

The Australian species of the genus *Ibacus* (Crustacea: Decapoda: Scyllaridae), with the description of a new species and addition of new records

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Key words: Decapoda; Scyllaridae; *Ibacus*; new species; Australia.

A new species of scyllarid lobster, *Ibacus chacei*, from eastern Australia is described and illustrated. The new species can be distinguished from all other known *Ibacus* species by the shape of the third maxilliped. *Ibacus brevipes* Bate, 1888 is recorded from Australia for the first time. Seven out of the eight known species of *Ibacus* are now recorded from Australia. Colour descriptions, and updated distributions for all Australian *Ibacus* species are included, plus further comments on the type locality of *Ibacus peronii* Leach, 1815. Colour illustrations and a key to the eight known species of *Ibacus* are also provided.

Introduction

The genus *Ibacus* occurs only in the Indo-West Pacific region (Holthuis 1985, 1991), and until the mid 1970's, only two species, *I. peronii* Leach, 1815 and *I. alticrenatus* Bate, 1888 were recorded from Australian waters. Holthuis (1977) described *I. brucei* from eastern Australia and New Zealand and in his review of the Ibacinae (1985) recorded *I. novemdentatus* Gibbes, 1850 and *I. ciliatus pubescens* Holthuis, 1960 from Western Australia.

Intensive trawling off the New South Wales coast by New South Wales State Fisheries Research Vessel 'Kapala', and off northeastern Queensland by Commonwealth Scientific and Industrial Research Organisation (CSIRO), has resulted in the discovery of a new species, *I. chacei*, and a new record, *I. brevipes* Bate, 1888. The number of *Ibacus* recorded in Australian waters is now seven out of eight known species. This is the largest number of *Ibacus* species recorded from any country in the Indo-West Pacific region. The only species not at present found in Australian waters is *Ibacus ciliatus* (Von Siebold, 1824) (text-fig. 1A, pl. 9), known from Japan, Korea, Taiwan and China south to Thailand and the Philippines.

The purpose of this paper is to describe the new species and compare it with the other known species of *Ibacus*; provide revised distributions, and colour descriptions of all the Australian species of *Ibacus*, and to provide colour illustrations and an updated key to the eight known *Ibacus* species. The opportunity is also taken to comment further on the type locality of *Ibacus peronii*.

In the present paper only the synonyms of each species, the newer references and those not or incorrectly cited in Holthuis, 1985 are included. For older references to the species, reference can be made to Holthuis, 1985.

Materials and methods

The descriptive format and terminology follows that of Holthuis (1985, 1991). All measurements (mm) are of median carapace length (cl), measured from the rostrum to posterior carapace margin. Colour descriptions of *Ibacus chacei*, *I. alticrenatus*, *I. peronii*, *I. novemdentatus*, and *I. brucei* are based on photographs of frozen specimens. The colour descriptions of *I. brevipes* and *I. pubescens* are based on photographs of fresh specimens. Type material is deposited in the Australian Museum, Sydney (AM); Northern Territory Museum, Darwin (NTM); Queensland Museum, Brisbane (QM); Tasmanian Museum, Hobart (TMH); National Museum of Natural History, Washington, D.C. (USNM); Nationaal Natuurhistorisch Museum, Leiden (RMNH). Other institutional abbreviations used are: Museum of Victoria, Melbourne (NMV); Western Australian Museum, Perth (WAM). Specimens prefaced with 'DB' before the number (e.g. DB5607) are to be deposited at the Australian Museum.

Systematic account

Family Scyllaridae Latreille, 1825
Subfamily Ibacinae Holthuis, 1985
Genus *Ibacus* Leach, 1815

Key to the species of the genus *Ibacus*
(After Holthuis, 1985, 1991)

1. Merus of third maxilliped with ventral surface slightly concave, not swollen and not coloured differently from the other segments; inner margin sometimes crenulate but not with deep incisions (eg. fig. 1A) 2
- Merus of third maxilliped swollen, often with yellowish tinge, with deep incisions on inner margin, several of which may reach beyond middle of merus (eg. fig. 1B) 5
2. Anterior margin of the wide cervical incision of carapace forming posterior margin of anterolateral angle of the carapace; the carapace shows no lateral margin between anterolateral angle and the cervical incision. Carapace with 7-9 posterolateral teeth 3
- Anterior margin of the narrow cervical incision of carapace reaching the lateral margin some distance behind the anterolateral angle. Part of the lateral margin of the carapace extends between the anterolateral angle and the cervical incision and bears teeth there. Carapace with 10-15 posterolateral teeth 4
3. Dorsal surface of body with short, velvety pubescence. Fourth segment of antenna slender, without lateral teeth, regularly narrowing from base to tip *Ibacus alticrenatus* Bate
- Dorsal surface of body naked to unaided eye, with microscopically small scattered setae. Fourth segment of antenna not slender, at first widening in lateral direction before narrowing into apex, with distinct lateral margin that is provided with well-developed teeth *Ibacus brucei* Holthuis
4. Carapace of adult specimens naked. Lateral margin of carapace with 10-12, usual-



- ly 11 posterolateral teeth *Ibacus ciliatus* (Von Siebold)
- Carapace of adult specimens with a thick cover of velvety pubescence. Lateral margin of carapace with 11-15, usually 12 posterolateral teeth *Ibacus pubescens* Holthuis
- 5. Lateral margin of carapace behind cervical incision with 12-18 teeth *Ibacus brevipes* Bate
- Lateral margin of carapace behind cervical incision with 6-9 (usually 7 or 8) teeth 6
- 6. Posterior incision of orbit without prominent tubercle *Ibacus novemdentatus* Gibbes
- Posterior incision of orbit with prominent tubercle 7
- 7. Posterior branchial carinae of carapace strongly convex, not lying in one line with the anterior branchial carinae. Merus of third maxilliped evenly swollen; wing-like expansion of outer meral margin long, strongly toothed along entire length ... *Ibacus peronii* Leach
- Posterior branchial carinae of the carapace straight, or slightly diverging distally, lying in one line with the anterior branchial carinae. Merus of third maxilliped unevenly swollen, produced into spherical knob distally; wing-like expansion of outer meral margin short, not reaching middle of segment, with a few blunt teeth basally *Ibacus chacei* spec. nov.

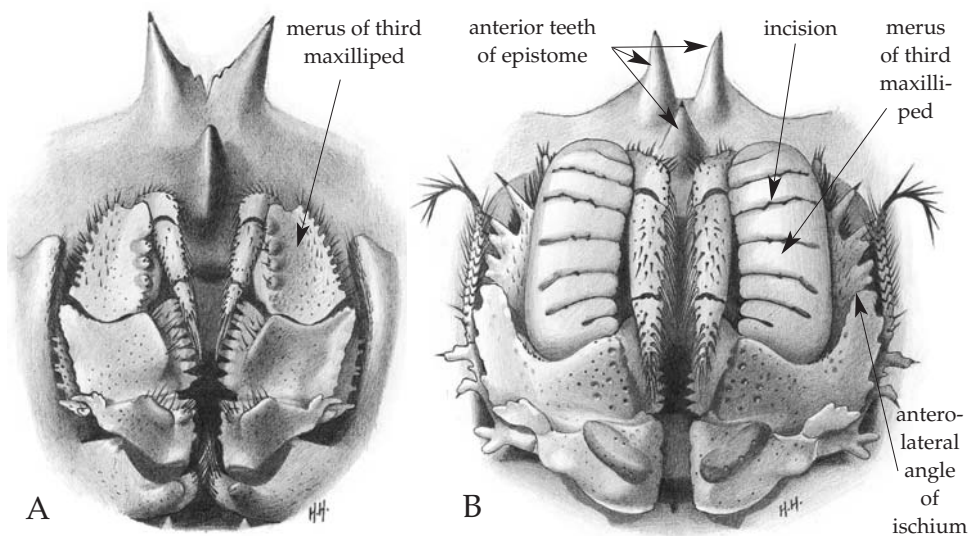


Fig. 1. Third maxillipeds in ventral view; A, *Ibacus ciliatus*; B, *I. peronii*. (From Holthuis, 1991).

Ibacus chacei spec. nov.
(figs 2A, 3A, B; Pl. 1)

Ibacus alticrenatus; Coleman, 1977: 132 (colour fig.); Coleman, 1987: 104 (colour fig.). (Not *I. alticrenatus* Bate, 1888).

Ibacus peronii; Grant, 1982: colour plate 455; Grant, 1993: colour plate 455; Dakin & Bennett, 1987: 221





116 Brown & Holthuis. The Australian species of the genus *Ibacus*. Zool. Med. Leiden 72 (1998)

(colour fig.); Bennett, 1992: 135 (colour fig.). (Not *I. peronii* Leach, 1815).

Ibacus sp. (smooth bug) Kailola et al., 1993: 396; Graham et al., 1993a: 11, 17, 64, fig. 14; Graham et al., 1993b: 10, 18, 73, fig. 16; Graham et al., 1995: 14, 15, 52; Graham et al., 1996: 63; Graham & Wood, 1997: 9, 90, figs 3, 12, 33; Stewart et al., 1997: 344.

Holotype.— ♂ (45 mm cl), AM P32741, SE of Cape Hawke, NSW, 32°18'S 152°43'E, 91 m depth, FRV 'Kapala', stn K78-19-06, 12.ix.1978.

Paratypes.— **New South Wales:** 1 ♂ (46.5 mm cl), AM P32742, same locality data as holotype; 3 ♂♂ (52-57 mm cl), 3 ♀♀ (56-60 mm cl), AM P31407, same locality as holotype; 2 ♂♂ (43-44 mm cl), 1 ♀ (35 mm cl), AM P31548, E of Cape Bryon, 28°37'S 153°50'E, 137-146 m depth, FRV 'Kapala', stn K78-17-19, 18.viii.1978; 2 ♀♀ (49-52 mm cl), AM P15589-15590, Ballina, off Richmond River mouth, 28°52'S, 52-56 m depth, 7.x.1962; 1 ♂ (33 mm cl), 1 ♀ (33 mm cl), AM E2026, 1 ♂ (33 mm cl), QM W3054, 2 ♂♂, (29-38 mm cl), TMH G1110 (not seen, but identified by A. Green), 1 ♂ (40 mm cl), 1 ♀ (36 mm cl), 1 juvenile (34 mm cl) RMNH D 37610, 11 miles SE of Ballina, 49-50 m depth, FIS 'Endeavour', 1909-1914; 2 ♀♀ (53-58 mm), NTM Cr 012310, 1 ♂ (41 mm cl), 2 ♀♀ (51-61 mm cl), USNM 243402, Between North and South Solitary Islands, Coffs Harbour, 64-73 m depth, Coffs Harbour Fish Cooperative, 12.viii.1988.— **Queensland:** 1 ♂ (55 mm cl), QM W14341, 17°52'S 146°55'E, 200 m depth, CSIRO RV 'Soela' Cruise 6, stn 52, 30.xi.1985; 1 ♀ (59 mm cl), RMNH D 36219, E of Townsville, 182 m depth, C. Jones, FV 'Apollo', xi.1984; 1 ♀, (46 mm cl), QM W15358, 23°33'S 152°23'E, 240 m depth, Queensland Fisheries MV 'Southern Intruder', shot 44, 1.xii.1983; 1 ♂ (59 mm cl with lepadids on ventral surface), RMNH D 25523, off the coast of S. Queensland, 26°17'S 153°42'E, 86-87 m, FV 'Nimbus', stn 2, 25.vi.1968; 1 juvenile (15 mm cl), RMNH D 25520, NE of Noosa Heads, 26°31'S, 152°40'E, 137 m depth, A.J. Bruce, FV 'Nimbus', stn 10, 26.vii.1968; 1 ♂ (49 mm cl), 1 ♀ (47 mm cl), 2 juveniles (29-30 mm cl), RMNH D 25522, SE of Noosa Heads, 26°48'S 153°32'E, 101 m depth, FV 'Nimbus', stn 17, 27.vii.1968; 1 ♂ (22 mm cl), RMNH D 25521, NE of Moreton Bay, 27°00'S, 153°33'E, 94-96 m depth, A.J. Bruce, FV 'Nimbus', stn 24, 28.vii.1968; 1 ♂ (33 mm cl), 4 ♀♀ (33-47 mm cl), AM P31406, 1 ♀ (20 mm cl) 1 ♂ (20 mm cl) AM P 31553, SE of Southport, 27°59'S 153°50'E, 137-146 m depth, FRV 'Kapala', stn K78-17-08/09, 16.viii.1978.

Additional Material examined.— **New South Wales:** 2 ♂♂ (16-50 mm cl), AM P31543, SE of Cape Bryon, 28°43'S 153°51'E, 128-138 m depth, collected with *I. brucei*, FRV 'Kapala', stn K78-23-04, 1.xi.1978; 1 ♂ (38 mm cl), 1 ♀ (35 mm cl), AM P31542, NE of Woolli, 29°50'S 150°38'E, 149-153 m depth, FRV 'Kapala', stn K78-16-02, 1.viii.1978; 2 ♂♂ (29-37 mm cl), AM P51098, E of Newcastle, 32°52'S 151°54'E, 27-33 m depth, FRV 'Kapala', stn K95-10-05, 1.viii.1995; 1 ♀ (38.5 mm cl), AM P51097, Wreck Bay, 35°14'S 150°36'E, 32-37 m depth, FRV 'Kapala', stn K93-01-05, 11.ii.1993.— **Queensland:** 1 ♂ (48 mm cl), QM W14298, 17°43'S 146°49'E, 200 m depth, CSIRO RV 'Soela' Cruise 6, stn 53, 30.xi.1985; 1 ♂ (58 mm cl), QM W14289, 17°58'S 147°01'E, 220 m depth, CSIRO RV 'Soela' Cruise 1/86, stn 38, 15.i.1986; 1 ♂ (46 mm), QM W2383, trawled off Cape Moreton, iv.1964; 2 juveniles (20-21 mm cl), QM W11462, 22°06'S 153°02'E, 170 m depth, 28.viii.1983; 2 ♂♂ (24-28 mm cl), 1 ♀ (24 mm cl), AM P48872, E of Swain Reefs, 22°25'S 153°20'E, 181 m depth, FV 'Seadar Bay', stn Qld-1255, 9.ix.1995; 1 ♀ (58 mm cl), QM W10182, 25°11'S 153°45'E, 330 m depth, 'Craigmin' Survey, stn 4, 14.ix.1980; 1 ♀ (44 mm cl), QM W3102, 26°48'S 153°32'E, 100 m depth, FV 'Nimbus', stn 17, 27.vii.1968.

Diagnosis.— Differs from all other known *Ibacus* species by the shape of the third maxilliped: merus swollen, rounded, produced distally into spherical knob, outer margin wing like, expanded in basal half only, with a few blunt teeth; distal half smooth; inner margin with 7-8 deep transverse incisions, with only second-fifth reaching to or beyond middle of segment. Carapace naked, glabrous but pitted, with 6-7 broad teeth behind cervical incision; posterior branchial carinae straight, diverging slightly distally. Posterior incision of orbit with a prominent tubercle.

Description.— Carapace relatively flat, widest at level of first anterolateral tooth; carapace surface strongly pitted, naked, and glabrous. Inner angle of orbit with single



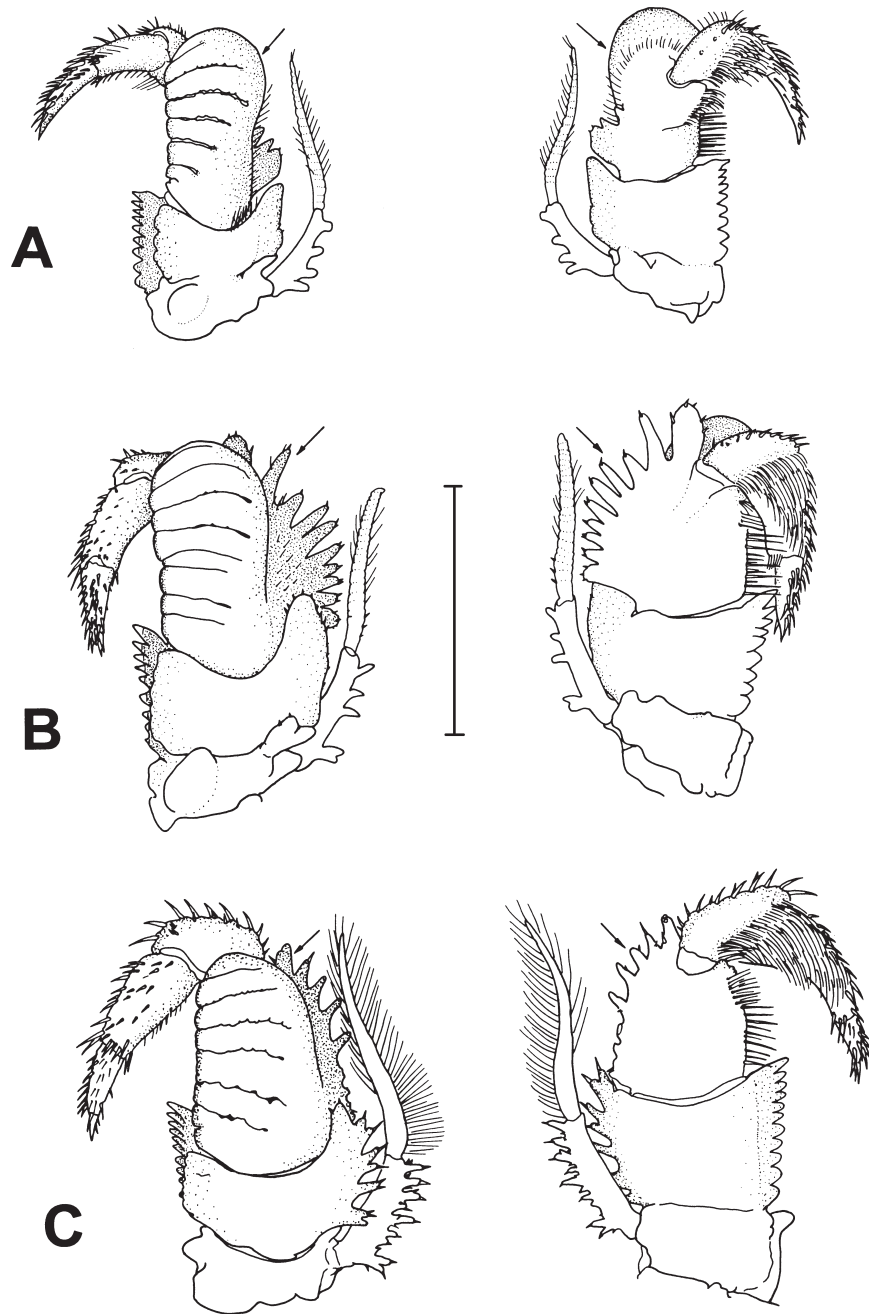


Fig. 2. A, *Ibacus chacei* spec. nov, holotype, AM P32741, left third maxilliped, ventral (left) and dorsal (right) view; B, *I. peronii* Leach, AM P32743, left third maxilliped, ventral (left) and dorsal (right) view; C, *I. novementatus* Gibbes, AM P32745, left third maxilliped, ventral (left) and dorsal (right) view.

blunt tooth; outer angle somewhat produced, with two blunt teeth. Orbital margin denticulate, with shallow incision posteriorly, containing a prominent tubercle (fig. 3B). Anterior margin of carapace between the orbit and anterolateral angle, with 14 small blunt teeth. Cervical incision narrow, rather straight, deep; anterior margin curving gradually forward, forming broad, sharply pointed anterolateral tooth; posterior margin evenly curved with no true anterolateral margin of the carapace between cervical incision and anterolateral tooth. No distinct teeth on this part of the margin, but sometimes slightly crenulate. Behind cervical incision, lateral margin of carapace with 6-7 broad teeth, decreasing in size posteriorly. Anterior branchial carinae and posterior branchial carinae lie in one line. Posterior branchial carinae straight, diverging slightly distally. Posterolateral carina distinct over entire length, with four blunt teeth (pregastric, gastric, cardiac and intestinal), cardiac the most prominent. Branchiocardiac groove present, shallow. Posterior marginal groove deep.

Abdominal somites strongly pitted, naked, glabrous like carapace. All somites with low longitudinal carina, strongest on second somite. Somites 2-6 with oblique groove, beginning medially, extending to posterior end of base of pleura, where it joins a transverse groove. Pleura 2-5 with somites elongate and pointed, with tip of second directed slightly anteriorly. Posterior margins of somites 4-5 with denticles, those of fifth the strongest. Strong median spine is present on margin of fifth somite. Sixth somite surface tuberculate (transverse band) with posterior margin denticulate.

Antennal segments 4 and 6 with surface pitted and naked like carapace. Sixth segment with 4-6 teeth on anterior margin; inner three teeth the largest. Fifth antennal segment terminating in strong, anteriorly directed tooth just exceeding basal segment of antennules. Fourth segment with 8-12 small teeth or granules along a rather straight anterior margin; 4 rather strong teeth on lateral margin, with first tooth elongate, sharp and directed forwards.

Epistome with 3 sharp, conical teeth; 2 are submedian on anterior margin and both directed forwards; third tooth posterior to upper two on median line, directed ventrally.

Merus of third maxillipeds (fig. 2A) swollen, rounded, produced distally into spherical knob. Inner margin with 7-8 deep transverse incisions, only second-fifth reaches to or beyond middle of segment. Outer margin of merus wing like, expanded in basal half only, with a few blunt teeth; distal half smooth, rounded. Outer margin of ischium like shape of small wing-shaped keel, being smooth to slightly crenulate; anterolateral angle slightly pointed, produced forward, falling far short of middle of merus. Basal segment of exopod with row of blunt teeth on outer margin.

Legs slender, with no spine on ischium.

Colour (pl. 1).— Dorsal surface of carapace with background colour of yellow to orange brown, overlaid with spots and marbling of dark red or purple, which tend to merge into vein like lines on lateral areas of carapace. Tip of large anterolateral tooth (before cervical incision) red or purple, with remaining lateral teeth of carapace tipped white. All abdominal somites with anterior and posterior margins dark red or purple, giving slight banded effect to somites. Soft parts of tail fan pale yellow-brown. Anterior margin of sixth antennal segment white, rest of segment plus fourth segment with colour like carapace. Antennular segments red or purple.

Remarks.— Specimens of the new species were first brought to the senior author's

attention, as being a 'variant *Ibacus peronii*' by K. Graham, Biologist, New South Wales Fisheries FRV 'Kapala'. Detailed investigation revealed that the specimens were morphologically distinct from *I. peronii* based principally on the shape of the third maxilliped. Inspection of Australian Museum collections showed that specimens of the new species had been collected as far back as 1909-1914 by FIS 'Endeavour' trawling off the New South Wales coast, but had been confused with *I. peronii*.

I. chacei spec. nov. differs from *I. ciliatus*, *I. pubescens*, *I. alticrenatus*, and *I. brucei* in having the 'merus swollen, with incisions' type of third maxilliped. Of the *Ibacus* species with this type of third maxilliped, *I. chacei* spec. nov. most closely resembles *I. peronii* and *I. novemdentatus* in having between 6-8 teeth on the lateral margin of the carapace (*I. brevipes* has 12-18 teeth). *Ibacus chacei* spec. nov., however, differs from both species in the shape of the merus of the third maxilliped. The outer margin of the merus of the third maxilliped of *I. chacei* has only a short wing-like expansion or keel in the basal part, which carries a few blunt teeth; the distal outer margin is smooth and produced to a rounded knob, and only two or fewer of the meral incisions reach past the middle of the segment (fig. 2A). In contrast, the merus of both *I. peronii* and *I. novemdentatus* is evenly swollen, not produced distally to a rounded knob, most of the incisions on the surface of the merus reach past the middle of the segment, and the wing-like keel of the outer meral margin has strong teeth along the entire length (top to bottom) (figs 2B, 2C).

The new species also resembles *I. novemdentatus* in having straight posterior branchial carinae, diverging slightly posteriorly (fig. 3A, 3E), but is easily distinguished from *I. novemdentatus* by the prominent tubercle in the posterior incision of the orbit (fig. 3B); *I. novemdentatus* lacks a tubercle in the posterior orbital incision. (fig. 3F). *Ibacus peronii* (fig. 3D), like *Ibacus chacei* (fig. 3B), has a tubercle in the posterior orbital incision, but differs from *I. chacei* in that the posterior branchial carinae are very prominent, and strongly convex (fig. 3C). The posterior branchial carinae of *I. chacei* are straight, diverging slightly posteriorly (fig. 3A).

Ibacus chacei, like *I. peronii*, is commercially important in both New South Wales and Queensland. Aspects of its reproductive biology were studied by Stewart et al. (1997). Their tagging studies showed that northern New South Wales is approximately the southern end of *I. chacei*'s distribution, and that the species does not mature or spawn in NSW, but probably farther north in Queensland. Extensive trawling by the FRV 'Kapala' also supports this conclusion, as only a single ovigerous female has been collected in NSW waters (K. Graham, FRV 'Kapala', personal commun.).

The common name 'smooth bug' (designated by K. Graham) which has been used for *I. chacei* in the literature refers to the smooth, round distal knob (end) of the merus of the third maxilliped.

Distribution.— Eastern Australia: SE of Innisfail, Qld. (17°43'S) south to NE of Bateman's Bay, NSW (35°43'S). Depth: 22-330 m.

Etymology.— Named in honour of Fenner A. Chace, Jr., Zoologist Emeritus, Department of Invertebrate Zoology, National Museum of Natural History, Washington, D.C., in recognition of his contribution to decapod crustacean taxonomy, particularly his 'Albatross' Expedition publications, commenced after retirement.



120 Brown & Holthuis. The Australian species of the genus *Ibacus*. Zool. Med. Leiden 72 (1998)

Ibacus alticrenatus Bate, 1888
(pl. 2)

Ibacus alticrenatus Bate, 1888: 63, pl. 9 fig. 2.

Ibacus alticrenatus septemdentatus Grant, 1905: 322, pl. 11 fig. 1.

Ibacus altricrenatus; George & Griffin, 1972: 228.

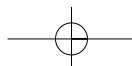
Ibacus alticrenatus; Holthuis, 1985: 23 (key), 36, fig. 9; Holthuis, 1991: 197 (key), 200; Takeda in: Amaoka, K. et al. (editors), 1990: 356; Wadley & Evans, 1991: 23 (text, colour fig.); Jones & Morgan, 1994: 105 (colour fig.); Griffin & Stoddart, 1995: 252.

not *I. alticrenatus*; Coleman, 1977: 132 (colour fig. = *I. chacei* spec. nov.); Coleman, 1987: 104 (colour fig. = *I. chacei* spec. nov.); Edgar, 1997: 196 (colour fig. = *I. peronii*, Leach).

Material examined.— **New South Wales:** 1 ♂ (37 mm cl), 1 ♀ (40 mm cl), AM P19387, E of Port Stephens, 32°42'S 152°06'E, 274 m depth, FRV 'Kapala'; 1 ♂ (37 mm cl), AM P14646, Off Newcastle, 32°56'S 151°46'E, 9.iv.1963; 1 ♂ (33 mm cl), 6 ♀♀ (24-42 mm cl), AM P25129, E of Broken Bay, 33°33'S 151°59'E, 365-373 m depth, FRV 'Kapala', stn K76-24-05, 21.xii.1976; 4 ♂♂ (26-39 mm cl), 3 ♀♀ (37-43 mm cl), AM P18987, E of Port Jackson, 33°44'S 151°48'E, 274 m depth, FRV 'Kapala', stn K72-02-13, 10.viii.1972; 1 juvenile (17 mm cl), AM P19620, E of Port Jackson, 33°51'S 151°55'E, 686 m depth, FRV 'Kapala', stn K72-06-03, 19.x.1972; 7 ♂♂ (34-38 mm cl), 1 ♀ (34 mm cl), AM P21034, NE of Wollongong, 34°16'S 151°26'E, 365 m depth, FRV 'Kapala', stn K75-05-01, 8.viii.1975; 1 ovigerous ♀ (39 mm cl), AM P31405, E of Kiama, 34°35'S 151°14'E, 247 m depth, FRV 'Kapala', stn K78-04-04, 12.iv.1978.— **Queensland:** 3 ♂♂ (37-38 mm cl), QM W14281, 17°56'S 147°03'E, 300 m depth, CSIRO RV 'Soela', Cruise 6, stn 45, 29.xi.1985; 4 ♀♀ (32-52 mm cl), 2 juveniles (22-24 mm cl), QM W14263, 17°59'S 147°09'E, 400 m depth, CSIRO RV 'Soela', Cruise 6, stn 47, 29.xi.1985; 1 ♂ (38 mm cl), QM W14318, NE Queensland, CSIRO RV 'Soela', Cruise 1/86, stn 73, approx. 18°00'S 147°05'E, 20.i.1986; 1 ♀ (46.2 mm), NTM Cr012294, Marion Plateau, Coral Sea, 18°59'S 149°26'E, 452 m depth, CSIRO FRV 'Soela', stn. 0685-41, 26.xi.1985; 1 ♂ (33 mm cl), QM W10168, 22°10'S 154°10'E, 570 m depth, 'Craigmin' Survey, 21.ix.1980; 6 ♂♂ (37-50 mm cl), 6 ♀♀ (43-47 mm cl), QM W11275, 23°27'S 152°23'E, 240 m depth, 'Southern Intruder' Survey, Shot 43, 1.xii.1984; 1 ♂ (27 mm cl), 6 ♀♀ (30-34 mm cl), QM W15732, 23°07'S 153°19'E, 400 m depth, MV 'Karumba', iv.1988.— **South Australia:** 1 ♂ (37 mm cl), AM E3695, E of Eucla, Great Australian Bight, 31°43'S 128°53'E, 365-457 m depth, 5.v.1913.— **Tasmania:** 1 ovigerous ♀ (40 mm cl), AM E2227, 1 ovigerous ♀ (40 mm cl), AM E437, East coast Flinders Island, Bass Strait, 40°01'S 148°02'E, FIS 'Endeavour', 4.iv.1909.— **Victoria:** 2 ♂♂ (26-36 mm cl), 1 ♀ (32 mm cl), NMV J1583, 20 miles S of Cape Nelson, 402 m depth, SARDA, 10.iii.1977; 1 ♂ (20 mm cl), 5 ♀♀ (1 ovigerous) (35-41 mm cl), AM P15066, Trawled off Cape Everard, 37°48'S 149°65'E, 128-137 m depth, 4.vi.1929; 1 ♂ (24 mm cl), NMV J1593, 3 ♂♂ (38-45 mm cl), 4 ♀♀ (3 ovigerous) (41-48 mm cl), NMV J1588, 27 miles SW of Portland, 292-329 m depth, 'Aquarius', v.1979.— **Western Australia:** 1 ♂ (32 mm cl), 5 ♀♀ (42-49.7 mm cl), AM P40061, 6 ♂♂ (40-49 mm cl), AM P40062, NW of Perth, 31°31'S 114°53'E, 470 m depth, CSIRO, FV 'South Passage', 11.i.1989; 4 ♂♂ (23.6-48.9 mm), 1 ♀♀ (22.3 mm), DB9001, NW of Perth, 31°31'S 114°57'E, 390 m depth, CSIRO, FV 'South Passage', 19.i.1990.

Diagnosis.— Carapace with wide cervical incision, 6-8 teeth behind the cervical incision. Dorsal surface of body with short, velvety pubescence. Fourth segment of antenna slender, narrowing from base to tip, without lateral teeth. Merus of third maxilliped with ventral surface slightly concave, not swollen; inner margin sometimes crenulate, but not with deep incisions. Sixth abdominal segment and hard parts of telson, uropods white in colour.

Colour (pl. 2).— Dorsal surface of carapace red-orange to brown, with darker red spots and marbling, particularly in middle of carapace. All distal lateral carapace parts tipped white. Antennular and antennal segments coloured like carapace.



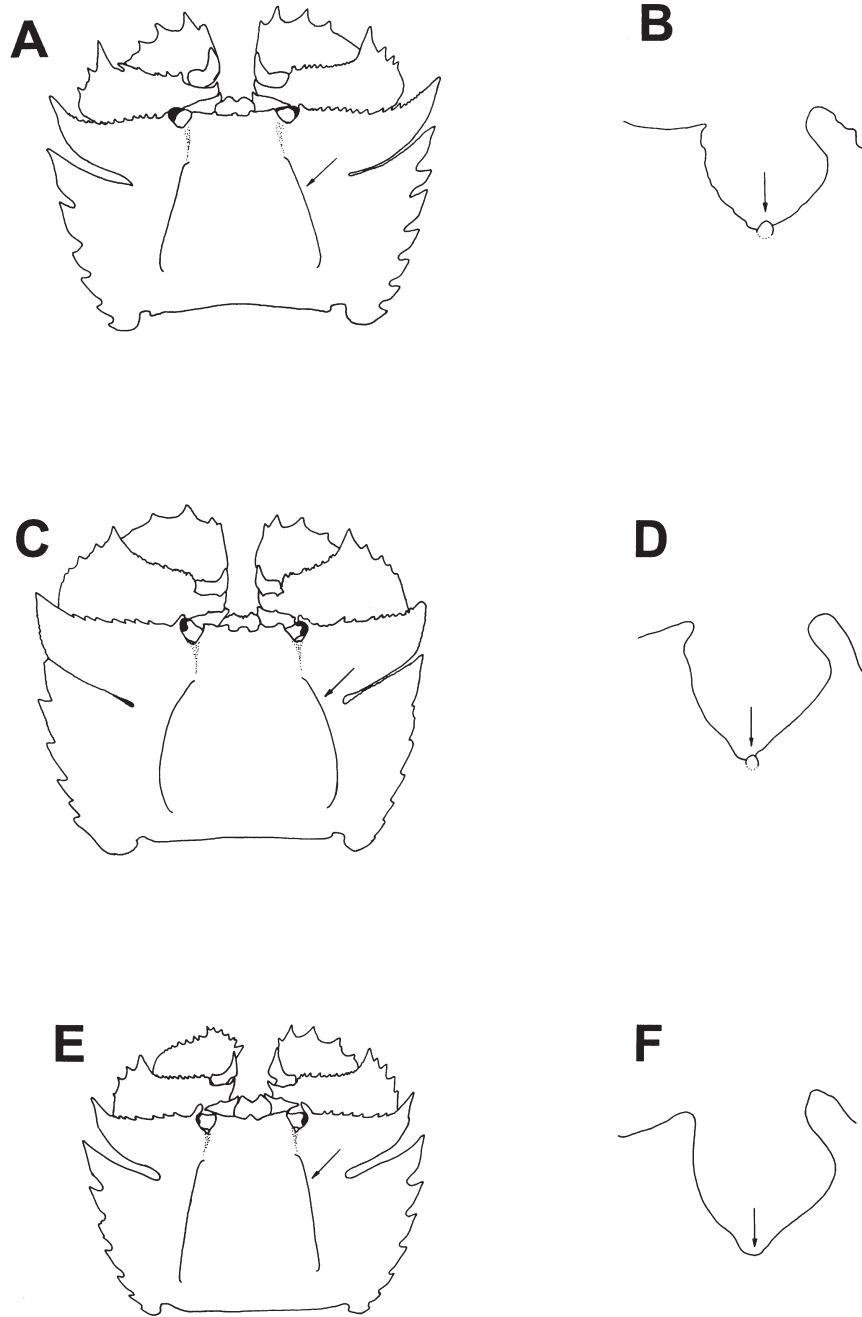


Fig. 3. A, B, *Ibacus chacei*, spec. nov., holotype, AM P34741: A, posterior branchial carinae; B, posterior incision of orbit with tubercle. C, D, *I. peronii*, AM P32743: C, posterior branchial carinae; D, posterior incision of orbit with tubercle. E, F, *I. novemdentatus* Gibbs, AM P32745: E, posterior branchial carinae; F, posterior incision of orbit, no tubercle.



Pl. 1. *Ibacus chacei* spec. nov., holotype, AM P32741. Photo: D. Brown.



Pl. 2. *Ibacus alticrenatus* Bate, AM P31405. Photo: D. Brown.

Abdominal segments 1-5 have proximal border dark red, distal portion light orange-red. Sixth abdominal segment, hard parts of uropods, telson white. Fleshy parts of uropods and telson yellow-brown.

Remarks.—The colour figures in Coleman (1977: 132; 1987: 104) show an *Ibacus* with broad 4th antennal segments, tubercle in posterior incision of orbit, and straight, distally diverging branchial carinae, characteristics of *I. chacei* spec. nov., not *I. alticrenatus*. Likewise, the red spotting and marbling on the carapace are also very consistent with that of the new species, *I. chacei*. The colour figure in Edgar (1997: 196) also shows an *Ibacus* with broad 4th antennal segments, but with strong, convex posterior branchial carinae, characteristics of *I. peronii* Leach, not *I. alticrenatus*.

Intensive trawling by CSIRO has extended the known distribution of this species into north Queensland (Coral Sea), and up the Western Australian coast to south of North West Cape (B. Wallner, CSIRO, pers. comm.).

I. alticrenatus is commercially important on the east, west, and southern coasts of Australia, as bycatch product of the prawn or scallop fishery.

Distribution.— Australia: NE Queensland (Coral Sea) to Bass Straits, Tasmania, Tasman Sea, southern Victoria, west across the Great Australian Bight to south of North West Cape, Western Australia; New Zealand: North & South Island, Chatham Islands. Depth: 82-686 m.

Ibacus brevipes Bate, 1888
(pls 3, 4)

Ibacus brevipes Bate, 1888: 62, pl. 9 fig. 1.

Ibacus verdi Bate, 1888: 58, pl. 7 fig. 2, pl. 8.

Ibacus brevipes; Holthuis, 1985: 47, figs 13, 14; Holthuis, 1991: 198 (key), 201; Chan, 1997: 411.

Material examined.— **Queensland**: 1 ♀ (45.6 mm cl), AM P51878, Far north Queensland, stn 32/48/50/63: most probably stn 32: 2-5 miles ENE of Raine Island, 11°35'S 144°04'E, 400-420 m depth, sand bottom, prawn trawl, AMS/AIMS, RV 'Lady Basten', 12.ii.1979; 1 ♀ (32 mm cl), QM W16219, Near Chilcott Island, 16°55'S 150°00'E, 406 m depth, MV 'Valyrie Voyager', 3.vii.1989; 3 ♂♂, (37-44 mm cl), 4 ♀♀ (37-48 mm cl), QM W14266, 17°31'S 149°40'E, 400 m depth, CSIRO RV 'Soela' Cruise 6, stn 63, 3.xii.1985; 1 ♂ (43 mm cl), 3 ♀♀ (39-45 mm cl), QM W14264, 17°34'S 149°34'E, 444-454 m depth, CSIRO RV 'Soela' Cruise 6, stn 62, 3.xii.1985; 3 ♀♀ (36-44 mm cl), 2 juveniles (27-28 mm cl), QM W14279, 17°32'S 149°46'E, 338-348 m depth, CSIRO RV 'Soela' Cruise 6, stn 64, 3.xii.1985; 1 ♂ (39 mm cl), 1 ♀ (49 mm cl), AM P40507, 1 ♂ (41 mm cl), 2 ♀♀ (1 ovigerous) (43-49 mm cl), QM W12883, 17°35'S 149°56'E, 302 m depth, CSIRO RV 'Soela' Cruise 6, stn 65, 3.xii.1985; 2 ♀♀ (45 mm cl), QM W14269, 17°39'S 150°10'E, CSIRO RV 'Soela' Cruise 6, stn 66, 225 m depth, 4.xii.1985.

Diagnosis.— Carapace with 12-18 teeth on lateral margins behind the cervical incision. Merus of third maxillipeds swollen, produced distally to rounded knob, inner margin with short, deep incisions not reaching middle of the segment; outer meral margin with broad wing-like expansion or keel strongly toothed along entire length (top to bottom).

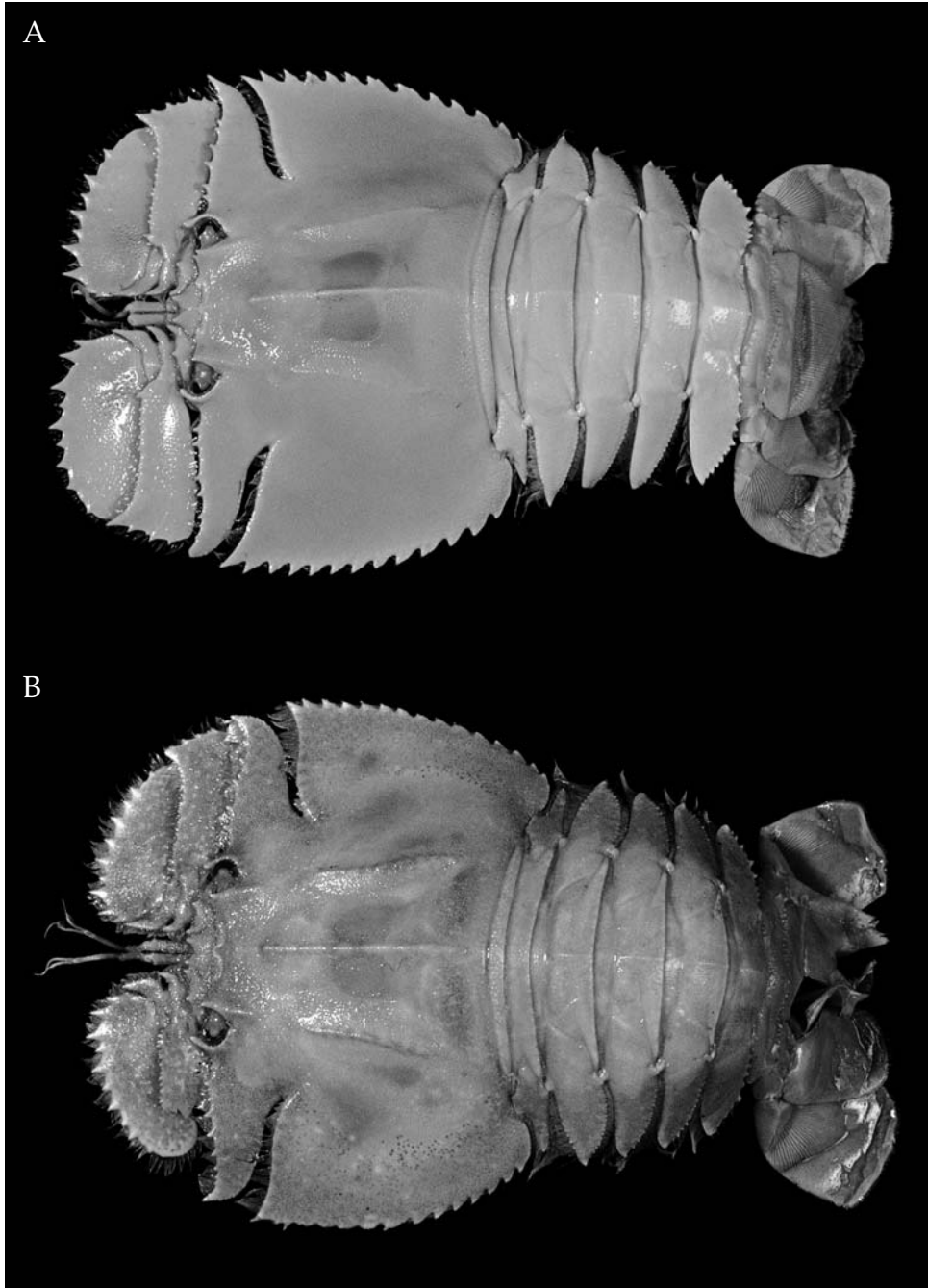
Colour (pl. 3).— Dorsal surface of body beige/white background colour, lightest on the antennal and antennular segments, anterolateral teeth, grading to grey on posterior half of carapace and abdomen. Background colour overlaid with red 'spotting'. Red spotting most prominent on antennal and antennular segments, eyestalks, large



Pl. 3. *Ibacus brevipes* Bate, Queensland. Photo: T. Ward, CSIRO.

tooth (before cervical groove), along border of the cervical groove, all lateral carapace teeth, posterior border of carapace, first abdominal segment, on posterior branchial grooves and carinae, and median carina. Second to 6th abdominal segments covered with fine red stippling. Soft parts of uropods and telson beige.

Remarks.— The merus of the third maxilliped of *I. brevipes* is similar to that of *I. chacei* spec. nov. in being distally produced to a spherical knob, but differs in having a broad wing-like expansion or keel strongly toothed along the entire length of the outer margin (top to bottom), and the incisions of the inner margin are deep, short, not reaching the median line (Holthuis, 1991, fig. 379). The outer margin of the merus



Pl. 4A. *Ibacus brevipes* Bate, QM W12883, ovigerous ♀ (cl 43 mm), 'naked, glabrous' form; B, *Ibacus brevipes* Bate, AM P51878, ♀ (cl 45 mm), 'pubescent form'. Photo: D. Brown.



of *Ibacus chacei* has only a very short wing-like expansion or keel barely reaching the middle of the meral segment and several of the incisions of the inner margin reach beyond the median line (fig. 2A).

Holthuis (1985) describes the surface of the carapace of *I. brevipes* as "...naked, or with a slight pubescence in the anteromedian region.." and the abdominal segments as "...naked but punctate". At the conclusion of this study, an unusual specimen from far north Queensland (AM P51878, female, cl 45.6, pl. 4) was discovered to be quite pubescent on both the carapace and abdomen. The pubescence is not as dense as that found on *I. pubescens* but rather more similar to the condition in *I. alticrenatus*. This is noticeably different to the smooth (but pitted), glabrous carapace of other *I. brevipes* material (AM P40507, QM W12883, 2 males, 2 females; pl. 4). In all other respects, the specimen agrees with the typical *I. brevipes*, particularly the distinctive knob-shaped third maxilliped, and 15 posterolateral teeth of the carapace. Unfortunately, little attention has been paid to the presence or absence of pubescence in this species. Thus, all known specimens of *I. brevipes* will need to be re-examined in light of this pubescent specimen in order to determine the extent and variation of this character. The taxonomic status of *I. ciliatus* and *I. pubescens* recently recognised by Chan (1997) may also need to be reviewed in time given that the major characteristic separating them into two species is the presence or absence of pubescence.

Holthuis (1985) discussed the status of *I. verdi* and *I. brevipes* and synonymised the two species, at the same time casting doubt on the Cape Verde Islands locality data. The fact that *I. brevipes* has now been found off eastern Australia at a depth of 225-454 m adds further support to this conclusion.

Distribution.— Indo-West Pacific region: South China Sea, Philippines, Indonesia, Moluccas, New Caledonia, and northeastern Australia (Coral Sea). Depth: 186-457 m.

Ibacus brucei Holthuis, 1977
(pl. 5)

Ibacus brucei Holthuis, 1977: 191, pls. 1,2; Holthuis, 1985:41, figs 10-12; Coleman, 1987: 105 (text, unnumbered fig.); Holthuis, 1991: 197 (key), 202; Griffin & Stoddart, 1995: 252.

Material examined.— **New South Wales:** 1 ♀ (34.8 mm cl), AM P31552, NE of Brunswick Heads, 28°21'S 153°51'E, 164-173 m depth, FRV 'Kapala', stn K78-09-16, 3.vi.1978; 7 ♂♂ (20-29 mm cl), 3 ♀♀ (29-30 mm cl), 2 juveniles (17-20 mm cl), AM P32746, SE of Cape Bryon, 28°43'S 153°51'E, 138-128 m depth, collected with *I. chacei*, FRV 'Kapala', stn K78-23-04, 1.xi.1978; 1 ♂ (46 mm cl), AM P31545, E of Coffs Harbour, 30°23'S 153°25'E, 270 m depth, FRV 'Kapala', 19.viii.1977; 1 ♂ (50.2 mm cl), AM P31550, E of Nambucca Heads, 30°27'S 153°24'E, 274 m depth, FRV 'Kapala', stn K77-13-03, viii.1977; 1 ♂ paratype (42 mm cl), AM P25056, SE of Broken Bay, 33°40'S 151°46'E, 167-172 m depth, FRV 'Kapala', stn K76-17-04/05, collected with *I. alticrenatus*, 2.xi.1976; 1 ♂ (40 mm cl), AM P36867, E of Jervis Bay, 35°06'S 151°00'E, 144 m depth, FRV 'Kapala', 20.ii.1986.— **Queensland:** 1 ♀ (57 mm cl), QM W10176, 23°59'S 152°47'E, 320 m depth, 'Craigmin' Survey, stn. 5, 15.ix.1980; 1 ♀ (49 mm cl), QM W10174, 26°20'S 153°53'E, 300 m depth, 'Craigmin' Survey, stn. 2, 13.ix.1980; 2 juveniles (21-23 mm cl), QM W4690, 7 miles NW Cape Moreton, 27.ii.1975; 2 ♂♂ paratypes (24-53 mm cl), AM P25072, E of Moreton Bay, 162 m depth, vii.1972; 1 ♂ (53 mm cl), QM W10671, NE of Brisbane, 27°18'S 153°54'E, 540 m depth, MV 'Iron Summer', Shot 5, 13.viii.1982; 1 ♀ (36 mm cl), QM W10666, 27°24'S 153°51'E, 260 m depth, MV 'Iron Summer', Shot 4, 25.ix.1982; 1 juvenile (18 mm cl), QM W14366, 27°35'S 153°50'E, 210 m depth, MV 'Iron Summer' Shot 5, 15.xii.1982; 1 ♀ (25 mm cl), AM P51137, E of Tweed Heads, Gold Coast, 28°02'S 153°59'E, 544-559 m depth, FRV 'Kapala', stn 78-09-05, 2.vi.1978.





Pl. 5. *Ibacus brucei* Holthuis, AM P25056. Photo: G. Millen, Australian Museum.



Diagnosis.— Carapace naked, glabrous (pitted), with wide cervical incision, 7-9 teeth on lateral margin behind cervical incision. Merus of third maxilliped with ventral surface slightly concave, not swollen, with inner margin sometimes crenulate, but not with deep incisions. Fourth antennal segment broad and toothed.

Colour (pl. 5).— The colour of this species has previously been described by Holthuis (1977) and illustrated in colour by Holthuis (1977) and Coleman (1987). A specimen (QM) trawled off northern Queensland was found to have a distinctly different colour to the all-over red brick colour described and illustrated (Holthuis, 1977). This specimen has a white/beige background colour overlaid by faint red stippling, giving the carapace only a faint pink tinge, edges of antennular segments, large tooth of anterior angle of carapace, cervical groove, and borders of all lateral areas of the carapace white; abdominal segments coloured like carapace; fleshy parts of uropods and telson distally stippled pink/red, with edges white. Coleman (1987) has commented on light coloured individuals, "...juveniles are light pink in colour with rusty blotches between the ridges on the carapace and the white tail". The extent and nature of this colour variation is unknown at the present time.

Remarks.— *I. brucei* is trawled and sold commercially along with *I. alticrenatus*, *I. peronii*, *I. chacei* spec. nov. on the east coast of Australia.

Distribution.— Australia: Central Queensland, south to Jervis Bay, New South Wales; New Zealand: Kermadec Islands. Depth: 83-559 m.

Ibacus novemdentatus Gibbes, 1850
(figs 2C, 3E, F; pl. 6)

Ibacus novemdentatus Gibbes, 1850: 19; Holthuis, 1985: 52, figs 15-17; Holthuis, 1991: 199 (key), 204; Chan & Yu, 1993: 184 (colour figs), 185, 186; Jones & Morgan, 1994: 105 (colour fig.); Griffin & Stoddart, 1995: 252; Chan, 1997: 412.

Material examined.— **Northern Territory:** 3 ♂♂ (49.2-51.9 mm cl), AM P40504, N of Cobourg Peninsula, Arafura Sea, 9°29'S 132°00'E, 132 m depth, CSIRO RV 'Soela', 3.vii.1981. -**Western Australia:** 1 ♂ (45.7 mm), DB9002, NW Shelf, 19°06'S 117°07'E, 169-175 m depth, CSIRO, RV 'Southern Surveyor', stn 02/90/104, 7.x.1990; 2 ♂♂ (46-49 mm cl), AM P32744, NNE of Dampier, 19°08'S 117°03'E, 183-176 m depth, CSIRO RV 'Soela', stn SO5/88/117, 5.i.1988; 1 ♀ (38.5 mm cl), WAM 154-81, NNE of Monte Bello Islands, 19°30'S 116°01'E, 142 m depth, CSIRO RV 'Soela', 3.xii.1979; 1 ♂ (51 mm cl), 1 ovigerous ♀ (60 mm cl), AM P32745, NW Shelf, NW between Barrow Island and Port Hedland, CSIRO RV 'Soela', stn SO5/88, ix.1988; 1 ♀ (36.1 mm cl), WAM 153-81, NW Shelf, CSIRO RV 'Courageous', Shot 0708, 30.v.1978; 1 ♂ (44 mm cl), WAM 155-81, NNW of Cape Cuvier, 23°05'S 113°22'E, 185 m depth, FV 'Highly 301', 10.iv.1981.

Diagnosis.— Carapace naked, glabrous (pitted), with narrow cervical incision; 7-8 teeth on the lateral margin behind the cervical incision; posterior branchial carinae straight (not convex), diverging slightly distally. Posterior incision of orbit without prominent tubercle (fig. 3F). Merus of third maxilliped (fig. 2C) swollen, with deep incisions on inner margin, many reach past the middle of the segment; wing-like expansion or keel of outer margin strongly toothed from top to bottom. Outer margin of ischium with wing shaped keel strongly toothed.

Colour (pl. 6).— Colour descriptions and illustrations of this species have been published previously (Holthuis 1985; Chan & Yu, 1993; Jones & Morgan, 1994). Cara-





130 Brown & Holthuis. The Australian species of the genus *Ibacus*. Zool. Med. Leiden 72 (1998)

pace beige/brown with scattered red spots concentrated around border of eye orbits, post rostral ridge, posterior branchial grooves and ridges, anterior edge of the carapace, and bases of the antennae. Tip of first anterolateral tooth of carapace tipped red.

Abdominal segments 1-4 beige with very faint red spotting; segments five-six, uropods and telson have slight pink-beige colour.

Remarks.— *Ibacus novemdentatus* resembles both *Ibacus chacei* spec. nov. and *I. peronii* and has in the past been confused with *I. peronii*. The characters distinguishing the three species are discussed under the account of *I. chacei*.

The specimens from the Arafura Sea expand the known Australian distribution of the species from north Western Australia further northeast to Northern Territory.

Distribution.— Indo-West Pacific region: East Africa (Kenya-Cape Province), Western Indian Ocean (NW Madagascar, Mauritius-Seychelles Ridge), Korea, Japan, South China Sea, Taiwan, Vietnam, Philippines, Indonesia, Australia: NW and N Western Australia, Northern Territory (Timor Sea and Arafura Sea). Depth: 37-400 m.

Ibacus peronii Leach, 1815
(figs 1B, 2B, 3C, D; pl. 7)

Ibacus Peronii Leach, 1815: 152, pl. 119.

Ibacus peronii; Holthuis, 1985: 61, figs 18-20; Bonnemains & Jones, 1990: 44, fig. 28; Wadley & Evans, 1991: 25 (text, colour fig.); Graham et al., 1993b: 73; Jones & Morgan, 1994: 105 (colour fig.); Graham et al., 1995: 15, 52, fig. 14; Griffin & Stoddart, 1995: 252; Graham et al., 1996: 15, 63, fig. 19; Holthuis, 1996: 216, figs 1, 2; Graham & Wood, 1997: 8-9, 90, figs 3, 12; Stewart & Kennelly, 1997: 191; Stewart et al., 1997: 344.

not *I. peronii* Grant, 1982 & 1993: pl. 455 (= *I. chacei*); Dakin & Bennett, 1987: 221 (fig. = *I. chacei*); Bennett, 1992: 134 (fig. = *I. chacei*).

Material examined.— **New South Wales:** 3 ♀♀ (38-78 mm cl), 1 juvenile (21 mm cl), AM P2121-2125, between Port Stephens and Newcastle, 40-110 m depth, FIS 'Endeavour', 1914; 1 ♀ (71 mm cl), AM E2, between Port Stephens and Newcastle, 40-110 m depth, FIS 'Endeavour', 1914; 1 ovigerous ♀ (51 mm cl), AM P15595, off Port Stephens, 32°42'S 152°06'E, Australian Museum party, x.1962; 1 ♀ (47 mm cl), AM P31546, E of Catherine Hill Bay, 33°08'S 151°46'E, 76 m depth, FRV 'Kapala', 5.x.1978; 1 ovigerous ♀ (74 mm cl), 2 ♂♂ (35-45 mm cl), AM P5345-5347, off Norah Head, 33°17'S 151°35'E, 47-69 m depth, vi.1921; 1 ♂ (61 mm cl), AM G1206, near Sydney, 33°51'S 151°16'E, xi.1894; 1 ♀ (60 mm cl), AM P4657, Shark Island, Port Jackson, 33°51'S 151°16'E, ii.1920; 1 ♀ (72 mm cl), AM G137, Port Jackson, 33°51'S 151°16'E, xi.1982; 1 ♂ (57 mm cl), 1 ♀ (64 mm cl), AM P18600-18601, Port Jackson, 33°51'S 151°16'E, NSW Fisheries, 27.ii.1970; 1 ♂ (69 mm cl), AM P1896, Port Jackson, 33°51'S 151°16'E, 1908; 1 ♂ (44 mm cl), AM P19619, Jarvis Bay, 35°00'S 150°45'E, FRV 'Kapala', 22-23.v.1972; 1 ♀ (68 mm cl), AM P32738, 15 km S of St. George's Head, 35°18'S 150°43'E, 117 m depth, FRV 'Kapala', 10.ii.1981; 1 ♂ (57 mm cl), 1 ♀ (64 mm cl), AM E6083-6084, off Tathra Head, 36°44'S, 149°49'E, 128 m depth, FIS 'Endeavour', 15.v.1914; 1 ♂ (60 mm cl) AM E6074, off Twofold Bay, 37°05'S 149°54'E, 73 m depth, FIS 'Endeavour', 15.v.1914.— **South Australia:** 3 ♂♂ (37-44 mm cl), 2 ♀♀ (47-52 mm cl), AM E731, 1 ♂ (46 mm cl), 1 ♀ (47 mm cl), RMNH D 15248, 1 ♂ (43.5 mm cl), 1 ♀ (43 mm cl), USNM 104647 (checked by B. Kensley, USNM), 40 miles W of Kingston, 36°50'S 139°0'E, 55 m depth, FIS 'Endeavour', 16.viii.1909; 1 ovigerous ♀ (63 mm cl), RMNH D 7263, off Cape Willoughby, Kangaroo Island, 35°51'S 138°08'E, i.1950; 1 ♀ (41 mm cl), QM W1532, off Marsden Point, Kangaroo Island, 35°34'S 137°38'E; 1 ♀ (42.5 mm cl), USNM 2139334 (checked by B. Kensley, USNM), Spencer Gulf, 104-110 m depth, Eltanin stn. 2249.— **Tasmania:** 1 ♂ (32 mm cl), USNM 104643 (checked by B. Kensley, USNM), East of Flinders Island, Bass Strait, FIS 'Endeavour', stn 5669; 1 ovigerous ♀ (48 mm cl), AM P14997, 1 ♂ (33 mm cl), AM P14996, Binalong Bay, near St. Helens, 41°16'S, 148°18'E, in scallop dredge, CSIRO,

1.vii.1964; 1 ovigerous ♀ (44 mm cl), AM P19624, 3 1/2 miles South East of Cape Bougainville, Mercury Passage, inside Maria Island, 42°34'S 148°02'E, 31-33 m depth, 25.iii.1970; 1 ♀ (42 mm cl), QM W1528, Oyster Bay, 42°42'S 148°03'E, 110 m depth.— **Victoria**: 1 ♂ (29 mm cl), 1 ♀ (58 mm cl), AM P32739-40, 17 km SE of Point Hicks, 37°53'S 149°02'E, 58 m depth, FRV 'Kapala', 28.ii.1981; 1 ♂ (48 mm cl), RMNH D 15249, S of Mt. Cann, 37°39'S 148°59'E, 100-128 m, FIS 'Endeavour', 1909-1914; 1 ♀ (44 mm cl), NMV J1596, off Lakes Entrance, East Gippsland Scallop Survey, ii.1971; 1 ovigerous ♀ (55 mm cl), AM P32743, 3 ovigerous ♀♀ (54-66 mm cl), AM P40063-40065, Lakes Entrance, 37°53'S 148°00'E, 5-27 m depth, 30.x.1979; 1 ♂ (38 mm cl), NMV J1603, SW of Lakes Entrance, 38°15'S 147°43'E, 44 m depth, East Gippsland Scallop Survey, 27.ii.1971; 1 ♂ (47 mm cl), 1 ♀ (52 mm cl), NMV J1602, SW of Lakes Entrance, 37°57'S 147°52'E, 29 m, East Gippsland Scallop Survey, 28.ii.1971; 1 ♂ (41 mm cl), NMV J1604, Bass Strait, 38°57'S 147°47'E, 18 m depth, East Gippsland Scallop Survey, 1.ii.1971; 1 ♂ (30 mm cl), NMV J1601, SSE of Seaspray, 38°45'S 147° 44'E, 18 m depth, East Gippsland Scallop Survey, 2.ii.1971; 1 ♂ (44 mm cl), NMV J1584, Bass Strait, 38°55'S 147°44'E, East Gippsland Scallop Survey, 1.ii.1971; 1 ♂ (37 mm cl), NMV J1591, 3 miles SSE Cape Woolama, 38°34'S, 145°22'E, 46 m depth, 'Mary Kain', 17.i.1980.— **Western Australia**: 1 ♂ (67.3 mm) DB9003, W of Perth, 31°47'S 115°04'E, 201-219 m depth, CSIRO, FV 'Daniel', stn 1, 19.ii.1991; 1 ♀ (dry specimen) (80 mm cl), RMNH D 23278, S of Fremantle, 17.xii.1963; 1 ♂ (dry specimen) (47 mm cl), RMNH D 23277, N of Fremantle, vii.1900.

Diagnosis.— Carapace naked, glabrous (pitted), with narrow cervical incision; 7-9 teeth on the lateral margin behind the cervical incision; posterior branchial carinae very prominent, strongly convex. Posterior incision of orbit with prominent tubercle (fig. 3D). Merus of third maxilliped (fig. 2B) evenly swollen, inner margin with deep incisions, several reaching beyond middle of segment; outer margin with wing-like expansion or keel strongly toothed from top to bottom.

Colour (pl. 7).— Several coloured illustrations have been published of this species previously (McCoy, 1890: pl. 199; Healy & Yaldwyn, 1970: pl. 27; Wadley & Evans, 1991: 25; Jones & Morgan, 1994: 105). The colour plate 455 in Grant (1982; 1993), the colour figure in Dakin & Bennett (1987: 221) and Bennett (1993: 134) are referable to the new species, *I. chacei*. In these figures, the *Ibacus* shown lacks the strongly convex branchial carinae characteristic of *I. peronii*, and have red spotting and marbling on the carapace consistent with the colouration of *I. chacei* spec. nov.

The carapace/abdomen colouration of *I. peronii* varies from overall dull orange-brown to red brown to deep purple; may be faintly marked with darker red spots, marbling around orbits, antennae, posterior carinae.

Remarks.— *I. peronii* is commonly known as the 'Balmain bug', and is the best known of all the Australian species. Its similarity in appearance to *I. chacei* spec. nov. and *I. novemdentatus* has been the cause of confusion with both of these species. The specific differences between the three species have been detailed in the remarks of *I. chacei* spec. nov.

This species is commercially important in NSW and Victoria. Although it has been specifically targeted by some fishermen in recent years, it is still mainly a bycatch product of the prawn and scallop fisheries (Kailola, 1993; Stewart et al., 1997). At present, it is still of limited commercial importance in Western Australia as bycatch (Wadley & Evans, 1991). Stewart & Kennelly (1997) and Stewart et al. (1997) have detailed aspects of its reproductive biology such as size at sexual maturity, fecundity and egg size.

Ibacus peronii is found at the shallowest depth of all *Ibacus* species. An Australian Museum specimen (AM P13377, destroyed in 1933) was recorded as having been col-



Pl. 6. *Ibacus novemdentatus* Gibbes, AM P32745. Photo: T. Carter, CSIRO.



Pl. 7. *Ibacus peronii* Leach, AM P32743. Photo: D. Brown.



lected in the Parramatta River (Port Jackson), NSW at 4 m depth.

The holotype of *Ibacus peronii* in the Paris Museum is labelled (locality indication) "Nouvelle Hollande. F. Péron". Leach (1815: 152), in the original description, gave the type locality of the species as "Habitat in Australasiae mari" and "New Holland". Leach also indicated that the specimens were brought from New Holland (= Australia) by F. Péron, who had given the specimens the manuscript name *Scyllarus incisus*. Since that time, until publications by Bonnemains & Jones (1990: 44, fig. 28) and Holthuis (1996: 261-264, figs 1,2), no new information on the type locality of the species was known. These authors, after a study of manuscript notes and drawings made during the 1800-1804 French voyage of discovery to the "Southern Lands" ("Expedition aux Terres Australes") under the leadership of Nicholas Baudin, were able to pinpoint the type locality to King Island in Bass Strait between Tasmania and the mainland of Australia. The manuscripts at present are held by the Museum d'Histoire Naturelle of Le Havre, France, and were made available by Mme Jacqueline Bonnemains, curator of the Lesueur collection at the Museum.

Francois Péron was one of the naturalists of the expedition; Charles-Alexandre Lesueur, originally a gunner, became one of the artists, and developed later to a full scale zoologist. Both made the voyage on board the ship 'Le Géographe', one of the two ships of the expedition, the other being the 'Le Naturaliste'.

Péron (born 22 August 1775 in Cérilly, dept. Allier, France) died in Cérilly on 14 December, 1818, and never had the opportunity to publish on all his zoological collections. He left his manuscripts to Lesueur, who, in turn, bequeathed them to the Museum at Le Havre. Lesueur (born 1 January 1778 in Le Havre), after his return from the Baudin Expedition, went to America, where he stayed until 1837, becoming one of the foremost American naturalists. In 1837, he settled in Le Havre where he died on 12 December 1846.

Further information on the type locality can be obtained from the posthumously published second volume of Péron's (1816) narrative of the expedition. It is clear that 'Le Géographe' reached King Island on 6 December 1802 and anchored there (p. 5). The naturalists went ashore in the evening of 10 December (p. 7) and put up their tents at the "Baie des Éléphants-marins" also indicated as "Baie des Éléphants"; they gave (p. 7) the position "de notre observatoire sur le rocher des Éléphants" (a small island at the north end of the bay) as "39°49'30" de latitude Sud, et par 142°07'2" de longitude à l'Est du méridien de Paris" (this longitude corresponds to 144°27'02" E of Greenwich). The locality is known at present as Sea Elephant Bay and its position is given in modern gazetteers as 39°53'S, 144°08'E. The naturalists (François Péron, zoologist; Jean Baptiste Louis Claude Leschenault de la Tour, botaniste; Charles Bailly, minéralogiste; Charles Alexandre Lesueur, peintre d'histoire naturelle; and Antoine Guichenot, garçon jardinier) stayed from 10 to 24 December 1802 (= 19 Frimaire-3 Nivôse An 4 de la République) at Sea Elephant Bay and evidently collected most, if not all of their material there. Péron (1816, p. 13, 14) described that King Island "présente à l'observateur des trésors pour ainsi dire inépuisables...en mollusques, en vers et en zoophytes" and continued to give more details of their catches, but no crustaceans are mentioned. However, they are mentioned (p. 4) as a source of food: "Enfin, les crustacés divers et les coquillages qui pullulent dans ces mers, complètent le riche ensemble des ressources que la nature ici présente à l'homme". Péron also



Brown & Holthuis. The Australian species of the genus *Ibacus*. Zool. Med. Leiden 72 (1998)

135

described the tasks of the zoologists: "Je décrivis ces objets avec soin, et M. Lesueur en fit un grand nombre de dessins et de peintures" (p. 13).

This information gives a good indication of the circumstances under which the type of *Ibacus peronii* was collected, and it greatly restricts the type locality of the species.

Distribution.— Australia: Moreton Bay, Queensland south to Victoria, northern and southeast Tasmania, South Australia to Western Australia. Depth: 4-288 m.

Ibacus pubescens Holthuis, 1960
(pl. 8)

Ibacus ciliatus pubescens Holthuis, 1960:147; Holthuis, 1985:33-36, fig. 8; Wadley & Evans, 1991: 24 (text, fig.); Griffin & Stoddart, 1995: 252.

Ibacus pubescens; Chan, 1997: 412, comb. nov.

Material examined.— **Western Australia:** 2 ♀♀ (64.5-70.7 mm cl), NTM Cr008786, 700-750 m depth, S of Ashmore Reef, Timor Sea, 13°05'S 123°00'E, CSIRO, unknown trawl ('Territory Pearl', Jan./Feb. 1988?); 1 ♂ (72.5 mm cl), DB9004, NW Shelf, 14°41'S 121°45'E, 290 m depth, CSIRO, RV 'Surefire', shot 2, 2.viii.1989; 2 ♂♂ (67.4-68.3 mm cl), 2 ♀♀ (62.6-70.9 mm cl), DB9005, NW Shelf, 14°47'S 121°35'E, 275 m depth, CSIRO RV 'Surefire', shot 3, 5.vii.1990; 5 ♂♂ (51-70 mm cl), AM P40048-40049, 40053-40054, 1 ♂ (69 mm cl) RMNH D 39205, 2 ♀♀ (62-68 mm cl), AM P40050, AM 40052, NW Shelf, 14°50'S 121°36'E, 290 m depth, CSIRO FV 'Surefire', shot 3, 6.viii.1989; 2 ♂♂ (68-71 mm cl) AM P40051, 40055, 1 ♀ (64.8 mm cl) RMNH D 39206, 7 ♀♀ (68-72 mm cl), AM P40052, 40056-40060, DB9006, NW Shelf, 14°50'S 121°39'E, 290 m depth, CSIRO FV 'Surefire', shot 1, 2.viii.1989; 1 ♀ (73.1 mm cl), DB9007, 22°13'S 113°44'E, 218-327 m depth, CSIRO, FV 'Kiana II', shot 7, 30.ix.1990.— **Northern Territory:** 2 ♂♂ (53.3-57.6 mm cl), 2 ♀♀ (59.6-64 mm cl), NTM Cr009744, Arafura Sea, 8°55'S 131°41'E, 179-187 m depth, stn RW 92-66, R. Williams, 20.x.1992; 1 ♂ (40.6 mm cl), NTM Cr009742, 1 ♂ (43 mm cl), 1 ♀ (39.4 mm cl), NTM Cr009743, Arafura Sea, 9°00'S 133°21'E, 193-195 m depth, stn RW 92-67, R. Williams, 20.x.1992; 4 ♂♂ (24.1-41.9 mm cl), 5 ♀♀ (28.9-65.3 mm cl), NTM Cr008265, Timor Sea, 9°40'S 130°13'E, 260 m depth, CSIRO RV 'Invincible', shot 3, 12.xii.1990; 1 ♀ (73 mm cl), NTM Cr012291, Timor Sea, 9°42'S 130°21'E, shot 1, CSIRO 'Dampier Pearl', depth unknown (over 275 m?), 1.vii.1988; 2 ♀♀ (57.6-67.8 mm cl), DB9008, 9°44'S 130°07'E, 260 m depth, CSIRO FV 'Invincible', 6.xii.1990.— **Philippines:** 1 ♂ paratype, (54.5 mm cl), AM P40505, off Malabrigo Light, off east coast of Mindoro, 13°27'20"N 121°17'45"E, 198 m depth, dark green mud, 'Albatross', stn 5121, 2.ii.1908.

Comparative material.— *Ibacus ciliatus*: 1 ♂ (53 mm cl), USNM 104300, Pacific Ocean: Kyushu, off Ose Saki Light, SW of Goto Islands, Japan, 32°30'10"N 128°34'40"E, 254 m depth, gray sand and broken shells, 'Albatross', stn 4901, 10.viii.1906; 1 ♂ (juvenile) (26 mm cl), 1 ♀ (54.5 mm cl), AM P40506, Pacific Ocean, Philippine Islands, Mindanao, Gulf of Davao, off Dumalog Islands, 07°02'00"N 125°38'45"E, 246 m depth, 'Albatross', stn 5247, 18.v.1908; 1 ♀ (57 mm cl), USNM 21610, Pacific Ocean, Japan, Coll. F.C. Dale; 1 ♂ (53 mm cl), USNM 104306, China Sea, E of Hong Kong, 21°40'N 116°58'E, 270 m depth, sand and shells, 'Albatross', stn 5315, 5.iii.1908.

Diagnosis.— Carapace and abdomen with short, dense velvety pubescence. Lateral margin of carapace with 11-15 teeth behind the cervical incision. Merus of third maxilliped with ventral surface slightly concave, not swollen, inner margin sometimes crenulate, but not with deep incisions. Prominent mid-dorsal carinae on abdominal segments 1 and 2.

Colour (pl. 8).— Dorsal surface of body uniformly light pink, with the tail fan white to pale yellow brown. Short dense, all over body pubescence brown/yellow in colour, with very heavy pubescence on the sixth antennal segment in males. Tips of





Pl. 8. *Ibacus pubescens* Holthuis, AM P40051. Photo: D. Evans, CSIRO.





Pl. 9. *Ibacus ciliatus* (Von Siebold), Taiwan. Not at present recorded from Australia.
Photo: T-Y. Chan, NTOU.



lateral carapace teeth white.

Remarks.— Chan (1997) elevated *I. ciliatus pubescens* to species rank mainly on the basis of the dense, all-over body pubescence. The only other *Ibacus* species with confirmed all-over pubescence is *I. alticrenatus*. In this species, throughout its distribution, no variation in pubescence has been reported in adults and the pubescence is also noticeable on the carapace and abdomen of very young juveniles. The Philippine *I. pubescens* material (Holthuis, 1985), Chan's (1997) Indonesian material, and all the Australian material examined, have the short, dense pubescence on the carapace and abdomen, with no intergrading apparent. Thus, it could be argued that the stability of the pubescence character would also apply to *I. pubescens*. The discovery, however, of a 'pubescent' form of *I. brevipes* (Pl. 4B) suggests the stability of this character might have to be re-assessed at a later date.

The number of anterolateral teeth on the carapace behind the cervical incision is a stable character within the genus. Again the *I. pubescens* Philippine material (Holthuis, 1985), Indonesian material (Chan, 1997) and all the Western Australian material examined had 12 or more (mostly more) posterolateral teeth behind the cervical incision. Additionally, all the *I. pubescens* specimens examined have stronger orbital ridges, anterobranchial and branchial carinae, and mid-dorsal carinae on the abdominal segments (strongest on 1 and 2) than *I. ciliatus*. Despite the possibility of instability in the pubescence character, these characters support Chan's recognition of two species.

The two large, female specimens (NTM Cr009744) from south of Ashmore Reef, Western Australia (Timor Sea) were caught at the greatest depth ever recorded for an *Ibacus*, 700-750 m. The Arafura Sea specimens expand the known Australian distribution of the species from north Western Australia (Timor Sea) further northeast to Northern Territory.

This species, because of its large size, is of some potential commercial importance, but is not yet caught in large quantities in Western Australia (Wadley & Evans, 1991) or Northern Territory.

Distribution.— Philippines, Indonesia, Australia: NW and N Western Australia, Northern Territory (Timor and Arafura Sea). Depth: 151-750 m.

Discussion

As is shown by the species key, the genus *Ibacus* can be divided into two groups on the basis of the shape of the third maxilliped: the 'ciliatus' group and the 'peronii' group. The 'ciliatus' group, comprising *I. ciliatus*, *I. pubescens*, *I. alticrenatus*, and *I. brucei*, have the ventral surface of the third maxilliped slightly concave, not swollen, with the inner margin sometimes crenulate, but not with deep incisions (eg. fig. 1A of *Ibacus ciliatus*). Two species of this group have the carapace and abdomen with pubescence, and are found at the greatest depths (*I. pubescens*, *I. alticrenatus*).

The 'peronii' group, comprising *I. peronii*, *I. chacei*, *I. brevipes*, and *I. novemdentatus*, have the ventral surface of the merus of the third maxilliped swollen, with deep incisions on the inner margin, several of which may reach beyond the middle of the merus (eg. fig. 1B of *I. peronii*). With the possible exception of *I. brevipes*, the species in this group have the carapace and abdomen glabrous (but pitted), and one, *I. peronii*, is

found at the shallowest depth.

With the addition of *Ibacus chacei* and *Ibacus brevipes* to the Australian fauna, Australia has seven of eight known species, the highest number of species of any country in the Indo-West Pacific region. Four of these species, *I. peronii*, *I. chacei*, *I. brucei* and *I. alticrenatus* are already commercially important on the east Australian coast, with *I. alticrenatus* also commercially important on the southern and western coasts. *I. novemdentatus*, *I. pubescens*, have the potential to become commercially important if sufficient numbers are caught off northwest and northern Australia. *I. brevipes*, off northern Queensland, probably has the least commercial prospect because of its small size, and has yet to be found in large numbers.

There is considerable overlap in the depth and geographical distribution of the four main east coast commercial species, particularly in New South Wales. In New South Wales, *I. peronii* is considered mainly an inshore species; *I. chacei* spec. nov. is mainly a mid-continental shelf species; *I. brucei* is mainly an outer continental shelf (edge) to upper continental slope species, with *I. alticrenatus* mainly a continental slope species (Graham, 1997, personal commun.)

Ibacus spp. are similar to 'rock lobsters', and easily susceptible to overfishing or exploitation. As the study by Stewart & Kennelly (1997) shows, more detailed research is needed, so that the Australian 'bug fishery', although small, is properly developed and sustainably managed.

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