

THE DEEP-WATER SWIMMING CRABS OF THE GENUS *BENTHOCHASCON*
(DECAPODA: BRACHYURA: PORTUNIDAE), WITH DESCRIPTION OF A
NEW GENUS FOR THE AMERICAN *B. SCHMITTI*

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A B S T R A C T

The taxonomy of the deep-water portunid genus *Benthochascon* Alcock and Anderson, 1899, is reappraised. *Benthochascon* is now restricted for its type species from the Indo-West Pacific, *Benthochascon hemingi* Alcock and Anderson, 1899. *Benthochascon schmitti* Rathbun, 1931, from the Gulf of Mexico, is referred to a new genus, *Raymanninus*, which differs from *Benthochascon* s. str. in the form of the anterolateral margin, first and third maxillipeds, chela, and structure of the fourth male thoracic sternite.

Recently, the author had an opportunity to examine specimens of the two known species of deep-water portunids of the genus *Benthochascon* Alcock and Anderson, 1899, *Benthochascon hemingi* Alcock and Anderson, 1899 (type species by monotypy) (Indo-West Pacific) and *B. schmitti* Rathbun, 1931 (mid-Atlantic). Detailed comparisons of both species show that they are not congeneric as currently accepted.

The present paper serves to rediagnose *Benthochascon* s. str. and describe a new genus, *Raymanninus*, for *B. schmitti*. Specimens examined are deposited in the Zoological Reference Collection of the Raffles Museum (ZRC), National University of Singapore; Taiwan Museum (TMCD), Taipei; and Muséum national d'Histoire naturelle (MNHN), Paris. Measurements provided are of the maximum carapace breadth and length respectively. Measurements and terminology follows Wee and Ng (1995). The abbreviations G1 and G2 are used for the male first and second pleopods respectively.

TAXONOMY

Family Portunidae

Benthochascon Alcock and Anderson, 1899

Benthochascon Alcock and Anderson, 1899: 10.

Carcinonectes Stephenson, 1972a: 129.

Diagnosis.—Carapace broader than long; regions poorly defined, without distinct ridges; front cut into 3 triangular teeth, including inner supraorbital teeth, tip of median tooth slightly cleft; supraorbital margin distinctly

concave, appears semicircular; anterolateral margin with 3 teeth (excluding external orbital tooth). Basal antennal segment quadrate, flagellum entering orbital hiatus. Endognath of first maxilliped with small but distinct ovate mesial lobe (or “portunid lobe”), separated from anteromesial margin of lacinia by small notch. Ischium of third maxilliped elongate, rectangular; merus without subauriculi-form anteroexternal angle. Merus of cheliped without spines; carpus with large spine on inner distal angle; outer surface without trace of costa; outer surface of proximal part of pollex of adult male chela with distinct oval patch of weakly calcified tympanum-like cuticle. Dactylus of first to third ambulatory legs dorsoventrally compressed, subspatuliform; propodus of fourth leg almost round, foliaceous. Male anterior thoracic sternites relatively narrow. Male abdomen with telson triangular; third to fifth segments immovable but sutures still discernible; fifth segment with very low median transverse ridge; fourth segment with more prominent median transverse ridge; third segment narrow, with strong transverse ridge which reaches almost to edges. G1 stout proximally but strongly tapering distally, distal surfaces with numerous very small, posteriorly directed tubercles; G2 longer than G1, distal segment about 0.5 times length of basal segment.

Remarks.—The genus *Benthochascon* was originally established for one species, *B. hemingi* Alcock and Anderson, 1899. Rathbun (1931) added a new species, *B. schmitti*,

from the mid-Atlantic. A second Indo-West Pacific species, *B. elongatum* Sakai, 1969, was subsequently described by Sakai (1969) from Japan. Stephenson (1972a) established a new genus for a new species, *Carcinonectes pacificus*, for a female specimen from New Caledonia, but Davie and Short (1989) commented that his taxa are clearly subjective junior synonyms of *Benthochascon hemingi* Alcock and Anderson, 1899.

Stežić (1991: 127, Table 1) argued that *B. elongatum* Sakai, 1969, differed substantially from *B. hemingi* and *B. schmitti* in numerous characters, and should be referred to its own genus, *Brusinia* Stežić, 1991, instead. Stežić (1991) also described a new species, *B. brucei*, from Australia (which he designated as the type species of *Brusinia*). Moosa (1996) subsequently described a third species of *Brusina*, *B. profunda*, from New Caledonia, Loyalty and Chesterfield Islands. Stežić (1991: 128) noted that he based his comparisons on the descriptions and figures of the various species (including *B. hemingi*), and he did not list any material of *B. hemingi* which he actually examined, although he had apparently examined a specimen of *B. schmitti*.

Benthochascon schmitti is, however, very different from *B. hemingi* in several important characters which indicate that the two species are not congeneric. A new genus, *Raymanninus*, is established here for *Benthochascon schmitti*. *Benthochascon* differs from *Raymanninus* in the following key generic characters: (1) the anterolateral margin has three lobiform teeth (excluding external orbital tooth) (Figs. 1A, B) (vs. with two sharp teeth or distinct spines, Fig. 5A, B); (2) the third maxilliped has the anteroexternal angle of the merus not subauriculiform and the ischium relatively elongate (Fig. 3E) (vs. meral anteroexternal angle subauriculiform; ischium not elongate, Fig. 7E); (3) the endognath of the first maxilliped has a mesial lobe (vs. absent); (4) the outer surface of proximal part of the pollex of the adult male chela has an oval patch of weakly calcified cuticle (Fig. 2C) (vs. entire outer surface evenly calcified, Fig. 6C); (5) the propodus of the fifth ambulatory leg is almost round and foliaceous (Fig. 1A) (vs. elongate, Fig. 5A); and (6) the fourth male thoracic sternite is relatively narrow (Figs. 2B, 3B) (vs. broad, Figs. 6B, 7B).

There are also other differences, but these may not be generic in value. Compared to

Benthochascon, the inner angle of the infra-orbital margin of *Raymanninus* has a long spine (Fig. 5A, C) (vs. a low tooth, Fig. 1A, C); the orbit appears semirectangular from dorsal view (Fig. 5A, C) (vs. semicircular, Fig. 1A, C); the basis and ischium of the third maxilliped are separated by a medially interrupted suture (Fig. 7E) (vs. complete suture, Fig. 3E); the outer surface of the carpus of the cheliped has a long spiniform tooth (Figs. 5A, 6C) (vs. absent, Fig. 1A); the merus of the cheliped has a long and well-produced ventral and a dorsal spine (Fig. 6B) (vs. absent); the dactylus of the fifth ambulatory leg is elongate and more slender (vs. ovate); the lateral part of the third male abdominal segment is distinctly expanded outwards (Fig. 7A) (vs. normal, Fig. 3A); and the lateral margins of the sixth male abdominal segment are strongly convex with the telson sitting in a strongly concave distal margin (Fig. 7A) (vs. lateral margins gently convex and distal margin gently concave, Fig. 3A).

Raymanninus is also superficially similar to *Bathynectes* Stimpson, 1871 (type species *Bathynectes superba* (Costa, in Costa and Costa, 1853)) from the north Atlantic and Mediterranean. *Raymanninus*, however, differs from *Bathynectes* in that the anterolateral margin has only two teeth (excluding the external orbital tooth) (Fig. 5A, B) (vs. with four teeth), the last anterolateral tooth is sharp but not substantially longer than others (Fig. 5A, B) (vs. last tooth very long and spiniform, much longer than others), the inner angle of the infraorbital margin has a long spine (Fig. 5A–C) (vs. not prominent), the inner distal spine of the carpus of the cheliped is short and simple (Figs. 5A, 6C) (vs. inner distal spine very long, curved, anterior margin with small spinules), the dorsal margin of the palm is entire except for distal tooth (Fig. 6C) (vs. dorsal margin serratifiform), and the male abdomen is broadly triangular (vs. triangular) (Figs. 6B, 7A) (cf. Rathbun, 1931: 27, pls. 9, 10; 1 male, 1 female [ZRC 1998.7], Florida, off Tortugas, 140–197 m depth, collected by W. L. Schmidt, 1 August 1932).

Benthochascon hemingi Alcock and Anderson, 1899

Figs. 1–4

Benthochascon hemingi Alcock and Anderson, 1899: 10; Alcock, 1899a: 69 pl. 3 fig. 2; Alcock, 1899b: 15; Doflein, 1904: 90, pls. 29, 41 figs. 1, 2; Alcock and

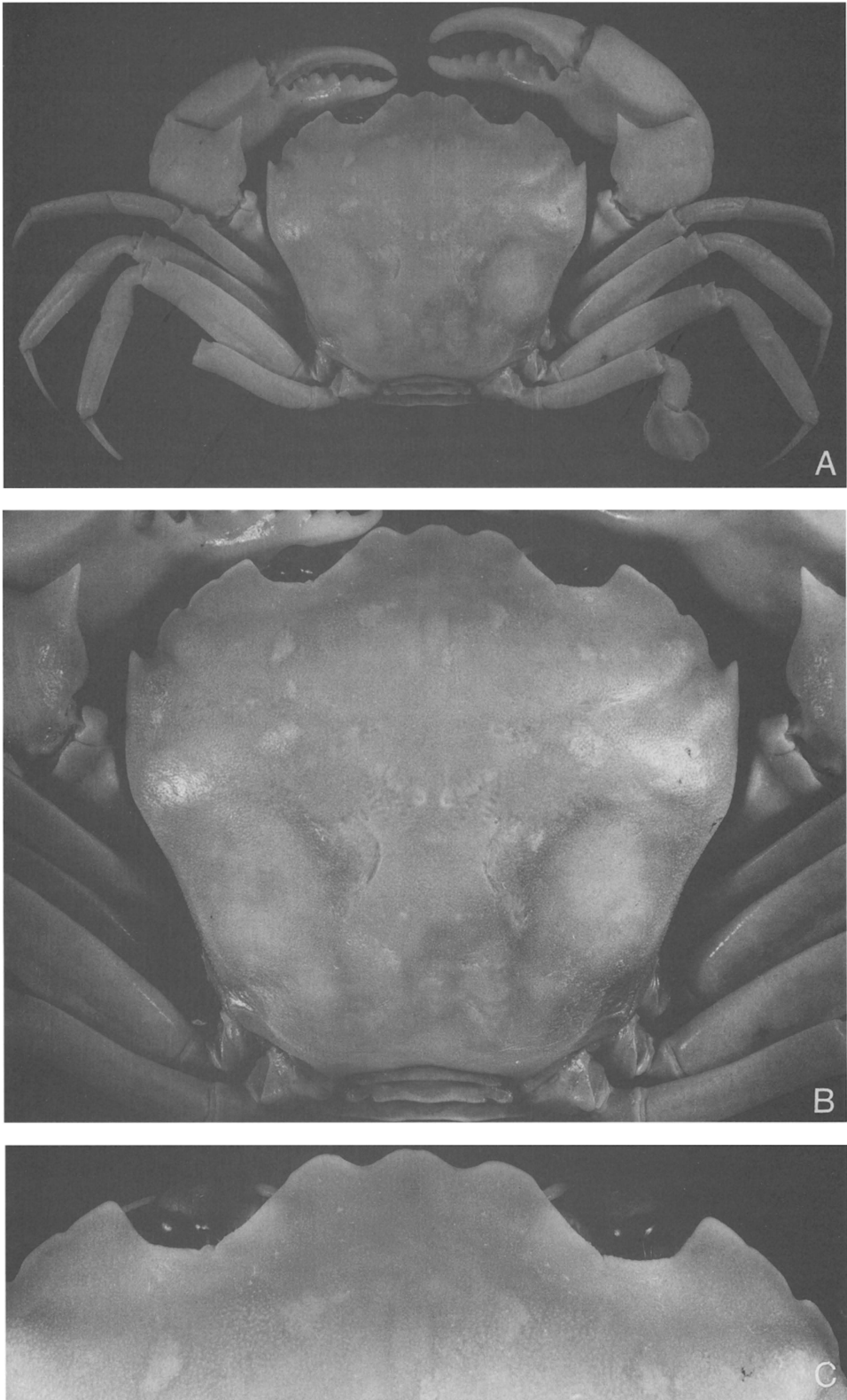


Fig. 1. *Benthochascon hemingi* Alcock and Anderson, 1899. Male (69.5 by 65.5 mm) (ZRC 1996.1875). A, overall view; B, carapace; C, front.

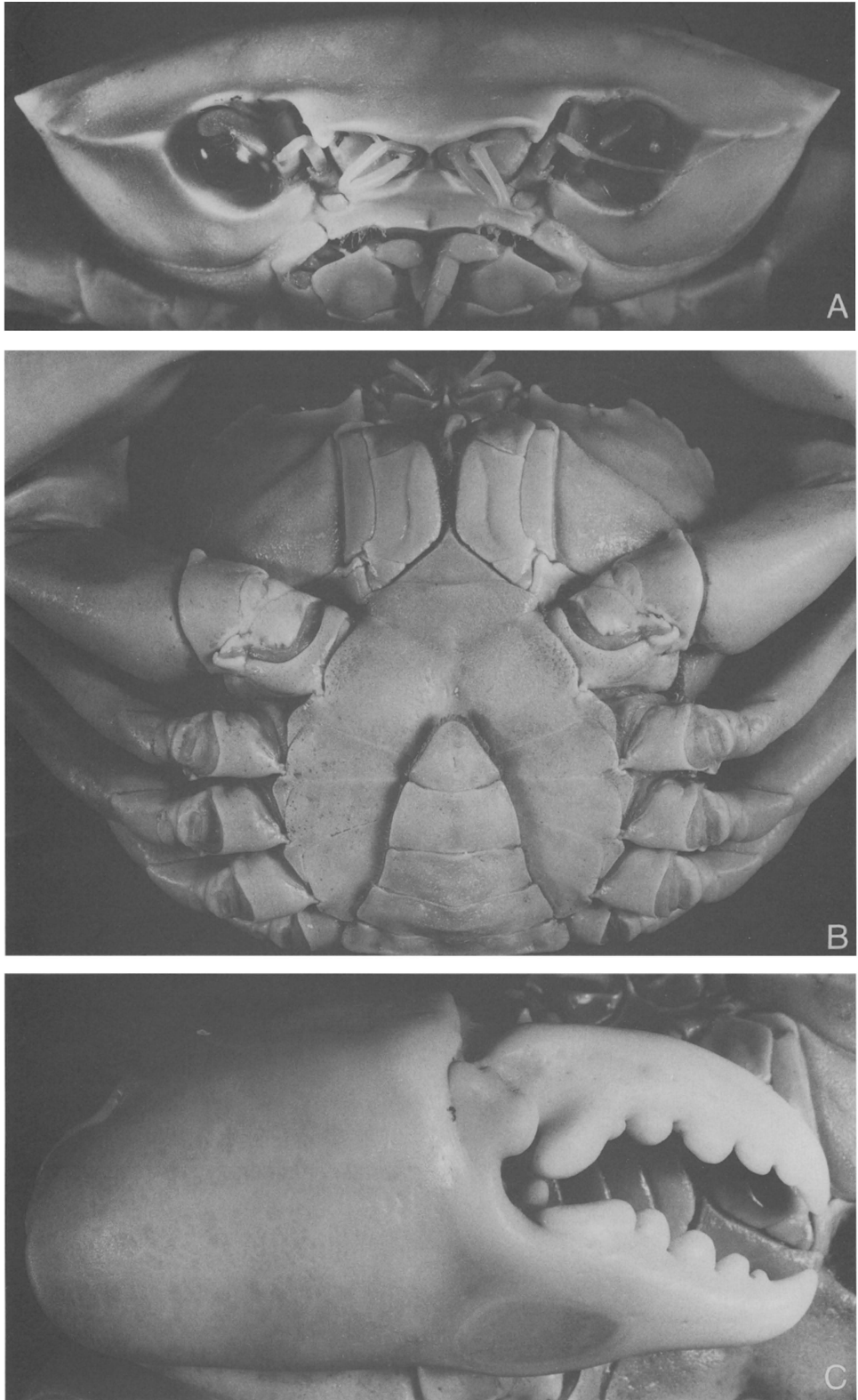


Fig. 2. *Benthochascon hemingi* Alcock and Anderson, 1899. Male (69.5 by 65.5 mm) (ZRC 1996.1875). A, frontal view; B, ventral view; C, right chela.

MacGilchrist, 1905: 76 figs. 4, 4a; Sakai, 1965: 39, 44, pl. 6 fig. 2; Serène, 1968: 67; Sakai, 1976: 333, pl. 114; Miyake, 1983: 79, pl. 27 fig. 3; Davie and Short, 1989: 183, fig. 14D; Stević, 1991: 128; Moosa, 1996: 513, Figs. 9d–e.

Carcinonectes pacificus Stephenson, 1972a: 129, fig. 3; Stephenson, 1972b: 3.

Material Examined.—2 males (53.0 by 47.8 mm, 39.4 by 37.4 mm) (MNHN), station CP 658, 21°13.45'S, 165°55.12'E, New Caledonia, 515–580 m, collected by research vessel *Alis*, B. Richer de Forges, BATHUS 1 Expedition, 12 March 1993. 1 female (39.1 by 36.2 mm) (ZRC 2000.0103), station CP 741, 22°35.53'S, 166°26.56'E, New Caledonia, 700–950 m, collected by research vessel *Alis*, B. Richer de Forges, BATHUS 2 expedition, 14 May 1993. 1 male (28.3 by 27.0 mm) (MNHN), station CP 743, 22°35.56'S, 166°26.23'E, New Caledonia, 713–950 m, collected by research vessel *Alis*, B. Richer de Forges, BATHUS 2 Expedition, 14 May 1993. 1 male (46.3 by 42.8 mm) (ZRC 2000.0102), 1 male (43.4 by 40.2 mm), station CP 892, 21°01.71'S, 164°27.32'E, New Caledonia, 580–600 m, collected by research vessel *Alis*, B. Richer de Forges, BATHUS 4 Expedition, 2 August 1994. 1 female (40.5 by 37.5 mm) (MNHN), station CP 1073, Vanuatu, 15°45.70'S, 167°22.24'E, 630–650 m, collected by research vessel *Alis*, B. Richer de Forges, MUSORSTOM 8, 4 October 1994. 1 male (69.5 by 65.5 mm) (ZRC 1996.1875), northeast of Calagula Islands, 14°50.46'–49.38'N, 123°17.30'–22.33'E, Philippines, 760–770 m, by 30-m otter trawl, collected by Taiwan Fisheries Research Institute vessel *Fishery Researcher I*, 27 September 1995. 1 male (TMCD), Tungsha Islands, South China Sea, 650 m, collected by Taiwan Fisheries Research Institute vessel *Fishery Researcher I*, P.-H. Ho, 22 April 1996.

Description of male.—Carapace hexagonal, broader than long (width to length ratio about 1.1); regions poorly defined, with no distinct ridges or deep grooves; dorsum very smooth, glabrous. Suborbital and pterygostomial regions very finely granulated. Front relatively narrow, with 3 large triangular teeth (including inner supraorbital teeth), median tooth with tip slightly but clearly cleft, appearing almost entire from distant view. Supraorbital margin strongly concave, semicircular from dorsal view, with distinct submedian fissure. Eyes filling most of orbit; cornea well developed, pigmented; ocular peduncle with small but distinct rounded granule on ventral surface. Infraorbital margin finely granulated, concave; inner angle with low but distinct triangular tooth, not obvious from dorsal view; outer edge confluent with external orbital tooth. Antero- and posterolateral margins well demarcated by last anterolateral tooth; anterolateral margin with 3 low but distinct lobiform teeth (excluding broadly triangular external orbital tooth); second and third teeth small, sometimes almost completely fused; last (posteriormost) tooth acutely triangular,

sharpest, directed anteriorly, outer lateral margin almost straight to gently concave. Posterolateral margin gently concave, distinctly converging posteriorly. Posterior carapace margin gently to distinctly concave. Posterior margin of epistome with broadly triangular median lobe, separated by distinct fissure; lateral margin with distinct fissure.

Basal antennal segment quadrate, almost squarish, outer angle with small tooth; flagellum entering wide orbital hiatus. Antennule folding transversely; first antennular segment cylindrical, subequal in length to basal segment. Lacinia of endognath of first maxilliped relatively broad, anterolateral margin rounded, mesial margin sinuous, anteromesial margin separated from small but produced ovate mesial lobe. Ischium of third maxilliped elongate, rectangular, with distinct oblique median sulcus; merus almost squarish, without subauriculiform anteroexternal angle; ischium separated from basis by complete suture; exopod relatively stout, distal part reaching almost to distal edge of merus.

Chelipeds distinctly unequal; chelae swollen, enlarged in large males. Fused basis-ischium with low tooth on distal angle. Merus of cheliped smooth, without spines, subdistal part of dorsal margin with low, blunt tubercle. Carpus with distinct straight to almost straight spine on inner distal angle; dorsal surface smooth. Palm in large males very stout; dorsal margin with 1 low, rounded distal angle which is never distinctly dentiform or spiniform, sometimes reduced to low, almost undiscernible tubercle; outer surface smooth, without trace of costa; outer surface of proximal part of the pollex of both chela with distinct oval patch of weakly calcified cuticle resembling a tympanum, also visible on inner surface; ventral margin below tympanum-like structure appears swollen. Dactylus of minor chela with distinct longitudinal sulcus; other fingers without distinct sulcus; all fingers unpigmented. Cutting edges of fingers of major chela with numerous distinct teeth; basal tooth of dactylus of major chela very stout, submolariform, gently curved inwards, fitting into depression on base of pollex, rest of margin with normal teeth; pollex with molariform proximal tooth. Cutting edges of fingers of minor chela with numerous teeth and denticles.

Merus, carpus and propodus of ambulatory legs laterally compressed; all margins

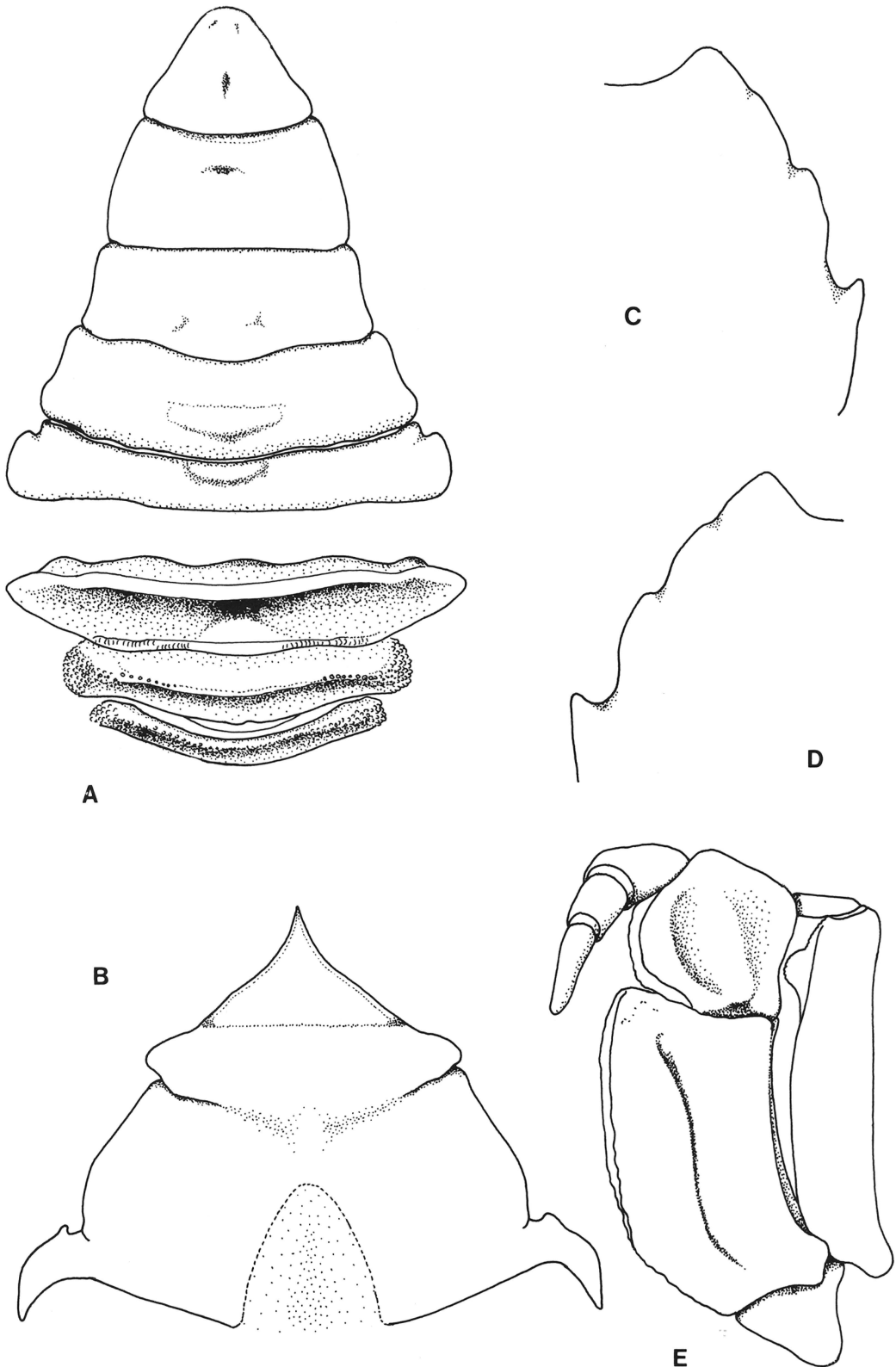


Fig. 3. *Benthochascon hemingi* Alcock and Anderson, 1899. Male (69.5 by 65.5 mm) (ZRC 1996.1875). A, abdomen (telson and segments 3–6; and segments 1–3); B, anterior thoracic sternites; C, right anterolateral margin; D, left anterolateral margin; E, left third maxilliped.

smooth; surfaces smooth. Merus with low but distinct distal tooth on dorsal margin, separated from rest of margin by deep V-shaped notch. Second leg longest. Dactylus of first to third ambulatory legs dorsoventrally compressed, subspatuliform. Propodus of fourth leg rounded, distinctly foliaceous; dactylus ovate with distal part tapering suddenly to sharp tip.

Male anterior thoracic sternites relatively narrow; sternites 1 and 2 completely fused; suture 2/3 faint but discernible, complete; suture 3/4 sloping, medially interrupted; sternite 4 broadest, largest. Male abdominal cavity reaching to median part of sternite 4. Sternites 4–7 medially interrupted; median part of sternite 5 very narrow, distinctly depressed; deep longitudinal groove present between sternites 7 and 8, reaching to just before anterior part of sternite 7. Granule of abdominal lock near posterior margin of sternite 5.

Male abdomen triangular; telson triangular, lateral margins gently concave; fourth to sixth segments increasingly trapezoidal; lateral margins of sixth segment convex, distal margin gently concave; third to fifth segments fused, immovable but sutures still clearly discernible; fifth segment with very low median transverse ridge; fourth segment with more prominent median transverse ridge; third segment narrow, with strong transverse ridge that reaches almost to edges.

Penis coxal. G1 gently curved outward; stout proximally but strongly tapering distally; basal part subtruncate, with outer margin almost straight, outer margin of median part strongly concave; distal surfaces with numerous very small, posteriorly directed tubercles. G2 longer than G1; distal segment flagelliform, about 0.5 times length of basal segment, forming cup-like structure at junction with basal segment.

Females.—The non-sexual characters of the female specimens agree well with those of the males, except that the chelae are relatively smaller and do not have the tympanum-like structures. The female abdomen is quite rounded and covers about three-quarters of the thoracic sternum. The vulvae are positioned near the anterior margin of sternite 6, with the genital opening being ovate, slightly oblique and open in the specimens examined.

Color.—The color in life varies from beige to orange on the dorsal surfaces, with the ven-

tral surfaces, dactyli and propodi of the ambulatory legs and fingers of the chela dirty-white.

Remarks.—The present specimens agree well with the descriptions of the species by Alcock and Anderson (1899) and Stephenson (1972a) (as *Carcinonectes pacificus*), as well as the figures in Alcock and MacGilchrist (1905), Doflein (1904), Sakai (1965, 1976), and Miyake (1983). Opportunity, however, is taken here to provide more detailed figures of the species, especially of its anterior male thoracic sternum, abdomen, and gonopods.

The G1 of *B. hemingi* has never been properly illustrated or described. Doflein provided figures of the dorsal and ventral views of the specimen (Doflein, 1904: pl. 29) as well as of the thoracic sternum, gonopods, and chela (Doflein, 1904: pl. 41, figs. 1, 2). Doflein's (1904) figure of the G1s, however, is too small and schematic to be useful, and the G2 was also not clearly figured.

The anterolateral margin of the Philippine specimen (ZRC 1996.1875) is unusual in that the first and second teeth are almost fused. On the left side, only a small and very shallow cleft separates the two teeth, while on the right side, the two teeth are almost completely fused. In all the other specimens of *B. hemingi* examined and reported from the literature thus far, the teeth are clearly separated. The fusion of these teeth may be associated with size, as the Philippine specimen, measuring 69.5 by 65.5 mm, is very large.

The most interesting feature of *B. hemingi* is the large oval patch of weakly calcified cuticle on the lower face of each adult male chela, on the proximal part of the pollex. This tympanum-like structure can be seen on both outer and inner surfaces of the chela. Doflein (1904: pl. 41 fig. 2) figured this "organ" but could not ascertain its function. This tympanum-like structure is present only in adults, and one small male specimen (28.3 by 27.0 mm, MNHN) does not have them. Although this structure appears as if it might be used for detection of pressure or sound waves, it is also possible that this is only a sexual character as it is present only in adult males.

It would be useful to directly compare male specimens of *B. hemingi* from the Indian and Pacific Oceans to see if the populations are indeed conspecific. At the moment, there are no obvious major differences. *Benthochascon*

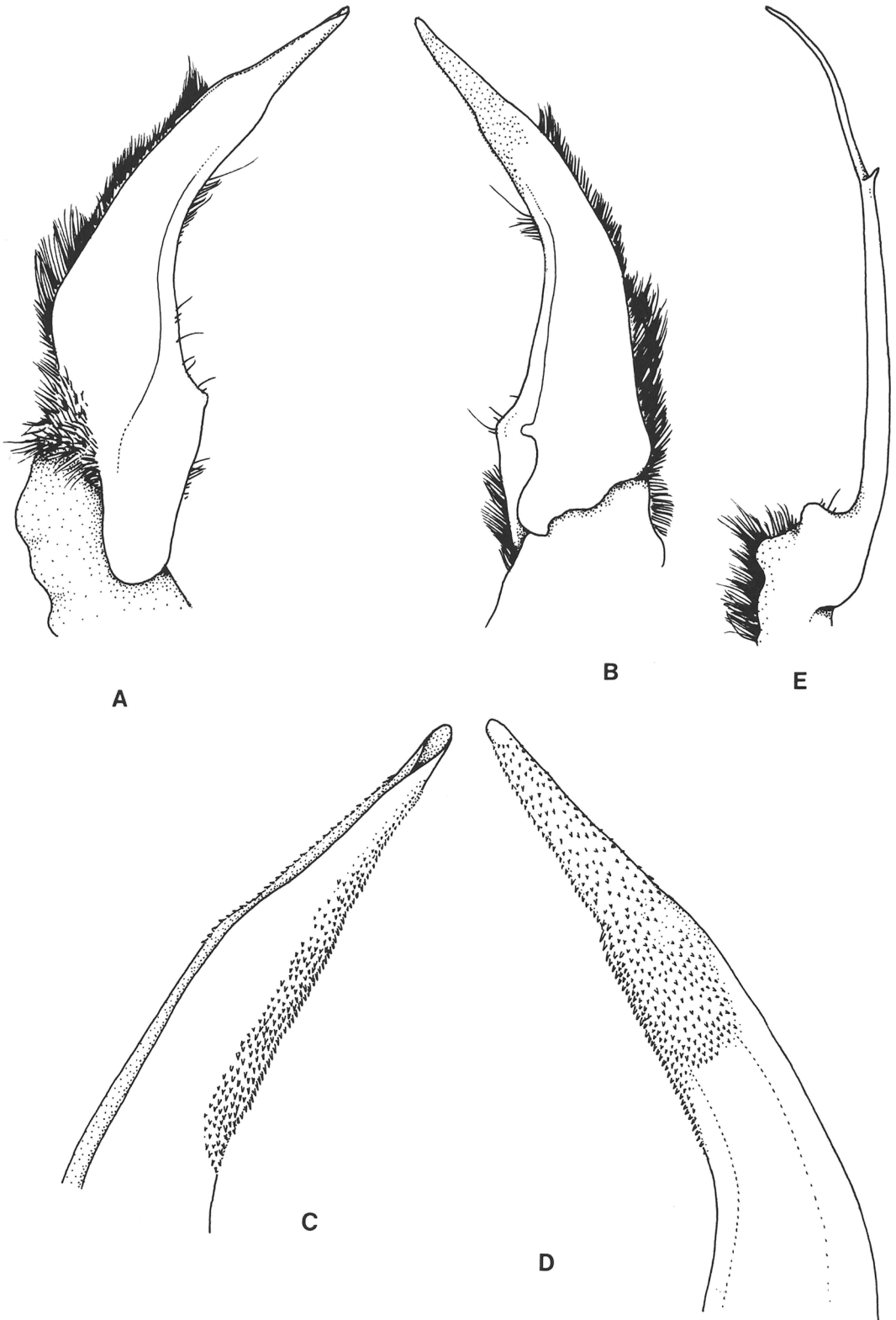


Fig. 4. *Benthochascon hemingi* Alcock and Anderson, 1899. Male (69.5 by 65.5 mm) (ZRC 1996.1875). A–D, left G1; E, left G2. A, C, ventral views; B, D, dorsal views; C, D, distal part of G1.

hemingi has been reported from the Andaman Sea (type locality) (330-m depth) (Alcock and Anderson, 1899), Nicobars (Doflein, 1904), Indonesia (390–502-m depth) (Moosa, 1996), Japan (150–200-m depth) (Sakai, 1965, 1976; Miyake, 1983), Philippines (760–770-m depth) (present data), New Caledonia (515–950-m depth) (Stephenson, 1972a; Moosa, 1996; present data), Vanuatu (630–650-m depth) (present data), and eastern Australia (410–568-m depth) (Davie and Short, 1989).

***Raymanninus*, new genus**

Type Species.—*Benthochascon schmitti* Rathbun, 1931, by present designation.

Diagnosis.—Carapace distinctly broader than long; regions weakly defined, with low transverse ridges on various regions; front cut into 4 acutely triangular teeth, including inner supraorbital teeth; supraorbital margin semirectangular; anterolateral margin with 2 distinct spiniform teeth (excluding external orbital tooth). Basal antennal segment quadrate, flagellum entering orbital hiatus. Endognath of first maxilliped with no discernible mesial lobe. Ischium of third maxilliped rectangular; anteroexternal margin of merus subauriculi-form. Merus of cheliped with 1 strong ventral and 1 strong dorsal spine; carpus with long recurved spine on inner distal angle and 1 sharp tooth on outer surface; palm with 1 weak oblique costa on outer surface, dorsal margin entire; outer surface of proximal part of pollex of chela evenly calcified. Dactylus of first to third ambulatory legs dorsoventrally compressed, subspatuliform; propodus of fourth leg longitudinally ovate, foliaceous. Male anterior thoracic sternites relatively broad. Male abdomen with telson triangular; third to fifth segments immovable but sutures still discernible; fifth segment with low but distinct median transverse ridge; fourth segment with distinct median ridge; third segment narrow, with transverse ridge which reaches almost to edges. G1 stout proximally but strongly tapering distally, distal surfaces with numerous very small, posteriorly directed tubercles; G2 longer than G1, distal segment about 0.3 times length of basal segment.

Remarks.—The differences between *Raymanninus* and *Benthochascon* have been discussed in detail earlier.

It is of interest to briefly comment that *Raymanninus* bears a superficial similarity to many species of geryonid crabs of the genera *Geryon* and *Chaceon*, especially with regards to the general carapace shape and features, male thoracic sternum, ambulatory dactyli, male abdomen, G1 and G2 structures (cf. Manning and Holthuis, 1989; Manning, 1993; Ng *et al.*, 1994, 1998; Ng and Manning, 1998). In addition, the male abdomen of *Chaceon* resembles that of *Raymanninus*, with all the sutures between segments three to five distinct but with all three segments immovable, and the G1 is very similar in shape and form, with the distal surfaces covered with small posteriorly directed tubercles (Ng *et al.*, 1994, 1998; Ng and Manning, 1998). The significance of these similarities cannot be ascertained until a proper phylogenetic analysis is done for the Portunidae and Geryonidae.

Etymology.—The genus is named after Ray Manning, one of the dons of 20th century carcinology and a good friend through thick and thin. Gender masculine.

***Raymanninus schmitti* (Rathbun, 1931),
new combination
Figs. 5–8**

Benthochascon schmitti Rathbun, 1931: 125, pl. 1; Stevčić, 1991: 128.

Material Examined.—1 male (68.2 by 50.6 mm), 1 female (49.2 by 37.3 mm) (ZRC 1998.62), Dry Tortugas, Florida, collected by P. Bartsch, 1931.

Description of Male.—Carapace hexagonal, distinctly broader than long (width to length ratio about 1.3); regions weakly defined; dorsal surface finely granulated, glabrous. Suborbital and pterygostomial regions granulated. Front relatively wide, with 4 acutely triangular teeth (including inner supraorbital teeth), inner teeth always distinct, separated by deep V-shaped cleft; median teeth closer to each other than to lateral teeth. Supraorbital margin semirectangular, with distinct submedian fissure. Eyes filling most of orbit; cornea well developed, pigmented; ocular peduncle smooth. Infraorbital margin gently concave; inner angle with long sharp spine, clearly visible from dorsal view; outer edge separated from external orbital tooth by distinct fissure. Antero- and posterolateral margins well demarcated by last anterolateral tooth; anterolateral margin with 2 distinct

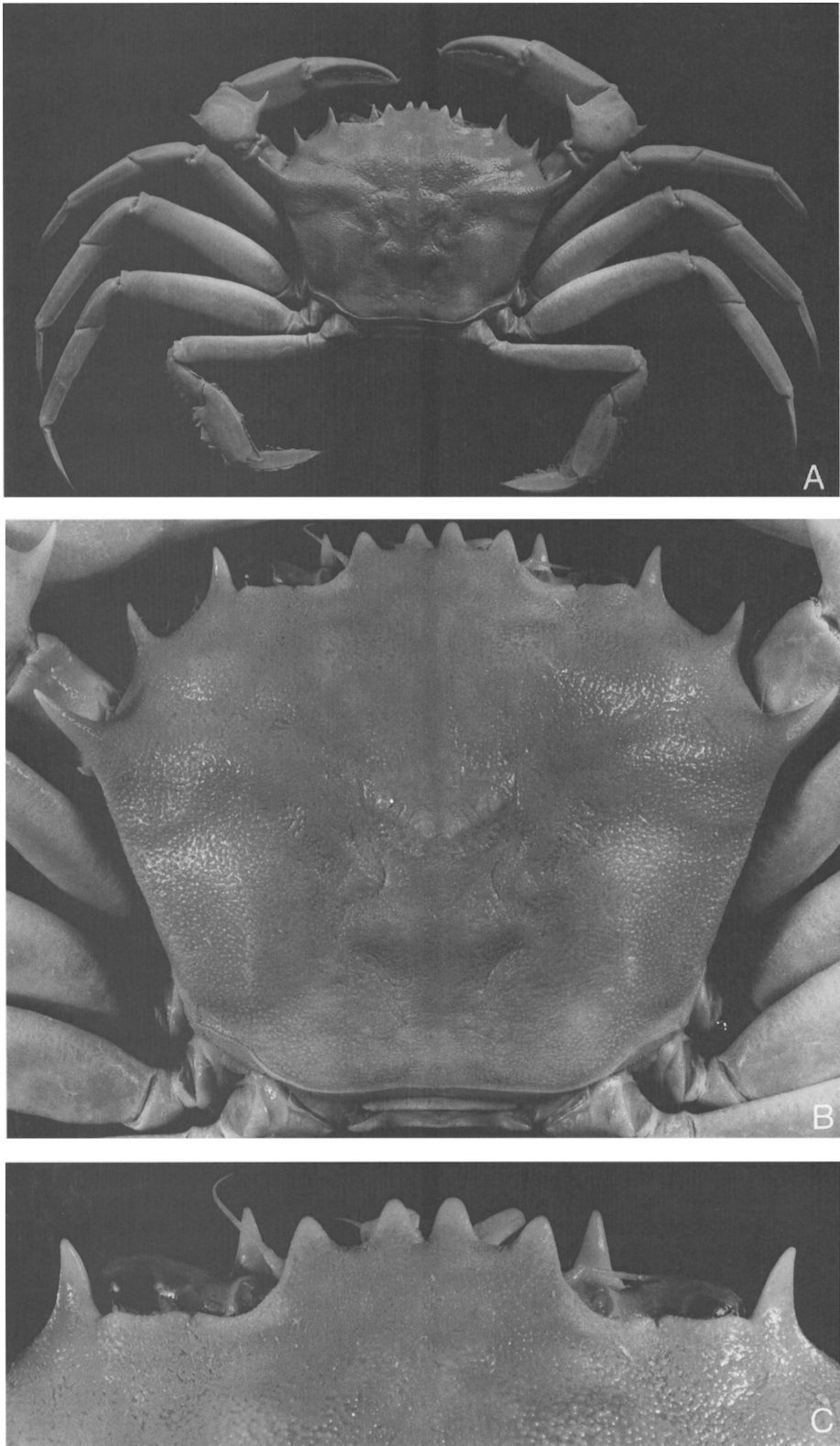


Fig. 5. *Raymanninus schmitti* (Rathbun, 1931). Male (68.2 by 50.6 mm) (ZRC 1998.62). A, overall view; B, carapace; C, front.

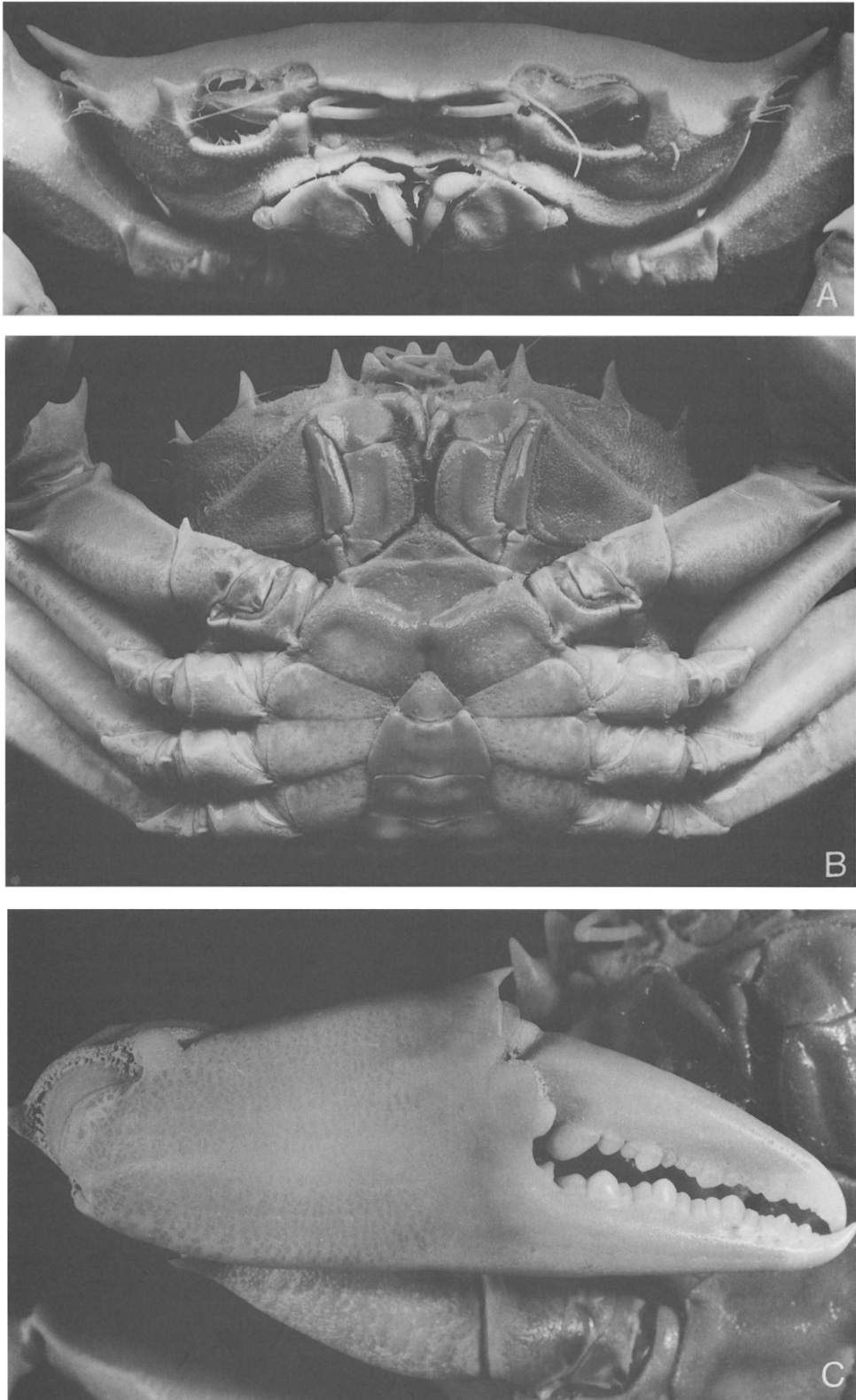


Fig. 6. *Raymanninus schmitti* (Rathbun, 1931). Male (68.2 by 50.6 mm) (ZRC 1998.62). A, frontal view; B, ventral view; C, right chela.

spiniform teeth (excluding external orbital tooth); first and second teeth subequal in size and length; last tooth longest, directed distinctly obliquely upward and outward. Posterolateral margin gently concave to almost straight, converging posteriorly. Posterior carapace margin gently concave. Posterior margin of epistome with broadly triangular median lobe, separated by distinct fissure; lateral margin with distinct fissure.

Basal antennal segment quadrate, almost squarish; flagellum entering orbital hiatus. Antennule folding transversely; first antennular segment cylindrical, length about 1.5 times width of basal segment. Lacinia of endognath of first maxilliped relatively broad, distal part very narrow, produced anteriorly, positioned at right angles to subtruncate mesial part, no mesial lobe discernible. Ischium of third maxilliped rectangular, not distinctly elongate, with distinct oblique median sulcus; merus squarish, with subauriculiform anteroexternal angle; ischium fused with basis, suture present but medially interrupted; exopod relatively stout, distal part reaching almost to distal edge of merus.

Chelipeds unequal; chelae not distinctly swollen even in large males. Fused basis-ischium with sharp spine on distal angle. Merus of cheliped with 1 strong ventral spine (on distal one-third) and 1 strong, recurved, dorsal submedian spine; margins finely granulated. Carpus with long recurved spine on inner distal angle and 1 sharp tooth on outer surface; dorsal surface with several depressed regions. Palm never swollen; outer surface with 3 low costae, 1 median, 1 subdorsal and 1 subventral; inner surface with low median costa; dorsal margin with 1 distinct, sharp subdistal tooth; outer surface of proximal part of pollex of chela evenly calcified. Dactylus of minor chela with shallow but distinct longitudinal sulcus; other fingers without distinct sulcus; all fingers unpigmented. Cutting edges of fingers of major chela with numerous teeth; basal tooth of dactylus of major chela stout, submolariform, gently curved inwards, fitting into depression on base of pollex, rest of margin with normal teeth; teeth on pollex all normal. Cutting edges of fingers of minor chela with numerous teeth and denticles.

Merus, carpus, and propodus of ambulatory legs laterally compressed; all margins smooth; surfaces finely granular to smooth. Merus with very low distal tooth on dorsal

margin, barely discernible from rest of margin by very shallow notch. Second leg longest. Dactylus of first to third ambulatory legs dorsoventrally compressed, subspatulate. Propodus of fourth leg longitudinally ovate, distinctly foliaceous; dactylus narrowly ovate with distal part sharp.

Male anterior thoracic sternites relatively broad; sternites 1 and 2 completely fused; suture 2/3 faint but discernible, medially interrupted; suture 3/4 sloping, medially interrupted; sternite 3 appears depressed; sternite 4 broadest, largest; male abdominal cavity reaching to median part of sternite 4. Sternites 4–6 medially interrupted; median part of sternite 5 very narrow, depressed; deep longitudinal groove present between sternites 7 and 8, reaching to just before anterior part of sternite 7. Granule of abdominal lock projects beyond posterior margin of sternite 5, appearing to be between sternites 5 and 6.

Male abdomen triangular; telson triangular, lateral margins gently concave; fourth to sixth segments increasingly trapezoidal; lateral margins of sixth segment convex, distal margin gently concave; third to fifth segments fused, immovable but sutures still clearly discernible; fifth segment with very low median transverse ridge; fourth segment with more prominent median transverse ridge; third segment narrow, with strong transverse ridge that reaches almost to edges.

Penis coxal. G1 curved outward; stout proximally but strongly tapering distally; basal part subtruncate with outer margin gently sinuous, outer margin of median part strongly concave; distal part gently curving upward; distal surfaces with numerous very small, posteriorly directed tubercles. G2 longer than G1; distal segment flagelliform, about 0.3 times length of slender basal segment, forming cup-like structure at junction with basal segment.

Female.—The female specimen agrees very well with the male in most non-sexual characters except that the chelipeds are equal in size. The ovate adult female abdomen covers only about half of the thoracic sternum, with most of the lateral surfaces exposed. It is nevertheless an adult as the pleopods are fully developed. The vulvae are positioned near the anterior edge of sternite 6, the genital opening being slit-like, oblique, and was closed in the specimen examined.

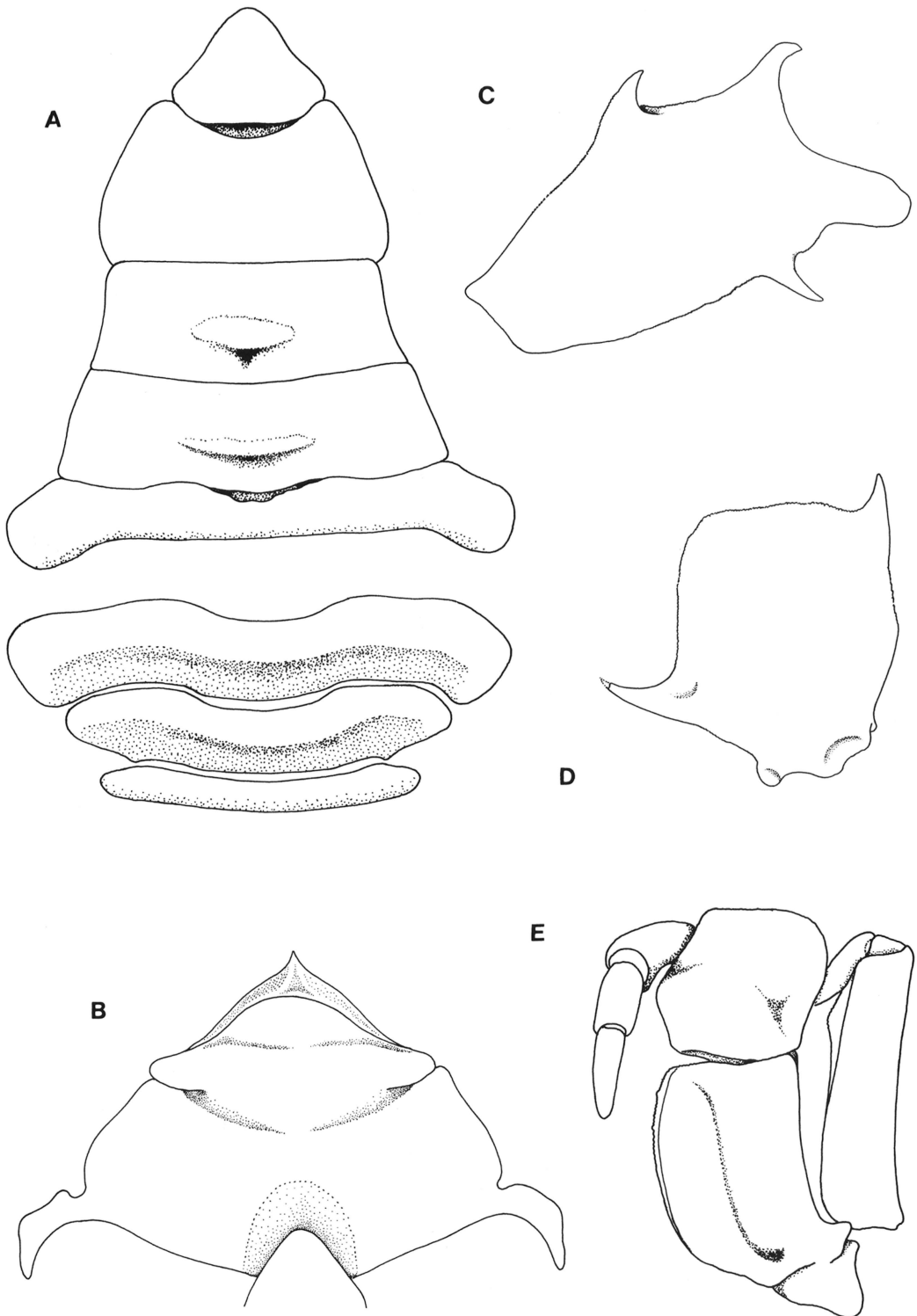


Fig. 7. *Raymanninus schmitti* (Rathbun, 1931). Male (68.2 by 50.6 mm) (ZRC 1998.62). A, abdomen (telson and segments 3–6; and segments 1–3); B, anterior thoracic sternites; C, right merus of cheliped (outer view); D, right carpus of cheliped (dorsal view); E, left third maxilliped.

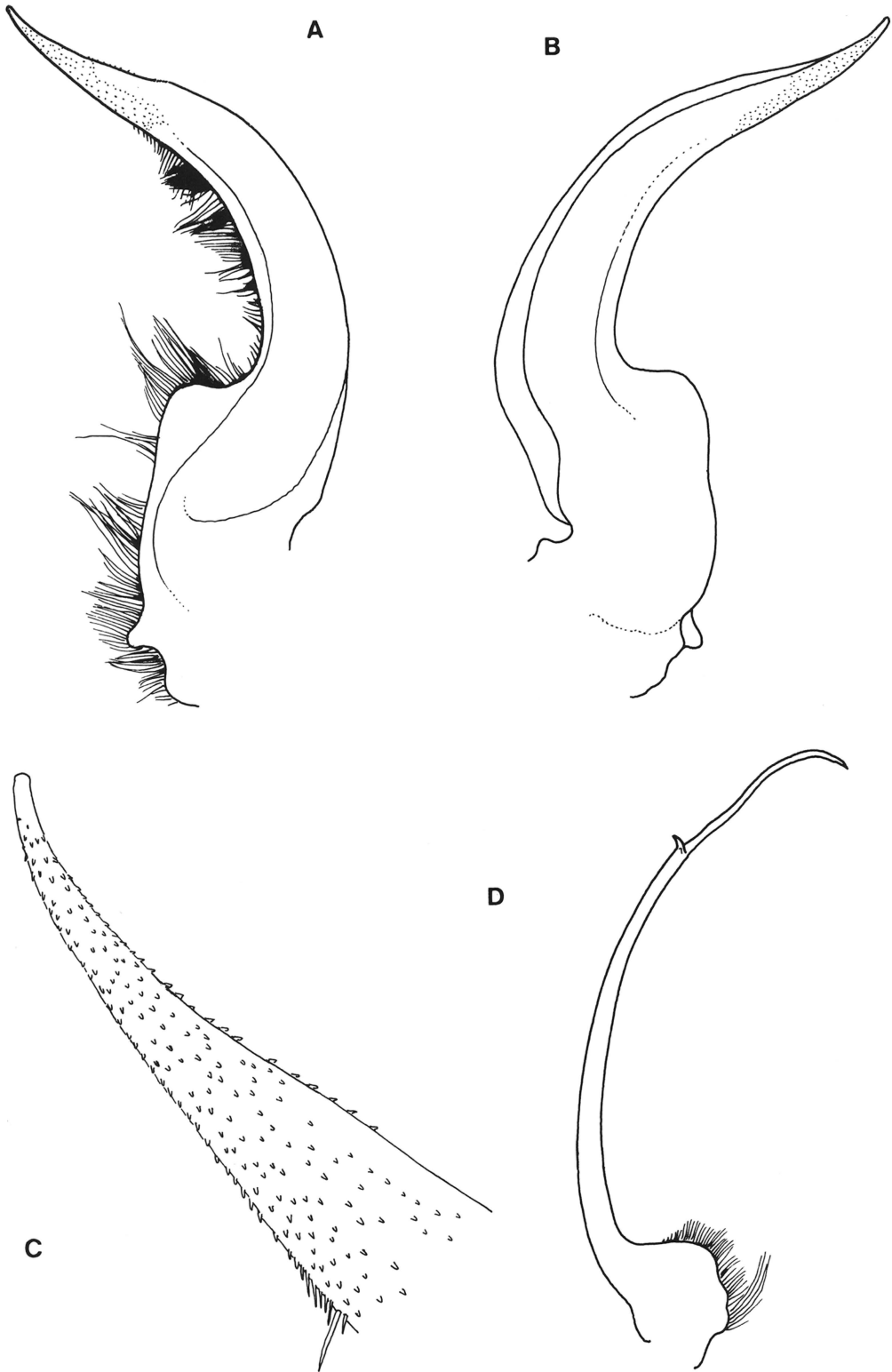


Fig. 8. *Raymanninus schmitti* (Rathbun, 1931). Male (68.2 by 50.6 mm) (ZRC 1998.62). A–C, left G1; D, left G2. A, dorsal view; B, ventral view; C, distal part of G1.

Color.—Rathbun (1931) provided a detailed account of the fresh colors of the species.

Remarks.—This species was originally described from three males and one female from the Tortugas, Florida, from a depth of about 329 metres. In describing this species, Rathbun (1931) referred it to *Benthochascon* without any comment, other than stating that the genus was previously known only from the Indian Ocean.

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LITERATURE CITED

- Alcock, A. 1899a. An account of the deep sea Brachyura collected by the Royal Indian Marine Survey Ship *Investigator*. Calcutta, 85 pp.
- . 1899b. Materials for a carcinological fauna of India, no. 4. The Brachyura Cyclometopa, Part 2. A revision of the Cyclometopa with an account of the families Portunidae, Cancridae, and Craystidae.—*Journal of the Asiatic Society of Bengal* 68(2): 1–104.
- , and A. R. S. Anderson. 1899. Natural history notes from H.M. Royal Indian marine survey ship *Investigator*, Commander T. H. Heming R.N., commanding, Series 3, number 2. An account of the deep-sea Crustacea dredged during the surveying-season of 1897–98.—*Annals and Magazine of Natural History* (7) 3: 1–27, 278–292.
- , and A. C. MacGilchrist. 1905. Illustrations of the zoology of the Royal Indian Marine surveying steamer *Investigator*.—*Crustacea*. Part 11: pls. 68–76.
- Costa, O. G., and A. Costa. 1838–1871. *Crostacei ed Aracnedi*. In: *Fauna del Regno di Napoli ossia enumerazione di tutti gli Animali che abitano le diverse regioni di questo regno e le acque che le bagnano contenente la descrizione de nuovi o poco esattamente conosciuti con figure ricavate da originali viventi e dipinte al naturale: foglia 1–43 (259 pp., 31 pls.), 1–4 (30 pp., 1 pl.), 1–5 (34 pp. 5 pls.)*
- Davie, P. J. F., and J. W. Short. 1989. Deepwater Brachyura (Crustacea: Decapoda) from southern Queensland, Australia with descriptions of four species.—*Memoirs of the Queensland Museum* 27: 157–187.
- Doflein, F. 1904. Brachyura. *Wiss. Ergebn. Deutschen Teifsee Valdivia Expedition* 6: i–xiv, 1–314, figs. 1–68, pls. 1–57.
- Manning, R. B. 1993. A new deep-sea crab, genus *Chaceon*, from Indonesia (Crustacea: Decapoda: Geryonidae).—*Raffles Bulletin of Zoology* 41: 169–172.
- , and L. B. Holthuis. 1989. Two new genera and nine new species of geryonid crabs (Crustacea: Decapoda: Geryonidae).—*Proceedings of the Biological Society of Washington* 102: 50–77.
- Miyake, S. 1983. Japanese crustacean decapods and stomatopods in color. Vol. I. Macrura, Anomura and Stomatopoda. Hoikusha Publishing Co., Osaka. 261 pp., 56 colour pls.
- Moosa, K. M. 1996. Crustacea Decapoda: Deep-water swimming crabs from the South-West Pacific, particularly New Caledonia (Brachyura, Portunidae). Pp. 503–550 in A. Crosnier, ed. *Résultats des Campagnes MUSORSTOM*, vol. 15. *Mémoires du Muséum national d'Histoire naturelle* (A)168.
- Ng, P. K. L., T.-Y. Chan, and S. H. Tan. 1998. The deep-water geryonid crab, *Chaceon granulatus* (Sakai) in Taiwan (Decapoda, Brachyura).—*Crustaceana* 71: 73–80.
- , D.-A. Lee, and H.-P. Yu. 1994. A new deep sea crab of the genus *Chaceon* (Decapoda, Geryonidae) from the South China Sea.—*Crustaceana* 67: 371–380.
- , and R. B. Manning. 1998. A new deep-water crab from Belau, Micronesia, with a key to the Pacific species of *Chaceon* (Crustacea: Decapoda: Brachyura: Geryonidae).—*Proceedings of the Biological Society of Washington* 111: 389–397.
- Rathbun, M. J. 1931. New crabs from the Gulf of Mexico.—*Journal of the Washington Academy of Science* 21: 125–128.
- Sakai, T. 1965. The Crabs of Sagami Bay collected by His Majesty, The Emperor of Japan. Maruzen Co., Tokyo. xvi + 206 pp., pls. 1–100, 1 map.
- . 1969. Two new genera and twenty-two new species of crabs from Japan.—*Proceedings of the Biological Society of Washington* 82: 243–280.
- . 1976. Crabs of Japan and the adjacent seas. In three volumes; English text, pp. xxix + 773 pp., Japanese text, pp. 1–461, Plates volume, pp. 1–16, pls. 1–251. Kodansha Ltd., Tokyo.
- Serène, R. 1968. The Brachyura of the Indo Pacific Region. Pp. 33–120 in *Prodromus for a check list of the non-planctonic marine fauna of South East Asia*. Singapore National Academy of Science, Special Publication No. 1.
- Stephenson, W. 1972a. Portunid crabs from the Indo-West Pacific and western America in the Zoological Museum, Copenhagen (Decapoda, Brachyura, Portunidae).—*Steenstrupia* 2: 127–156.
- . 1972b. An annotated check list and key to the Indo-West Pacific swimming crabs (Crustacea: Decapoda, Portunidae).—*Bulletin of the Royal Society of New Zealand* 10: 1–64.
- Stežić, Z. 1991. Note on some rare and aberrant Australian crabs.—*Beagle, Records of the Northern Territory Museum of Arts and Science* 8: 121–134.
- Stimpson, W. 1871. Preliminary report on the Crustacea dredged in the Gulf Stream in the Straits of Florida, by L. F. de Pourtales, Assist. U. S. Coast Survey.—*Bulletin of the Museum of Comparative Zoology at Harvard College* 2: 109–160.
- Wee, D. P. C., and P. K. L. Ng. 1995. Swimming crabs of the genera *Charybdis* de Haan, 1833, and *Thalamita* Latreille, 1829 (Crustacea: Decapoda: Brachyura: Portunidae) from Peninsular Malaysia and Singapore.—*Raffles Bulletin of Zoology*, Supplement 1, 128 pp.

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