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**A New Swimming Crab from the New Zealand Subantarctic and
a Review of the Genus *Nectocarcinus* A. Milne Edwards**

By R. K. DELL,
Dominion Museum,

D. J. G. GRIFFIN and J. C. YALDWYN,
Australian Museum, Sydney

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Abstract

A large, new *Nectocarcinus* is recorded from 10–22 fathoms off Auckland and Campbell Islands and compared with the closely allied *N. antarcticus* (Jacquinot) here redescribed. The latter occurs throughout the New Zealand—Chatham, Bounty, Auckland and Campbell Islands area from 6–300 fathoms. The presence of two species in the New Zealand Subantarctic is regarded as an example of the development of two allopatric species with a climatic barrier (i.e., Pleistocene glaciation) breaking down later to give partially sympatric ranges. Types of *N. bullatus* Balss from Juan Fernandez are re-examined and additional material is recorded; a lectotype is selected and the species is considered close to the two New Zealand species. Features distinguishing the southern Australian *N. integrifrons* (Latreille) and *N. tuberculosus* A. Milne Edwards at all sizes are discussed and tabulated. *N. spinifrons* Stephenson from western and southern Australia is intermediate in systematic position between the New Zealand—Juan Fernandez species group and the Australian *N. integrifrons/tuberculosus* group. Figures are provided of the two New Zealand species, of *N. bullatus*, and of *N. spinifrons* and a key is given for the six species of *Nectocarcinus*.

INTRODUCTION

A combined Dominion Museum—D.S.I.R. Botany Division field party occupied Cape Expedition Camp 1 at Ranui Cove, Port Ross, Auckland Islands, about 300 miles south of the New Zealand mainland, during late December, 1962, and January, 1963 (see Yaldwyn, 1964). The Dominion Museum's Ichthyologist, Mr J. Moreland, made a series of hauls with a small otter trawl in Port Ross with one of the authors (J.C.Y.) to build up a collection of shallow water fish, decapods and other marine invertebrates. Numbers of large, purplish-red, iridescent, swimming crabs of the genus *Nectocarcinus* were taken in 12 to 15 fathoms on a sand bottom. From their quadrilobate front and general facies, these were at first assumed to be the well-known New Zealand and subantarctic *N. antarcticus* (Jacquinot), originally described from the Auckland Islands.

Later, from a different bottom, a very similar *Nectocarcinus* with a quadrilobate front was taken. These were, however, red and the obviously hirsute carapace con-

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trasted immediately with the naked and iridescent carapace of the first form. The shape of the male abdomen and the male pleopods were very different and there could be no doubt that two distinct species were represented. A later examination of Jacquinet's colour plate of *Nectocarcinus antarcticus* showed clearly that the second, hirsute species was the true *antarcticus*, leaving the iridescent and naked species unnamed. This fine subantarctic swimming crab must now be known as *Nectocarcinus bennetti* Takeda and Miyake, 1969 (see note p. 68).

Drawings of both these species (prepared by D.J.G.G.) are presented with a formal description of each and a discussion of their generic position. New Zealand and subantarctic material of this genus has been examined in detail and the distribution and historical zoogeography of both species is discussed. Type material of *Nectocarcinus bullatus* Balss, from Juan Fernandez and material recently collected by the *Anton Bruun*, was obtained on loan from the Naturhistoriska Museet, Goteborg, Sweden, and the Allan Hancock Foundation, Los Angeles, respectively and additional data on this diminutive species is given here.

While working on the decapod collections made by the National Museum of Victoria during the Port Phillip Survey 1957-63 (Griffin and Yaldwyn, in press), difficulty was experienced in adequately distinguishing juvenile and small-sized adults of the two common southern Australian species of *Nectocarcinus*, *N. integrifrons* (Latreille) and *N. tuberculosus* A. Milne Edwards. Additional features were recognised as being diagnostic in smaller specimens and these are discussed and listed here.

A key to all six species in the genus, the five mentioned above and *N. spinifrons* Stephenson from western and southern Australia, is given as a final contribution to the present review of this temperate Australasian and eastern Pacific portunid genus.

The terminology employed in this paper for the raised aggregations of granules (structures) of the carapace follows that used by Garth and Stephenson (1966: 6-7), while other terms used mainly follow Stephenson and Campbell (1959: 86) and Rathbun (1930: 2-3). The standard measurement used in the "Material examined" sections is the maximum carapace width including the lateral "teeth".

Family PORTUNIDAE

Subfamily CARCININAE Alcock

Carcininae Alcock, 1899: 12. Stephenson and Campbell, 1960: 76, 80.

Portunids with carapace relatively narrow and with four or five anterolateral teeth. Eystalks not elongated. Basal antennal article fixed *or free*, not broader than long, lying in longitudinal axis of carapace. Walking legs long and stout, at least one pair as long as chelipeds; 5th leg either similar to other walking legs *or modified as swimming paddle*, dactyl either lanceolate and distally acute, *or ovate, lamellate and distally mucronate*. (Additional *or modified* sub-familial features in italics.)

Three Indopacific genera are placed in this subfamily: *Carcinus* Leach, *Xaiva* Macleay and *Nectocarcinus* A. Milne Edwards. A key to their separation is given by Stephenson and Campbell (1960: 80, *Portumnus* used for *Xaiva*). The 5th legs are not modified as swimming paddles in *Carcinus* and only weakly modified in the three Australian species of *Nectocarcinus*. In *Xaiva* and in the two New Zealand and one eastern Pacific species of *Nectocarcinus*, they are typical swimming paddles with a broadened propodus and a lamellate dactyl. The dactyl is always distally acute, or at least mucronate, in this subfamily.

Genus NECTOCARCINUS A. Milne Edwards, 1860

Nectocarcinus A. Milne Edwards, 1860: 219-220, 228; 1861: 404. Stephenson and Campbell, 1960: 82.

Carcinines with carapace somewhat wider than long and with regions well defined. Anterolateral borders and front form a regular curve of short radius; front protruding, either entire or subdivided into lobes. Four *more or less subequal* anterolateral teeth. Basal antennal article fixed *or free*, not broader than long. Third maxilliped elongate, ischium hollowed on

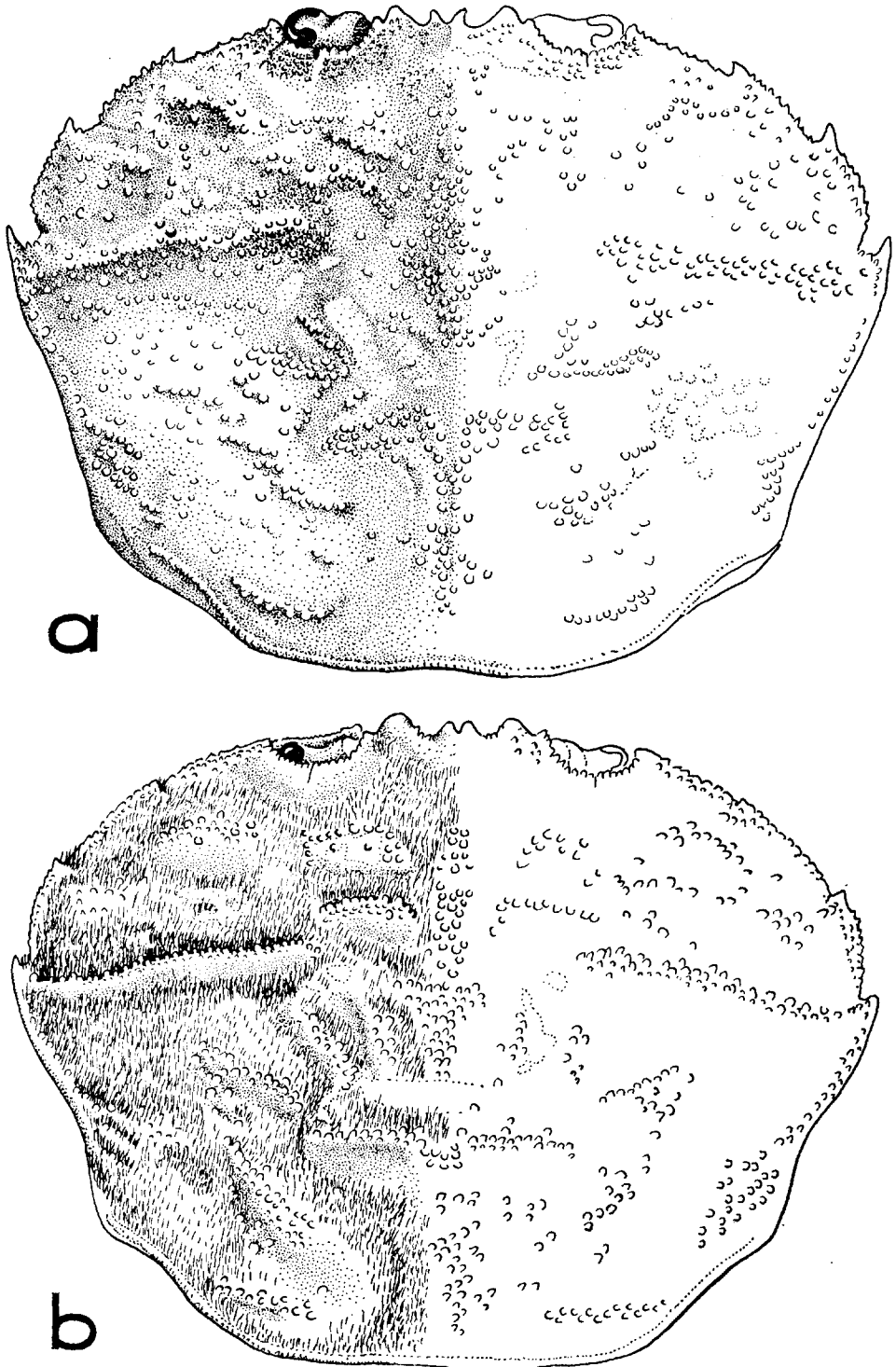


FIG. 1.—Dorsal view of carapace (a) *Nectocarcinus bennetti* (study male) and (b) *N. antarcticus* (study male).

outer surface. Chelipeds relatively short, but robust. Fifth leg *modified for swimming*, but degree of modification varying interspecifically and ranging from slight, with lanceolate dactyl, to complete, with lamellate dactyl. (Additional or modified generic features in italics.)

Type species: A. Milne Edwards originally established this genus to include four species and no type species was designated. No other author has designated a type species for the genus. We now select *Portunus integrifrons* Latreille, 1825, as the type species of *Nectocarcinus*.

The six included species have already been indicated and a key for their separation is provided below. First the two species in the New Zealand area are described and figured, then additional data on the other species are presented.

THE NEW ZEALAND AND SUBANTARCTIC SPECIES *N. bennetti* AND *N. antarcticus*
Nectocarcinus bennetti Takeda and Miyake, 1969. Figs. 1a; 2a, c, d; 3a, b. Pl. 1.

Nectocarcinus "species or form" Dawson, 1963: 313.

Material examined

Study male (72.4mm), Webling Bay, south of Crozier Point, Port Ross, Auckland Islands, trawled 10–15fms, J. Moreland and J. C. Yaldwyn, January, 1963 (Dom. Mus. Z. Cr. 1851).

Twenty ♂♂, 15 ♀♀, 16.5–75.3mm (all in the collections of the Dominion Museum, Wellington, and the Australian Museum, Sydney). Study ♀ (45.3mm), between Rose and Ocean Islands, Port Ross, Auckland Islands, trawled 12–15fms, J. Moreland and J. C. Yaldwyn, January, 1963 (Z. Cr. 1850).

Auckland Islands: Between Rose Island and Ocean Island, trawled 12–15fms, J.M. and J.C.Y., January 1963, 7 ♀♀. Webling Bay, 10–15fms, J.M. and J.C.Y., January 1963, 5 ♂♂. Between Deas Head and Tucker Point, trawled 14–15fms, sand bottom, J.M. and J.C.Y., 18/1/1963, 5 ♂♂. Northwest side of Auckland Islands, 11–18fms, C. de Riek, February, 1966, 5 ♂♂, 5 ♀♀.

Campbell Island: *Galathea* Sta. 595, Perseverance Harbour, 52°33'S, 169°9'E, dredged, 43 metres, mud, sand, shells and stones, 4/1/1952, 2 ♂♂.

Diagnosis

A *Nectocarcinus* species with four frontal lobes, carapace and dorsal surface of chelipeds naked (but granulate) and to a certain extent iridescent, sternum pale, penultimate segment of male abdomen with prominently convex lateral margins and male first pleopod strongly curved laterally.

Description

Carapace hardly wider than long; naked, with rounded granules forming distinct ridges and structures on anterior half but more generally scattered on posterior half; regions distinct. Central gastric and metagastric structures low; cardiac elevation prominent, forming a T-shaped structure with median postcardiac structure. Protogastric structure a low sinuous ridge of granules extending almost from central gastric structure towards 2nd anterolateral tooth; mesogastric structure a low curved granulated ridge near central gastric, widely separated from ill-defined transverse structure near 3rd anterolateral tooth; epibranchial ridge relatively strong and densely granulated, extending from near anterolateral tooth to almost converge with mesogastric structure and then curving sharply posteriorly, with a brief interruption at a discrete, structural white patch, to terminate in a distinct oblique structure lateral to an elongate structural white patch at metagastric level. Mesobranchial region with scattered granules and a poorly defined anterior structure; lateral postcardiac structure low, oblique; metabranchial structure a distinct, narrow, curved and short ridge subparallel with posterior border; posterolateral border granular anteriorly and with three to five short, oblique, granular ridges midway along; posterior part of posterolateral border and posterior border with a strong, beaded ridge forming a sinuous margin to carapace in dorsal view.

Front quadrilobate, slightly upturned, medial lobes smaller, narrower, more acute, closer to each other than to submedials; submedial lobes with concave, minutely tuberculate inner and convex, smooth, outer margins, slightly over-reaching medial lobes. Internal orbital angle subacute, not extending anteriorly as far as frontal lobes but on a level with external orbital angle (1st anterolateral tooth). Orbit shallow, broad, as wide as distance between tips of submedial frontal lobes; dorsal edge of orbit with rounded tubercles, two supraorbital fissures

present, medial fissure the stronger, at about midpoint of orbit, forming distinct but narrow notch in margin, lateral fissure in outer quarter of orbit, subparallel to adjacent margin of carapace; ventral edge of orbit concave, bearing rounded tubercles, interrupted laterally by distinct suborbital notch immediately below external orbital angle, incomplete medially, antenna having complete access to orbit.

Anterolateral margin with four subequally spaced teeth, 1st subacute, others acute, 3rd and 4th stronger and standing out more distinctly from margin than others; margin between teeth edged with granules and one or two granules in concave portions of margin anterior and medial to the outstanding 3rd and 4th teeth.

Eyestalk short, narrowed slightly near terminal subspherical cornea.

Basal antennal article narrow, nearly twice as long as wide, smooth, with two minute, distal spinules ventrally, not fused to orbit but free to move to limited extent in vertical plane, and not excluding flagellum from orbit.

Third maxillipeds meeting in midline, with coarse fringe of short hairs medially; ischium narrow, about twice as long as wide, with a longitudinal narrow groove bordered medially by a narrow, naked, low ridge extending almost full length of segment; merus with rounded anterolateral angle, anterior margin straight, with bluntly produced anteromedial angle.

Chelipeds subequal in length and size, right chela armed with strong, rounded lobe-like teeth on fingers, left chela with more numerous, smaller, more acute teeth on fingers; with some fringes of long hairs and scattered patches of short tomentum. Merus (or arm) relatively short and distally expanded, with a short acute spine on dorsal surface about $\frac{1}{4}$ length of segment from distal border. Carpus (or wrist) broad, with a small blunt spine distolaterally, a long, stout, acute medial spine extending to $\frac{1}{2}$ dorsal length of palm when hand is folded back against wrist, and a small spine on medial border of medial spine. Hand with tuberculated ridges and scattered tubercles but no carinae, length three times greatest width, dactyl (or free finger) subequal in length with palm. Inner surface of palm tuberculate but without distinct ridges; dorsal surface of palm flattened and marked off from inner and outer surfaces by a prominent tuberculated angular ridge along each side, inner ridge terminating in a short spine, some tubercles forming an irregular longitudinal band along slightly raised midline of surface, remainder of surface smooth; outer surface of palm with two irregular longitudinal bands of tubercles, upper band the narrower, with raised tubercles, lower band with tubercles elevated and more scattered distally; ventral surface of palm with numerous tubercles arranged in closely-spaced, irregular, transverse aggregations. Fixed finger with five very distinct, raised, rounded and tuberculated longitudinal ridges extending full length of finger and merging distally in the curved, terminal tooth of cutting edge—one ridge along outer surface, two closely spaced along ventral surface and two along inner surface; teeth on cutting edge irregularly sized and spaced, fixed finger of right chela with about 10 teeth irregularly graded in size, second the largest, first and fourth smaller, fixed finger of left chela with about 14 teeth irregularly associated in groups of three proximally. Dactyl with five distinct ridges similar to those of fixed finger—one along outer surface, one dorsolateral, one dorsal ridge of irregularly sized spines, larger proximally and two ridges along inner surface; teeth on cutting edge irregularly sized and spaced, dactyl of right chela with about 10 teeth irregularly graded in size, the largest being the proximally curved, blunt and boss-like proximal tooth, distal teeth smaller, dactyl of left chela with about 16 teeth more or less in groups of three proximally.

Walking legs flattened and unspined. Second, third and four pereopods elongate, subequal in length, slightly over-reaching chelipeds in length and similar in form. Second pereopods (first walking legs) with merus subequal in length to carpus and propodus combined and with low transverse tuberculate ridges dorsally; propodus equal to about twice midlateral length of carpus and subequal to elongate, slender, acute dactyl; carpus, propodus and dactyl with longitudinal grooves and associated smooth rounded ridges, carpus with a groove on each side of a dorsal ridge, propodus and dactyl with a pair of closely spaced dorsal ridges, two ridges along anterior surface (one partly hidden by anterodorsal fringe of hairs on propodus) and two along posterior surface; fringes of long hairs associated with ridges and grooves on anterior surface only of distal three segments: one fringe along carpus, three along propodus and two along dactyl. Fifth pereopod reaching articulation of propodus and dactyl of fourth pereopod, strongly modified as a swimming paddle and with low, longitudinal, naked and pigmented ridges on merus and following segments contrasting strongly with pale tomentum of appendage surface; merus and propodus subequal in length, carpus about $\frac{2}{3}$ merus; merus with two low longitudinal ridges along flattened dorsal (structurally posterior) surface, carpus with one longitudinal ridge along posterior surface; propodus expanded and lamellate, as wide as long, with four low ridges along posterior surface: one along each margin, one along midline and one between midline ridge and that along dorsal margin; dactyl oval, lamellate and distally mucronate, one and a half times length of merus and twice as long as broad, with three low ridges along posterior surface: one along each margin and one along midline; similar, matching, low ridges along anterior (structurally ventral) surfaces of merus, carpus, propodus and dactyl. Fringes of elongate hairs along both edges of segments of fifth pereopod except on proximal $\frac{1}{4}$ of ventral edge of merus and ventral edge of ischium.

Male abdomen with ultimate segment triangular, a little broader than long, with bluntly rounded apex; penultimate segment with strongly convex lateral margins, length a little more than half greatest width; segments one to five with a distinct transverse ridge across middle of segment, ridges on second and third segments edged proximally with a dense fringe of hairs, penultimate segment with incomplete transverse ridge in midline only; third segment with a rather distinct, low, rounded boss on each side of midline distal to transverse ridge. Surface of abdomen, sternum and ventral surface of body and appendages in general covered with a very short, fine, pale tomentum.

First pleopod of male stout proximally, bent outwards almost at a right angle $\frac{1}{3}$ length from tip, strongly curved laterally, distally tapering, blunt; distal section twisted spirally so that the shallow groove runs across abdominal surface proximally and curves across lateral surface to become sternal on bent distal portion; a broad band of closely spaced spinules extending along lateral surface proximally, passing across sternal surface with twist of distal section to extend along mediolateral surface and to surround terminal part of abdominal surface.

Colour

Carapace and dorsal surface of chelipeds mainly purplish-red with areas of pink iridescence and some regularly patterned paler areas especially on the posterior half of the carapace. Walking legs and ventral surface of body and appendages pale off-white to dirty cream in colour. Fingers of chela not distinctly pigmented. Main areas of iridescence in large specimens are across the front of the carapace from the frontal margin, the orbits and the anterolateral margins as far posteriorly as the protogastric ridges; along each anterolateral margin in an irregular broad band to the level of the fourth tooth; along the anterior side of each epi-branchial ridge in a narrow band, and over the entire dorsal surface of the wrist, palm and free finger of each cheliped. Small specimens show less iridescence, have more tomentum on the carapace and have the various structures and ridges of the carapace marked out in dark red.

Measurements

Measurements of the male and female study specimens are given in Table I following the description of *N. antarcticus*.

Remarks

The differences between *N. bennetti* and *N. antarcticus* are discussed following the description of the latter species.

Distribution

Auckland and Campbell Islands, 10–22fms. (Mr E. W. Dawson informs us that there is additional material in the N.Z. Oceanographic Institute collections from a depth of 108fms off the Auckland Ids.). Chatham Rise, east of Banks Peninsula, 140m (Takeda and Miyake, 1969).

Nectocarcinus antarcticus (Jacquinot, 1853) Figs. 1b; 2b, e; 3c, d. Pl. 2.

Portunus antarcticus Jacquinot, in Jacquinot and Lucas, 1853: 51, pl. 5, figs. 1–5.

Nectocarcinus antarcticus; A. Milne Edwards, 1860: 220; 1861: 407. Miers, 1874: 2, pl. 1, fig. 2 (*Portunus antarcticus* in caption); 1876: 30. Hutton, 1879: 340. Filhol, 1886: 383. Hodgson, 1902: 229. Wilson, 1907: 65. Chilton, 1909: 608; 1911: 291. Thomson, 1913: 237. Rathbun, 1918: 3. Thomson and Anderton, 1921: 98, 2 figs. (of zoea). Stephensen, 1927: 293. Chilton and Bennett, 1929: 754. Young, 1929: 151. Powell, 1937: 375, 377, 387. Richardson, 1949: 31, fig. 1. Ralph and Yaldwyn, 1956: 74, fig. 42 (5th leg only). ?Yaldwyn, 1958: 125. Dell, 1960: 5. Stephenson, 1962: 315. Dell, 1963a: 44, fig.; 1963b: 253. Bennett, 1964: 65, fig. 130. ?Inoue, Arai and Abe, 1968: 135, 137.

Localities previously recorded

(Some specimens of *N. bennetti* may be included here as well as *N. antarcticus*.)

NEW ZEALAND: New Zealand (Miers, 1876). 10 miles NW of Cape Maria van Diemen; off Little Barrier Id., 35fms; Colville Channel; The Watchman, Hauraki Gulf (Chilton and Bennett). Waitemata Harb., Auckland; Northcote, Waitemata Harb.; Motuihi Channel, Waitemata Harb.; between Kaipara and New Plymouth (Bennett). Off Stokes Pt., Northcote, 8fms; $\frac{3}{4}$ mile N of Rangitoto beacon, 8fms; of NE coast of Motutapu Id., 9 fms; $\frac{1}{2}$ mile NW of Tiri Tiri wharf, off Whangaparoa Peninsula, 7fms, all Auckland area bottom community dredgings (Powell). Castlecliff; Wellington; Cloudy Bay, Cook Strait, 19fms (Chilton and Bennett). Between Foxton and Wanganui, 50fms (Griffin and Yaldwyn, 1965). Wellington Harb., 3–10fms (Bennett). Cook Strait; E coast of South Island (Filhol). C.I.E. Stas. 1 and 2, Mernoo Bank, Chatham Rise, 60–100fms (Dell, 1960). Lyttelton Harb.; Sumner, Banks Peninsula (Bennett). *Nora Niven* Sta. 30, 18 miles ENE of Oamaru, 35fms; Sta. 26, 19 $\frac{1}{2}$

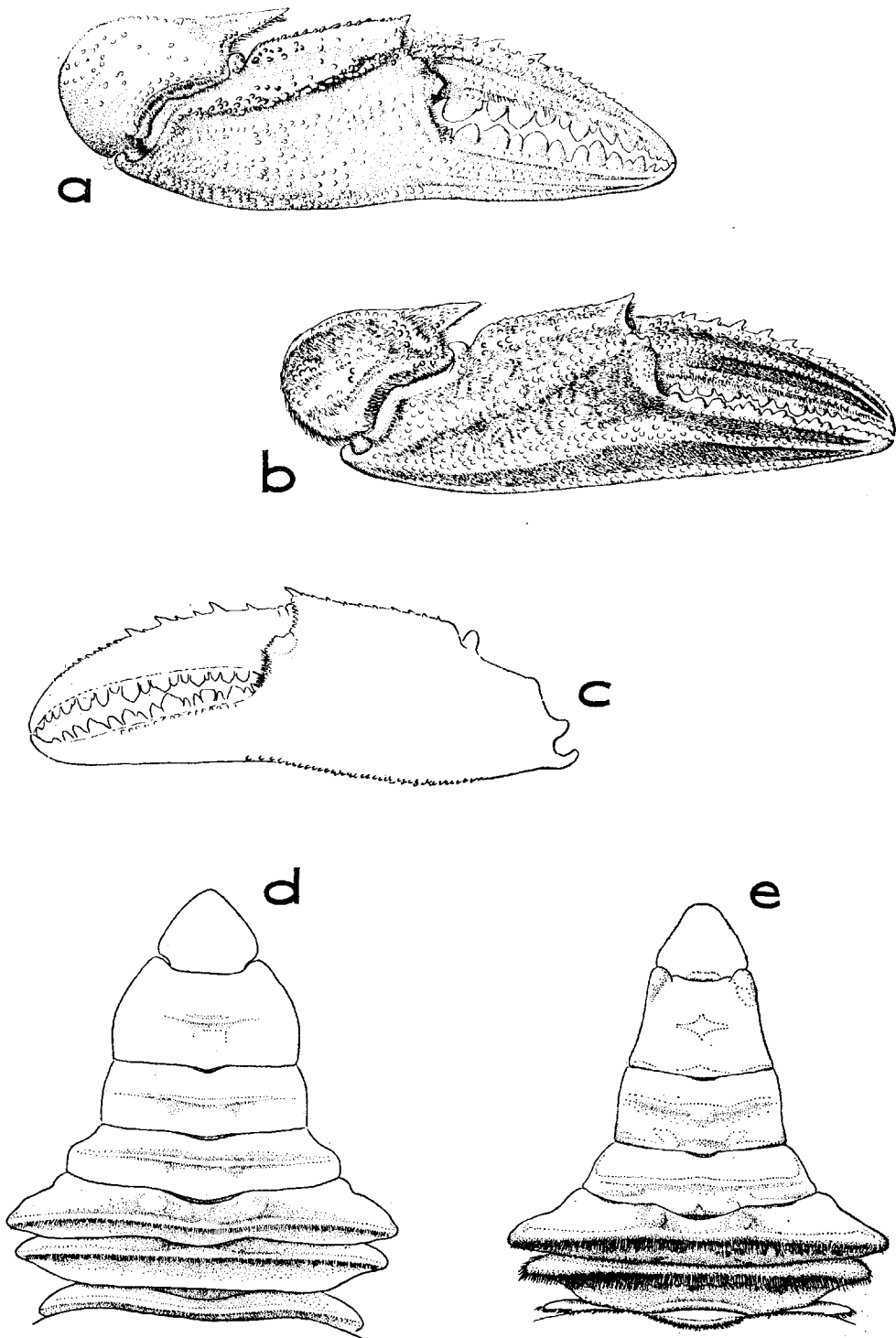


FIG. 2.—Chelae and abdomens of *Nectocarcinus bennetti* (study male) (a, c, d) and *N. antarcticus* (study male) (b, e). a, b, right chela, outer aspect; c, left chela, outer aspect.

miles S of Oamaru, 40–43fms; Sta. 23, 4 miles SE of Mocraki, 13–24fms (Chilton, 1911). Otago Harb. (Thomson; Thomson and Anderton; Bennett). St Kilda, Dunedin; off Portobello Marine Station, Otago Harb.; Warrington, Otago; E of Papanui Inlet, Otago, 40fms; off Otago, 23–40fms; off Otago, from Red Cod stomachs, 20fms; E of Taiaroa Head, Otago, 30–50fms (Bennett). Off E Otago, 120fms (Dell, 1963b). *Nora Niven* Sta. 12, Molyneux Bay, 6 miles NW of Nuggets, Otago, 20–46fms; Sta. 5, 50 miles E off Wreck Reef, Foveaux Strait, 65, 67 and 183fms; Sta. 2, 10 miles NE of Port Adventure, Stewart Id., 54–55fms (Chilton, 1911). Stewart Id. (Chilton and Bennett; Bennett). E coast of Stewart Id. (Filhol). Dusky Sound, over 40fms (Bennett). Off Snares Ids., approx. 80fms (Inoue, Arai and Abe).

CHATHAM ISLANDS: Chatham Ids. (Chilton, 1911; Bennett). Chatham Ids., from Blue Cod stomachs (Young). C.I.E. Stas. 14, 15, 20, 24, 28, 30, 38, Chatham Ids. shelf, 15–70fms (Dell, 1960).

AUCKLAND ISLANDS: Auckland Ids. (Jacquinot; Milne Edwards, 1861; Miers, 1876; Bennett). Aucklands Ids., 10fms (Hodgson). Auckland Ids., from *Notothenia microlepidota* stomachs (Hutton). Auckland Ids., food of Hooker's Sealion (Wilson). Port Ross, 9–10fms; Coleridge Bay, Carnley Harb. (Stephensen). Off Auckland Ids., approx. 98fms (Inoue, Arai and Abe).

CAMPBELL ISLAND: Perseverance Harb., 20fms (Stephensen).

Material examined

Forty ♂♂, 27 ♀♀ (6 ovigerous), 10.5–87.0mm (smallest ovig. ♀ 10.5mm) and other unmeasured and unsexed specimens. Study ♂ (72.7mm), study ♀ (70.9mm), between Deas Head and Tucker Point, Port Ross, Auckland Islands, trawled 14–15fms, J. Moreland and J. C. Yaldwyn, January 1963 (Z. Cr. 1849). Other material as follows:

NEW ZEALAND: New Zealand, E. W. Bennett, 1931, 1 ♂ (Australian Mus. P.9957). Colville Channel, 26fms, N.Z. Marine Dept., 14/11/1962, 1 ♂, 2 ♀♀ (ovig.) (Dom. Mus.). Twelve miles N of Whale Island, Bay of Plenty, 58–68fms, N.Z. Marine Dept., 8/12/1962, 1 ♂ (Dom. Mus.). Eleven miles S of East Cape, 100fms, N.Z. Marine Dept., 5/4/1963, 1 ♂ (Dom. Mus.). Sixteen miles SE of East Cape, 70fms, N.Z. Marine Dept., 5/4/1963, 1 ♀ (ovig.) (Dom. Mus.). Three miles NE of Hick's Bay, 100–120fms, N.Z. Marine Dept., 4/4/1963, 3 ♂♂ (Dom. Mus.). Between Foxton and Wanganui, 50fms, M.V. *Admiral*, J. C. Yaldwyn, 14/6/1956, 1 ♀ (ovig.) (Dom. Mus.). Dom. Mus. Bottom Sta. 173, Kapiti Channel, 33fms, M.V. *Alert*, August 1951, 1 ♂ (Dom. Mus.). Off Days Bay, Wellington Harbour, R. A. Falla, 5/10/1953, 3 ♂♂ (Dom. Mus.). Off Days Bay, Wellington Harbour, 9fms, R. K. Dell and J. Moreland, 19/1/1953, 1 ♂ (Dom. Mus.). D.M.B. Sta. 163, Cook Strait, 40°52.6'S, 174°49.5'E, 75fms, M.V. *Alert*, 30/8/1951, 1 ♂, 1 ♀ (Dom. Mus.). Ships Cove, Queen Charlotte Sound, taken at surface at night, attracted by light, R. K. Dell, 30/8/1951, 3 small specimens (Dom. Mus.). Tasman Bay, 40°20'S, 172°41'E, 45–55fms, N.Z. Marine Dept., 8/8/1963, 1 ♂, 1 ♀ (ovig.) (Dom. Mus.). Lyttelton Harbour, dredged, G. M. Thomson, 1910 (Otago Mus.). Off Oamaru, J. Graham, 2 ♂♂ (Dom. Mus.). D.M.B. Sta. 189, off East Otago, 120fms, M.V. *Alert*, 14/8/1955, 1 ♂, 1 ♀ (Dom. Mus.). D.M.B. Sta. 191, off East Otago Coast, 250–300fms, M.V. *Alert*, 16/8/1955, 1 ♂ (Dom. Mus.). D.M.B. Sta. 202, off Taiaroa Head, Otago, 75fms, M.V. *Alert*, 23/1/1957, 1 ♂ (Dom. Mus.). D.M.B. Sta. 189, off East Otago, 120fms, M.V. *Alert*, 14/8/1955, numerous small specimens (Dom. Mus.). Off Otago, dredged 40fms, D. H. Graham, 1931 (Otago Mus.). Foveaux Strait Oyster beds, September 1961, 1 ♂ (Dom. Mus.). Five miles W of Otorokua Point, north of Jackson's Bay, 20fms, N.Z. Marine Dept., 24/1/1964 (specimen examined R.K.D.).

CHATHAM ISLANDS: Specimens reported on by Dell, 1960, and re-examined for the purpose of this report. Hanson Bay, off Cape Young, South of the Sisters Islands, Petre Bay and south of Little Mangere Id., 15–70fms, C.I.E. Stas. 14, 15, 20, 24, 28, 30 and 38, 3 ♂♂, 1 ♀ (Dom. Mus.) and additional specimens (Canterbury Mus.).

BOUNTY ISLANDS: Off Bounty Islands, *Magga Dan* Expedition, M. M. Darby, dredged in 40fms, 12/12/1968, 1 ♀ (Cant. Mus.).

AUCKLAND ISLANDS: Musgrave Peninsula, R. W. Oliver, 5/1/1944, Cape Expedition, 1 ♀ (Dom. Mus.). Between Deas Head and Tucker Point, trawled 14–15fms, sponge bottom, J. C. Yaldwyn and J. Moreland, 18/1/1963, 15 ♂♂, 16 ♀♀ (1 ovig.) (Dom. Mus.). Camp Cove, Carnley Harbour, speared in six feet of water, E. Mitchell, 8/5/1943, Cape Expedition, several large specimens (Dom. Mus.). Emergency Bay, Carnley Harbour, 6fms, Cape Expedition, several specimens (Dom. Mus.). Togua Bay, 10fms, W. H. Dawbin, 6/10/1943, Cape Expedition, several small specimens (Dom. Mus.).

LOCALITY UNCERTAIN: ?Subantarctic, Mawson's Australian Antarctic Expedition, 1 ♂, 1 ♀ (fragments) (det. Mary J. Rathbun) (Aust. Mus. P.4063).

Diagnosis

A *Nectocarcinus* species with four frontal lobes, carapace and dorsal surface of chelipeds clothed in dark-coloured tomentum (and granulate), sternum dark col-

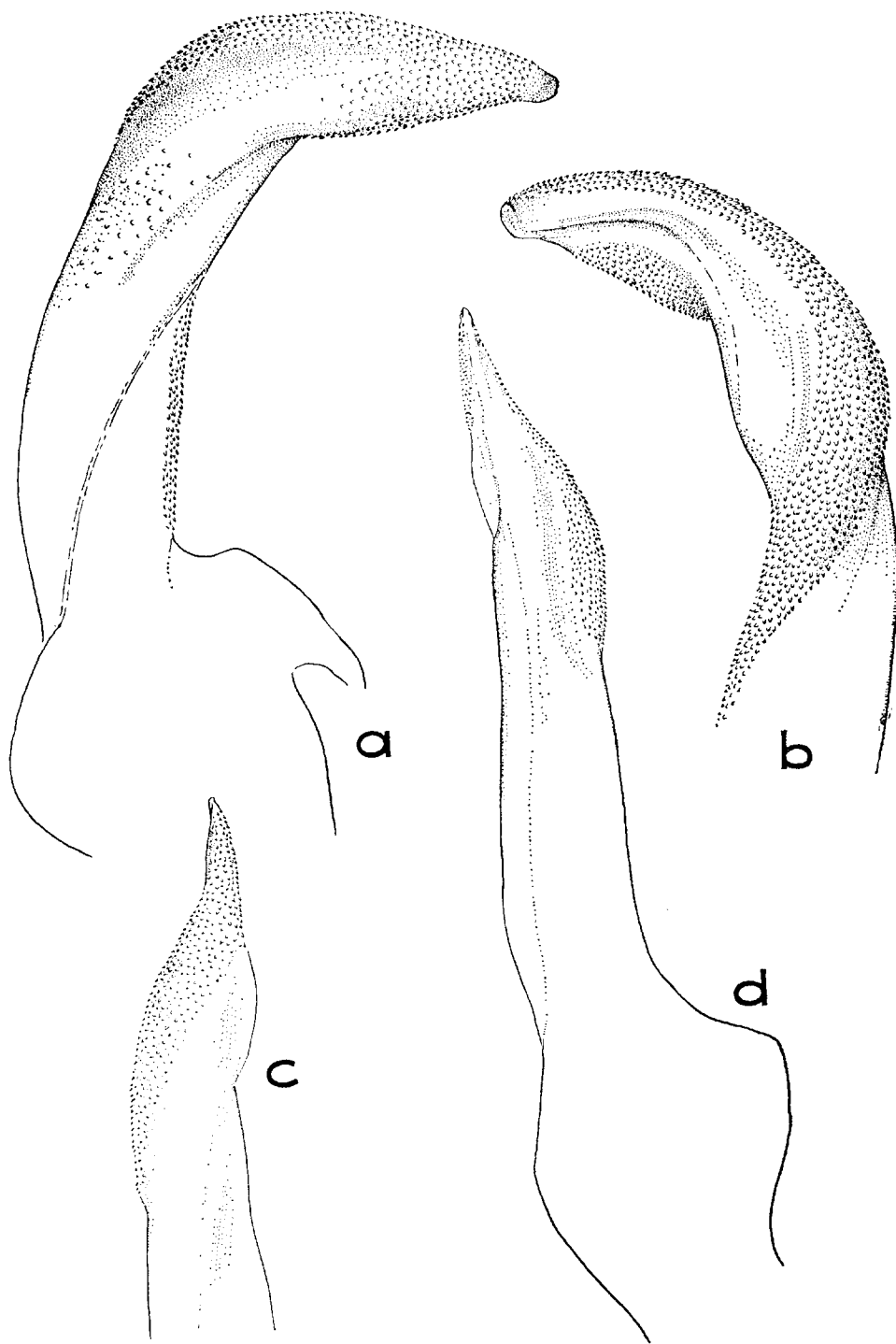


FIG. 3.—Male left first pleopods of *Nectocarcinus bennetti* (study male) (a, b) and *N. antarcticus* (study male) (c, d). a, d, whole pleopod, abdominal aspect; b, c, tip, sternal aspect.

oured, penultimate segment of male abdomen with weakly concave lateral margins and male first pleopod straight.

Description

This description is mainly based on the study male, carapace width 72.7mm, from Port Ross, Auckland Islands, with additional information from the associated study female (both Z. Cr. 1849).

Carapace hardly wider than long; completely clothed in short, fine, dark tomentum, but with rounded granules forming distinct ridges and structures projecting through tomentum; regions distinct. Central gastric and metagastric structures low; cardiac elevation prominent, forming a T-shaped structure with median postcardiac structure, with granules concentrated along anterior edge of cardiac structure and bunched in posterior part of postcardiac. Proto-gastric structure a low sinuous ridge of granules extending from near central gastric structure but widely separated from transverse ridge near second anterolateral tooth; mesogastric structure low, curved, widely separated from ill-defined structure near third anterolateral tooth; epibranchial ridge relatively strong with large granules concentrated anteriorly, extending from near fourth anterolateral to converge slightly with mesogastric, then curving sharply posteriorly, with a brief interruption at a discrete, structural white patch, to terminate in a distinct oblique structure lateral to elongate white patch at metagastric level. Mesobranchial region with some granules forming an irregular structure; lateral postcardiac structure granulated and elevated; metabranchial region with a distinct, narrow, straight and short ridge inclined at angle to posterior border; posterolateral border granular anteriorly and with three ill-defined, short, oblique, granular ridges midway along; posterior part of posterolateral border and posterior border, with a distinct, finely beaded ridge forming a sinuous margin to carapace in dorsal view.

Front quadrilobate, in plane of carapace; medial lobes smaller, narrower, blunt and closer to each other than to submedials; submedial lobes with concave, strongly tuberculate inner margins and smooth, convex outer margins, rounded distally and slightly over-reaching medial lobes. Internal orbital angle subacute, not extending anteriorly as far as frontal lobes but somewhat in advance of level of external orbital angles. Orbit shallow, broad, as wide as distance between tips of submedial frontal lobes; dorsal edge of orbit with rounded tubercles, one supraorbital fissure at about midpoint of orbit forming narrow slit in margin rather than a notch, second fissure in outer quarter of orbit, a narrow slit in margin only; ventral edge of orbit concave, bearing rounded tubercles, and interrupted laterally by distinct suborbital notch immediately below external orbital angle, incomplete medially, antenna having complete access to orbit.

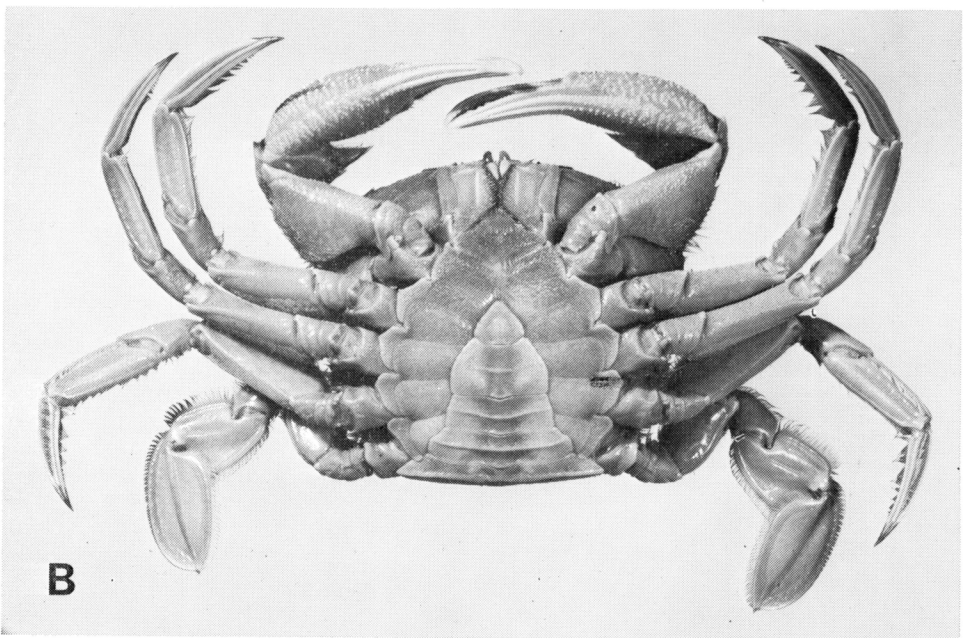
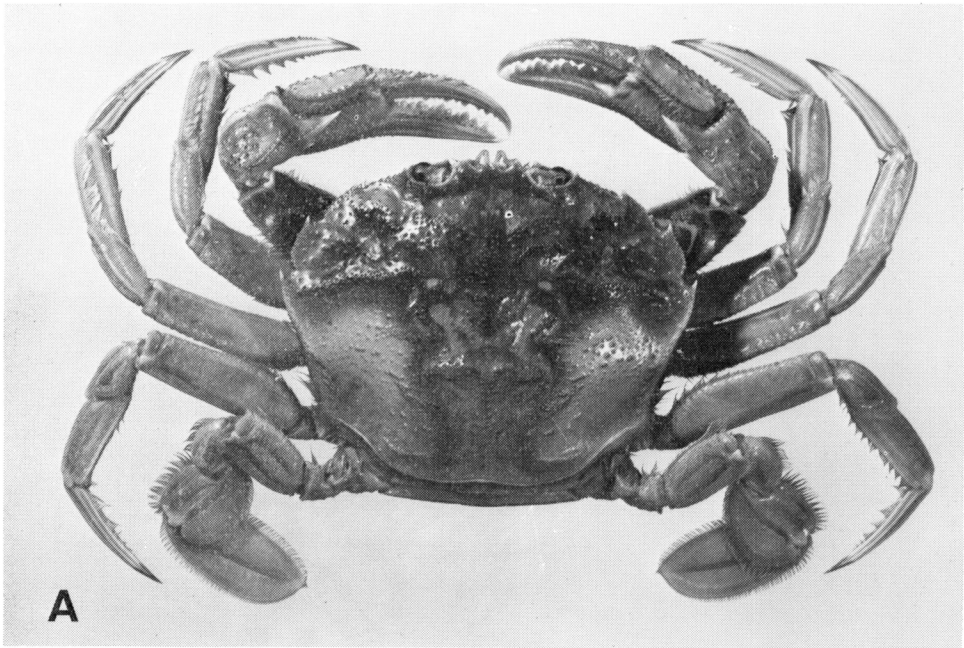
Anterolateral margin with four subequally spaced teeth, first blunt, others acute; first and second not standing out from anterolateral margin but third and fourth stronger and standing out distinctly from margin; margin between teeth edged with small granules.

Eye, basal antennal article and third maxilliped as in *N. bennetti* but distal edge of basal antennal article minutely granulate ventrally.

Chelipeds subequal in length and size, both right and left chelae with similar teeth on fingers. Merus relatively short and distally expanded, with a short and subacute spine on dorsal surface somewhat less than $\frac{1}{2}$ of segment length from distal border. Carpus broad, with strong blunt, sometimes apically bifid, distolateral spine, a stout, acute spine medially, extending to $\frac{1}{3}$ dorsal length of palm when hand is folded back against wrist, and a small spine on medial border of medial spine; dorsal surface of wrist with several short tuberculated ridges and some scattered tubercles. Hand with strong tuberculated ridges and many scattered tubercles, length three times greatest width, dactyl and palm subequal in length. Inner surface of palm tuberculate but without distinct ridges; dorsal surface of palm marked off from inner surface by a tuberculated angular ridge terminating distally in a short spine, and from outer surface by a broad, rounded, tuberculated ridge, midline of dorsal surface raised into an incomplete tuberculated ridge; outer and ventral surfaces of palm each with a rounded, tuberculated ridge extending on to base of fixed finger. Fixed finger with five very distinct, raised, rounded and tuberculated longitudinal ridges merging distally in straight tip of cutting edge—one along outer surface, two closely spaced along ventral surface and two along inner surface; about 15 teeth or more on cutting edge somewhat irregularly sized and spaced, and irregularly associated in groups of three. Dactyl with five distinct ridges similar to those of fixed finger—one along outer surface, one dorsolateral, one dorsal ridge of irregularly sized spines, larger proximally, and two ridges along inner surface; about 15 teeth or more on cutting edge irregularly sized and spaced. Both hands with prominent longitudinal bands of dark-coloured tomentum between the pale tuberculated ridges on fingers and on palm distally—outer surface with two such bands on dactyl, one irregular broad band on palm medially extending on to fixed finger and one distinct band on palm ventrolaterally extending on to fixed finger.

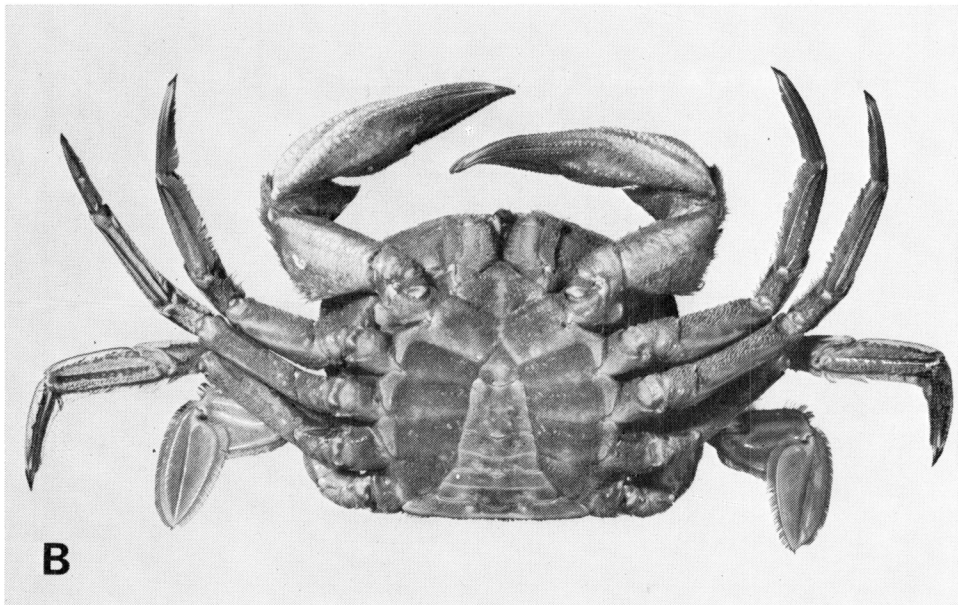
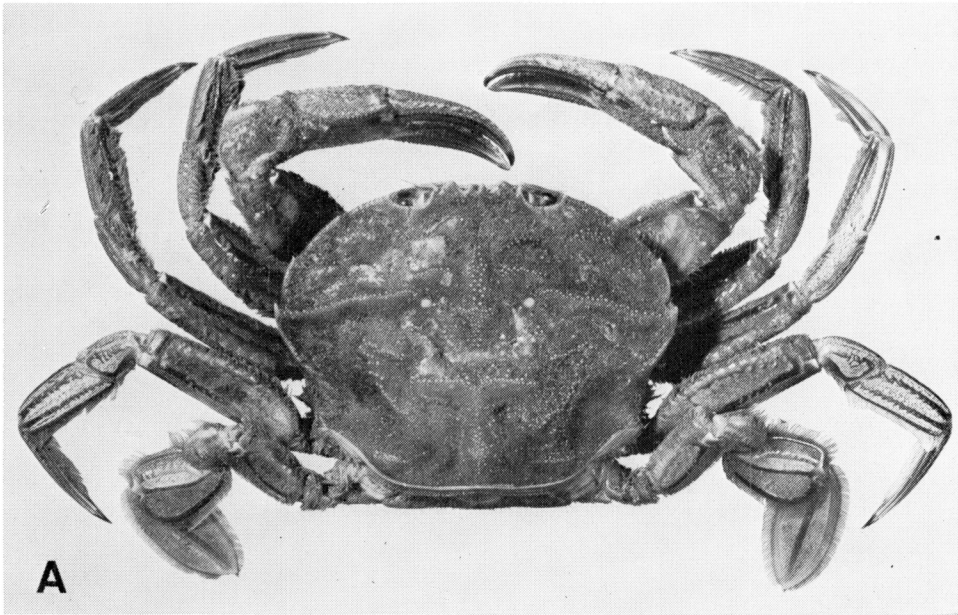
Walking legs (second to fifth pereopods) as described for *N. bennetti*.

Male abdomen with ultimate segment triangular, a little broader than long, with apex somewhat truncated and rounded, penultimate segment with weakly concave lateral margins,



Nectocarcinus bennetti (study male). A, dorsal view; B, ventral view.

Photos: Charles Turner, Australian Museum.



Nectocarcinus antarcticus (study male). A, dorsal view; B, ventral view.

Photos: Charles Turner, Australian Museum.



A, *Nectocarcinus bullatus* (δ , 24.6mm, off Juan Fernandez, Anton Bruun), dorsal view. B, *Nectocarcinus spinifrons* (Aust. Mus. E.4511), dorsal view.

Photos: Anthony Healy.

length subequal to distal width; segment 1 largely obscured by proximal expansion of segment 2; segments 2 to 5 each with a distinct transverse ridge across middle of segment, ridges on 2nd and 3rd segments edged proximally with a very dense fringe of long hairs; penultimate segment with trace of transverse ridge centrally only; 3rd segment with a rather indistinct, low rounded boss on each side of midline distal to transverse ridge. Surface of abdomen, sternum and ventral surface of body and appendages in general covered with short, fine, dark-coloured tomentum.

First pleopod of male stout and straight, subdistally slightly swollen, tip elongate, acute; groove extending along sternal surface proximally, curving around medial surface at level of swollen subdistal portion to become abdominal distally; a patch of small, closely spaced spinules present on lateral and sternal surfaces of swollen subdistal section, passing on to sternal and medial aspects of tip.

Colour

Carapace and dorsal surface of chelipeds and walking legs mottled with dark red over a background of pinkish red. No trace of iridescence, but with some small white marks on various ridges and spines. Ventral surface of body and legs pale with some regularly placed bands of red across sternum and coxa of each leg. These bands and the general dark-coloured tomentum of the body surface give the sternum a general dark appearance in contrast to the pale appearance of the *N. bennetti* sternum. Fingers of chelae dark red on the longitudinal ridges especially on the inner surface.

TABLE I.—Dimensions (in mm) of *Nectocarcinus bennetti* and *N. antarcticus*.

Dimension	<i>N. bennetti</i>		<i>N. antarcticus</i>	
	study male	study female	study male	study female
Carapace length	55.7	36.4	55.2	53.5
Carapace width	72.4	45.3	72.7	70.9
Cheliped length	85.1	50.3	89.6	77.5
Chela length	43.7	24.9	44.4	38.9
Chela height	19.2	10.7	18.7	15.0
Ambulatory leg 2 length	100.4	59.8	98.4	92.7

Remarks

The most obvious differences between the two subantarctic species of *Nectocarcinus* are the colour (including iridescence), hairiness, and shape of the abdomen and first pleopod in males. Although the position and relative size of the structures on the carapace is the same in both species there are marked differences in the position of the larger tubercles making up the structures. In *N. stephensoni* the granules are somewhat uniformly distributed over each structure, the protogastric structure is almost continuous with that near the second anterolateral tooth, the granules making up the cardiac and medial postcardiac structures merge into one another and the posterolateral structure is curved and subparallel with the posterior border. In *N. antarcticus*, on the other hand, the protogastric structure, like the mesogastric in both species, is widely separated from that near the anterolateral tooth, the granules on the structures are typically larger and more concentrated near the anterior part (particularly noticeable on the protogastric, mesogastric, epibranchial and cardiac ridges) with smoother, naked areas behind them, the granules on the cardiac and medial postcardiac structures are distinctly separated by a smooth area and the posterolateral structure is straight and set at a slight angle to the posterior border. There are differences between the two species in the shape and tuberculation of the frontal lobes, although these are slight and variable, in the relative prominence of the outer dorsal ridge of the palm of the chelae, in the shape of the teeth on the fingers of the chelae, although in *N. bennetti* those on the right chela are not always larger than those on the left and the arrangement of the teeth is variable, and in the relative length of the medial spine of the cheliped carpus. Finally, the anterolateral teeth of the carapace stand out much more in *N. bennetti* so that the whole of the margin of the anterior part of the carapace does not appear to be as smoothly rounded as in *N. antarcticus*.

When the two species of *Nectocarcinus* were collected at the Auckland Islands in January, 1963, it was noted that at no time were they taken together in the same trawl haul. *N. bennetti* was taken between 10 and 15 fathoms at three localities in or just outside Port Ross, from bottoms of sand, dead shell and red algae, while *N. antarcticus* was taken between 14 and 15 fathoms at one locality in the same area from a bottom of abundant, finger-like sponges and some *Macrocystis* kelp. The following decapods were taken in association with these portunids: the cancrid crab *Cancer novaezelandiae* (Jacquinot), the hermit crab *Pagurus* sp. and the crangonid shrimp *Pontophilus pilosoides* Stephensen with *N. stephensoni*; the majid crab *Leptomithrax australis* (Jacquinot), the hymenosomatid crab *Halicarcinus planatus* (Fabricius) and the squat lobster *Galathea pusilla* Henderson with *N. antarcticus*. The hippolytid shrimp *Nauticaris marionis* Bate occurred with both species.

A surprising feature amongst material of *N. antarcticus* from Cook Strait northwards is the occasional occurrence of extremely small ovigerous females. Specimens examined can be listed with their respective carapace widths as follows: Colville Channel (26fms), 12.0mm, 14.4mm; Off East Cape (70fms), 29.4mm; between Foxton and Wanganui (50fms), 10.5mm (smallest ovig. ♀, see Griffin and Yaldwyn, 1965), and Tasman Bay (45–55fms), 13.6mm. At one stage it was suspected that these small ovigerous females might represent a different species. We can, however, find no consistent differences between them and typical *N. antarcticus*. All the specimens concerned are from depths greater than 25 fathoms but too little material is available to draw any conclusions regarding bathymetric or geographic variation at present. Northern examples certainly do not attain the size of Auckland Island specimens in either sex. At the Auckland Islands ovigerous females with carapace widths up to 65.7mm occur.

Distribution

New Zealand mainland from Cape Maria van Diemen to Stewart Island, Chatham Islands, Bounty Islands, Auckland Islands and possibly Campbell Island, 6–300fms. (Mr E. W. Dawson informs us that there is undoubted material of *N. antarcticus* from Campbell Id. in the N.Z. Oceanographic Institute collections.)

THE AUSTRALIAN SPECIES *N. integrifrons* AND *N. tuberculosus*

Large specimens of the two well-known Australian species of *Nectocarcinus* are easily distinguished from each other, the carapace differing markedly in convexity, tuberculation and hairiness; this has been clear from the time of Milne Edwards (1861: pls. 37 and 38) who provided excellent illustrations of the two species. However, small juveniles and even moderately sized adults have historically provided difficulties. The fact that the two species have been usually separated by the presence or absence of a central notch in the frontal margin, a feature which is variable—a notch is sometimes present in both species—and the shape of the first pleopods in the males, which is very similar in the two species (Stephenson and Campbell, 1960: 82–83, pl. 6, figs. A and B), made positive identification of small specimens extremely difficult and often virtually prevented a clear separation of a sample into two species, or alternatively, suggested the existence of two species in a sample when only one was present.

Examination of the large series of specimens of *Nectocarcinus* taken in Port Phillip Bay (Griffin and Yaldwyn, in press) eventually showed that but a single species, *N. integrifrons* (Latreille), was present, although the presence of a central notch in the frontal margin and the pattern of tuberculation of the carapace in some specimens at times suggested that *N. tuberculosus* A. Milne Edwards occurred sympatrically with *N. integrifrons*. Further examination of a number of features in the large series of specimens of both species reported on previously by Rathbun (1923) and by Stephenson and Campbell (1960) allowed a discrimination between

these species, the results of which are summarised in Tables II (juveniles) and III (adults). Table II is based on two males, carapace width ca 10 and 14mm, of *N. integrifrons* from the Port Phillip Survey material and a male, c.w. ca 13mm (Aust. Mus. P.5970) of *N. tuberculatus* from southern New South Wales; Table III is based on a male, c.w. ca 76.5mm (AM P.11422) of *N. integrifrons* from Port Phillip, Victoria, and a male, c.w. ca 85mm (AM E.6082), of *N. tuberculatus* from Bay of Fires, Tasmania. Small specimens of the two species are distinguished most obviously by the shape of the junction of the frontal and orbital margins and the ornamentation of the cheliped carpus. There are also differences in the shape of the penultimate segment of the abdomen in the males. The shape of this segment in large males is the same in both species—the proximal width is ca 1.3 times the distal width, the lateral borders are straight and the junction with the ultimate segment is a small notch. However, in moderately large to very large specimens there continue to be differences in the shape and ornamentation of the front and the ornamentation of the cheliped carpus. Specimens of *N. integrifrons* of intermediate size possess scattered hairs on the carapace and there are no greatly marked differences between intermediate specimens of the two species in arrangement of tubercles on the carapace.

Though Stephenson and Campbell (1960: 83) repeat old records of *N. integrifrons* from New Zealand there is no recent record of this species known to us. As Chilton and Bennett (1929: 754) point out, three overseas workers reported it from New Zealand last century but it still "remains unknown to local naturalists". Bennett (1964: 14) firmly lists it as an Australian species incorrectly recorded from New Zealand.

THE REMAINING SPECIES *N. bullatus* AND *N. spinifrons*

In 1924 Balss described a new species of *Nectocarcinus*, *N. bullatus*, from the Juan Fernandez Islands off Chile in the south eastern Pacific. His description was

TABLE II.—Summary of differences between small specimens of *N. integrifrons* and *N. tuberculatus*.

Character	<i>integrifrons</i>	<i>tuberculatus</i>
Anterolateral teeth of carapace	2nd in higher plane but parallel with posterior border of 1st.	sharp spines, 2nd upwardly directed, not parallel with 1st.
Frontal margin of carapace	smoothly but weakly convex, uninterrupted or sometimes with a very shallow and minute central notch; junction with orbital margin smoothly rounded, a shallow concavity above antenna.	smoothly and obviously convex, with a strong, obvious V-shaped notch; junction with orbital margin forming a definite angle, a shallow notch above antenna.
Inner dorsal margin of cheliped carpus (wrist)	completely lacking spines or tubercles distal to spinous inner angle.	with a few long spines distal to spinous inner angle.
Lateral junction of penultimate and ultimate segments of male abdomen	very shallowly notched.	distinctly and deeply notched, lateral margin of penultimate segment distally and ultimate segment proximally strongly convex.
Shape of penultimate segment of male abdomen	lateral margins straight, distal margin $\frac{2}{3}$ width of proximal margin.	distal margin and proximal margin subequal in width.

TABLE III.—Summary of differences between large specimens of *N. integrifrons* and *N. tuberculosus*.

Character	<i>integrifrons</i>	<i>tuberculosus</i>
Anterolateral teeth of carapace	first 3 almost obtuse, very broad, with low tubercles on dorsal surfaces and lateral borders; 4th a short, sharp spine with numerous tubercles dorsally and laterally.	all 4 short, stout spines surrounded at their bases by small blunt tubercles.
Frontal margin of carapace	smoothly but weakly convex, with a shallow central emargination, bordered dorsally by a single row of numerous rounded tubercles with fewer tubercles behind them, a ventral row of tubercles not visible dorsally; junction with orbital margin rounded; a very shallow concavity above antenna.	almost straight, with a distinct narrow V-shaped notch centrally, bordered by a double row of prominent blunt tubercles both visible in dorsal view; junction with orbital margin almost a right angle; a deep semi-circular notch above antenna.
Epibranchial region	with ill-defined groups of tubercles merging with those on dorsal surface of anterolateral teeth, not continuing down posterolateral border.	small, low blunt tubercles, groups of tubercles merging with groups surrounding anterolateral teeth and continuing partway down posterolateral border.
Protogastric and postfrontal regions	protogastric structures distinct, more steeply inclined anteriorly; postfrontal structures ill-defined, broad.	protogastric structures ill-defined, uniformly convex, tubercles more prominent anteriorly; postfrontal structures distinct, closer to midline than protogastrics.
Carapace surface	weakly tuberculate, tubercles more or less arranged in ill-defined short transverse rows; naked.	virtually smooth; densely tomentose, particularly anteriorly.
Inner dorsal margin of cheliped carpus (wrist)	about 10 low, blunt tubercles in line from tip of spine at inner angle to dorsal articulation with chela.	a few (about 4) short, stout spines on distal border of spine at inner angle.
Outer surface of cheliped palm	tubercles in transverse rows, none more prominent or more darkly coloured than any other.	some more prominent and darker in colour than others, hand appears to be covered by scattered dark tubercles.

based on several males and an ovigerous female from Masatierra Island collected by K. Bäckström of the Swedish 1916–17 expedition. As the illustration of this species given by Balss (1924: fig. 2) was not labelled as to sex, and as the carapace width was given as only 6mm, it was thought advisable to re-examine the type material. Dr B. Hubendick (Naturhistoriska Museet, Goteborg, Sweden) kindly sent us two type specimens (registered as Crust. 5162) on loan and the following notes are based on an examination of this material.

The two type specimens of *N. bullatus* Balss seen by us consist of an ovigerous female (carapace width 5.9mm, carapace length 5.3mm) and a non-ovigerous

female (carapace width 5.45mm, carapace length 5.0mm). No male specimen was sent to us. The specimen figured is a non-ovigerous female and the shape of the abdomen is accurately represented. Since Balss makes no specific mention of a holotype, these two specimens are to be considered syntypes. We here select the non-ovigerous female as the LECTOTYPE. Twelve other specimens from the type series are in the collections of the Naturhistoriska Museet.

Through the kindness of Dr John S. Garth and Miss Janet Haig (Allan Hancock Foundation, Los Angeles) we have been able to examine additional specimens of this species—2 ♂♂, c.w. 14.6, 24.6mm. 1 ♀, 20.2mm, off Juan Fernandez Id., 125–200 metres, *Anton Bruun*, 15/12/1965 (Sta. 65-IV-67).

All the material agrees with the generic characters given for *Nectocarcinus* by Stephenson and Campbell (1960: 82) except that the basal antennal article is completely free, *not* fused to the front (it is also narrow, as is usual for this subfamily). The antennules are not located in fossae, but lie in unrimmed shallow excavations. The fifth legs have the dactyls lanceolate but not ridged or grooved. Balss's figure shows the posterior margin of this dactyl sinuate. However, the feature is exaggerated—the posterior margin is in fact convex proximally but straight distally.

The shape of the front in the lectotype is not as shown in Balss's figure. The frontal lobes are much shorter and blunter, while the sinuses between the two medial lobes and the submedial lobes do not nearly reach back to the level of the internal orbital angle. In the *Anton Bruun* material, however, the shape of the front is as shown by Balss. The frontal and dorsal orbital margins are minutely tuberculate in all specimens. The fourth anterolateral teeth in the lectotype and in the ovigerous female (paralectotype) do not extend outwards beyond the third anterolaterals. There is a single spinule on the anterior margin of each anterolateral tooth, but that on the third tooth is very slightly larger than that on the fourth. Minute tubercles or spinules are also present ventrally on the anterior margin of the anterolaterals. In the three *Anton Bruun* specimens, however, the fourth anterolateral tooth projects laterally beyond the third and its posterior border is almost straight (see Pl. 3A). The second anterolateral tooth in these specimens bears only a single spinule on the anterior margin; the third tooth bears a single spinule in the two smaller specimens and two spinules in the largest specimen (the inner spinule is broken on the left tooth); the fourth tooth bears two spinules, the inner one ranging from smaller than the outer in the smallest specimen to subequal with the outer in the largest specimen.

The large rounded tubercles shown on the carapace in Balss's figure are in fact raised granulated structures, while the epibranchial ridge is a low and granulated band with the tubercles in the posterior part of the band tending to be the largest. The carapace is naked and there are granules along the outer edges of the anterolateral teeth. At least the right cheliped in Balss's figure is drawn from the ovigerous female as evidenced by the presence of two spinules larger than the others on the dorsal surface of the dactyl, a character not present in the lectotype. The two males from the *Anton Bruun* series have up to five larger spinules; in the female the dorsal edge of the dactyl possesses numerous small, close-set spinules. It appears that the left cheliped in the figure is also probably from the ovigerous female paralectotype.

The first pleopod of the larger *Anton Bruun* male is more or less straight but with the tip weakly curved abdominally; a band of spinules extends along the lateral surface for almost the whole length and curves on to the sternal surface distally. In general this is similar to the first pleopod of *N. antarcticus* as illustrated here.

Nectocarcinus bullatus then, with its quadrilobate front, its epibranchial ridge, its moveable basal antennal article and its modified fifth leg is more closely related to the New Zealand and subantarctic *N. antarcticus/bennetti* group than to the

three Australian species. *N. bullatus* differs from the New Zealand group in that the carapace is mostly smooth with only a few discrete groups of granules, and the width of the carapace between the first anterolateral teeth is about $\frac{2}{3}$ of the greatest carapace width (compared with $\frac{2}{5}$ in *N. antarcticus* and *N. bennetti*).

Nectocarcinus spinifrons Stephenson is described and figured from three specimens dredged off Shark Bay, Western Australia, in 40fms (Stephenson, 1961: 92). The bilobed (though spinulate) front and the lack of epibranchial ridges link this species with the Australian *N. integrifrons/tuberculosis* group, but the fact that the basal antennal article is capable of a small amount of movement and that the fifth leg shows a certain degree of modification for swimming, indicate that *N. spinifrons* has a somewhat intermediate position between this Australian group and the New Zealand–Juan Fernandez grouping. Stephenson and Rees (1968) extend the known range of this species to South Australia with a record of a large male off Greenly Island from 44fms, and this specimen is illustrated here on Pl. 3B.

KEY TO SPECIES OF THE GENUS *Nectocarcinus*

- 1 Front entire or bilobate, edge tuberculate or spinulate. Dorsal surface of carapace without distinct transverse ridges 2
- Front quadrilobate, edge smooth or minutely tuberculate. Dorsal surface of carapace with a medially interrupted tuberculate (epibranchial) ridge extending obliquely transversely from 4th anterolateral tooth 4
- 2 (1) Front entire or shallowly divided medially, convex in dorsal view. Merus of cheliped lacking prominent spines except for one distally on dorsal border; palm of chela with a small distal spine on inner surface dorsally 3
- Front divided medially by a deep V-shaped notch, weakly concave in dorsal view. Merus of cheliped with four to five spines on lower posterior border including one distally; palm of chela with a very large distal spine on inner surface dorsally *N. spinifrons* Stephenson
- 3 (2) Front entire or with very shallow medial notch, edge (in larger specimens) with single row of numerous small rounded tubercles. Carapace naked in larger specimens. Cheliped with inner upper margin of wrist, distal to spinous inner angle, with no spines or tubercles in smaller specimens and several (up to 10) low, blunt tubercles in larger specimens; outer surface of palm in larger specimens with transverse rows of uniformly coloured tubercles *N. integrifrons* (Latreille)
- Front with V-shaped medial notch, edge (in larger specimens) with double row of prominent blunt tubercles. Carapace tomentose. Cheliped with inner upper margin of wrist, distal to spinous inner angle, with a few long spines in smaller specimens and a few stout spinules in larger specimens with transverse rows of tubercles, mostly light in colour but with an irregular scattering of dark tubercles present *N. tuberculosis* A. Milne Edwards
- 4 (1) Carapace dorsally with numerous granules scattered over surface. Width of carapace between 1st anterolateral teeth (external orbital angles) about $\frac{2}{5}$ greatest carapace width 5

- Carapace dorsally with a few granular tubercles and some discrete groups of granules; width of carapace between 1st anterolateral teeth about $\frac{2}{3}$ greatest carapace width *N. bullatus* Balss
- 5 (4) Surface of carapace naked and iridescent, sternum pale. Male abdomen with penultimate segment markedly convex laterally, greatest width (of penultimate segment) about twice length *N. bennetti* Takeda and Miyake
- Surface of carapace and legs tomentose, sternum dark. Male abdomen with penultimate segment weakly concave laterally, greatest width (of penultimate segment) barely exceeding length *N. antarcticus* (Jacquinot)

HISTORICAL ZOOGEOGRAPHY OF THE NEW ZEALAND AND SUBANTARCTIC SPECIES

The Auckland Islands and Campbell Island are close to the southern limit for Brachyura. Only one species, *Halicarcinus planatus*, is known from further south at Macquarie and Kerguelen Islands (Yaldwyn, 1965). Seven species are known from the Aucklands, and six from Campbell, whereas some 21 species are known from Stewart Island and Foveaux Strait (Dell, 1968).

The species concerned are:

- Jacquinotia edwardsi* (Jacquinot), Auckland Ids., Campbell Id.
Leptomithrax australis (Jacquinot), Auckland Ids., Campbell Id.
Cancer novaezelandiae (Jacquinot), Auckland Ids.
Nectocarcinus antarcticus (Jacquinot), Auckland Ids., Campbell Id.
Nectocarcinus bennetti Takeda and Miyake, Auckland Ids., Campbell Id.
Chlorinoides filholi (Milne Edwards), Auckland Ids.
Leptomithrax richardsoni Dell, off Campbell Id.
Halicarcinus planatus (Fabricius), Auckland Ids., Campbell Id.

Apart from *Halicarcinus planatus* and the Chatham Rise *Nectocarcinus bennetti*, the six other species are all also known from the southern part of the mainland of New Zealand. The general interpretation of the distributional data might lead one to postulate that on the whole the brachyuran fauna of the Southern Islands consists of those species occurring on the mainland of New Zealand which have been able to extend their ranges to the south. This may well be true for all of them. *Jacquinotia* is a monotypic genus found living only in the southern part of the South Island in a much smaller size range than in the Southern Islands and usually only in deep water. Fossil records of *Jacquinotia* extend to the present latitude of Cook Strait.

The development of another species of *Nectocarcinus* in the Southern Islands, and its present occurrence with a second, more widely spread species in the same area seems somewhat anomalous.

The major climatic phenomenon which must have affected the distribution of animals in New Zealand in comparatively recent geological times is the last major Pleistocene glaciation. Fleming (1962a: 235) has discussed the distribution of the marine bivalve *Bassina* in New Zealand in relation to "the rigours of the later Pleistocene, when violent alternations of cold and warm climate completely eliminated many long-established lineages, particularly shallow water forms that could not survive by migration far to north or south".

There have been few discussions on the effect of the late Pleistocene glaciation on the marine fauna of New Zealand's Southern Islands but there can be little doubt that temperatures were lowered significantly. As a result there would be a drastic reduction in the number of species of many groups, either by forced migration to the north (if sea levels were lowered sufficiently by the widespread formation of terrestrial ice) or by extinction. On present indications this would have been

the fate of all the crabs except for *Halicarcinus planatus*. If some members of *Nectocarcinus* had been able to withstand colder conditions these may well have survived around the Auckland Islands while the rest died out, a situation in which theoretically two species could have evolved. On the mainland of New Zealand, *Nectocarcinus antarcticus* (which in spite of its specific name extends further to the north at present) could either have lived on in its present form, or have evolved into its present form from an ancestor common to both species. Around the Auckland Islands the surviving members of the genus could well have evolved to form the present *bennetti*. The general morphological differences between *bennetti* and *antarcticus* (though constant) are relatively slight except for the form of the first pleopods. This quite marked change in these important organs is just the kind of change which would prevent interbreeding of *antarcticus* and *bennetti* when their ranges overlapped with the onset of warmer conditions.

On this explanation it seems a relatively simple case of the development of two allopatric species while a barrier existed, involving changes of sufficient magnitude in a crucial organ to maintain genetic isolation when the ranges became sympatric later. If the last Pleistocene Glaciation was a major stimulus involved in this specific differentiation the time scale involved (approximately 20,000 years) is a very short one as far as marine biologists are concerned. At the same time, faced with a similar time scale and undoubtedly much more severe conditions on land, some New Zealand biologists have been prepared to accept the possibility of specific differentiation taking place within the same period for terrestrial organisms. In the case of *Nectocarcinus*, however, there is no necessity to invoke the last Pleistocene Glaciation as the causal agency. Cold periods earlier in the Pleistocene could equally well have been responsible.

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R. K. DELL, and J. C. YALDWYN,
Dominion Museum,
Wellington.

D. J. G. GRIFFIN,
Australian Museum,
Sydney.

Note: While this paper was at page proof stage, the following study (published 30 October 1969) was sent to us.

TAKEDA, M.; MIYAKE, S., 1969. A small collection of crabs from New Zealand. *Ohmu, Occ. Pap. Zool. Lab. Fac. Agric. Kyushu Univ.* 2(8): 157-93, 7 figs., 3 pls.

Takeda and Miyake described and figured a new species of *Nectocarcinus*, *N. bennetti*, from 3 ♂♂ and 3 ♀♀ taken in 140m on the Chatham Rise, east of Banks Peninsula (44° 7.2'S, 175° 55.5'E). It became immediately clear that a *Nectocarcinus* from the New Zealand Subantarctic, about to be described as new by us, was identical with Takeda and Miyake's *N. bennetti*. The text of the present paper has been altered to suppress our manuscript name, but does not include Takeda and Miyake's new records of *N. antarcticus* and other details.

R. K. D., D. J. G. G. and J. C. Y.