base to tip; a moderately dense tuft of setae at the tip almost concealing short, blunt, horny tip and flap on sternal surface.

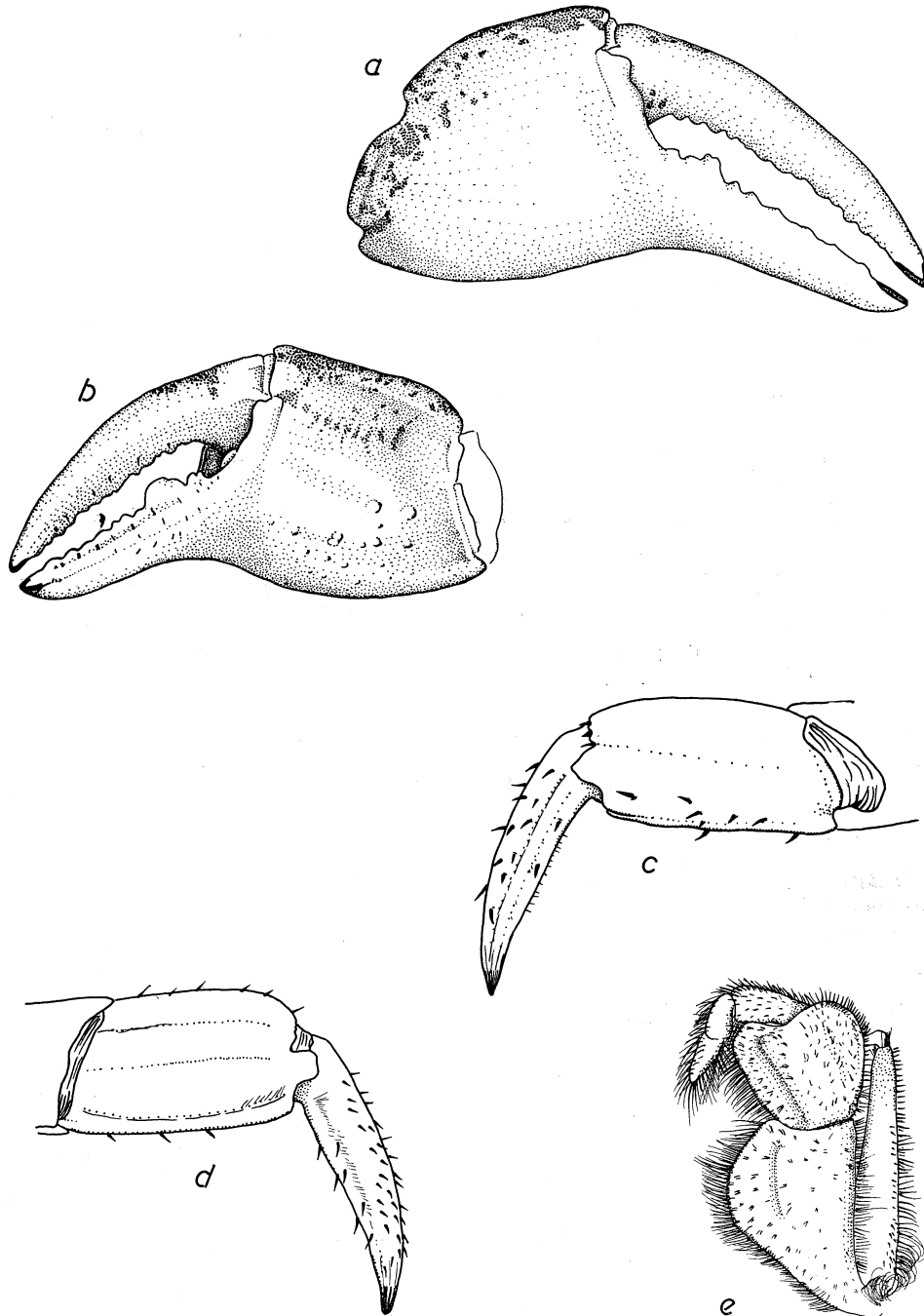


Figure 1.—*Leptograpsodes octodentatus*. Male, 33 mm, Pirates Bay: a, right chela, outer aspect; b, same, inner aspect; c, right first ambulatory leg, propodus and dactyl, anterior aspect; d, right fourth ambulatory leg, propodus and dactyl, posterior aspect; e, left third maxilliped, outer aspect.

Colour.—Olivaceous, mottled or spotted with dark brown (Tweedie). Carapace mottled with black, dark blue or purple and yellow (George). The underside of the body, the chelipeds and legs are usually much paler than the carapace, and the mottling, which occurs on the dorsal surface of the chelipeds and legs, is sometimes bright red.

Remarks.—Amongst the distinguishing characters of this species are the very strongly convex lateral borders of the carapace, the anterior half bearing three teeth behind the external orbital angle (*not* two as stated by Tweedie), the last very small; the long, outwardly smooth and inwardly sparsely tuberculate chelae with the fixed finger moderately bent from the palm; and the absence of spines from the posterior ventrodistal border of the ambulatory meri.

The carapace bears on the branchial regions, close to the lateral edge, a few weak ridges, and the suborbital spine is three-sided and only moderately large. The fingers of the chela are strongly toothed, those of the fixed finger near the base generally grouped into a strong lobe. The propodi and dactyls of the ambulatory legs bear short, stiff, black, spine-like hairs.

Montgomery (following views expressed to him by De Man) and George placed *Leptograpsodes* in the subfamily Grapsinae. However, it should be noted that *L. octodentatus* shows reasonably strong similarities to the Australian varunine *Brachynotus spinosus* (Milne Edwards) in the shape of the merus of the third maxillipeds, the appearance of the front in ventral view, especially the straight suborbital border, and in the form of the male first pleopods. The two species are quite different in the shape of the carapace and of the male chela. The presence in *L. octodentatus* of two pairs of postfrontal lobes, the strong tuberculation of the anterior part of the dorsal surface of the carapace and the presence of transverse striations on the ambulatory meri are all reminiscent of species of *Grapsus* and allied grapsines.

Montgomery realized that his *Leptograpsodes webhaysi* was very close to the species then known as *Brachynotus octodentatus*, but listed some differences between the two. Balss (1935) considered the two species almost certainly identical; the same conclusion was reached by George (1962). Hess's *Grapsus inornatus* has been considered a synonym of the present species since the time of Tesch (1918), although the type locality of the former (Sydney) is almost certainly outside the geographical range of the species (see above).

In a study of this species throughout its geographical range R. W. George examined a total of 84 specimens (50 ♂♂, 34 ♀♀, carapace width 10–70 mm). Eight characters were studied in detail by George including all those mentioned by Montgomery and De Man as delineating *L. webhaysi* and *G. inornatus* respectively. The characters concerning ridges around the orbits appear difficult to evaluate and the differences (cited by Montgomery) too slight to warrant specific separation. All other characters, including the prominence of the pits on the dorsal surface of the carapace, the dentition and shape of the fingers and ornamentation of the carpus of the cheliped are subject to significant variation with either age or sex, sometimes both. Montgomery's material (adult females), according to that author's description, agrees entirely with the typical adult females examined by George; Hess's material, according to the latter's description, does not support any taxonomic separation of eastern and western populations (George, pers. comm., December, 1962).

Examination of the Tasmanian material to hand fully supports George's conclusions; in addition to the characters already found to vary with age and sex, it appears that the ridges on the branchial regions also become less prominent with increasing overall size.

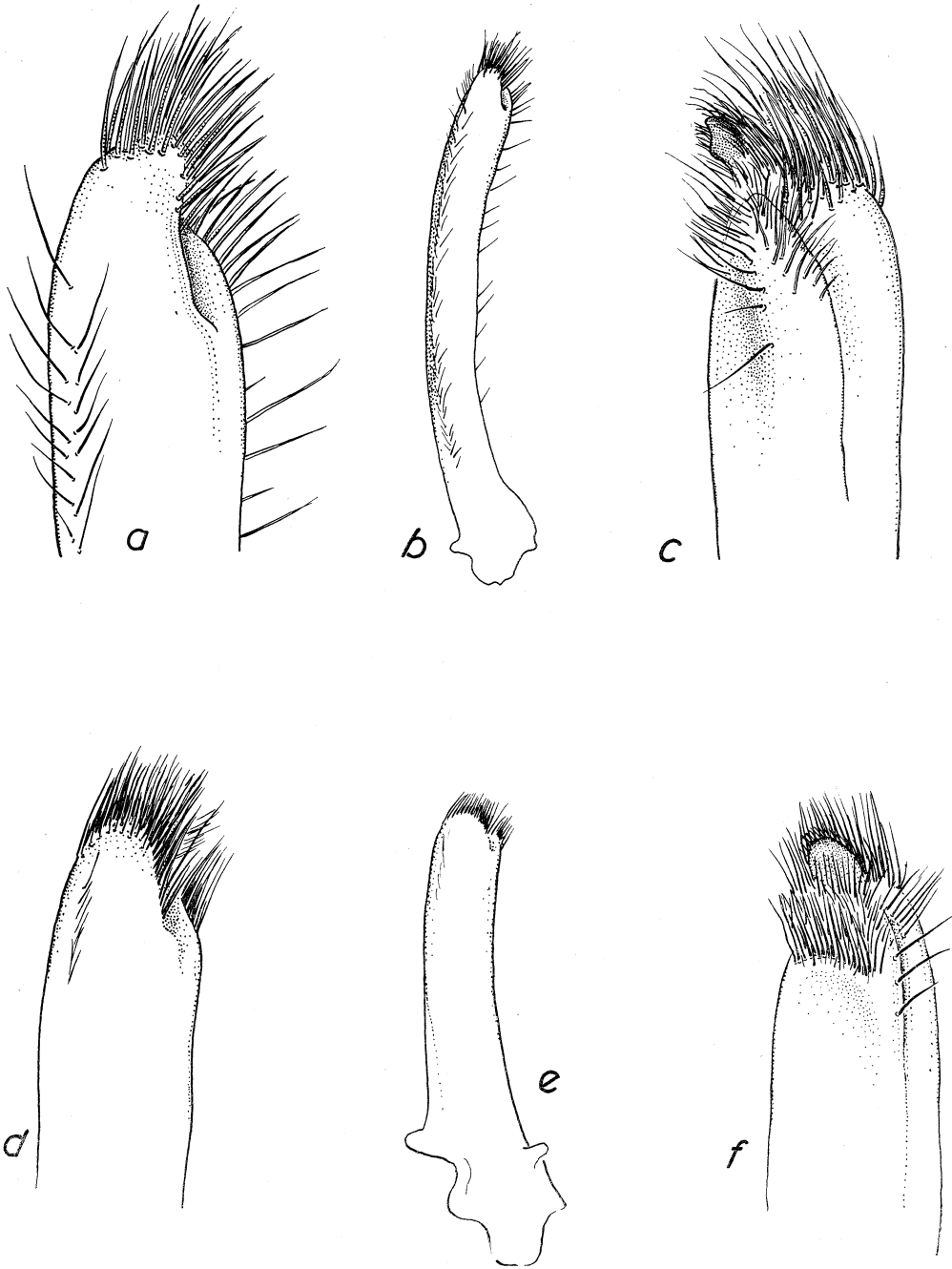


Figure 2.—Male left first pleopods of *Leptograpsodes octodentatus*, 33 mm, Pirates Bay (a-c) and *Brachynotus spinosus*, 17 mm, Pittwater (d-f): a, d, tip of pleopod, abdominal aspect; b, e, whole pleopod, abdominal aspect; c, f, tip of pleopod, sternal aspect.

Subfamily VARUNINAE

Genus **Brachynotus** De Haan, 1835**Brachynotus spinosus** (H. Milne Edwards)

Figs. 2d-f, 3b-e

Heterograpsus spinosus H. Milne Edwards, 1853: 194. A. Milne Edwards, 1874: 82. Kingsley, 1880: 210. De Man, 1891: 56, pl. 4 fig. 15. Ortmann, 1894: 715. Fulton and Grant, 1906: 19.

Brachynotus spinosus; Tesch, 1918: 106 (in key). Tweedie, 1942: 16, fig. 3. Guiler, 1952a: 40.

Eriocheir spinosus; Hale, 1927a: 184, fig. 185; 1927b: 312, fig. 2.

Type locality.—Vanikoro, Santa Cruz, Pacific Ocean; types in Muséum National d'Histoire Naturelle, Paris—*vide* De Man, 1891.

Material examined.—A total of 62 specimens (27 ♂♂, 35 ♀♀, 6–17 mm).

Localities.—Tasmania: Detention R.; just W. of Crayfish Ck.; Triabunna; Double Ck.; Prosser R. at Orford; Carlton R.; Dunalley B.; Fort Direction; Pittwater; Bellerive Beach; Sandy B.; Howden; Margate; Oyster Cove; Huon R. at Lymington.

Habitat.—In estuaries and sheltered bays, intertidal towards high tide level, under small stones.

Distribution.—Southeastern Australia (see fig. 9), southwest Pacific Ocean.

Fulton and Grant (1906) reported this species from Port Phillip and Hale (1927b) recorded it from the Bay of Shoals and Busby Island, Kangaroo Island. Within Tasmania it was recorded from Brown's River and Carlton by Tweedie (1942) and from north of the Pieman River by Guiler (1952a). McNeill (pers. comm.) considers that Haswell's (1882) record of *Leptograpsodes octodentatus* (as *Heterograpsus octodentatus*) from the north coast of Tasmania was based on a specimen of the present species. De Man recorded this species from Upolu, Samoa.

Description.—Good descriptions of this species were given by De Man (1891) and Tweedie (1942). Additional features are as follows:

Abdomen.—Seven segmented, in the male widest towards distal edge of laterally convex third segment, following segments smoothly tapering to close to distal edge of sixth which narrows abruptly, seventh segment much narrower than sixth. Fifth segment markedly concave laterally.

Male first pleopod.—Moderately stout and hardly tapering; short groove on sternal surface towards lateral surface ending in definite flap; strong tufts of hairs, confined to distal part of the pleopod, borne towards tip of flap and surrounding horny tip of pleopod; a few short hairs extending a little way down abdominal surface somewhat medially.

Colour.—Dull green or brown with or without white markings, which may be so extensive as largely or wholly to replace the colour (Tweedie). Innumerable colour variations occur; some examples are green, others different shades of brown. Some are very dark brown, with large or small white markings, while others have the whole upper surface of the carapace milk-white (Hale, 1927a). Hale's remarks apply quite satisfactorily to Tasmanian populations. Banding of the legs is quite common.

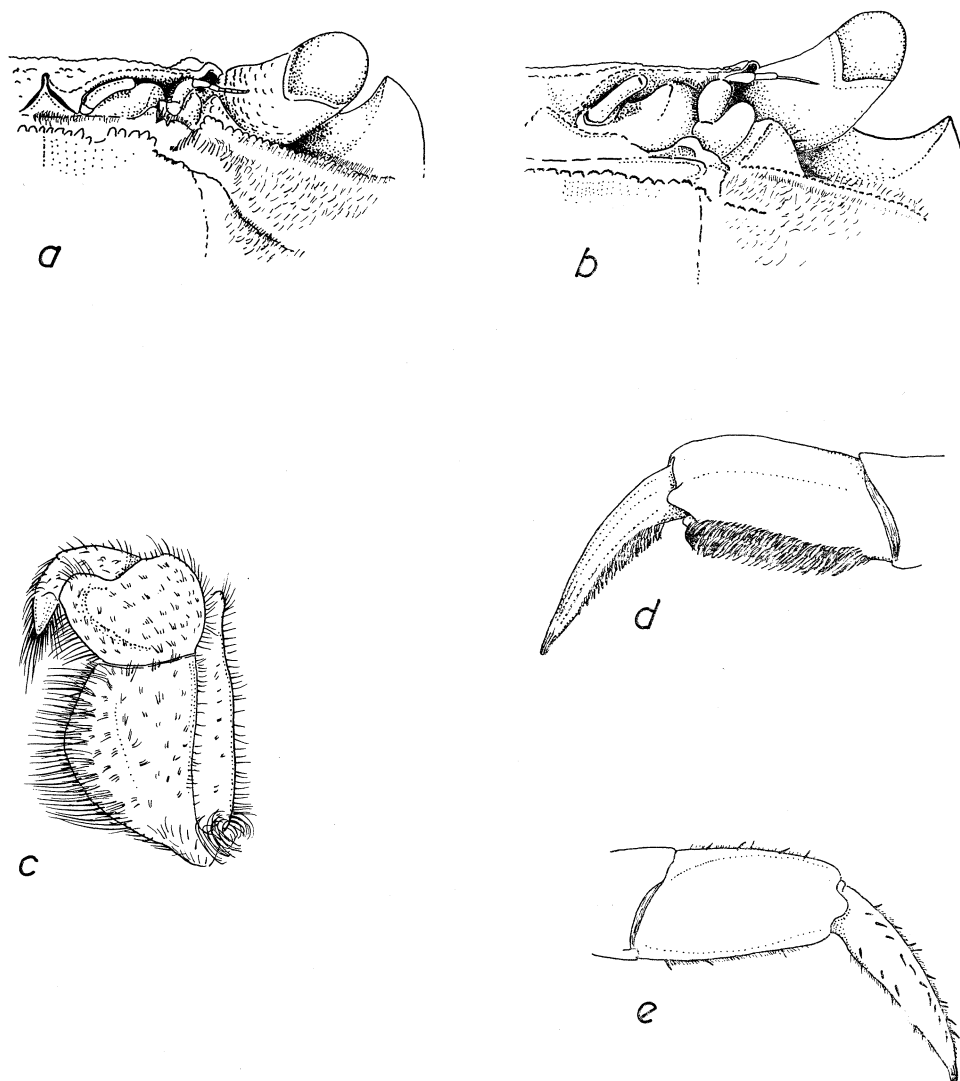


Figure 3.—*Leptograpsodes octodentatus*, male, 33 mm, Pirates Bay (a only) and *Brachynotus spinosus*, male, 17 mm, Pittwater (b-e): a, b, front of carapace and left orbit, ventral aspect; c, left third maxilliped, outer aspect; d, right first ambulatory leg, propodus and dactyl, anterior aspect; e, right fourth ambulatory leg, propodus and dactyl, posterior aspect.

Remarks.—The distinguishing characters of this species are the presence of three spines on the anterolateral margin, behind the prominent external orbital spine, the second of these smaller than the others and rounded instead of sharp, the concave front and weak postfrontal lobes, the oblique ridge from the third anterolateral spine to the posterior edge of the carapace, the large, pyramidal, three-edged, suborbital spine, the outwardly smooth and inwardly granular chelae with a strong tuft of hairs at the end of the palm between the fixed fingers on both inner and outer surfaces in males only, the presence of a strong distal dorsal spine on the ambulatory meri and stout, black, spine-like hairs distributed sparsely on the ambulatory propodi and dactyls, males also having prominent tufts of hair on the ventral surfaces of these two segments of the first ambulatories.

Tweedie (1942: 17) considered that records of this species from the tropical Pacific (De Man, 1891) required confirmation. Comparison of Tasmanian material, Tweedie's and Hale's descriptions and figures with De Man's description and figure of specimens from Samoa does not reveal to me any differences which might be regarded as warranting specific separation of Australian material from Samoan. De Man also compared his specimens with material from Australia.

Subfamily **SESARMINAE**

Only one of the five Tasmanian species belonging to this subfamily is discussed here. The remaining four, *Cyclograpsus granulatus* H. Milne Edwards, *Helograpsus haswellianus* (Whitelegge), *Paragrapsus quadridentatus* (H. Milne Edwards), and *P. gairmardii* (H. Milne Edwards) are treated in detail by Campbell and Griffin (1966).

Genus **Paragrapsus** H. Milne Edwards, 1853

Paragrapsus laevis (Dana)

Restricted synonymy:

Chasmagnathus laevis Dana, 1852a: 252.

Paragrapsus laevis; Campbell and Griffin, 1966: 160, 162, text-figs. 8B, 10c; pl. 22 fig. 2; pl. 23 fig. 10 (synon.).

Material examined.—A total of 68 specimens (51 ♂♂, 17 ♀♀, 5–37 mm).

Localities.—Tasmania: Kelso, Tamar R.; MacLaine's Ck.; Double Ck.; Prosser R. at Orford; Blackman B. at mouth of Bream Ck. (see fig. 8).

Habitat.—On sheltered stony beaches and in estuaries, intertidally under stones and in burrows.

Distribution.—Restricted to eastern Australia, from Moreton B. (Queensland) in the north, through Victoria to southeastern Tasmania (see fig. 9). Its presence in Tasmania is now fully confirmed; previously its existence here had been supported by only one specimen in the Australian Museum collections (AM P.7418). Campbell and Griffin (1966) listed 16 localities from which material of this species had been examined. It had previously been recorded from Western Port, Lakes Entrance, and Port Phillip in Victoria by Fulton and Grant (1906) as well as from more northern localities.

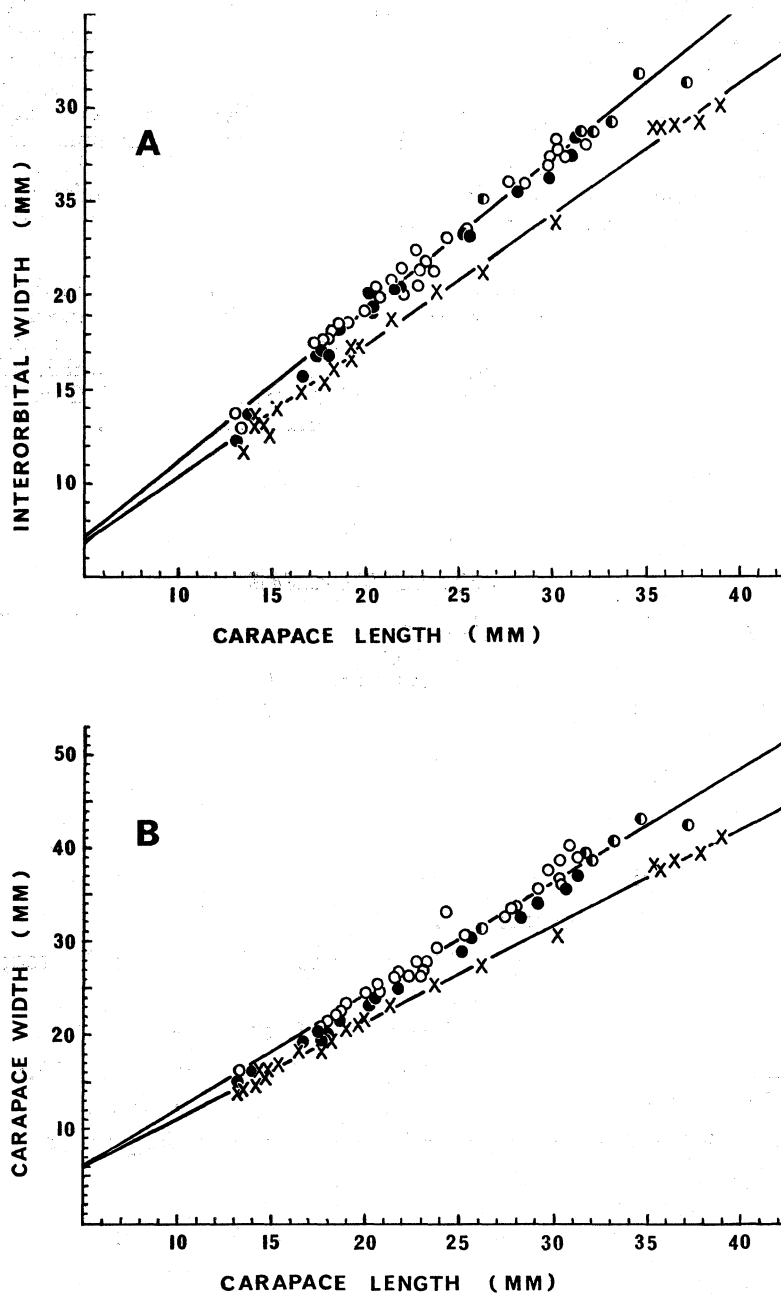


Figure 4.—Relative growth of three dimensions of the carapace in *Paragrapsus* species: A, interorbital width relative to carapace length; B, carapace width relative to carapace length. *P. laevis* (N.S.W.) are represented by open circles; *P. laevis* (Victoria) by half-closed circles; *P. laevis* (Tasmania) by closed circles and *P. gaimardii* by crosses. The lines are the regression lines fitted by the method of least squares (see text and table 1).

Remarks.—A full description of this species was given by Campbell and Griffin (1966), who dealt briefly with the differences between *P. gaimardii* and *P. laevis* and illustrated and commented upon one specimen from Victoria which appears to be intermediate between the two species in at least nine characters.

Examination of the specimens from eastern Tasmania similarly revealed at first some rather striking differences from the typical mainland specimens of this species. These differences mainly involve four characters: the felting of the propodus of the first ambulatory leg; the felting of the propodus of the fourth ambulatory leg, the nature of the junction of the first and second thoracic sternites; and the shape of the sixth segment of the male abdomen. The marked differences usually existing between the two species in these characters are set out by Campbell and Griffin (1966: 162–9).

Critical examination of seventeen of these Tasmanian specimens shows, however, on comparison with six specimens from Victoria and twenty-nine New South Wales specimens of *P. laevis* (listed in Campbell and Griffin), that there is a slight tendency for the former to have:

(1) the felt on the anterior surface of the first ambulatory propodus divided by a thin naked stripe throughout the length of the segment (2 Tasmanian, 2 Victorian, and 1 N.S.W. specimen);

(2) the felt on the dorsal surface of the fourth ambulatory propodus confined to the distal third (9 Tasmanian, 1 Victorian, and 3 N.S.W. specimens);

(3) the second sternite in the male to be raised above the first (7 Tasmanian, 5 Victorian, and 11 N.S.W. specimens);

(4) the sixth segment of the male abdomen to be twice as broad as long (see table 2).

Table 1. Relative growth of three dimensions of the carapace of *P. laevis* and *P. gaimardii* (see fig. 4); x and y are the variables given by the equation $y = a + bx$; x in all cases is carapace length. The values of a and b are given (together with their standard error) for each species and each regression. The significance given is the sums of squares due to the regression as a percentage of the total sums of squares.

Species	<i>P. laevis</i>		<i>P. gaimardii</i>	
Area (n)	N.S.W., Victoria, and Tasmania		Victoria and Tasmania	
	(52)		(22)	
	interorbital width			
y	..	..	..	..
a	..	..	..	..
b	..	..	..	..
significance	..	..	..	..
		2.95 (0.086)		3.28 (0.182)
		0.81 (0.015)		0.70 (0.021)
		98.39		98.30
	carapace width			
y	..	..	..	..
a	..	..	..	..
b	..	..	..	..
significance	..	..	..	..
		—0.47 (0.145)		1.10 (0.268)
		1.22 (0.025)		1.02 (0.031)
		97.99		98.20

Table 2. Ratio width/length of sixth abdominal segment of males of *Paragrapsus* species.

Species	<i>P. laevis</i>			<i>P. gaimardii</i>
	N.S.W.,	Victoria,	Tasmania	Victoria and Tasmania
Area				
<i>n</i>	29	6	17	22
Mean	1.68	1.77	1.90	2.08
<i>s</i>	0.070	0.110	0.112	0.096
Range	1.50– 1.96	1.70– 2.00	1.66– 2.12	1.92– 2.28

Whilst these features do represent slight differences between the two groups—in the case of the last two features there are resemblances to *P. gaimardii*—they are not consistent enough to allow any kind of taxonomic separation between Tasmanian *P. laevis* and mainland specimens. Equally, there is clear evidence that *P. gaimardii* and *P. laevis* are distinct species. The four features exhibited by the Tasmanian specimens are sometimes found in mainland ones. Tasmanian specimens show no differences from other *P. laevis* in the relative width of the carapace between the external orbital angles or more posteriorly, dimensions which differ significantly in *P. laevis* and *P. gaimardii* (see fig. 4 and table 1).

Subfamily **PLAGUSIINAE**

Genus **Plagusia** De Haan, 1835

Plagusia chabrus (Linnaeus)

Restricted synonymy:

Cancer chabrus Linnaeus, 1758: 628.

Plagusia capensis; Tweedie, 1942: 22. Guiler, 1952a, 41; 1956: 7.

Plagusia chabrus; Bennett, 1964: 85.

Material examined.—A total of 12 specimens (7 ♂♂, 5 ♀♀, 36–79 mm).

Localities.—Bass Strait: Currie Harb., King I. Tasmania: Off Stanley; Eddystone Point; Bicheno; Maria I.; Adventure B., Bruny Is.

Habitat.—On rocky coasts exposed to light to heavy surf, in crevices and pools below low tide.

Distribution.—Temperate southern Indian and Pacific Oceans from South Africa through Australia and New Zealand to Chile. Within Australia this species has been recorded from several localities in western, southern, and eastern Australia (see fig. 9). In Tasmania Guiler (1956) records the species from Pt. Puer and Port Arthur, whilst earlier Fulton and Grant (1906) and Rathbun (1923) had recorded it from Bass Strait.

Remarks.—Bennett and Pope (1960) found this species at Grant Pt., Bicheno, Sleepy Bay, C. Forestier, Fossil Island in Pirates Bay, Tasman Island, and Bruny Island (Elizabeth C. Pope, pers. comm.).

Only Guiler (see above) had previously published Tasmanian localities for this species; as in the case of *Leptograpsus variegatus*, Tweedie did not collect any specimens of *P. chabrus* from Tasmanian coasts.

Family **OCYPODIDAE**Subfamily **OCYPODINAE**Genus **Heloecius** Dana, 1851**Heloecius cordiformis** (H. Milne Edwards)

Figs. 5a-g, 6a-c, 7a-c

Gelasimus cordiformis H. Milne Edwards, 1837: 53 (type locality: "Australasie"; type in Muséum National d'Histoire Naturelle, Paris).

Heloecius cordiformis; Dana, 1852a: 248. Hess, 1865: 144. Heller, 1874: 75. Haswell, 1882b: 91 (synon.). Whitelegge, 1889: 229. Fulton and Grant, 1906: 18. Chilton and Bennett, 1929: 762 (synon.). Tweedie, 1942: 23, fig. 9. Guiler, 1952a: 41. Guinot, 1962: 10, fig. 7a, b.

Heloecius inornatus Dana, 1852a: 248 (type locality: "New South Wales"; type probably not extant); 1852b: 321; 1855: pl. 19 fig. 7.

Heloecius areolatus Heller, 1862: 519 (type locality: "Sydney"; location of type unknown). Hess, 1865: 144.

Heloecius signatus Hess, 1865: 145 (type locality: Sydney; type in Gottingen Museum). (Not *Gelasimus signatus* Hess, 1865: 146, pl. VI fig. 6.)

Material examined.—A total of 65 specimens (38 ♂♂, 27 ♀♀, 5–25 mm).

Localities.—Tasmania: Crayfish Ck.; Swan B., Tamar R.; Double Ck.; Prosser R. at Orford; Eaglehawk B.; Risdon Cove; Elwick B.; North West B.; Margate; Snug B.

Habitat.—In muddy estuaries, intertidal, in burrows (see Griffin, 1965).

Distribution.—Confined to eastern Australia, from Brisbane R. in the north to Tasmania in the south (see fig. 10). Tweedie recorded this species from Brown's River and Orford and it has also been recorded from several eastern Australian localities.

Hess (1865: 144) recorded this species from "South Australia" under the name *Heloecius inornatus* Dana. It has not since been recorded west of Western Port, Victoria, so that its presence in South Australia should be regarded as unlikely.

Remarks.—A reasonably good description and figure of this species were provided by Tweedie (1942: 23, fig. 9).

The suborbital border bears, not far from the base, a small, sharp, slender spine. As Tweedie notes, the first three ambulatory meri are densely hairy dorsally and ventrally. However, this is true only of the males; females have all the ambulatories naked, the dorsal, anteroventral and posteroventral edges of the meri being finely tuberculate. The whole of the ventral surface of the merus of the cheliped is also densely felted in the male but naked in females. Sexes can be separated on the basis of this last character down to a carapace width of 5 mm. Females, and juveniles of both sexes, have a relatively small chela with the fingers somewhat longer than the palm.

The basal teeth of the dactyl of the cheliped are generally grouped into a prominent lamina.

Supplementary characters include the presence of more or less broad, spooned hairs on the tip of the endopodite of the second maxilliped and of "woolly" hairs on the inner edge of the merus (cf. *Uca* species—Crane, 1941).

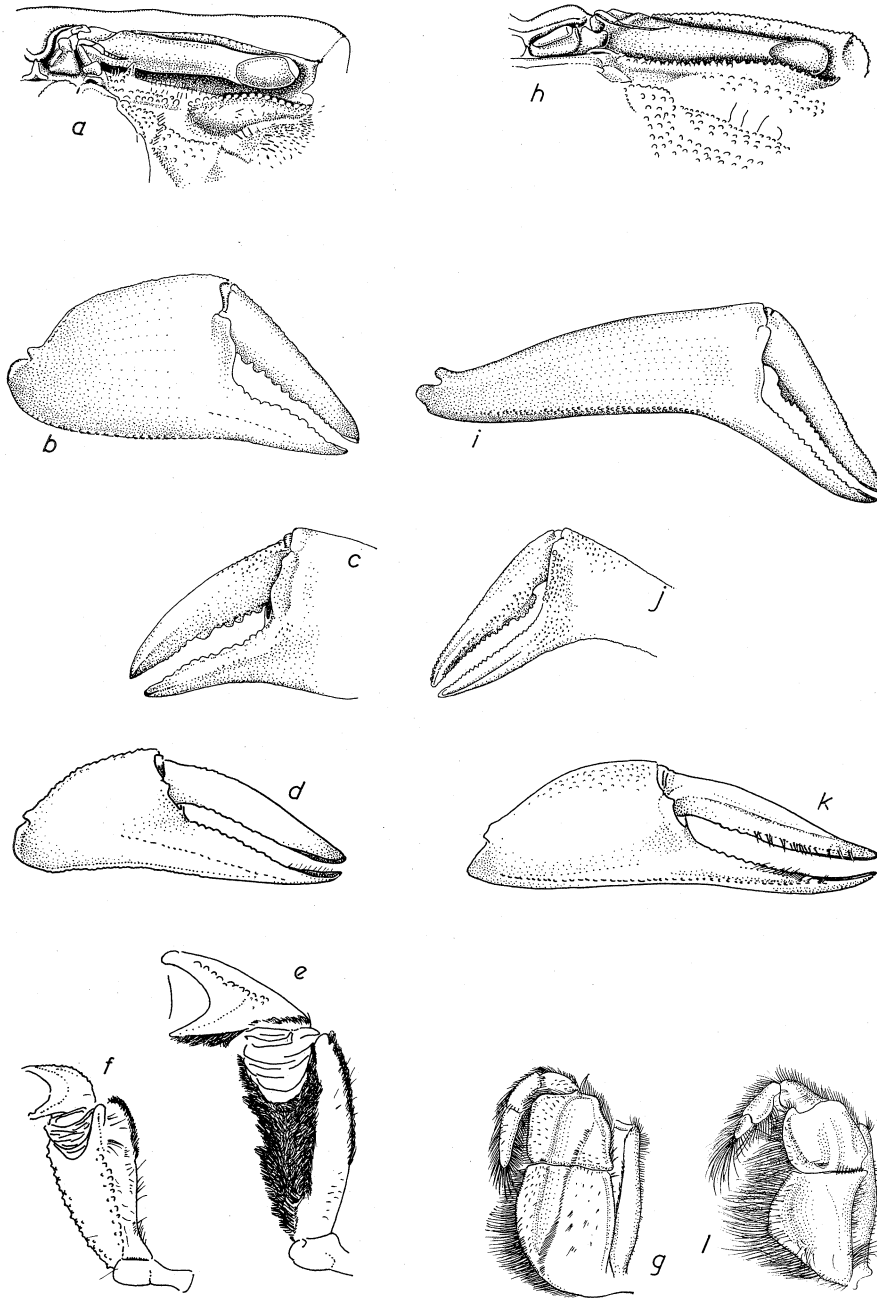


Figure 5.—*Heloecioides cordiformis* (a-g), male, 22 mm, Snug Bay (a-c, e-g), female, 20 mm, Margate (d, f); and *Hemiplax latifrons* (h-l), male, 26 mm (h-j, l), female, 21 mm (k only), near Wynyard: a, h, front of carapace and left orbit, ventral aspect; b, i, male right chela, outer aspect; c, j, tip of same, inner aspect; d, k, female right chela, outer aspect; e, f, right cheliped, merus and carpus, oblique inner aspect (e, male; f, female); g, l, left third maxilliped, outer aspect.

The male first pleopod has previously been figured by Guinot (1962).

The carapace, legs, and proximal segments of the chelipeds of this species are dark greenish-blue obscurely mottled with brown, the palm of the chelae dull slate-blue, paler distally and fading to white on the fingers (Tweedie, 1942).

Subfamily **MACROPHTHALMINAE**

Genus **Hemiplax** Heller, 1865

Hemiplax latifrons (Haswell)

Figs. 5h-l; 6d, e; 7d-f

Macrophthalmus latifrons Haswell, 1882a: 549; 1882b: 90. Tesch, 1915: 154-5.

Microphthalmus latifrons; Fulton and Grant, 1906: 19 (incorrect subsequent spelling of *Macrophthalmus* Heller).

Hemiplax latifrons; Etheridge and McCulloch, 1916: 13, pl. iv figs. 4-5; pl. vi figs. 2-4. Hale, 1927a: 186, fig. 187. Tweedie, 1942: 25, fig. 10. Guiler, 1952a: 41.

Type.—Holotype, a male, carapace width 29.6 mm, a dry specimen fixed on glass with printed label "Type *Macrophthalmus latifrons*, Hasw. Loc. Port Phillip, Victoria" and registered as P.697; Australian Museum, Sydney. The carapace is slightly fractured, the first right ambulatory leg is missing and all the right ambulatory legs, except the first, are independently fixed to the glass.

Material examined.—A total of 77 specimens (45 ♂♂, 32 ♀♀, 8-26 mm).

Localities.—Tasmania: Wynyard; Swan B., Tamar R.; Prosser R. at Orford; Carlton R. near Carlton; Eaglehawk B.; Coal R.; Pittwater; Risdon Cove; Brown's R.; North West B.; Margate; Snug B.; Huon R. at Franklin.

Habitat.—In muddy estuaries, intertidal, in burrows (see Griffin, 1965).

Distribution.—Confined to southeastern Australia, from St Vincent's Gulf through Victoria to Tasmania (see fig. 10). This species has been reported from Orford and the Carlton River in Tasmania (Tweedie) and from a few localities in Victoria and South Australia (Fulton and Grant; Hale).

Remarks.—A reasonably good description of this species was provided by Tweedie (1942: 25, fig. 10) and it has also been figured by Hale (1927a: fig. 187).

The second to fourth ambulatory legs are densely felted in both sexes, the first leg being naked with the merus finely tuberculate along the edges.

The male pleopod bears a dense fringe of plumose setae along its lateral surface. The distal flap is almost wholly on the sternal surface and the tip bears quite a dense cluster of simple setae.

Supplementary characters include the presence of poorly expanded, deeply serrate spooned hairs on the tip of the endopodite of the second maxilliped and of simple hairs on the inner edge of the merus.

Individuals of this species are generally dark greenish or greyish brown, the chelae paler (Tweedie, 1942). The underside of the body is also pale and there may be a transverse band of pale pink across the central sternites.



Figure 6.—*Heloecius cordiformis* (a-c) and *Hemiplax latifrons* (d-f), same specimens as in fig. 5: a, d, male right first ambulatory leg, anterior aspect; b, female right first ambulatory leg, merus, anterior aspect; c, e, male right fourth ambulatory leg, posterior aspect

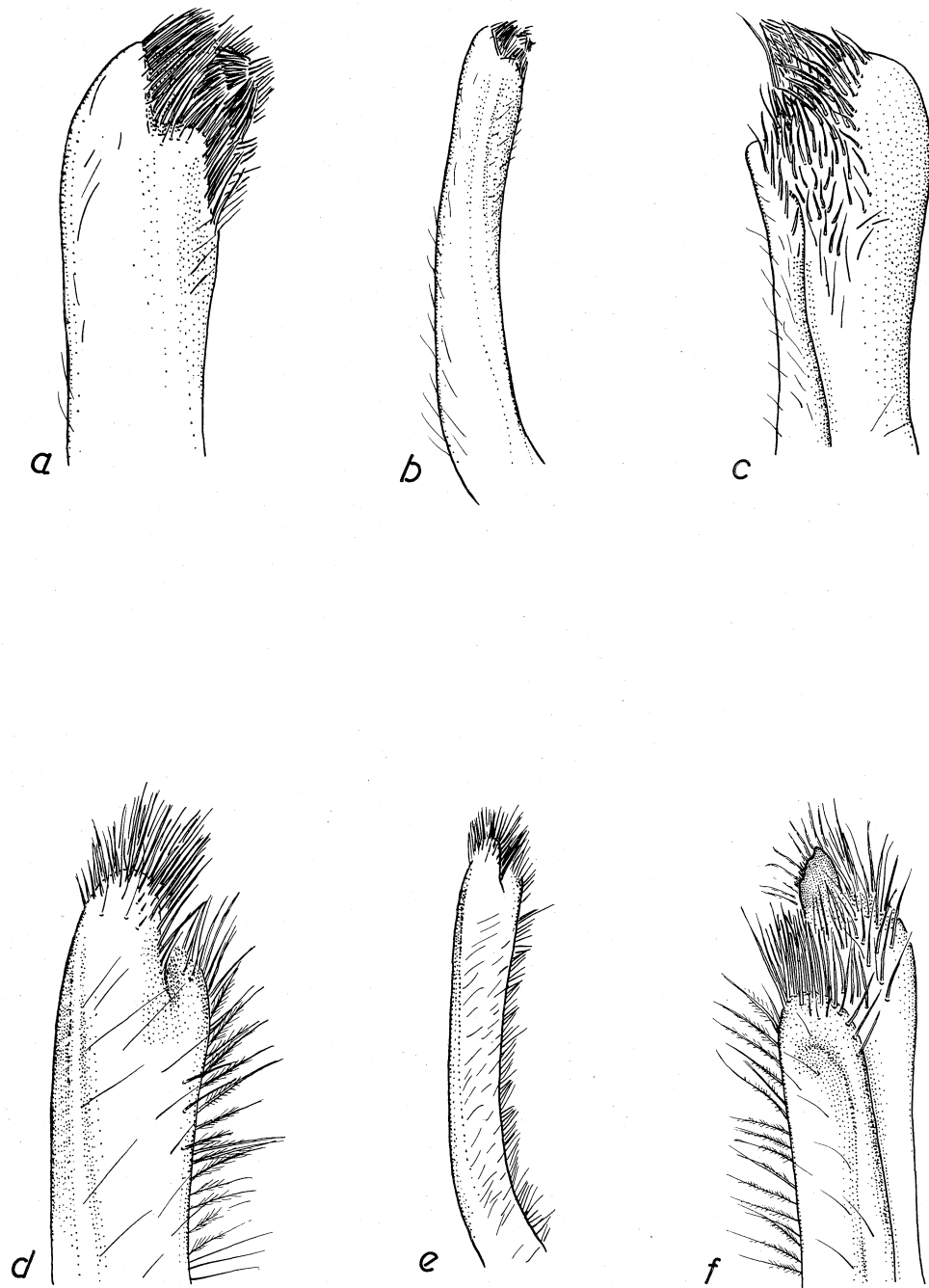


Figure 7.—Male first pleopods of *Heloecius cordiformis* (a-c) and *Hemiplax latifrons* (d-f), same specimens as in fig. 5: a, d, tip of pleopod, abdominal aspect; b, e, whole pleopod (except base), abdominal aspect; c, f, tip of pleopod, sternal aspect.

H. latifrons can be easily distinguished from the New Zealand congener *H. hirtipes* (Jacquinot) by the slightly narrower front [from a quarter to a fifth carapace width (Tweedie) as opposed to one-third carapace width in the New Zealand species—Richardson, 1949a: 36.] Examination of material of *H. hirtipes* (an adult male and female—AM P.700—in the Australian Museum's collections) show the following other differences between the two species:

(1) the eyestalks are slender and reach fully to the tip of the exorbital spine in *H. latifrons* but are stout in *H. hirtipes* and shorter, not nearly reaching the exorbital spine;

(2) the carapace widens markedly posteriorly in *H. latifrons* but narrows in *H. hirtipes*;

(3) the anterolateral margin bears two broad, rounded lobes behind the orbit in *H. latifrons* and two sharp flattened spines, in *H. hirtipes*;

(4) the carpus of the cheliped is long and slender in *H. latifrons* without a spine but short and fairly stout in *H. hirtipes* with a dorsal spine on the inner surface.

The relationship of *H. latifrons* to species of *Macrophthalmus* requires further elucidation in view of these strong differences from *H. hirtipes*.

ZOOGEOGRAPHY AND RELATIONSHIPS OF THE TASMANIAN GRAPSID AND OCYPODID FAUNA

Of the eleven Tasmanian grapsids and ocypodids, all but two are widely distributed around Tasmania. These two are *Leptograpsus variegatus* and *Paragrapsus laevis*, which appear to be confined to the northern part of the east coast, perhaps due to the influence of the warm East Australian current. Previously, *L. octodentatus* has been reported only from the north coast. This species is, however, quite widely distributed around Tasmania.

None of the species is confined to Tasmania. However, five species are otherwise known only from Victoria and eastern South Australia. These are *C. granulatus*, *P. quadridentatus*, *P. gaimardii*, and *H. latifrons*, which are endemic to Australia, and *B. spinosus*, which is known also from two localities in the central-west Pacific Ocean. The distributional limits of these species are additional evidence for the existence of the southeastern Australian "Maugean" marine province (Bennett and Pope, 1953, 1960).

Of the remaining six species, three (*H. haswellianus*, *P. laevis*, and *H. cordiformis*) have an eastern distribution in Australia, being known from as far north as Brisbane (Queensland) and along Victorian coasts; the distribution of *H. haswellianus* also includes South Australia. Of those species which occur outside Victoria and South Australia, *L. octodentatus* is the only one which is not known from central eastern Australia. The distribution of this species is western; it is not known outside Australia.

Two species only, *L. variegatus* and *P. chabrus*, are widespread outside Australia. Within Australia, both species are widely distributed southern forms.

The distribution patterns of the eleven are compared in table 3; text-figure 8 shows the Tasmanian distribution of four species, the two with limited eastern distributions and two with wider distributions. Text-figures 9 and 10 show the Australian distributions of all species.

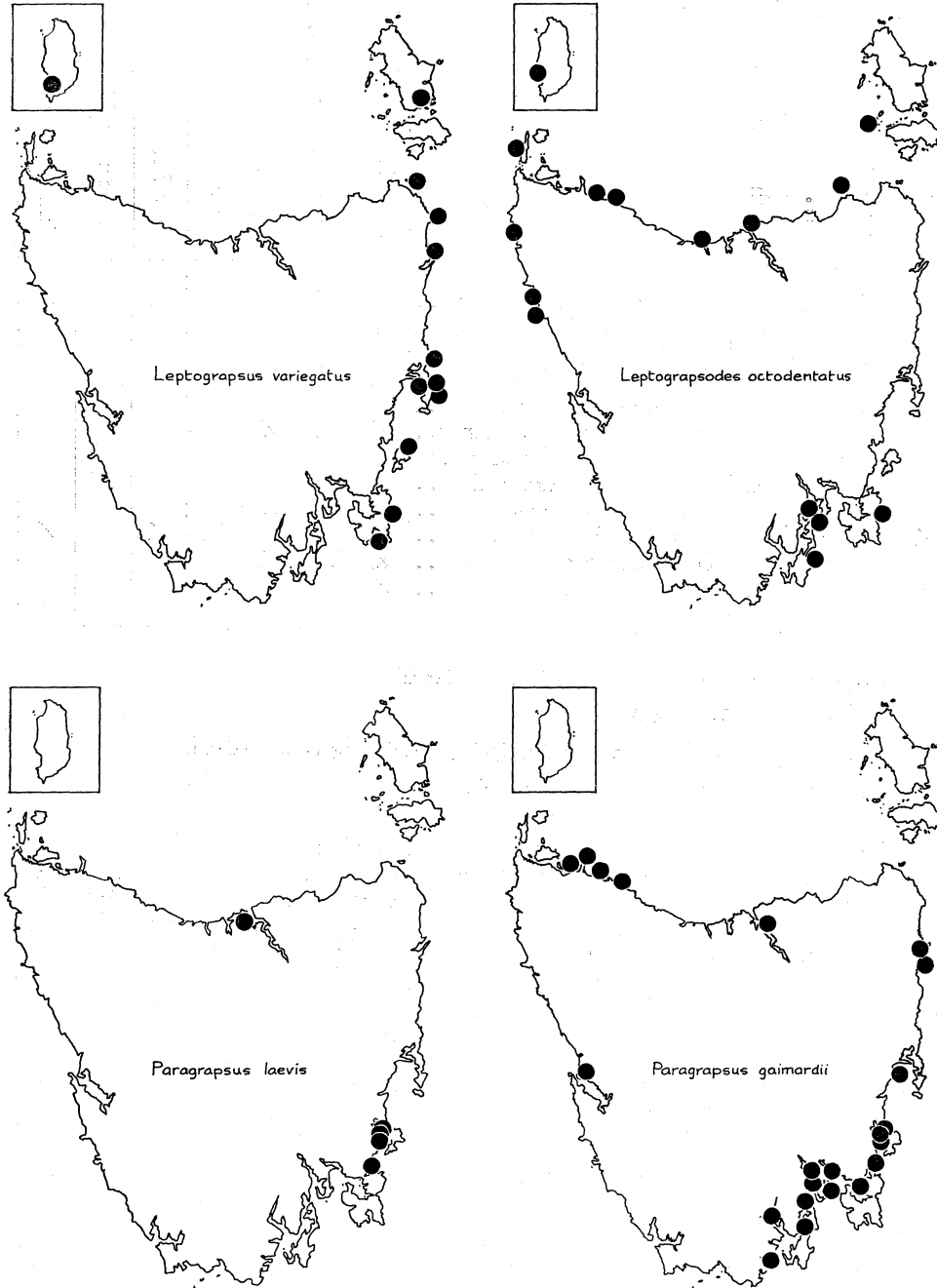


Figure 8.—Known Tasmanian distribution of four species of Grapsidae. As far as possible each circle represents a single locality.

Table 3. Geographical distribution throughout Australia and the southern Indo-Pacific of the eleven species of Tasmanian Grapsidae and Ocypodidae.

South Africa	N.W. Australia ¹	S.W. Australia ²	South Australia		Victoria	New South Wales	Queensland	Western Pacific ³	New Zealand	Eastern Pacific ⁴	Chile
	X	X	X	<i>Leptograpsus variegatus</i> ..		X	X	X	X	X	X
		X	X	<i>Leptograpsodes octodentatus</i> .	X						
			X	<i>Brachynotus spinosus</i> ..	X						
			X	<i>Cyclograpsus granulatus</i> ..	X						
			X	<i>Helograpsus haswellianus</i> ..	X	X	X				
			X	<i>Paragrapsus quadridentatus</i>	X						
			X	<i>Paragrapsus gaimardii</i> ..	X						
			X	<i>Paragrapsus laevis</i> ..	X	X	X				
X		X	X	<i>Plagusia chabrus</i> ..	X	X		X	X		X
			X	<i>Heloecioides cordiformis</i> ..	X	X	X				
			X	<i>Hemiplax latifrons</i> ..	X						

¹ Western Australia north of the Abrolhos Islands.

² Remainder of Western Australia.

³ Pacific Ocean west of Tuamotu Archipelago, excluding New Zealand.

⁴ Pacific Ocean east of Tuamotu Archipelago.

The eleven Tasmanian species are at present included in nine genera. Four of these, *Leptograpsodes*, *Helograpsus*, and *Heloecioides*, which are monotypic, and *Paragrapsus*, which contains three species, are restricted to Australia, and one *Hemiplax*, which contains one other species, is represented only in New Zealand and perhaps the south Pacific. The genera *Brachynotus*, *Cyclograpsus*, and *Plagusia*, all containing fairly large numbers of species, are widely represented throughout the Indo-west-Pacific.

Lastly, the monotypic *Leptograpsus* is a widely distributed, southern warm temperate genus. Thus, of the five genera found outside Australia three are widespread Indo-west-Pacific taxa and four are represented in other temperate regions including New Zealand.

Of the grapsid subfamilies, the best represented is the Sesarminae with five species and three genera; the other subfamilies are each represented by one or two species and genera.

The relationships of the Tasmanian (and southeastern Australian in general) grapsid and ocypodid fauna are clearly with the rest of Australia and the Indo-west-Pacific. There, the local species and genera find their closest relatives if they are not actually present themselves. Certainly, there are similarities with other non-Australian cool temperate regions, particularly New Zealand, such as the sharing

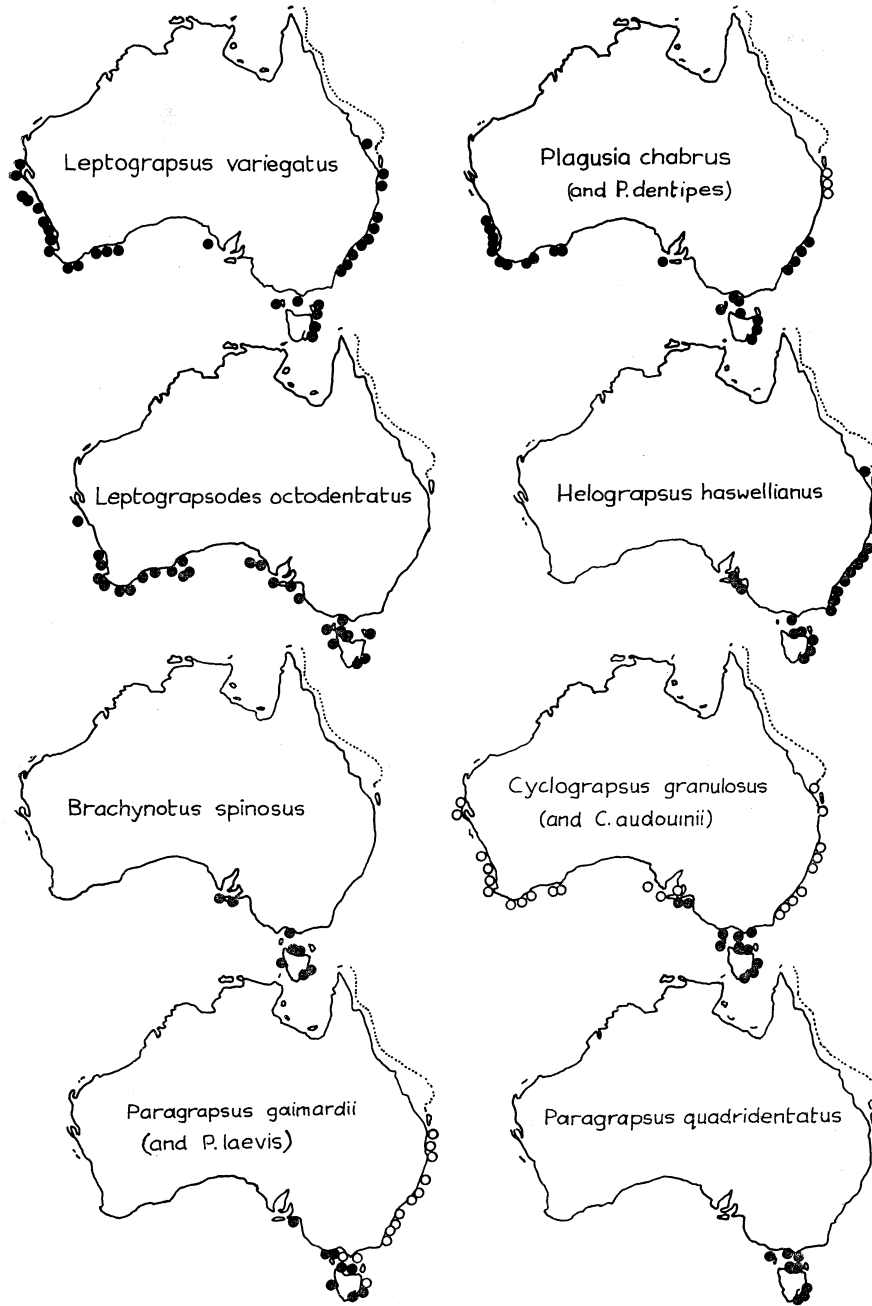


Figure 9.—Known geographical distribution, within Australia, of the nine species of Tasmanian Grapsidae. In the case of *Plagusia*, *Cyclograpsus*, and *Paragrapsus* species the distribution of one congener (*P. dentipes*, *C. audouinii*, and *P. laevis*) is shown by open, instead of filled, circles. As far as possible each circle represents a single locality; distribution of *Leptograpsodes octodentatus* after George (1962).

of the species *L. variegatus* and *P. chabrus* and of the genera *Cyclograpsus* and *Hemiplax*. Numerous similarities between the distribution patterns of southern temperate intertidal floras and faunas have been reviewed by Guiler (1952c), Knox (1960, 1963), and others. However, New Zealand, which, like Tasmania, possesses few grapsids and ocypodids (Bennett, 1964), differs notably from Tasmania in the dominance of many of its shores by varunines of the genus *Hemigrapsus*, not by sesarmines. The New Zealand species of this genus are markedly different from the Tasmanian varunine *Brachynotus spinosus*. It is doubtful, too, if the Australian *Hemiplax latifrons* is more closely related to the New Zealand *H. hirtipes* than to species of the Indo-Pacific genus *Macrophthalmus*, which is well represented on warm temperate to tropical Australian shores.

Chile (Garth, 1957) shares two species with Tasmania (see table 1) and, apart from this, one genus, *Cyclograpsus*. The two species of the latter genus are quite different from Australasian species, one, *C. punctatus*, being found also in South Africa, which possesses one species in common with Tasmania. Both Chile and South Africa (Barnard, 1950) possess varunines rather different from Tasmanian ones (species of *Crytograpsus*, *Hemigrapsus*, and *Aratus* in Chile and of *Varuna* in South Africa). The similarities of the grapsid faunas of southern temperate regions due to sharing of *L. variegatus* and *P. chabrus* may be accounted for by the possible existence in these species of relatively long-living larvae, widely travelling by means of the West Wind Drift. The Tasmanian grapsids and ocypodids appear to show similar patterns in their geographic distributions and relationships to those of other Australian Brachyura (e.g., portunid crabs—Stephenson, 1962; majid crabs—Griffin, 1966).

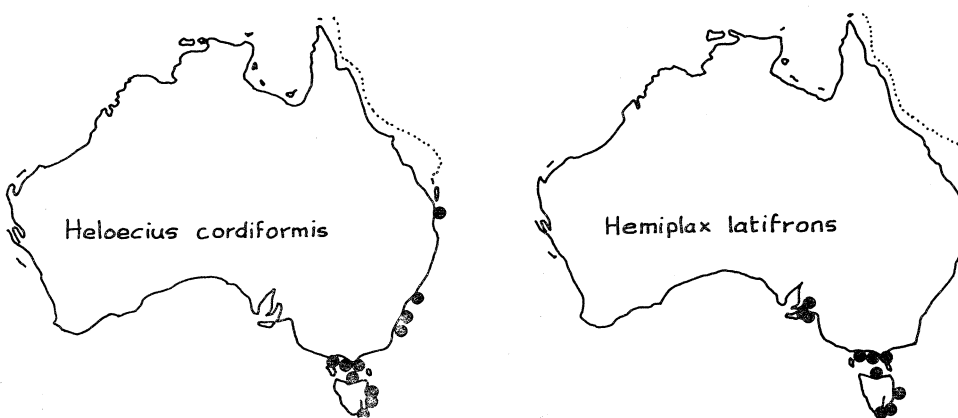


Figure 10.—Known geographical distribution of the two species of Tasmanian Ocypodidae.

ACKNOWLEDGEMENTS

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ADDENDUM

Since this paper was written Griffin (*Crustaceana* 15: 210-213, 1968) has designated the lectotype of *Plagusia capensis* De Haan, 1835, as the neotype of *Cancer chabrus* Linnaeus, 1758.

Barnes (*Trans. zool. Soc. Lond.* 31: 239, 1968) has returned *Hemiplax latifrons* (Haswell) to the genus *Macrophthalmus* and created for it the new subgenus (*Tasmanoplax*). *Hemiplax hiriipes* (Jacquinot) has been transferred to *Macrophthalmus*, *Hemiplax* being considered as a subgenus.