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The Cymonomid Crabs of New Zealand and Australia (Crustacea: Brachyura: Cyclodorripoida)

Shane T. Ahyong

Australian Museum Research Institute, Australian Museum,
1 William Street, Sydney NSW 2010, Australia; and

School of Biological, Earth & Environmental Sciences,
University of New South Wales NSW 2052, Australia

Abstract. The cymonomid crabs of New Zealand and Australia are revised. Prior to the present study, three species each were known from New Zealand and Australia, respectively. Here, eight new species are described and the six previously known species are redescribed and refigured based on type material. Although based on few locality records, the New Zealand species of *Cymonomus* show north-south distributions corresponding to the Aupourian and Cookian Provinces, respectively, demarcated by the subtropical convergence in the vicinity of the Chatham Rise. Notably, the New Zealand species, *C. clarki*, is the southernmost occurring cymonomid worldwide. Most Australian records of *Cymonomus* are from southern waters; few are known from northern Western Australia or Queensland, and none from the Northern Territory, probably reflecting limited sampling effort. One new species from Tasmania is unique in *Cymonomus* in having transparent, well-defined corneas, rather than opaque-translucent corneal surfaces that are undifferentiated from surrounding cuticle. The New Zealand and Australian species of *Cymonomus* belong to species groups that range widely in the Indo-West Pacific, or even globally; whether these groups represent natural divisions awaits revision of the Atlanto-East Pacific cymonomid fauna. A key to the species of *Cymonomus* from New Zealand and Australia is provided.

Introduction

The cyclodorippoidan crabs of the family Cymonomidae Bouvier, 1898 are small, cryptic forms usually occurring in deep outer shelf or slope waters. Phylogenetically, cymonomids (along with other cyclodorippoidans) are sister to the eubrachyurans (Ahyong *et al.*, 2007; Tsang *et al.*, 2014). Of the five recognized cymonomid genera, only *Cymonomus* A. Milne-Edwards, 1880 is known from New Zealand and Australian waters. Species of *Cymonomus* are characterized by elongate eyestalks that are fixed or only slightly movable, a quadrate carapace without functional orbits, reduced, sub-dorsal pereopods 4 and 5, and a pleotelson in both sexes (Ahyong *et al.*, 2009). Prior to the present study, 35 species of *Cymonomus* were known worldwide, with highest diversity in the Indo-West Pacific (Ng *et al.*, 2008; De Grave *et al.*, 2009; Ahyong & Ng, 2017). In the last decade, new species of *Cymonomus* have been described from Australia (Ahyong & Brown, 2003), New Zealand (Ahyong, 2008), the Philippines (Ahyong & Ng, 2009, 2011), East Africa (Ahyong, 2014) and East Asia (Ahyong & Ng, 2017). To date, six species of *Cymonomus* have been recorded from New Zealand and Australia (Dell, 1971; Griffin & Brown, 1976; Ahyong & Brown, 2002; Ahyong, 2008). Cymonomids are uncommon but deep-water sampling in the region, largely over the past two decades, by the National Institute of Water and Atmospheric Research, New Zealand (NIWA) and the Commonwealth Scientific and Industrial Research

Keywords: Crustacea; Cymonomidae; Cymonomus; deep-sea; New Zealand; Australia
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Corresponding author: Shane T. Ahyong shane.ahyong@austmus.gov.au
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Organisation (CSIRO), has resulted in important collections of *Cymonomus* containing many new distributional records and species new to science. The present study reviews the New Zealand and Australian species of *Cymonomus*, more than doubling the known fauna of the region.

Materials and methods

Measurements and terminology largely follow Ahyong & Ng (2009, 2017) (Fig. 1). Carapace length (cl) is measured along the dorsal midline and includes the rostrum. Postrostral carapace length (pcl) excludes the rostrum. Carapace width (cw) is the greatest width across the branchial regions. Antennular peduncle length is the stretched length of all three articles combined. Material examined is generally listed from north to south and east to west. Specimens are deposited in the collections of the Australian Museum, Sydney (AM); the Lee Kong Chian Museum of Natural History, National University of Singapore (ZRC); Museum Victoria, Melbourne (NMV); National Institute of Water and Atmospheric Research, Wellington (NIWA); National Museum of New Zealand Te Papa Tongarewa, Wellington (NMNZ); and the South Australian Museum, Adelaide (SAM).

Systematics

Reptantia Boas, 1880

Brachyura Linnaeus, 1758

Cymonomidae Bouvier, 1898

Cymonomus A. Milne-Edwards, 1880

Remarks. *Cymonomus* now comprises 43 species including the eight new species described herein. Two broad species groups within *Cymonomus* have been recognized in older literature: the *C. granulatus* group and the *C. quadratus* group, distinguished by whether the rostrum is longer or shorter than the eyestalks, respectively (Dell, 1971). This division follows the early taxonomic history of the genus in which most new taxa were described as subspecies of either *C. granulatus* (Norman *in* Wyville Thomson, 1873) (rostrum longer than the eyestalks) or *C. quadratus* A. Milne-Edwards, 1880 (rostrum shorter than the eyestalks) (Dell, 1971). This binary division based on rostral length, however, does not adequately reflect the morphological diversity within the genus. Among the Indo-West Pacific species of *Cymonomus*, multiple groups have been recognized and additional groups are delineated below for species from the study area. Atlanto-East Pacific species of *Cymonomus* may also belong to these groupings, which may or may not represent natural groups. Whether these informal species groups are natural or artificial is currently under study and contingent on evaluation of the Atlanto-East Pacific species of *Cymonomus* (currently under revision by M. Tavares). They are used here for taxonomic utility pending revision of the cymonomid generic system in collaboration with M. Tavares, currently underway. For species of *Cymonomus* from New Zealand and Australia, the following informal groups are delineated herein:

- ***Cymonomus bathamae* group** (recognized herein): includes species having the outer orbital processes inclined anterolaterally, straight rather than curved eyestalks, and the anterior margin of the carapace lateral to the outer orbital processes curving inwards and sloping posteriorly towards the midline. In other species of *Cymonomus*, the anterior margins are transverse or slope posterolaterally. The *C. bathamae* group includes: *C. bathamae* Dell, 1971, *C. umitakae* Takeda, 1981, *C. brevis* sp. nov., *C. confinis* sp. nov., *C. triplex* sp. nov., *C. espinosus* sp. nov., and *C. valdiviae* Lankester, 1903, and might also include *C. guillei* Tavares, 1991 from Brazil. Of these, the eyestalks are fused basally and immovable in *C. bathamae*, *C. espinosus*, *C. brevis*, and *C. confinis*, all from the Indo-West Pacific; the eyestalks are slightly movable in others of the group. Of those species with slightly movable eyestalks, the rostrum is shorter than the eyes in the three Indo-West Pacific species (*C. umitakae*, *C. valdiviae*, *C. triplex*), and as long as or longer than the eyes in the Western Atlantic species, *C. guillei*.
- ***Cymonomus curvirostris* group** (Ahyong & Ng, 2017): includes species adorned with large, pedunculate, globose tubercles on the carapace and pereopods: *C. curvirostris* Sakai, 1965 (Japan), *C. liui* Ahyong & Ng, 2011 (Philippines), *C. mariveneae* Ahyong & Ng, 2009 (Philippines), and *C. trifurcus* Stebbing, 1920 (South Africa). These are among the smallest species of *Cymonomus*, with the maximum pcl of adults ranging from 2.0 to 3.1 mm.
- ***Cymonomus delli* group** (Ahyong & Ng, 2017): includes species with short, stout, relatively broad, ventrally flattened eyestalks; a small, triangular rostrum that is distinctly shorter than the eyestalks; a relatively swollen carapace with a finely granulate surface and margins, rounded anterolateral margins; and a pleotelson with a partial to full demarcation between abdominal somite 6 and the telson (yet to be confirmed in *C. andamanicus* Alcock, 1905). The *C. delli* group includes *C. cognatus* Ahyong & Ng, 2017, *C. cubensis* Chace, 1940, *C. delli* Griffin & Brown, 1976, *C. diogenes* Ahyong & Ng, 2009, and *C. andamanicus* Alcock, 1905. The demarcated telson and abdominal somite 6 in the *C. delli* group is similar to that of the American *Cymonomoides* Tavares, 1993a (to which *C. cubensis* and *C. delli* were previously assigned). Apart from the abdominal segmentation, however, *Cymonomoides guinotae* (Tavares, 1991), the type species of the genus, appears to have few obvious similarities to members of the *C. delli* group.
- ***Cymonomus granulatus* group** (Dell, 1971): includes species with the combination of a long rostrum that overreaches the eyestalks and well-developed outer orbital processes, namely, *C. aequilonius* Dell, 1971 (New Zealand), *C. alius* sp. nov. (New Zealand), *C. granulatus* (Norman in Wyville Thomson, 1873) (northeast Atlantic), *C. indicus* Ihle, 1916 (Indonesia), *C. japonicus* Balss, 1922 (Japan), and *C. magnirostris* Tavares, 1991 (Brazil).

- ***Cymonomus karenae* group** (recognized herein): includes only *C. karenae* sp. nov., in which the eyes are stout and widely divergent with well-defined, transparent corneal surfaces, and in which the telson and abdominal somite 6 are separated by a distinct groove except on the central one-third, which is indistinguishably fused.

- ***Cymonomus soela* group** (recognized herein): includes species in which the anterolateral margins of the carapace are transverse or slope posteriorly, the outer orbital processes and rostrum are well-developed and of similar length (but distinctly shorter than the eyestalks), and in which the pleotelson shows no evidence of a demarcation between somite 6 and the telson. The *C. soela* group includes *C. soela* Ahyong & Brown, 2003*, C. clarki* Ahyong, 2008, *C. deforgesi* Ahyong & Ng, 2009, *C. dianae* sp. nov. and *C. tesseris* sp. nov. from the Indo-West Pacific, and possibly also *C. menziesi* Garth & Haig, 1971, from the eastern Pacific, and *C. caecus* Chace, 1940, from the Western Atlantic.

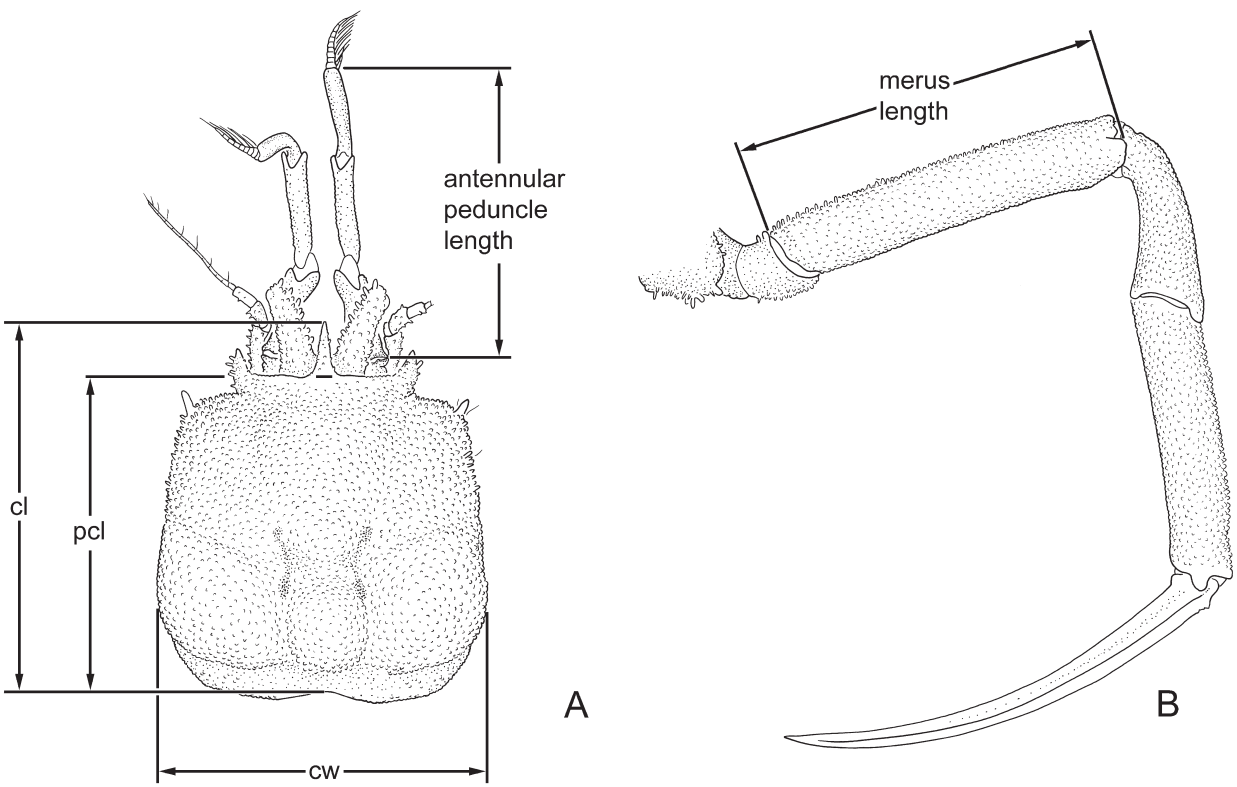

Figure 1. Measurements of carapace and antennules *(A)*, and pereopod 3 *(B)*.

Key to species of *Cymonomus* from New Zealand and Australia

1	Cornea well-defined and demarcated from surrounding cuticle, transparent ..... *C. karenae* sp. nov.
——	Cornea obsolete, not demarcated from surrounding cuticle, opaque or translucent 2
2	Rostrum extending well beyond eyes 3
——	Rostrum extending at most to end of eyes 4
3	Pereopod 3 merus of females longer than carapace length (including rostrum) ..... *C. aequilonius* Dell, 1971
——	Pereopod 3 merus of females shorter than carapace length (including rostrum) ..... *C. alius* sp. nov.
4	Carapace with large rounded boss on branchial margins ..... *C. kapala* Ahyong & Brown, 2003
——	Carapace without rounded boss on branchial margins 5

5	Carapace anterior margin lateral to outer orbital processes curving inwards and sloping posteriorly towards midline. Outer orbital processes inclined anterolaterally	6
——	Anterior margin of carapace lateral to outer orbital processes transverse or sloping posterolaterally. Outer orbital processes directed anteriorly	10
6	Carapace surface largely smooth, with few groups of sparsely distributed granules or spinules	*C. espinosus* sp. nov.
——	Carapace surface evenly granulated	7
7	Eyestalks subparallel, slightly movable	*C. triplex* sp. nov.
——	Eyestalks strongly divergent, immovable, fused to anterior margin of carapace below base of rostrum	8
8	Maxilliped 3 exopod not reaching end of merus	*C. confinis* sp. nov.
——	Maxilliped 3 exopod reaching beyond end of merus	9
9	Carapace granulation dense, covering entire surface. Pereopod 3 merus in females 0.9 pcl	*C. bathamae* Dell, 1971
——	Carapace granules widely spaced. Pereopod 3 merus in females as long as pcl	*C. brevis* sp. nov.
10	Rostrum short, triangular, about as long as wide	*C. delli* Griffin & Brown, 1976
——	Rostrum elongate, slender, spiniform, length more than twice width	11
11	Pereopod 5 merus, when folded against carapace, extending to anterior one-third of carapace	*C. clarki* Ahyong, 2007
——	Pereopod 5 merus, when folded against carapace, extending to anterior half of carapace	12
12	Cheliped palm smooth or microscopically granular on outer, central surface. Carapace anterolateral margin with numerous long setae	*C. dianae* sp. nov.
——	Cheliped palm granulate on outer, central surface. Carapace anterolateral margin glabrous or with few short setae	13
13	Male pereopod 3 merus length < 0.2 pcl	*C. tesseris* sp. nov.
——	Male pereopod 3 merus length ≥ 0.3 pcl	*C. soela* Ahyong & Brown, 2003

Cymonomus aequilonius Dell, 1971

Figs 2, 3

Cymonomus aequilonius Dell, 1971: 59–61, figs 11–15.—Tavares, 1993b: 258.—Ahyong & Brown, 2003: 1372.—Ng *et al.*, 2008: 32.—Webber *et al.*, 2010: 225.—Yaldwyn & Webber, 2011: 227.

Holotype: NMNZ Cr1866, female (cl 7.1 mm, pcl 5.7 mm, cw 6.4 mm), NE of Mayor Island, Bay of Plenty, New Zealand, 37°10'S 176°23.5'E, 400 fm [732 m], trawl, BS 210, 28 February 1957.

Description of holotype. Carapace quadrate, almost square, lateral margins slightly divergent posteriorly; regions weakly indicated, cervical groove weakly indicated, broadly V-shaped; lower pterygostomian region swollen; anterolateral surfaces with few scattered setae. Anterolateral spine short, blunt, conical, directed anteriorly; smaller spine on lateral margin behind anterolateral spine. Dorsal and lateral surfaces entirely covered with minute rounded granules, granules becoming slightly larger and more elongate anterolaterally, bluntly conical, not globose. Fronto-orbital margin (excluding rostrum and outer-orbital processes) advanced beyond anterolateral margins; 0.6 anterior carapace width; outer orbital processes stout, elongate, directed anteriorly, situated below plane of rostrum, laterally spinulate, apex acute, half rostral length. Rostrum distinctly longer than eyestalks; 0.27 pcl; slender, tapering to acute apex, granulate dorsally and laterally.

Eyestalks strongly divergent (about 40° from median axis), stout, flattened, minutely granulate dorsally, acutely granulate and weakly spinulate along mesial margin, fused to carapace below rostral base but demarcation distinct, reaching anteriorly to midlength of antennular peduncle article 1; cornea apparently vestigial, not pigmented.

Epistome with tubercle mesial to base of antennules, otherwise smooth; strong spine with smaller secondary spine mesial to base of antenna.

Antennular peduncle 0.83 pcl (female); articles 1 and 2 minutely granulate; article 3 smooth. Antennal articles irregularly granulate or minutely spinular.

Maxilliped 3 ischiobasis subquadrate, sparsely granulate and minutely spinular; longitudinal sublateral groove; ischium and basis demarcated by faint groove. Merus slightly

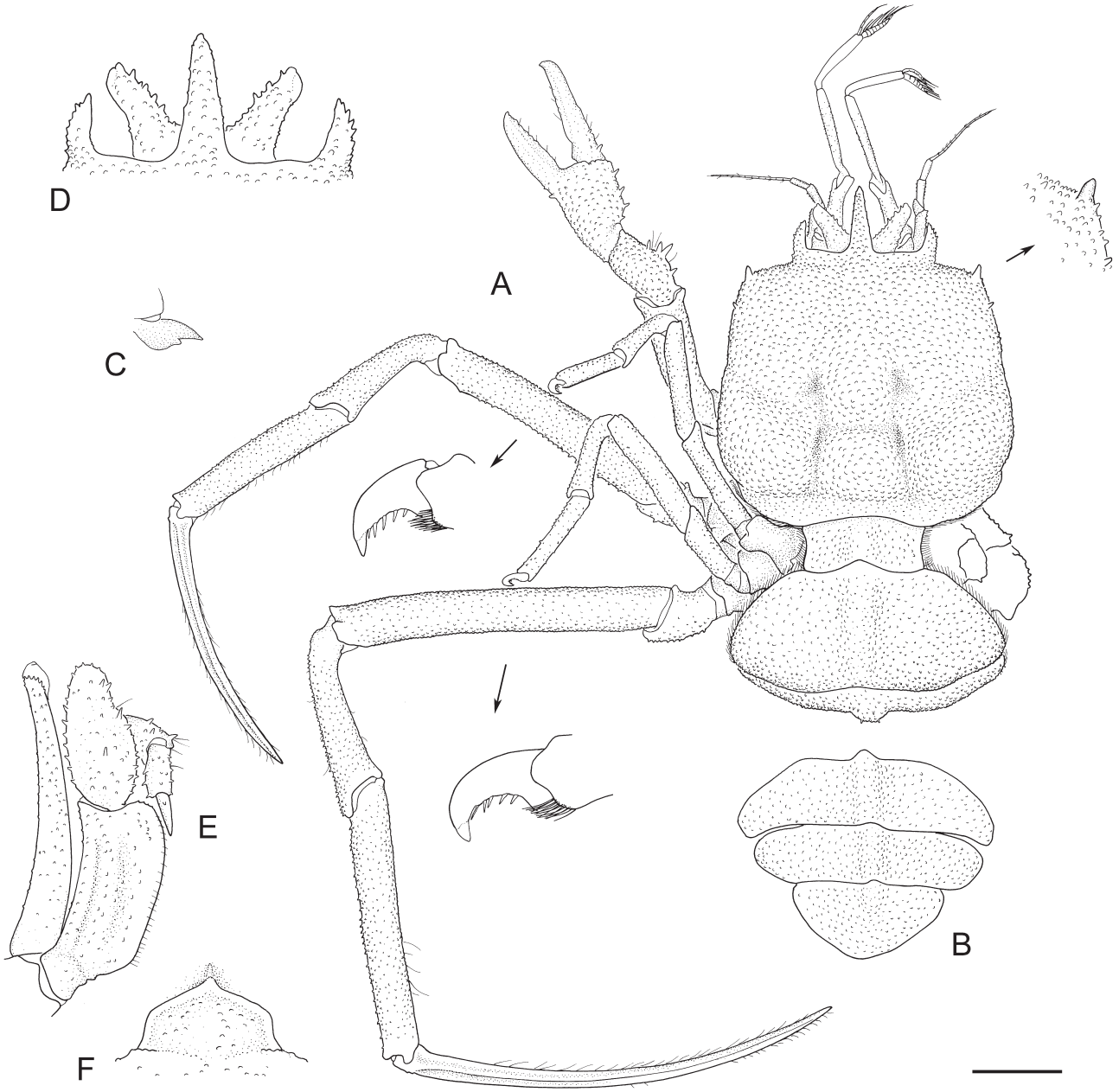

Figure 2. *Cymonomus aequilonius* Dell, 1971, female holotype, cl 7.1 mm, pcl 5.7 mm, cw 6.4 mm, Bay of Plenty, New Zealand, NMNZ Cr1866. *(A)* dorsal habitus; *(B)* posterior abdomen; *(C)* right epistomial spine mesial to base of antenna; *(D)* fronto-orbital region; *(E)* right maxilliped 3; *(F)* thoracic sternite 3. Scale: A, B = 2.0 mm; C = 0.5 mm; D–F = 1.0 mm.

shorter than ischium; length about twice width, tapering distally to rounded apex; surface and margins spinulate. Dactylus conical, with scattered granules; propodus and carpus sparsely spinulate. Exopod surface sparsely granulate, distal margin spinulate; apex reaching beyond carpo-meral articulation but not reaching beyond end of endopod merus.

Chelipeds (pereopod 1) equal in size and ornamentation, setose. Merus finely granulate. Carpus granulate, dorsal margin with 4 spines. Propodus palm surfaces granulate, dorsal and ventral margins with few conical spines and tubercles. Dactylus longer than dorsal palm length; proximal dorsal half with few small spines; with faint longitudinal carina on outer surface, occlusal surfaces of dactylus and pollex weakly crenulate, without gape when fingers closed.

Pereopods 2 and 3 sparsely setose; all articles except for dactylus finely granulate; propodus and carpus with minutely spinular extensor margins; merus flexor margins minutely spinular on P2, unarmed on P3; dactylus broadly curved, smooth, with longitudinal rib. Pereopod 3 longest, merus 1.33 pcl (female); dactylus slightly shorter than combined length of propodus and carpus.

Pereopods 4 and 5 finely granulate, some minute spines, glabrous; longer than pereopod 3 merus (female); propodus distoextensor margin unarmed; dactylus markedly shorter than propodus, falcate, with corneous apex and 5 obliquely inclined, corneous spines on flexor margin. Pereopod 5 merus, when folded against carapace, reaching anterior one-fifth of carapace.

Thoracic sternite 3 pentagonal, width about 1.8 × length; lateral margins divergent posteriorly; surface sparsely

granulate. Margins of sternites 4 and 5 weakly granulate.

Abdomen surface finely granulate or minutely spinulate; pleotelson without trace of demarcation between somite 6 and telson distally obtuse, bluntly rounded, length half width (female).

Remarks. *Cymonomus aequilonius* was described from a single spent female from the Bay of Plenty, New Zealand, and subsequently reported further south on the Chatham Rise (Ahyong, 2008). Restudy of all previous records of *C. aequilonius* revealed that the southern specimens represent a separate species, herein named *C. alius* sp. nov. As such, *C. aequilonius* remains known only from the type locality.

As a member of the *C. granulatus* group, *C. aequilonius* shares the combination of well-developed outer orbital processes and the long rostrum overreaching the eyestalks (Fig. 2A, D) with *C. alius* sp. nov. (Fig. 4A, D) (New Zealand), *C. granulatus* (Norman in Wyville Thomson, 1873) (northeast Atlantic), *C. indicus* Ihle, 1916 (Indonesia), *C. japonicus* Balss, 1922 (Japan), and *C. magnirostris* Tavares, 1991 (Brazil). Not surprisingly, *C. aequilonius* is morphologically closest to its New Zealand congener, *C. alius*, agreeing in almost all respects including the bifid epistomial spine mesial to the base of the antenna (Fig. 2C, 4C), but is readily distinguished by the distinctly longer walking legs (female pereopod 3 merus 1.33 versus 1.03–1.05 pcl, longer than cl versus shorter than cl) and longer antennular peduncle (females: 0.83 versus 0.58–0.74 pcl). *Cymonomus aequilonius* can be separated from *C. indicus* by the rounded versus polygonal or stellate carapace tubercles, and from *C. japonicus* by the longer pereopod 5, with the merus reaching to the anterior one-fourth, rather than the midlength of the carapace. *Cymonomus aequilonius* differs from *C. magnirostris* in the shorter maxilliped 3 exopod (which under- rather than overreaches the apex of the merus; Fig. 1E), and from *C. granulatus* in the more slender rostrum (Fig. 1A, D) (basal width about half length in *C. granulatus*).

Distribution. Known only from the Bay of Plenty, New Zealand (Fig. 3); 732 m.

Figure 3. *Cymonomus aequilonius* Dell, 1971, distribution.

Cymonomus alius sp. nov.

http://zoobank.org/NomenclaturalActs/84215778-F073-409A-9732-88D4D3860A68

Figs 4, 5, 30A

Cymonomus aequilonius.—Ahyong, 2008: 12–13, fig. 1F [not *C. aequilonius* Dell, 1971].

Holotype: NIWA 34966, spent female (cl 7.7 mm, pcl 6.2 mm, cw 6.7 mm), Tims Bank, S of Ritchie Hill, New Zealand, 40°01.26–01.20'S 178°04.15–04.09'E, 797–804 m, KAH9907/01, RV *Kaharooa*, 1 June 1999. **Paratypes** (all New Zealand): NIWA 121121, 1 male (cl. 6.0 mm, pcl 4.5 mm, cw 4. 7 mm), collected with holotype; NIWA 16829, 1 ovigerous female (cl 8.9 mm, pcl 7.1 mm, cw 8.2 mm), Mernoo Bank, Chatham Rise, 44°20.0'S 173°54.2'E, 675 m, S0161, 28 October 1979; NIWA 31642, 1 male (cl 5.9 mm, pcl 4.7 mm, cw 4.8 mm), 44°07.25–07.45'S 178°50.59–50.69'E, Chatham Rise, 512–513 m, TAN0705/24, RV *Tangaroa*, 4 April 2007.

Description. Carapace quadrate, almost square, lateral margins subparallel to slightly divergent posteriorly; regions weakly indicated, cervical groove weakly indicated, broadly V-shaped; lower pterygostomian region swollen; anterolateral surfaces with few scattered setae.

Anterolateral spine short, blunt, conical, directed anteriorly; similar spine on lateral margin behind anterolateral spine. Dorsal and lateral surfaces entirely covered with minute rounded granules, with granules becoming slightly larger and more elongate anterolaterally, bluntly conical, not globose. Fronto-orbital margin (excluding rostrum and outer-orbital processes) advanced beyond anterolateral margins; 0.6 anterior carapace width; outer orbital processes stout, elongate, directed anteriorly, situated below plane of rostrum, laterally spinulate, apex acute, about half rostral length. Rostrum distinctly longer than eyestalks; 0.25–0.34 pcl; slender, tapering to acute apex, granulate dorsally and laterally.

Eyestalks strongly divergent (about 45° from median axis), stout, flattened, minutely granulate dorsally, acutely granulate and weakly spinulate along mesial margin, fused to carapace below rostral base but demarcation distinct, reaching anteriorly beyond midlength of antennular peduncle article 1; cornea apparently vestigial, not pigmented.

Epistome with tubercle mesial to base of antennules, otherwise smooth; bifid spine mesial to base of antenna.

Antennular peduncle 0.93–1.00 pcl (male), 0.58–0.74 pcl (female); articles 1 and 2 minutely granulate; article 3 smooth. Antennal articles irregularly granulate or minutely spinular.

Maxilliped 3 ischiobasis subquadrate, sparsely granulate and minutely spinular; longitudinal sublateral groove; ischium and basis demarcated by faint groove. Merus slightly shorter than ischium; length about twice width, tapering distally to rounded apex; surface and margins spinulate. Dactylus conical, unarmed; propodus and carpus sparsely spinulate. Exopod surface sparsely granulate, distal margin unarmed; apex not reaching beyond end of endopod merus.

Chelipeds (pereopod 1) equal in size and ornamentation, setose. Merus finely granulate. Carpus granulate, dorsal margin with 4 or 5 spines. Propodus palm surfaces granulate; dorsal and ventral margins with few conical spines and tubercles. Dactylus longer than dorsal palm length; proximal dorsal half with few small spines; with faint longitudinal carina on outer surface, occlusal surfaces of dactylus and pollex uneven, without gape when fingers closed.

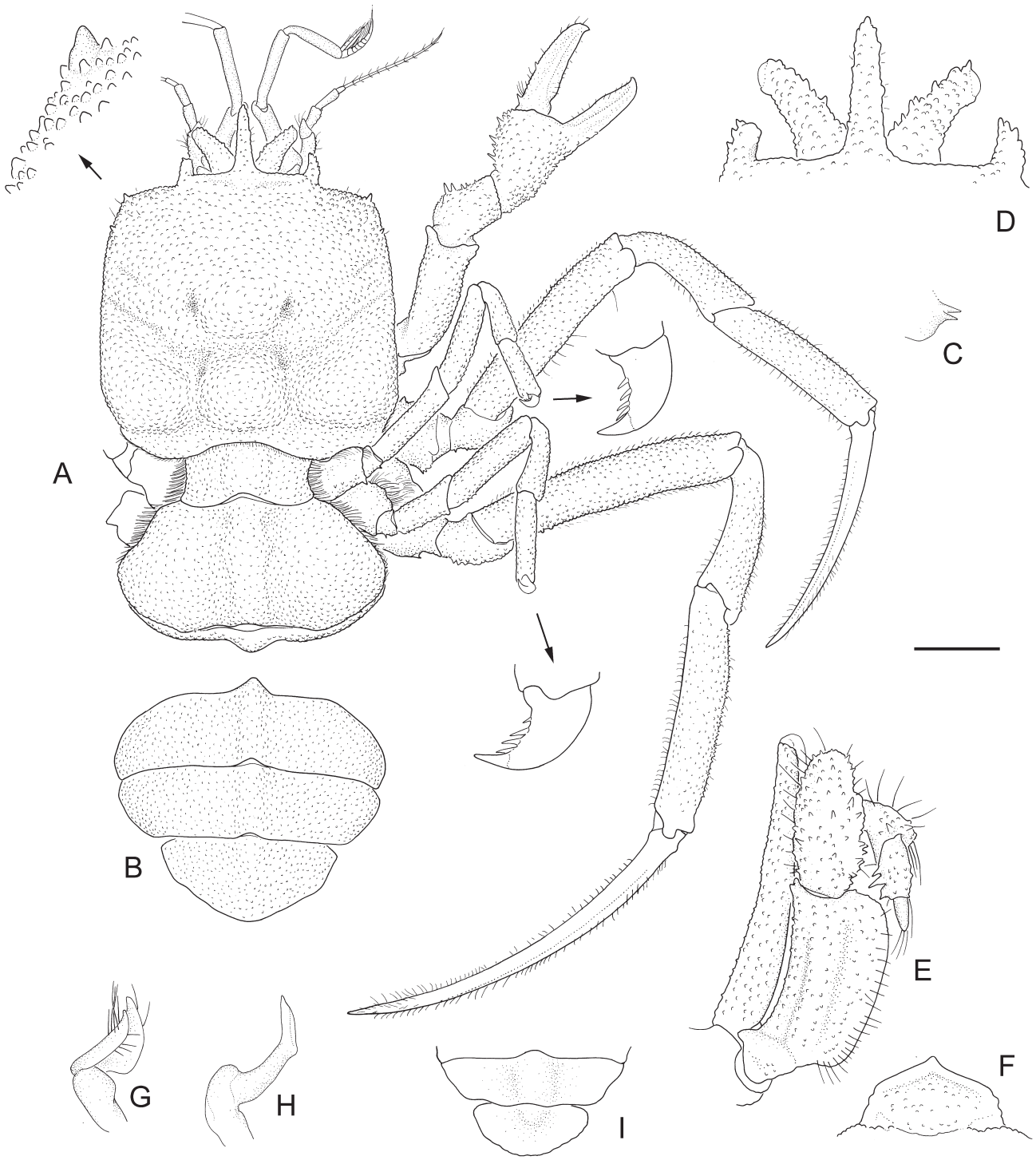

Figure 4. *Cymonomus alius* sp. nov., Tims Bank, New Zealand. *(A–F)* spent female holotype, cl 7.7 mm, pcl 6.2 mm, cw 6.7 mm, NIWA 34966. *(G–I)* male paratype, cl 6.0 mm, pcl 4.5 mm, cw 4.7 mm, NIWA 121121. *(A)* dorsal habitus; *(B, I)* posterior abdomen; *(C)* right epistomial spine mesial to base of antenna; *(D)* fronto-orbital region; *(E)* right maxilliped 3; *(F)* thoracic sternite 3; *(G)* right G1, abdominal view; *(H)* right G2, abdominal view. Scale: A–B = 2.0 mm; C = 0.5 mm; D–I = 1.0 mm.

Pereopods 2 and 3 finely setose; all articles except for dactylus finely granulate; propodus and carpus with minutely spinular extensor margins; merus margins unarmed; dactylus broadly curved, smooth, with weak longitudinal rib. Pereopod 3 longest, merus 1.29–1.37 pcl (male), 1.03–1.05 pcl (female); dactylus slightly shorter than combined length of propodus and carpus.

Pereopods 4 and 5 finely granulate, some minute spines, glabrous; longer than pereopod 3 merus in both sexes; propodus distoextensor margin unarmed; dactylus markedly shorter than propodus, falcate, with corneous apex and 4 obliquely inclined, corneous spines on flexor margin. Pereopod 5 merus, when folded against carapace, reaching anterior one-fifth of carapace.

Thoracic sternite 3 pentagonal, width about twice length; lateral margins divergent posteriorly; surface sparsely granulate. Margins of sternites 4 and 5 weakly granulate.

Abdomen surface finely granulate or minutely spinulate.

Pleotelson without trace of demarcation between somite 6 and telson distally obtuse, bluntly rounded, length about half width in both sexes.

Gonopod 1 distal article cannulate, forming copulatory tube, with moderately long distal setae. Gonopod 2 with articles fused; distomesial margin slightly hollowed, apex acute.

Egg diameter 1.14 mm.

Etymology. From the Latin adjective *alius*, another, alluding to the similarity of the new species to *C. aequilonius*.

Remarks. *Cymonomus alius* sp. nov. is morphologically and geographically nearest to its New Zealand congener, *C. aequilonius*. Males of *C. aequilonius* are presently unknown, but females of the two species differ by the proportional lengths of the walking legs and antennular peduncle: pereopod 3 merus in females 1.03–1.05 pcl in *C. alius* (Fig. 4A), 1.33 pcl in *C. aequilonius* (Fig. 2A); antennular peduncle 0.58–0.74 pcl in *C. alius*, 0.83 in *C. aequilonius*. As such, the proportional lengths of the walking legs of male *C. alius* resemble those of female *C. aequilonius*. Apart from sexual dimorphism, the type specimens of *C. alius* are largely uniform. All have two epistomial spines mesial to the base of the antenna (Fig. 4C), although the posteriormost spine in one male (NIWA 31642) is blunt on one side, broken on the other.

Although based on few records, the known distributions of *C. aequilonius* and *C. alius*, respectively, with one species occurring north and the other south of East Cape (c. 37°40'S) (Figs 3, 5), parallel those of another apparent species pair, *C. brevis* and *C. bathamae* (Figs 7, 9). The north-south distributions of these species pairs correspond to the Aupourian and Cookian provinces, respectively, demarcated by the subtropical convergence in the vicinity of the Chatham Rise (Morton, 2004). The holotype of *C. alius* was collected together with the goneplacid crab, *Pycnoplax victoriensis* (Rathbun, 1923) (Ahyong 2008).

Distribution. Southeastern New Zealand, from Tims Bank to the Chatham Rise (Fig. 5); 512–804 m.

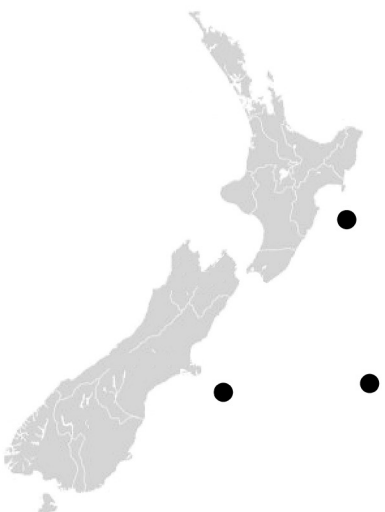

Figure 5. *Cymonomus alius* sp. nov., distribution.

Cymonomus bathamae Dell, 1971

Figs 6, 7

Cymonomus bathamae Dell, 1971: 56–59, figs 1–10.—Wear & Batham, 1975: 113, figs 1–8.—Chapman, 1977: 341, figs 1–10.—Tavares, 1993b: 258.—Ahyong & Brown, 2003: 1373.—Ng *et al.*, 2008: 32.—Webber *et al.*, 2010: 225.—Yaldwyn & Webber, 2011: 227.

Holotype: NMNZ Cr1867, male (cl 4.6 mm, pcl 3.8 mm, cw 4.0 mm), Papanui Canyon, Otago, New Zealand, 45°51'S 170°02'E, 732 m, RV *Munida* stn 67-142, 30 November 1967. **Paratypes** (all New Zealand): NIWA 68007, 1 female (cl 3.8 mm, pcl 3.1 mm, cw 3.5 mm), Chatham Rise, 44°05.99'S 179°25.00'E, 344 m, NZOI stn G184, 18 January 1968; NMNZ Cr1868, 1 ovigerous female (cl 5.0 mm, pcl 4.5 mm, cw 5.3 mm), Karitane Canyon, Otago, 45°38'S 171°08'E, 540–720 m, RV *Munida* stn 68-27, 8 May 1968; NIWA 68021, 1 ovigerous female (cl 4.4 mm, pcl 3.7 mm, cw 4.1 mm), off Otago, 46°18.5'S 170°34.5'E, 680 m, NZOI stn G696, 21 January 1970.

Other material examined. *Chatham Rise, New Zealand*: NIWA 31653, 1 male (cl 4.1 mm, pcl 3.3 mm, cw 3.5 mm), 44°12.260–12.750'S 178°55.560–55.398'E, 470–479 m, TAN0705/88, RV *Tangaroa*, 9 April 2007.

Description. Carapace quadrate, almost square, lateral margins weakly divergent posteriorly; regions weakly indicated, cervical groove weakly indicated; lower pterygostomian region swollen; anterior and anterolateral surfaces with few long, fine setae, other surfaces sparsely setose. Anterolateral spine prominent, inclined laterally; similar spine on lateral margin behind anterolateral spine. Anterior carapace margin mesial to the anterolateral spine sloping posteriorly towards midline, with short spinules, acute granules. Dorsal and lateral surfaces densely covered with minute granules and spinules anteriorly, spinules longest anterolaterally. Fronto-orbital margin (excluding rostrum and lateral projections) advanced beyond anterolateral margins; 0.6 anterior carapace width; outer orbital processes sharply triangular, elongate, divergent, directed anterolaterally, situated below plane of rostrum, dorsally and laterally spinulate, apex acute, shorter than rostrum. Rostrum length about two-thirds length of eyestalks; 0.11–0.22 pcl; slender, sharply triangular, spinose dorsally and laterally.

Eyestalks strongly divergent (about 30° to median axis), margins subparallel for most of length, ventrally flattened, fused to carapace below rostral base but demarcation distinct; reaching anteriorly slightly beyond antennular peduncle article 1; dorsal surface acutely granulate, lateral and mesial margins spinulate; cornea apparently vestigial, not pigmented.

Epistome with granulate median tubercle and small tubercle mesial to base of antennule; with slender bifid or trifid spine mesial to base of antenna.

Antennular peduncle 0.75–0.76 pcl (male), 0.65–0.70 pcl (female); articles 1 and 2 minutely granulate; article 3 smooth. Antennal articles 1–4 granulate or spinose; article 5 smooth.

Maxilliped 3 ischiobasis subquadrate, surface and margins sparsely granulate, with few acute granules or short spines; shallow longitudinal sublateral groove; ischium and basis demarcated by faint groove. Merus slightly shorter than ischium; length 2.2 × width (excluding spines); tapering distally to rounded apex; surface and margins spinulate.

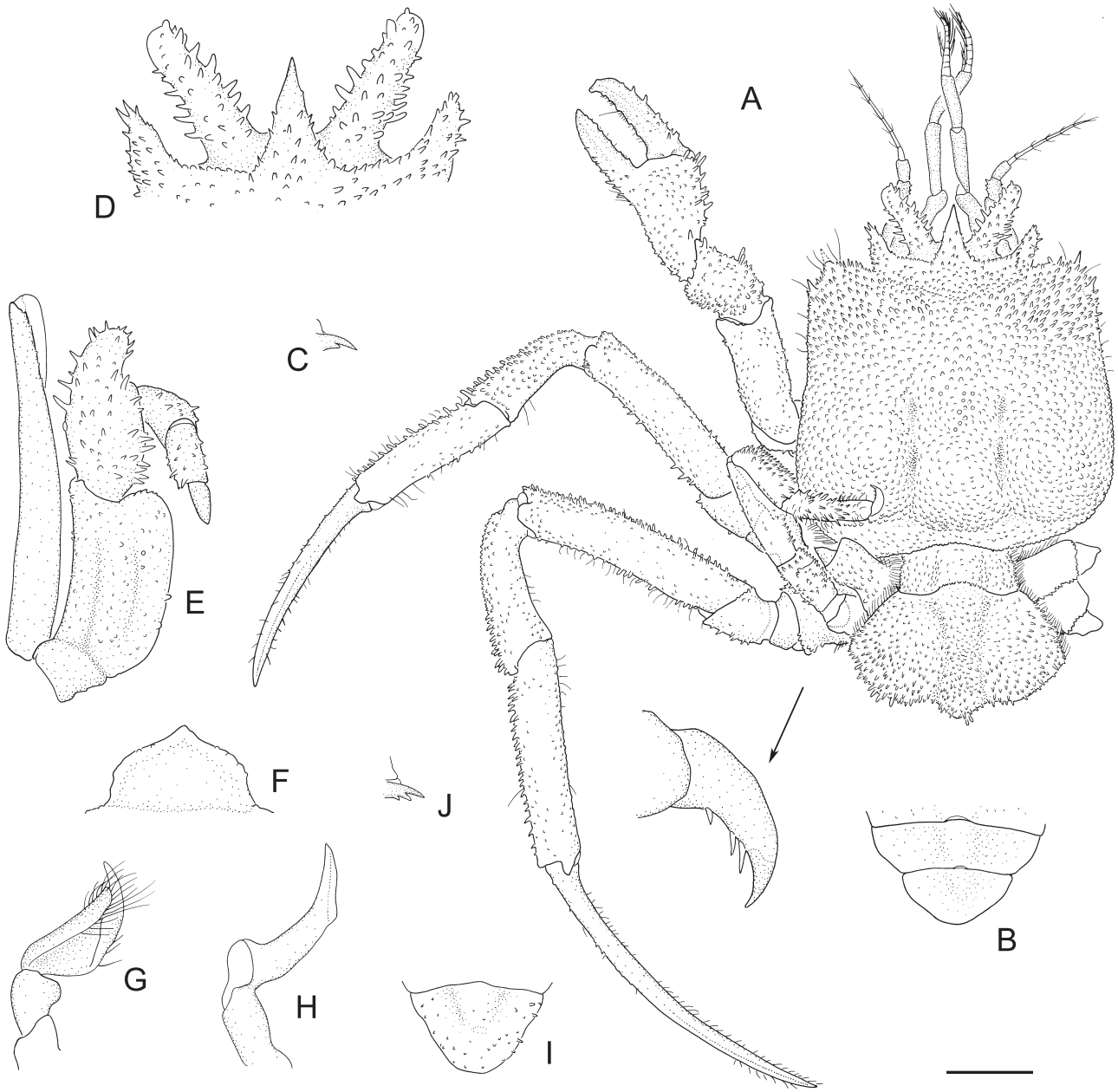

Figure 6. *Cymonomus bathamae* Dell, 1971. *(A–F)* spent female paratype, cl 3.9 mm, pcl 3.3 mm, cw 3.6 mm, Chatham Rise, New Zealand, NIWA 68007. *(G–I)* male, cl 6.0 mm, pcl 3.3 mm, cw 3.5 mm, Chatham Rise, New Zealand, NIWA 31653. *(J)* ovigerous female paratype, cl 4.4 mm, pcl 3.7 mm, cw 4.1 mm, off Otago, New Zealand, NIWA 68021. *(A)* dorsal habitus; *(B)* posterior abdomen; *(C, J)* right epistomial spine mesial to base of antenna; *(D)* fronto-orbital region; *(E)* right maxilliped 3; *(F)* thoracic sternite 3; *(G)* right G1, abdominal view; *(H)* right G2, abdominal view; *(I)* pleotelson. Scale: A–B = 2.0 mm; C, J = 0.5 mm; D–I = 1.0 mm.

Dactylus unarmed. Propodus and carpus spinulate. Exopod unarmed, distally overreaching endopod merus.

Chelipeds (pereopod 1) equal in size and ornamentation, sparsely setose, almost glabrous. Merus finely granulate, with few short, scattered spines. Carpus acutely granulate and spinose, dorsal spines longest. Propodus palm surfaces granulate; dorsal and ventral margins spinose, extending onto pollex. Dactylus longer than dorsal palm length; dorsal margin spinose; outer surface with faint longitudinal carina, occlusal surfaces of dactylus and pollex irregularly crenulate, without gape when fingers closed.

Pereopods 2 and 3, sparsely setose, flexor and extensor margins granulate and spinose, other surfaces granulate; longest spines on extensor margins and dorsal surfaces of propodus and carpus; merus extensor and flexor margins with short spines; dactylus broadly curved, sparsely and minutely spinose proximally, otherwise smooth, without distinct longitudinal rib. Pereopod 3 longest, merus shorter than carapace, 0.91–0.93 pcl (males), 0.87–0.91 pcl (females); dactylus slightly shorter than combined length of propodus and carpus.

Pereopods 4 and 5 finely granulate, sparsely spinose; longer than pereopod 3 merus in both sexes; propodus distoextensor margin unarmed; dactylus markedly shorter than propodus, falcate, with corneous apex and 3 obliquely inclined, corneous spines on flexor margin. Pereopod 5 merus, when folded against carapace, reaching anterior 1/4 of carapace.

Thoracic sternite 3 pentagonal, width 1.8 × length; lateral margins slightly divergent posteriorly to subparallel; surface very sparsely granulate. Margins of sternites 4 and 5 granulate.

Abdomen granulate and minutely spinose, most prominent on somites 2 and 3, very sparsely ornamented on somites 4 and 5. Pleotelson without trace of demarcation between somite 6 and telson; subtriangular, sparsely granulate or minutely spinose; margins straight to slightly convex; apex rounded; width 1.4 × length (male), 1.9 (female).

Gonopod 1 distal article cannulate, forming copulatory tube, apex slightly fluted, with moderately long distal setae. Gonopod 2 with articles fused; distomesial margin slightly hollowed, apex acute.

Egg diameter 0.92 mm.

Remarks. Within the *C. bathamae* group, *C. bathamae* is most similar to *C. espinosus*, *C. confinis*, and *C. brevis*, all of which have basally fused, immovable eyes. *Cymonomus bathamae* is readily distinguished from *C. espinosus* by the densely granulate carapace surface (Fig. 6A) (versus largely smooth, with a few patches of spinules or granules; Fig. 18A) and from *C. confinis* by the longer pereopod 5 (Fig. 8A) (merus reaching anteriorly to the anterior one-third [Dell, 1971: fig. 4] rather than midlength of the carapace; Fig. 12A) and longer maxilliped 3 exopod (Fig. 8E) (distinctly overreaching the merus versus reaching to the distal three-fourths; Fig 12E). Distinctions between *C. bathamae* and *C. brevis* are outlined under the account of the latter.

Unlike other congeners, sexual dimorphism in the length of the walking legs in *C. bathamae* is very slight; the proportional pereopod 3 length differs by only 4–5% between the sexes compared to 10–30% in other species. Dell (1971) reported ovigerous females with up to 23 eggs, to 1.4 mm diameter. Development in *C. bathamae* is abbreviated, with one (possibly two) zoeal stages prior to the megalopa (Wear & Batham, 1975). This reduced developmental staging limits dispersal capabilities and is consistent with the small known range of the species. The eyes of *C. bathamae* are degenerate, lacking corneal facets, although photoreceptors remain, permitting light detection without image formation (Chapman, 1977).

Distribution. Southeastern New Zealand, from the Chatham Rise to Otago (Fig. 7); 344–732 m.

Figure 7. *Cymonomus bathamae* Dell, 1971, distribution.

Cymonomus brevis sp. nov.

http://zoobank.org/NomenclaturalActs/7BCA2CEE-DEE6-4C00-AC5F-82982D41957D

Figs 8, 9

Holotype: NIWA 76191, spent female (cl 3.2 mm, pcl 2.7 mm, cw 3.1 mm), Bay of Plenty, New Zealand, 35°47.80'S 175°13.00'E, 151 m, NZOI stn I4, 2 May 1975.

Description of holotype. Carapace quadrate, almost square, lateral margins weakly divergent posteriorly; regions weakly indicated, cervical groove weakly indicated; lower pterygostomian region swollen; anterior and anterolateral surfaces with few long, fine setae, other surfaces sparsely setose. Anterolateral spine prominent, inclined laterally; similar spine on lateral margin behind anterolateral spine. Anterior carapace margin mesial to the anterolateral spines sloping posteriorly towards midline, with minute spinules, acute granules. Dorsal and lateral surfaces sparsely covered with rounded or conical granules. Fronto-orbital margin (excluding rostrum and lateral projections) slightly advanced beyond anterolateral margins; 0.6 anterior carapace width; outer orbital processes sharply triangular, elongate, divergent, directed anterolaterally, situated below plane of rostrum, dorsally and laterally minutely spinulate, apex acute, shorter than rostrum. Rostrum length about three-fourths length of eyestalks; 0.23 pcl; slender, sharply triangular, sparsely granulate dorsally.

Eyestalks strongly divergent (35° to median axis), margins subparallel for most of length, ventrally flattened, fused to carapace below rostral base but demarcation distinct; not reaching anteriorly to end of antennular peduncle article 1; dorsal surface acutely granulate, lateral and mesial margins spinulate; cornea apparently vestigial, not pigmented.

Epistome with acute granule mesial to base of antennule, otherwise smooth; with slender spine mesial to base of antenna.

Antennular peduncle 0.71 pcl (female); articles 1 and 2 minutely granulate; article 3 smooth. Antennal articles granulate or spinose.

Maxilliped 3 ischiobasis subquadrate, surface and margins sparsely granulate, with few acute granules or short spines; shallow longitudinal sublateral groove; ischium and basis demarcated by faint groove. Merus slightly shorter than ischium; length twice width (excluding spines); tapering distally to rounded apex; surface and margins spinulate. Dactylus, propodus and carpus spinulate. Exopod sparsely granulate, distally overreaching endopod merus.

Chelipeds (pereopod 1) equal in size and ornamentation, sparsely setose. Merus finely granulate, with few slender spines, longest distoventrally. Carpus granulate and with long, slender spines. Propodus palm surfaces with long, slender spines, longest along dorsal and ventral margins, extending onto pollex. Dactylus longer than dorsal palm length; proximal three-fourths spinose; outer surface with faint longitudinal carina, occlusal surfaces of dactylus and pollex crenulate, without gape when fingers closed.

Pereopods 2 and 3, sparsely setose, flexor and extensor margins spinose, other surfaces granulate, minutely spinose; longest spines on extensor margins of propodus and carpus; merus extensor and flexor margins with short spines dactylus broadly curved, sparsely and minutely spinose proximally, otherwise smooth, without distinct longitudinal rib. Pereopod 3 longest, merus 0.97 pcl (female); dactylus slightly shorter than combined length of propodus and carpus.

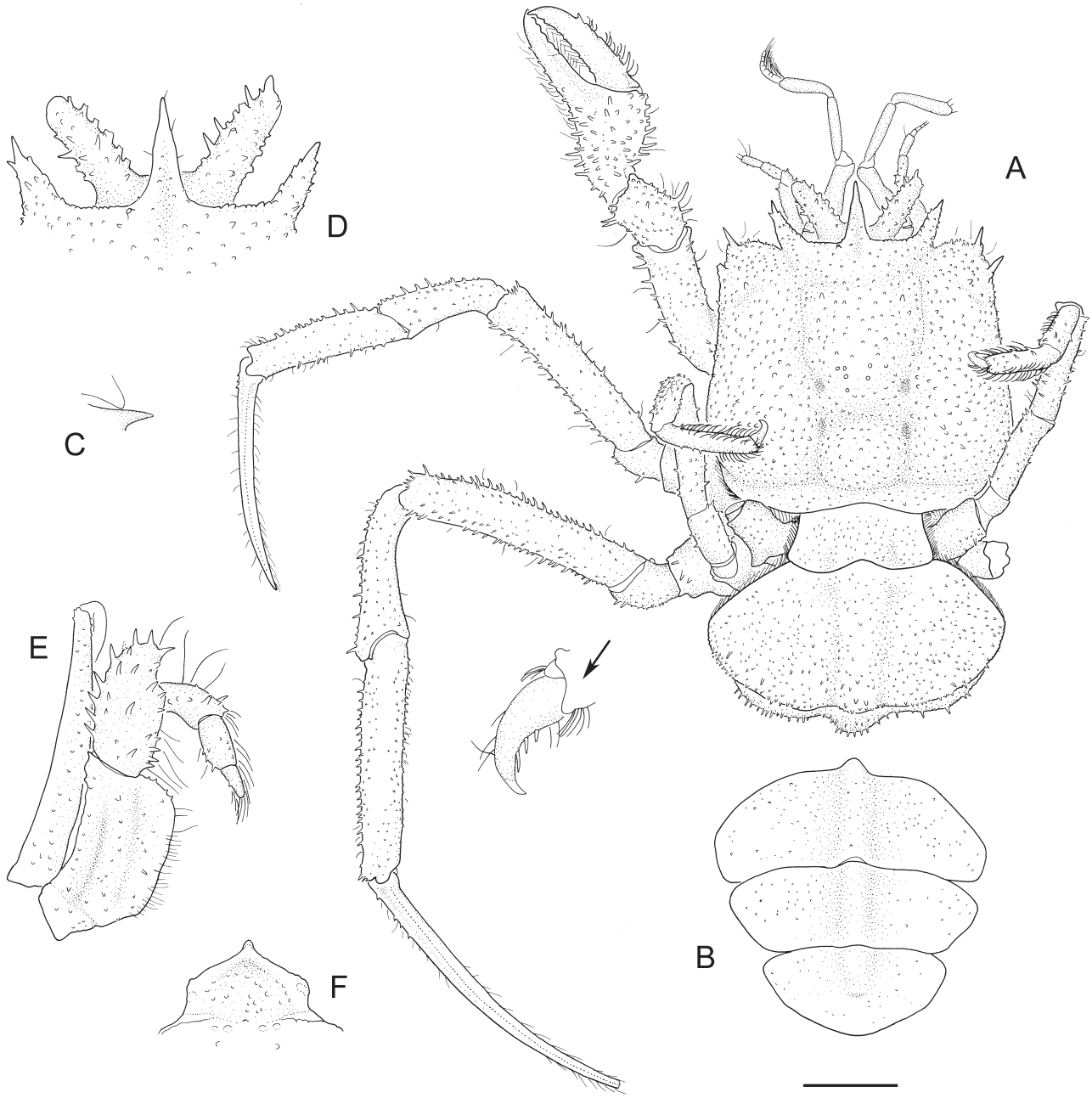

Figure 8. *Cymonomus brevis* sp. nov., female holotype, cl 3.9 mm, pcl 2.8 mm, cw 3.3 mm, Bay of Plenty, New Zealand, NIWA 76191. *(A)* dorsal habitus; *(B)* posterior abdomen; *(C)* right epistomial spine mesial to base of antenna; *(D)* fronto-orbital region; *(E)* right maxilliped 3; *(F)* thoracic sternite 3. Scale: A–B = 1.0 mm; C = 0.25 mm; C–F = 0.5 mm.

Pereopods 4 and 5 finely granulate, minutely spinose; longer than pereopod 3 merus (female); propodus distoextensor margin unarmed; dactylus markedly shorter than propodus, falcate, with corneous apex and 2 or 3 obliquely inclined, corneous spines on flexor margin; propodus setose. Pereopod 5 merus, when folded against carapace, reaching anterior 1/4 of carapace.

Thoracic sternite 3 pentagonal, width twice length; lateral margins subparallel; surface sparsely granulate. Margins of sternites 4 and 5 granulate.

Abdomen granulate and minutely spinose, most prominent on somites 2 and 3, very sparsely ornamented on somites 4 and 5. Pleotelson without trace of demarcation between somite 6 and telson; rounded, sparsely granulate or minutely spinose; margins straight to slightly convex; apex rounded; width 2.0 × length (female).

Etymology. Named *brevis*, Latin adjective for short, alluding to the single instead of bifid or trifid epistomial spine mesial to the base of the antenna and reduced carapace granulation relative to its morphologically and geographically nearest relative, *C. bathamae*.

Remarks. *Cymonomus brevis* sp. nov., a member of the *C. bathamae* group, is most closely related to *C. bathamae*. The new species differs from *C. bathamae* in having more sparsely distributed carapace granules (Fig. 8A), a single instead of bifid or trifid epistomial spine mesial to the base of the antenna (Fig. 8C), a more slender rostrum (Fig. 8D) (length exceeding, versus distinctly less than, twice basal width), proportionally longer pereopod 3 (Fig. 8A) (as long as pcl versus 0.87–0.93 pcl) and a proportionally broader telson (Fig. 8B). *Cymonomus brevis* sp. nov. might also mature at a smaller size than *C. bathamae*. The holotype

Figure 9. *Cymonomus brevis* sp. nov., distribution.

of *C. brevis* sp. nov. has an abdomen of fully mature form and appears to be "spent", whereas the smallest female *C. bathamae* (pcl 3.3 mm), despite being larger than the holotype of *C. brevis* (pcl 2.8 mm), has a proportionally narrower, "pre-spawning" abdomen (also cf Dell, 1971: fig. 4). The smallest known ovigerous female of *C. bathamae* measures 3.7 mm pcl (NIWA 68021).

Distribution. Known only from the Bay of Plenty, New Zealand (Fig. 9); 151 m.

Cymonomus clarki Ahyong, 2008

Figs 10, 11, 30B

Cymonomus clarki Ahyong, 2008: 13–14, fig. 2D, 6.—Webber *et al.*, 2010: 225.—Yaldwyn & Webber, 2011: 227.
Cymonomus soela.—Clark *et al.*, 2010: app. 1. [Not *C. soela* Ahyong & Brown, 2003]

Holotype: NIWA 29666, ovigerous female (cl 6.9 mm, pcl 5.9 mm, cw 6.6 mm), Graveyard Seamount, Chatham Rise, New Zealand, 42°45.91'S 179°59.26'W, 993–1090 m, coral rubble and rocks, TAN0604/16, RV *Tangaroa*, 29 May 2006. **Paratypes** (all New Zealand): NIWA 34965, 1 ovigerous female (cl 7.3 mm, pcl 6.4 mm, cw 7.1 mm), Ritchie Hill, Hawkes Bay, 39°29.44–28.51'S 178°25.05–25.48'E, 980–1000 m, KAH9907/37, 3 June 1999; NIWA 29663, 1 ovigerous female (cl 6.7 mm, pcl 5.9 mm, cw 6.6 mm), Ghoul Seamount, Chatham Rise, 42°47.85'S 179°59.26'E, 925–1054 m, coral rubble and rocks, TAN0604/118, RV *Tangaroa*, 7 June 2006.

Other material examined (all New Zealand). *Bay of Plenty*: NIWA 83182, 1 ovigerous female (cl 6.8 mm, pcl 5.7 mm, cw 6.3 mm), 37°31.72'S 177°17.82'E, 1190–1207 m, seamount sled, TAN1206/146, RV *Tangaroa*, 28 April 2012; NIWA 83183, 1 ovigerous female (cl 6.9 mm, pcl 5.8 mm, cw 6.4 mm), TAN1206/146.

Chatham Rise: NIWA 64202, 1 female (cl 8.4 mm, pcl 7.0 mm, cw 7.7 mm), 41°53.77–54.22'S 174°55.63–55.80'E, 913–948 m, TAN1004/134, RV *Tangaroa*, 27 April 2010; NIWA 24563, 1 ovigerous female (cl 6.3 mm, pcl 5.2 mm, cw 5.7 mm), 42°29.220'S 179°35.406'E, 975 m, beam trawl, TAN1208/57, RV *Tangaroa*, 24 June 2012; NIWA 53429, 1 ovigerous female (cl 6.3 mm, pcl 5.3 mm, cw 5.9 mm), 42°46.34–46.61'S 179°53.91–54.08'E, 1073–1100 m, TAN0905/68, RV *Tangaroa*, 22 June 2009; NIWA 31675, 2 ovigerous females (cl 6.8 mm, pcl 6.0 mm, cw 6.5 mm; cl 7.2 mm, pcl 6.2 mm, cw 6.4 mm), 1 spent female (cl 7.1 mm, pcl 6.2 mm, cw 6.7 mm), 42°47.23–47.16'S 176°42.66–43.32'W, 996–1009 m, TAN0705/163, RV *Tangaroa*, 16 April 2007; NIWA 87220, 1 male (cl 5.1 mm, pcl 4.1 mm, cw 4.2 mm), 1 ovigerous female (cl 7.8 mm, pcl 6.8 mm, cw 7.1 mm), 42°48.40–48.78'S 179°49.59–49.13'E, 1002–1005 m, TAN1208/58, RV *Tangaroa*, 24 June 2012.

Otago: NIWA 96702, 1 juvenile male (damaged, cl 4.0 mm, pcl 3.3 mm), E of Karitane, 45°38.46'S 171°30.60'E, 1117 m, box core, TAN1310 Caraval FF2, RV *Tangaroa*, coll. Anadarko Petroleum Corporation, 2013.

Description. Carapace quadrate, almost square, lateral margins subparallel; regions indistinct; cervical groove indistinct, slightly more pronounced in males than females; lower pterygostomian region swollen; anterior and anterolateral surfaces with long, fine, wiry setae, other surfaces with short fine setae. Anterolateral spine prominent, slender conical, directed anteriorly; 1 or 2 smaller spines on lateral margin behind anterolateral spine. Dorsal and lateral surfaces entirely covered with minute rounded granules, with granules becoming slightly larger and more elongate anterolaterally, bluntly conical, not globose. Fronto-orbital margin (excluding rostrum and outer-orbital processes) at most slightly advanced beyond anterolateral margins; 0.6 anterior carapace width; outer orbital processes slender, elongate, directed anteriorly, situated below plane of rostrum, laterally spinulate, with acute apices, as long as or slight shorter than rostrum. Rostrum about half-length of eyestalks or slightly less; 0.13–0.27 pcl; slender, tapering to acute apex, minutely granulate dorsally and laterally.

Eyestalks divergent (25–30° from median axis), gently tapering, slender, flattened, minutely granulate dorsally, margins acutely granulate, fused to carapace below rostral base but demarcation distinct, reaching anteriorly to end of antennular peduncle article 1; cornea apparently vestigial, not pigmented.

Epistome with small cluster of granules at base of rostrum and blunt tubercle mesial to base of antennules, otherwise smooth; small spine mesial to base of antenna.

Antennular peduncle 1.16 pcl (male) (0.86 juvenile male), 0.72–0.85 pcl (female); articles 1 and 2 minutely granulate; article 3 smooth. Antennal articles irregularly granulate.

Maxilliped 3 ischiobasis subquadrate, sparsely granulate; longitudinal sublateral groove; ischium and basis demarcated by faint groove. Merus slightly longer than ischium, length about 2.5 × width, tapering distally to rounded apex; surface and margins with short, slender spines. Dactylus unarmed; propodus and carpus sparsely spinulate. Exopod granulate, reaching beyond carpo-meral articulation but not reaching end of merus of endopod.

Chelipeds (pereopod 1) equal in size and ornamentation, distinctly setose. Merus finely granulate. Carpus granulate, dorsal margin with slender spines. Palm surfaces with fine granules and few scattered acute granules, more prominent on dorsal margin but none produced to spines. Dactylus longer than dorsal palm length; proximal half with scattered granules; with faint longitudinal carina on outer surface, occlusal surfaces of dactylus and pollex crenulate, with slight gape when fingers closed.

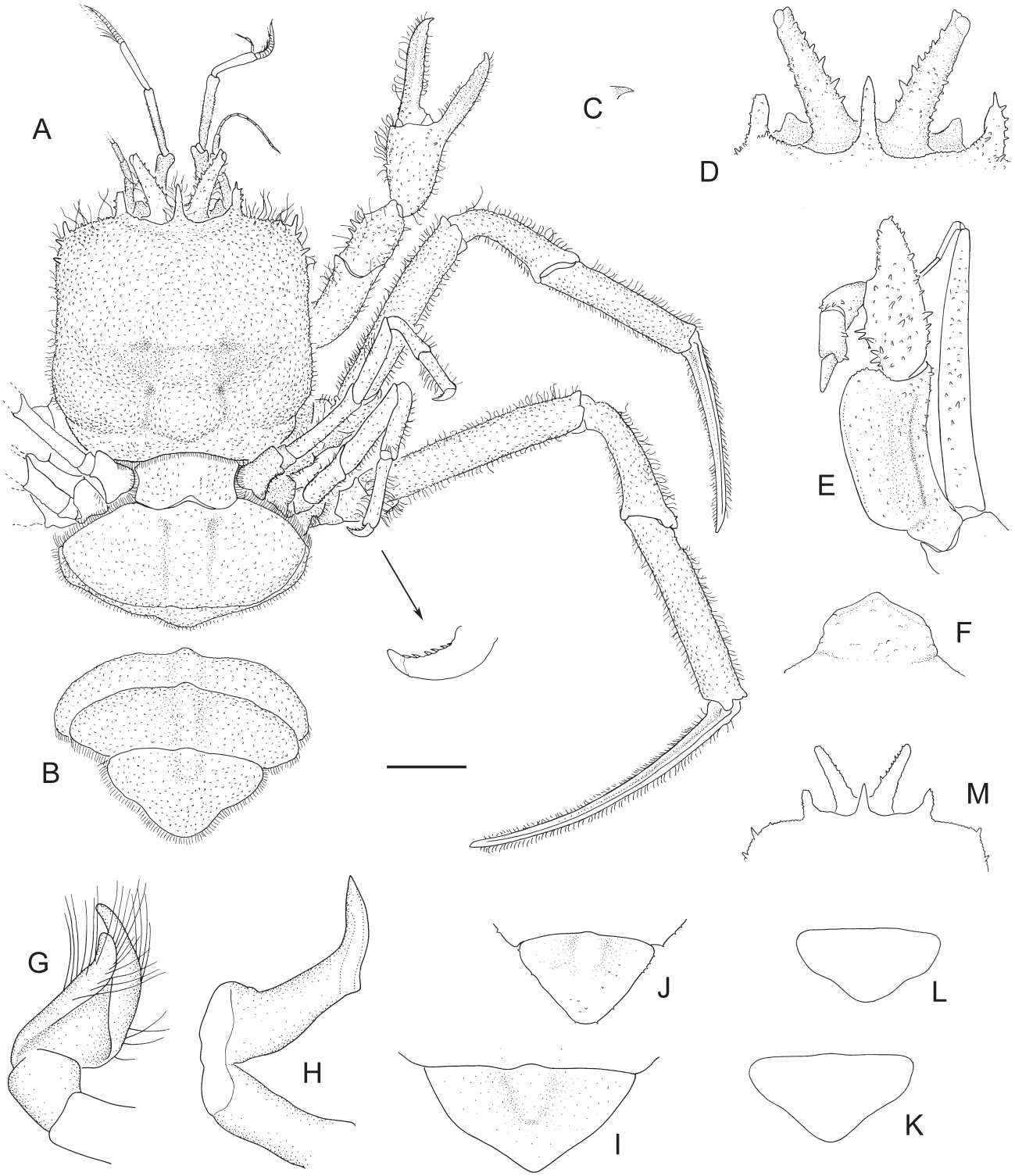

Figure 10. *Cymonomus clarki* Ahyong, 2008. *(A–F)* ovigerous female holotype, cl 6.9 mm, pcl 5.9 mm, cw 6.6 mm, Chatham Rise, New Zealand, NIWA 29666. *(G–I)* male, cl 5.1 mm, pcl 4.1 mm, cw 4.2 mm, NIWA 87220. *(J)* juvenile male (damaged), cl 4.0 mm, pcl 3.3 mm, E of Karitane, New Zealand, NIWA 96702. *(K)* spent female, cl 7.1 mm, pcl 6.2 mm, cw 6.7 mm, Chatham Rise, New Zealand, NIWA 31675. *(L–M)* ovigerous female paratype, cl 6.7 mm, pcl 5.9 mm, cw 6.6 mm, Chatham Rise, New Zealand, NIWA 29663. *(A)* dorsal habitus; *(B)* posterior abdomen; *(C)* right epistomial spine mesial to base of antenna; *(D)* fronto-orbital region; *(E)* left maxilliped 3; *(F)* thoracic sternite 3; *(G)* right G1, abdominal view; *(H)* right G2, abdominal view; *(I–L)* pleotelson; *(M)* anterior carapace outline. Scale: A, B, K–M = 2.0 mm; C–F = 1.0 mm; G–J = 0.5 mm.

Pereopods 2 and 3 distinctly setose; all articles except for dactylus finely granulate; dactylus broadly curved, smooth, with longitudinal rib. Pereopod 3 longest, merus 1.35 pcl (male) (1.13 juvenile male), 1.03–1.08 (female); dactylus slightly shorter than combined length of propodus and carpus.

Pereopods 4 and 5 granulate, setose; longer than pereopod 3 merus in both sexes; propodus distoextensor margin unarmed; dactylus markedly shorter than propodus, falcate, with corneous apex and 4–6 obliquely inclined, corneous spines on flexor margin. Pereopod 5 merus, when folded

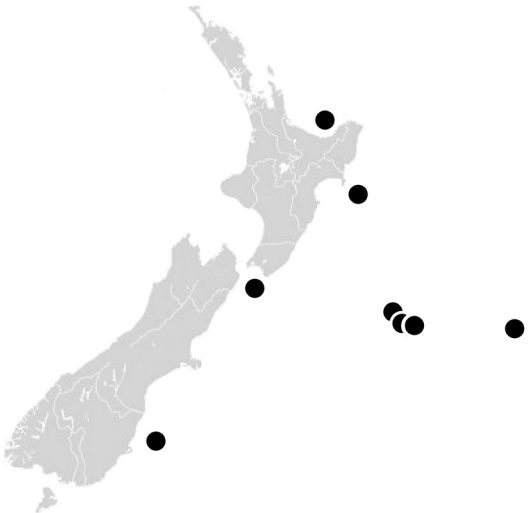

Figure 11. *Cymonomus clarki* Ahyong, 2008, distribution.

against carapace, reaching anterior 1/4 of carapace.

Thoracic sternite 3 pentagonal, about 1.5 × wider than long; lateral margins divergent posteriorly; surface sparsely granulate. Margins of sternites 4 and 5 granulate.

Abdomen surface finely granulate. Pleotelson without trace of demarcation between somite 6 and telson; in juveniles males, narrowly triangular; in adult males, broadly subpentagonal, distolateral margin straight, apex obtuse, bluntly angular, width twice length; in females, broadly triangular, distolateral margin concave, apex obtuse rounded, width 1.8–1.9 × length.

Gonopod 1 distal article cannulate, forming copulatory tube, with moderately long distal setae. Gonopod 2 with articles fused; distomesial margin slightly hollowed, apex acute.

Egg diameter 1.20–1.49 mm.

Remarks. *Cymonomus clarki*, a member of the *C. soela* group, most closely resembles *C. menziesi*, from Peru and Chile, in the proportionally elongate pereopod 5, in which the merus reaches to the anterior one-third of the carapace (Fig. 10A) (versus merus not reaching beyond the carapace midlength). *Cymonomus menziesi*, however, lacks the setose anterolateral carapace margins of *C. clarki* and has more strongly divergent eyestalks — about 30° from the midline in *C. clarki* (Fig. 10A, D, M) versus about 45° in *C. menziesi* (see Garth & Haig, 1971: pl. 1; Guzman, 2003: fig. 1). Overall, *C. clarki* appears to be the most setose member of the *C. soela* group, having long, fine setae over the surface of the chelipeds and walking legs (Fig. 10A) (versus very sparse setae in other members of the group). Of the regional species of the *C. soela* group, *C. clarki* is most similar to *C. dianae*, sharing similarly slender eyestalks and setose anterolateral carapace margins (Figs 10D, 16D) (versus comparatively thick eyestalks and almost glabrous anterolateral carapace margins in *C. soela* and *C. tesseris*; Fig. 24A, 26D). The granulose (Fig. 10A) rather than nearly smooth (Fig. 16A) outer surface of the cheliped palm will separate *C. clarki* from *C. dianae*.

Specimens of *C. clarki* are largely uniform. The margins of the female pleotelson are usually distinctly concave (Fig. 10B, L), occasionally only weakly concave (Fig. 10K), and the fronto-orbital margin may be slightly advanced ahead of the anterolateral margins (Fig. 10M). As in other congeners, the walking legs and antennular peduncle of *C. clarki* are proportionally longer in males. The juvenile male substantially resembles the adult male, differing in aspects related to its immaturity: incompletely developed gonopods, a proportionally narrower, more triangular pleotelson (Fig. 10J), and proportionally shorter antennular peduncles and walking legs than in the adult male (0.86 vs 1.16; 1.13 vs 1.35). All females examined are mature; the smallest female (NIWA 24563) is ovigerous. Of the two males examined (NIWA 87220, pcl 4.1 mm; NIWA 96702, pcl 3.3 mm), the smaller is a juvenile, suggesting that males become mature near 4 mm pcl.

Cymonomus clarki is the most widely distributed species of the genus in New Zealand, ranging from the Bay of Plenty south to Otago. It was collected together with the atelecyclid crab, *Trichopeltarion janetae* Ahyong, 2008, on Ghoul Seamount, Chatham Rise (Ahyong 2008).

Distribution. Eastern New Zealand, from seamounts on the southern Kermadec Ridge (Bay of Plenty), northern Chatham Rise, and off Otago (Fig. 11); 913–1207 m.

Cymonomus confinis sp. nov.

http://zoobank.org/NomenclaturalActs/37AFC73F-4124-4327-8EDB-59C5806C3DAB

Figs 12, 13

Holotype: NMV J52177, male (cl 3.2 mm, pcl 2.7 mm, cw 2.9 mm), Great Australian Bight, South Australia, Australia, 33°15.87'S 130°37.83'E, Yvonne Bone sled, 139 m, SS10/00/334, RV *Southern Surveyor*, 9 May 2000.

Description of holotype. Carapace quadrate, almost square, lateral margins weakly divergent posteriorly; regions weakly indicated, cervical groove weakly indicated; lower pterygostomian region swollen; anterior and anterolateral surfaces with few long, fine setae, other surfaces sparsely setose. Anterolateral spine prominent, directed anteriorly; smaller spine on lateral margin behind anterolateral spine. Anterior carapace margin mesial to the anterolateral spine sloping posteriorly towards midline, with short spinules, acute granules. Dorsal and lateral surfaces densely covered with minute granules; few, scattered spinules anteriorly. Fronto-orbital margin (excluding rostrum and lateral projections) advanced beyond anterolateral margins; 0.6 anterior carapace width; outer orbital processes sharply triangular, elongate, divergent, directed anterolaterally, situated below plane of rostrum, dorsally and laterally granulate, few spinules, apex acute, shorter than rostrum. Rostrum length about two-thirds length of eyestalks; 0.17 pcl; slender, triangular, sparsely granulate dorsally and laterally.

Eyestalks weakly divergent (18° to median axis), strongly tapering, ventrally flattened, fused to carapace below rostral base but demarcation distinct; reaching anteriorly to distal ¾ of antennular peduncle article 1; dorsal surface sparsely granulate, lateral and mesial margins weakly spinulate; cornea apparently vestigial, not pigmented.

Epistome with tubercle at base of rostrum and tubercle mesial to base of antennules; with slender spine mesial to base of antenna.

Antennular peduncle 0.75 pcl (male); articles 1 and 2 minutely granulate; article 3 smooth. Antennal articles granulate or spinose.

Maxilliped 3 ischiobasis subquadrate, surface and margins sparsely granulate, with few acute granules or short spines; shallow longitudinal sublateral groove; ischium and basis

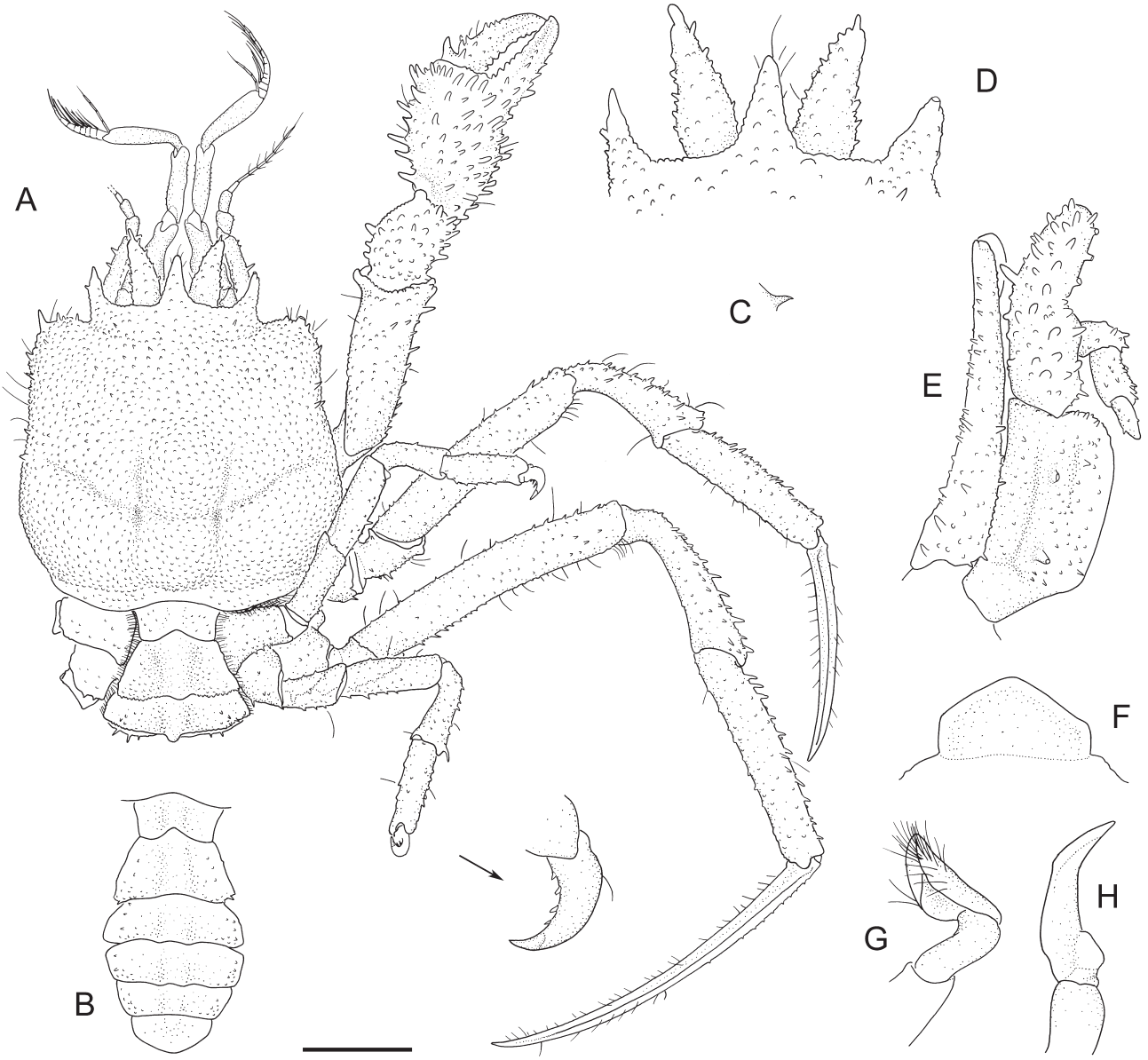

Figure 12. *Cymonomus confinis* sp. nov., male holotype, cl 3.2 mm, pcl 2.7 mm, cw 2.9 mm, Great Australian Bight, South Australia, NMV J52177. *(A)* dorsal habitus; *(B)* abdomen; *(C)* right epistomial spine mesial to base of antenna; *(D)* fronto-orbital region; *(E)* right maxilliped 3; *(F)* thoracic sternite 3; *(G)* left G1, abdominal view; *(H)* left G2, abdominal view. Scale: A–B = 1.0; C–H = 0.5 mm.

demarcated by faint groove. Merus longer than ischium, as long as ischiomerus; length 2.9 × width (excluding spines); tapering distally to rounded apex; surface and margins bluntly spinulate. Dactylus, propodus and carpus granulate or spinulate. Exopod granulate, spinulate, not distally reaching 2/3 length of endopod merus.

Chelipeds (pereopod 1) equal in size and ornamentation, sparsely setose, almost glabrous. Merus finely granulate, with few short distal and ventral spines. Carpus granulate, spinose, spines slender, conical to allantoid. Propodus palm surfaces and margins with numerous long, blunt, allantoid spines, few conical spines, extending onto pollex. Dactylus as long as dorsal palm length; proximal two-thirds spinose; outer surface with faint longitudinal carina, sparsely granulate, occlusal surfaces of dactylus and pollex crenulate, slight gape when fingers closed.

Pereopods 2 and 3, sparsely setose, flexor and extensor margins granulate and spinose, other surfaces sparsely granulate; longest spines on extensor margins and dorsal surfaces of propodus and carpus; merus extensor and flexor margins with short spines; dactylus broadly curved, sparsely and minutely spinulate proximally, otherwise smooth, with distinct longitudinal rib. Pereopod 3 longest, merus as long as carapace, 1.00 pcl (male); dactylus shorter than combined length of propodus and carpus.

Pereopods 4 and 5 finely granulate, sparsely spinose; longer than pereopod 3 merus (male); propodus distoextensor margin unarmed; dactylus markedly shorter than propodus, falcate, with corneous apex and 4 obliquely inclined, corneous spines on flexor margin. Pereopod 5 merus, when folded against carapace, reaching midlength of carapace.

Thoracic sternite 3 pentagonal, width twice length; lateral proximal margins parallel; surface unadorned. Margins of sternites 4 and 5 granulate.

Abdomen very sparsely granulate, minutely spinose on lateral surfaces. Pleotelson without trace of demarcation

between somite 6 and telson; semi-ovate, unadorned; apex broadly rounded; width 2.1 × length (male).

Gonopod 1 distal article cannulate, forming copulatory tube, apex slightly fluted, with moderately long distal setae. Gonopod 2 with articles fused; distomesial margin slightly hollowed, apex acute.

Etymology. From the Latin adjective, *confinis,* neighbouring, alluding to the Australian occurrence of the new species, adjacent to its close New Zealand relative, *C. bathamae*.

Remarks. *Cymonomus confinis* sp. nov., a member of the *C. bathamae* species group, is closest to *C. brevis* sp. nov. and *C. bathamae* Dell, 1971, from New Zealand, differing from both in the weakly tapering eyestalks with outer margins subparallel for most of their length (Fig. 12D) (versus strongly divergent; Figs 6D, 8D), shorter maxilliped 3 exopod (Fig. 12E) (reaching to the distal three-fourths, rather than distinctly overreaching the merus; Figs 6E, 8E) and shorter pereopod 5 (merus reaching anteriorly to the midlength, rather than to the anterior one-third of the carapace; Fig. 12A versus Fig. 8A). Other distinctions between the regional members of the *C. bathamae* species group are outlined under the account of *C. espinosus*.

Distribution. Presently known only the Great Australian Bight, South Australia (Fig. 13); 139 m.

Figure 13. *Cymonomus confinis* sp. nov., distribution.

Cymonomus delli Griffin & Brown, 1976

Figs 14, 15, 30C

Cymonomus delli Griffin & Brown, 1976: 251–252, figs 4, 5 [type locality: off Sydney, Australia].—Tavares, 1993a: 141; 1993b: 258.—Poore, 2004: 318, fig. 93c.—MacIntosh *et al.*, 2018: 15.

Cymonomoides delli.—Ahyong & Brown, 2003: 1372.—Ng *et al.*, 2008: 32.

Cymonomus andamanicus.—Poore *et al.*, 2008: 36.—McEnnulty *et al.*, 2011: app. 1. [Not *C. andamanicus* Alcock, 1905].

Cymonomus sp. 1.—Currie & Sorokin, 2011: app. 1.

Holotype: AM P19379, female (cl 8.6 mm, pcl 7.9 mm, cw 8.3 mm), off Sydney, New South Wales, Australia, 33°51–45'S 151°51–55'E, 675 m, trawl, FRV *Kapala*, 19 October 1972.

Other material examined. *South Australia*: SAM C7657, 1 ovigerous female (cl 8.5 mm, pcl 7.6 mm, cw 8.3 mm), Great Australian Bight, 33°27.096'S 130°41.190'E, 500 m, trawl, SS010_T02 BPZ-500, RV *Southern Surveyor*, coll. D. Currie, 15 August 2010; AM P102703, 2 males (cl 5.9 mm, pcl 5.3 mm, cw 5.3 mm to cl 6.2 mm, pcl 5.5 mm, cw 5.4 mm), 3 ovigerous females (cl 7.8 mm, pcl 7.2 mm, cw 7.8 mm to cl 8.2 mm, pcl 7.5 mm, cw 7.9 mm), 2 females (cl 7.6 mm, pcl 6.6 mm, cw 7.1 mm to cl 7.9 mm, pcl 7.0 mm, cw 7.7 mm; both with rhizocephalan parasite), 33°29.286–29.544'S 131°04.44–03.72'E, 373.6–391.6 m, beam trawl, IN2015_C02_186_135 & 136, RV *Investigator*, 7 December 2015; AM P103089, 1 male (cl 6.4 mm, pcl 5.7 mm, cw 5.7 mm), 2 ovigerous females (cl 7.3 mm, pcl 6.5 mm, cw 7.1 mm to cl 8.0 mm, pcl 7.2 mm, cw 7.9 mm), 35°02.568–02.268'S 134°04.740–03.960'E, 366.8–409.4 m, beam trawl, IN2015_C02_126_127, RV *Investigator*, 4 December 2015; SAM C12920, 1 ovigerous female (cl 8.2 mm, pcl 7.2 mm, cw 8.0 mm), 33°22.866–22.998'S 130°15.360–15.06'E, 420.7–430.6 m, beam trawl, IN2015_C02_389_142, RV *Investigator*, 15 December 2015.

Western Australia: NMV J53919, 1 ovigerous female (cl 9.0 mm, pcl 8.2 mm, cw 8.9 mm), Jurien Bay, 29°50.52–51.02'S 114°21.72–22.02'E, 408–427 m, SS10/2005 080, RV *Southern Surveyor*, coll. G. Poore, 1 May 2006.

Description. Carapace quadrate, almost square, lateral margins subparallel; regions weakly indicated; lower pterygostomian region swollen; surfaces sparsely setose; carapace slightly more inflated in females than males. Anterolateral spine short, conical; with 1 or 2 small anteriorly directed spines on lateral margin behind anterolateral spine. Dorsal and lateral surfaces entirely covered with minute granules, granules becoming larger and more elongate anterolaterally. Fronto-orbital margin (excluding rostrum and lateral projections) advanced slightly beyond anterolateral margins; 0.5–0.6 anterior carapace width; outer orbital processes pointed, directed anteriorly, triangular in lateral view, situated below plane of rostrum, laterally with acute granules, small spines, reaching midlength of rostrum. Rostrum small, about half-length of eyestalks; 0.08–0.14 pcl; triangular, apex acute, margins concave, minutely granulate laterally and dorsally.

Eyestalks strongly divergent (about 30° to median axis), flattened, stout, width at midlength exceeding one-third length, fused to carapace below rostral base but demarcated from frontal margin; reaching anteriorly beyond midlength

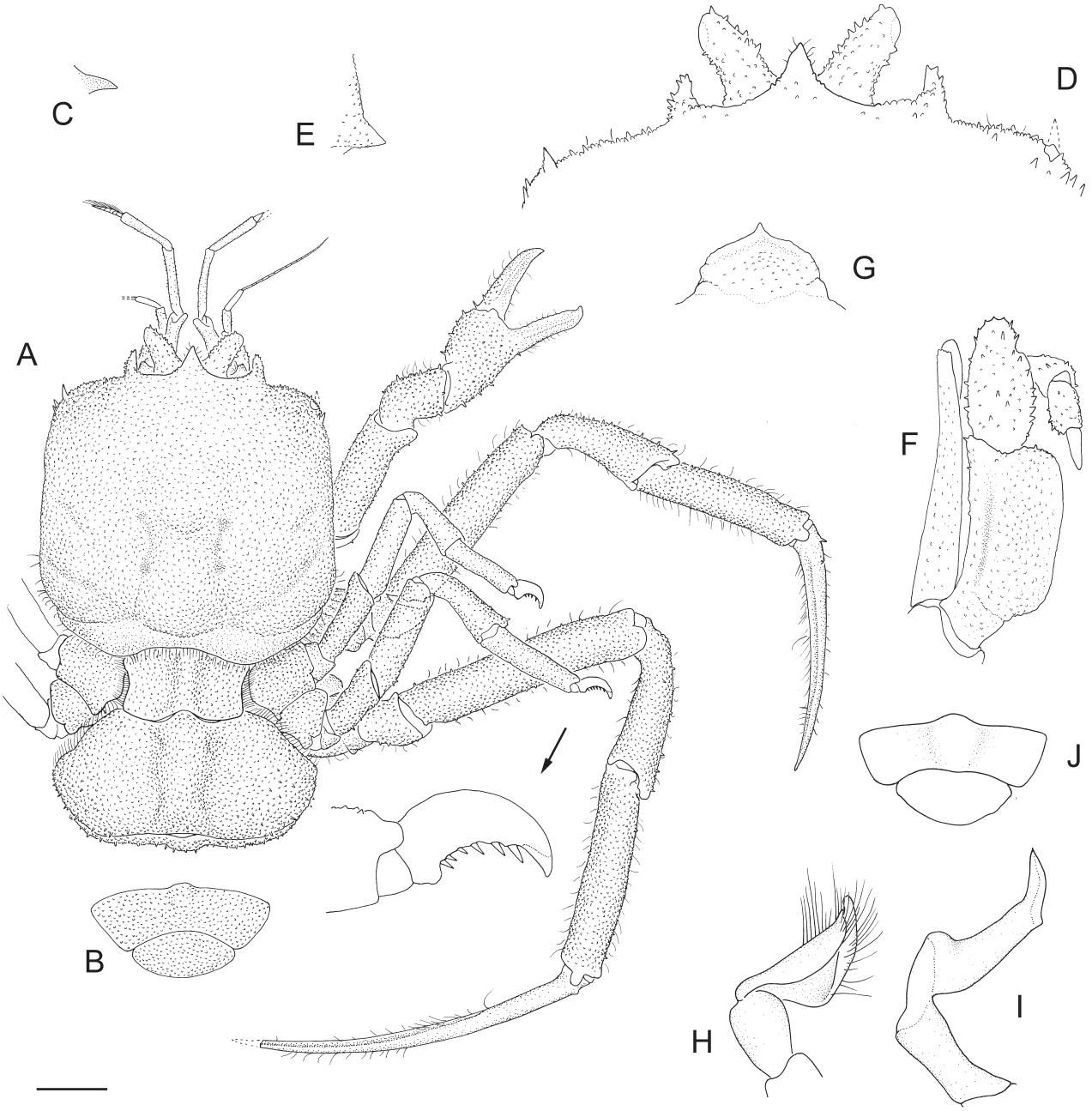

Figure 14. *Cymonomus delli* Griffin & Brown, 1976. *(A–G)* female holotype, cl 8.7 mm, pcl 7.9 mm, cw 8.3 mm, off Sydney, New South Wales, AM P19379. *(H–J)* male, cl 6.4 mm, pcl 5.7 mm, cw 5.7 mm, Great Australian Bight, South Australia, AM P103089. *(A)* dorsal habitus; *(B, J, L)* pleotelson; *(E)* right epistomial spine mesial to base of antenna; *(D, K)* anterior carapace; *(E)* right outer-orbital process, lateral view; *(F)* right maxilliped 3; *(G)* thoracic sternite 3; *(H)* right G1, abdominal view; *(I)* right G2, abdominal view. Scale: A–B = 2.0 mm; C = 0.5 mm; D–J = 1.0 mm.

of antennular peduncle article 1; dorsal surface minutely granulate, lateral and mesial margins weakly spinulate; cornea apparently vestigial, not pigmented.

Epistome surface granulate, small tubercle at base of rostrum and tubercle mesial to base of antennule; small spine mesial to base of antenna.

Antennular peduncle 0.90–0.92 pcl (male), 0.68–0.75 pcl (female); articles minutely granulate. Antennal articles 1–4 irregularly granulate or minutely spinular; article 5 minutely granulate.

Maxilliped 3 ischiobasis subquadrate, granulate and minutely spinular distally; longitudinal sublateral groove; ischium and basis demarcated by faint groove. Merus shorter than ischium; length twice width, tapering distally to rounded apex; surface and margins spinulate. Dactylus unarmed. Propodus and carpus sparsely spinulate. Exopod surface granulate; apex reaching to or slightly beyond carpo-meral articulation but not reaching beyond end of endopod merus.

Chelipeds (pereopod 1) equal in size and ornamentation, sparsely setose. Merus finely granulate, scattered small spines. Carpus finely granulate, dorsal margin with few short spines. Propodus palm surfaces with fine granules and few scattered acute granules, dorsal and ventral margins irregularly spinulate. Dactylus longer than dorsal palm length; proximal dorsal two-thirds with spines and granules; with faint longitudinal carina on outer surface, occlusal

Figure 15. Distribution of *Cymonomus delli* Griffin & Brown, 1976.

surfaces of dactylus and pollex crenulate, without gape when fingers closed.

Pereopods 2 and 3 sparsely setose; all articles finely granulate; propodus, carpus and merus with serrated granules and scattered spinules on extensor margins; dactylus broadly curved, few granules or small spines proximally, with longitudinal rib, though slightly less distinct proximally; setose. Pereopod 3 longest; merus 1.04–1.08 pcl (male), 0.87–0.96 pcl (female); dactylus about as long as combined length of propodus and carpus.

Pereopods 4 and 5 minutely granulate, sparsely setose; longer than pereopod 3 merus in both sexes; propodus distoextensor margin unarmed; dactylus markedly shorter than propodus, falcate, with corneous apex and 4–6 obliquely inclined, corneous spines on flexor margin. Pereopod 5 merus, when folded against carapace, reaching anterior one-third of carapace.

Thoracic sternite 3 pentagonal, 1.7–1.8 × wider than long; lateral margins divergent posteriorly, surface granulate. Margins of sternites 4 and 5 granulate.

Abdomen with margins and surface finely granulate or minutely spinulate. Pleotelson without somite 6 and telson clearly demarcated by well-defined transverse groove in both sexes; telson broadly rounded, smaller in males than in females but shape and proportions similar in both sexes, width about twice length.

Gonopod 1 with 3 articles; distal article cannulate, forming copulatory tube, with long distal setae. Gonopod 2 with articles fused, distomesial margin slightly hollowed, apex acute.

Egg diameter 0.93–1.40 mm.

Remarks. *Cymonomus delli* Griffin & Brown, 1976, long known only from the female holotype collected off Sydney, southeastern Australia, is now known from Tasmania, South Australia and southwest Western Australia as result of several CSIRO expeditions off southern Australia (MacIntosh *et al.*, 2018). Most records of *C delli* are from the upper slope near the shelf-break (c. 400 m) although it has been recorded to 675 m. Like its congeners, sexual dimorphism in *C. delli* is evident in the proportionally longer walking legs and antennules of males. All examined specimens appear to be mature, and the smallest recorded female is ovigerous at pcl 6.5 mm. Two specimens of *C. delli* (AM P102703) from the Great Australian Bight are infected by rhizocephalan parasites.

Distinctions between species of the *C. delli* group are primarily morphometric. In *C. delli*, the fronto-orbital width (as a proportion of the distance between anterolateral carapace spines) is comparatively narrow (0.49–0.58; mean 0.54) relative to other species in the *C. delli* group (0.58 or greater, usually > 0.60). Within the group, *C. delli* is closest to *C. cognatus* from East Asia and *C. andamanicus* from the Andaman Sea, sharing similar walking leg morphometrics. From *C. cognatus*, *C. delli* differs in having proportionally shorter antennules (0.89–0.92 pcl in males and 0.69–0.78 pcl in females versus 0.98–1.00 pcl in males and 0.80–0.88 pcl in females), and a distally wider maxilliped 3 ischiomerus. The portion of the maxilliped 3 ischiomerus distal to the palp articulation is as long as wide in *C. delli* but longer than wide in *C. cognatus*.

Cymonomus delli is difficult to distinguish from *C. andamanicus*, which, unfortunately, is known only from the description and figures of the male holotype (Alcock, 1905; Alcock *et al.*, 1907: pl. 79 figs 2, 2a, b). *Cymonomus delli* appears to differ from *C. andamanicus* in the proportionally narrower fronto-orbital width (<0.60 versus 0.66) and subparallel versus posteriorly divergent lateral carapace margins (cf Alcock *et al.*, 1907: pl. 79 fig. 2a). Accordingly, the previous record of *C. andamanicus* Alcock, 1905, from southern Western Australia (Poore *et al.*, 2008) corresponds to *C. delli*. Nevertheless, the currently recognized distinctions between *C. andamanicus* and *C. delli* rely on the accuracy of Alcock's account and figures, and it is conceivable that the two nominal species could be conspecific. A redescription of *C. andamanicus* is required.

Distribution. Southern Australia, from New South Wales (off Sydney), the Great Australian Bight and Jurien Bay, Western Australia (Fig. 15); 367–675 m, usually about 400 m.

Cymonomus dianae sp. nov.

http://zoobank.org/NomenclaturalActs/5AC1C3A8-6A5D-4272-A3AD-C120296D2E60

Figs 16, 17, 30D

Cymonomus quadratus valdiviae.—Ihle, 1916: 121–124, fig. 67. [Not *C. valdiviae* Lankester, 1903]

Cymonomus sp. MoV 5001.—Poore *et al.*, 2008: 36 (part).—McEnnulty *et al.*, 2011: app. 1.

Holotype: NMV J58733, ovigerous female (cl 6.4 mm, pcl 5.3 mm, cw 6.1 mm), Mermaid L24 transect, Western Australia, Australia, 16°38.06–38.76'S 119°09.21–08.03'E, 987–990 m, SS05/2007/068, RV Southern Surveyor, 17 June 2007 (Aq.#037, "*Cymonomus* sp. MoV5001"). **Paratypes**: NMV J58734, 3 males (cl 5.2 mm, pcl 4.3 mm, cw 4.5 mm to cl 6.0 mm, pcl 5.0 mm, cw 5.4 mm), Leveque L27 transect, Western Australia, Australia, 14°33.06–33.58'S 121°15.36–16.58'E, 1021–1023 m, SS05/2007/155, RV Southern Surveyor, 4 July 2007 (Aq.#035, "*Cymonomus* sp. 2").

Other material examined. *Western Australia*: NMV J53916, 5 males (cl 6.3 mm, pcl 5.3 mm, cw 5.8 mm to cl 6.8 mm, pcl 5.7 mm, cw 6.1 mm), 1 ovigerous female (cl 7.1 mm, pcl 5.8 mm, cw 6.6 mm), 3 spent females (cl 6.7 mm, pcl 5.4 mm, cw 6.4 mm to cl 7.4 mm, pcl 6.1 mm, cw 7.1 mm), Perth Canyon, 31°58.283–57.317'S 115°06.000–06.833'E, 848–1050 m, beam trawl, SS10/2005/071, RV Southern Surveyor, coll. R. Wilson, 29 November 2005.

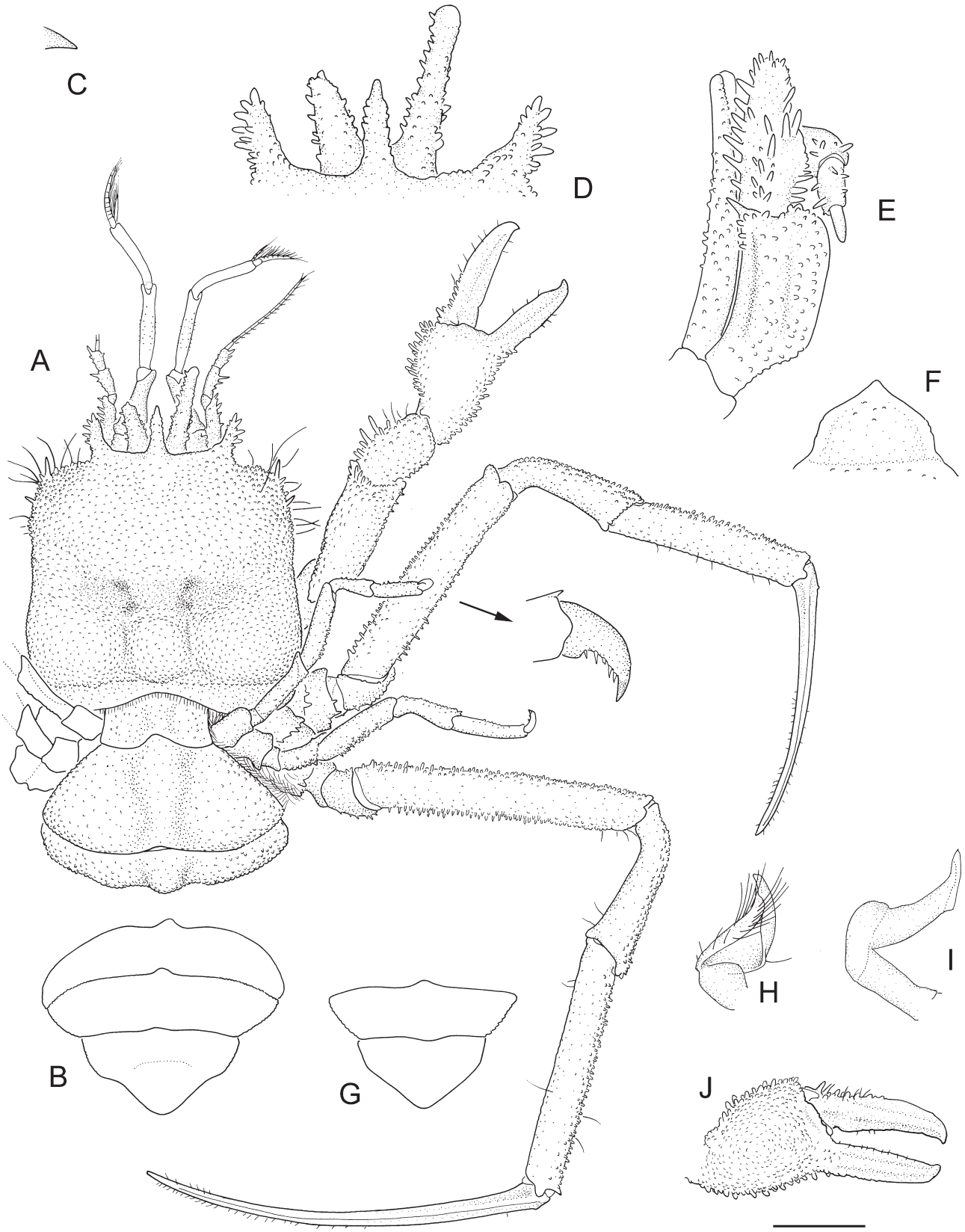

Figure 16. *(A–F) Cymonomus dianae* sp. nov., ovigerous female holotype, cl 6.4 mm, pcl 5.3 mm, cw 6.1 mm, Mermaid L24 transect, Western Australia, NMV J58733. *(G–I) Cymonomus dianae* sp. nov., male paratype, cl 6.4 mm, pcl 5.4 mm, cw 5.8 mm, Perth Canyon, Western Australia, NMV J53916. *(J) Cymonomus deforgesi* Ahyong & Ng, 2009, male, cl 6.4 mm, pcl 5.5 mm, cw 6.0 mm, Dongsha Islands, South China Sea, ZRC 2017.0107. *(A)* dorsal habitus; *(B)* posterior abdomen; *(C)* fronto-orbital region; *(D)* right epistomial spine mesial to base of antenna; *(E)* right maxilliped 3; *(F)* thoracic sternite 3; *(G)* abdominal somite 5 and pleotelson; *(H)* right G1, abdominal view; *(I)* right G2, abdominal view; *(J)* right chela. Scale: A–B, J = 2.0 mm; C = 0.5 mm; D–I = 1.0 mm.

Description. Carapace quadrate, almost square, lateral margins slightly divergent; regions indistinct, cervical groove deeper, distinctly more pronounced in males than females, broadly V-shaped; lower pterygostomian region swollen; anterior and anterolateral surfaces with long, fine, wiry setae, other surfaces with sparse, short fine setae. Anterolateral spine prominent, slender conical, directed anteriorly; 1 or 2 smaller spines on lateral margin behind anterolateral spine. Dorsal and lateral surfaces entirely covered with minute rounded granules, with granules becoming slightly larger and more elongate anterolaterally, bluntly conical, not globose. Fronto-orbital margin (excluding rostrum and outer-orbital processes) advanced beyond anterolateral margins, more pronounced in males than females; 0.6 anterior carapace width; outer orbital processes slender, elongate, directed anteriorly, situated below plane of rostrum, laterally spinulate, with acute apices, as long as or slight shorter than rostrum. Rostrum about half-length of eyestalks; 0.16–0.24 pcl; slender, tapering to acute apex, granulate dorsally and laterally.

Eyestalks divergent (17– 22° from median axis), margins subparallel for most of length, slender, flattened, minutely granulate dorsally, margins acutely granulate, fused to carapace below rostral base but demarcation distinct, extending anteriorly to slightly short of to slightly beyond antennular peduncle article 1; cornea apparently vestigial, not pigmented.

Epistome with cluster of granules at base of rostrum and blunt, elongated compound tubercle mesial to base of antennules, otherwise smooth; small spine mesial to base of antenna.

Antennular peduncle 1.08–1.21 pcl (male), 0.88–0.93 pcl (female); article 1 granular, often with small spines distally; article 2 minutely granulate; article 3 smooth. Antennal articles irregularly granulate, laterally spinular.

Maxilliped 3 ischiobasis subquadrate, sparsely granulate; longitudinal sublateral groove; ischium and basis demarcated by faint groove. Merus as long as ischium, length about 2.5 × width, tapering distally to rounded apex; surface and margins with slender spines. Dactylus unarmed; propodus and carpus spinulate. Exopod granulate, reaching beyond carpo-meral articulation but not reaching end of merus of endopod.

Chelipeds (pereopod 1) equal in size and ornamentation, sparsely setose. Merus finely granulate, distally sparsely spinulate. Carpus granulate, dorsal margin with slender, allantoid spines. Propodus palm central surface smooth (at most microscopically granulate, granules considerably smaller than granules at periphery), dorsal and ventral margins with distinct granules, conical and allantoid spines. Dactylus longer than dorsal palm length; proximal dorsal half with few small blunt spines; with faint longitudinal carina on outer surface, occlusal surfaces of dactylus and pollex weakly crenulated to smooth, without gape when fingers closed.

Pereopods 2 and 3 sparsely setose; all articles except for dactylus finely granulate; propodus and carpus with bluntly spinular extensor margins; merus with bluntly spinular extensor and flexor margins; dactyli broadly curved, smooth, with longitudinal rib. Pereopod 3 longest, merus 1.37–1.47 pcl (male), 1.16–1.27 (female); dactylus almost as long as combined length of propodus and carpus.

Pereopods 4 and 5 granulate, minutely spinulate, almost glabrous; longer than pereopod 3 merus in both sexes; propodus distoextensor margin unarmed on pereopod 4, with small spine or tubercle on pereopod 5; dactylus markedly shorter than propodus, falcate, with corneous apex and 4–6 obliquely inclined, corneous spines on flexor margin. Pereopod 5 merus, when folded against carapace, reaching midlength of carapace.

Thoracic sternite 3 pentagonal, about 1.5 × wider than long; lateral margins divergent posteriorly; surface sparsely granulate. Margins of sternites 4 and 5 granulate.

Abdomen surface finely granulate or minutely spinulate. Pleotelson without trace of demarcation between somite 6 and telson; pentagonal; apex obtuse, bluntly rounded; male pleotelson distolateral margin straight in males, concave in females; width about twice length in both sexes.

Gonopod 1 distal article cannulate, forming copulatory tube, with moderately long distal setae. Gonopod 2 with articles fused; distomesial margin slightly hollowed, apex acute.

Egg diameter 1.16–1.22 mm.

Etymology. Named after Diane Brown, formerly Australian Museum, for her enthusiastic interest in cymonomid crabs and other decapod crustaceans.

Remarks. *Cymonomus dianae* sp. nov., a member of the *C. soela* group, most closely resembles *C. deforgesi* Ahyong & Ng, 2009, from the northern hemisphere (South China Sea to Japan; Ahyong & Ng, 2009, 2017), sharing slender, divergent eyestalks and prominent anterolateral spines on the carapace with long "wiry" setae. The new species differs from *C. deforgesi* in the following features: the cheliped palm surface is smooth or microscopically granular rather than distinctly granulate (Fig. 16A, J); the pereopod 3 merus in females is proportionally more elongate (1.16–1.27 pcl versus 1.00–1.09 pcl) and the margins of the female telson are distinctly concave in the distal half (Fig. 16B), rather than straight (Ahyong & Ng, 2017: fig. 4K). Males of both *C. dianae* and *C. deforgesi*, however, have similarly elongated walking legs (Fig. 16A) (1.36–1.47 pcl versus 1.36–1.41 pcl, respectively). As in *C. deforgesi* and *C. soela*, the cervical groove of female *C. dianae* is less pronounced than in males and the fronto-orbital region less anteriorly

Figure 17. *Cymonomus dianae* sp. nov., distribution.

"protruding". Aside from sexual dimorphism, little variation is evident in the present series. In *C. dianae*, the granulation of the margins of the pereopods 2 and 3 merus is typically pronounced (as in the holotype), though shorter and less distinct in some specimens.

Cymonomus dianae was collected together with *C. tesseris* in Perth Canyon, southwestern Australia. On the basis of the published account, Ihle's (1916: fig. 67) "*Cymonomus quadratus valdiviae*", from Ceram at 835 m, is referred here to *C. dianae*, extending the range of the species to southern Indonesia. "*Cymonomus* sp. MoV 5001", reported and figured by Poore *et al.* (2008) (and repeated by McEnnulty *et al.*, 2011), comprises three species: *C. dianae* sp. nov., *C. tesseris* sp. nov. and *C. triplex* sp. nov. (figured).

Distribution. Perth Canyon, southern Western Australia to the North-West Shelf and Ceram, Indonesia (Fig. 17); 848–1050 m.

Cymonomus espinosus sp. nov.

http://zoobank.org/NomenclaturalActs/FF2E3D31-7DC9-426D-B6D7-3F7F47461BFD

Figs 18, 19

Holotype: NMV J55982, ovigerous female (cl 3.9 mm, pcl 3.4 mm, cw 3.5 mm), off Two Rocks, Western Australia, Australia, 31°37.08–37.38'S 114°58.32–115°14.65'E, 364–404 m, beam trawl, SS10/2005/004, RV Southern Surveyor, coll. R. Wilson, 19 November 2005. **Paratypes**: NMV J52178, 2 ovigerous females (cl 4.1 mm, pcl 3.6 mm, cw 3.7 mm; cl 4.0 mm, pcl 3.6 mm, cw 3.7 mm), SE Victoria, Australia, 38°09.80'S 149°41.71'E, 260–265 m, epibenthic sled, SS01/00/199, RV Southern Surveyor, 22 April 2000; NMV J58198, 1 spent female (cl 4.4, pcl 3.8 mm, cw 4.2 mm), Huon 400 site, S of Tasmania, Australia, 43°59.50–59.70'S 147°32.77–33.80'E, 370–410 m, epibenthic (Sherman) sled, SS02/2007/06, RV Southern Surveyor, coll. T. O'Hara & T. Costa, 31 March 2007.

Description. Carapace quadrate, almost square, lateral margins subparallel; regions weakly indicated, cervical groove weakly indicated; lower pterygostomian region swollen; anterior and anterolateral surfaces sparsely setose. Anterolateral spine prominent, conical, directed anteriorly; similar spine on lateral margin behind anterolateral spine, followed by several smaller, well-spaced spines or acute granules. Anterior carapace margin mesial to the anterolateral spines sloping posteriorly towards midline, with spinules, acute granules. Dorsal and surface very sparsely ornamented: gastric region with transverse field of spinules in approximately W-shaped pattern; cardiac, intestinal and branchial regions each with field of widely spaced granules. Fronto-orbital margin (excluding rostrum and lateral projections) advanced beyond anterolateral margins; about 0.6 anterior carapace width; outer orbital processes sharply triangular, elongate, divergent, directed anterolaterally, situated below plane of rostrum, dorsally and laterally strongly spinulate, apex acute, shorter than rostrum. Rostrum length exceeding three-fourths length of eyestalks; 0.12–0.16 pcl; slender, sharply triangular, sparsely spinular dorsally and laterally, slightly inclined ventrally.

Eyestalks divergent (23–30° to median axis), margins subparallel for most of length, ventrally flattened, fused to carapace below rostral base but demarcation distinct; reaching anteriorly slightly beyond end of antennular peduncle article 1; dorsal surface sparsely spinulate, lateral and mesial margins spinose, most pronounced and numerous mesially; cornea apparently vestigial, not pigmented.

Epistome with tubercle mesial to base of antennule, otherwise smooth; multidentate lobe mesial to base of antenna, anteriormost largest, prominent, followed by 2 or 3 smaller spines or blunt projections.

Antennular peduncle 0.72–0.83 pcl (female); article smooth or minutely granulate. Antennal article 1 granulate; articles 2–4 spinose or granulate; article 5 smooth.

Maxilliped 3 ischiobasis subquadrate, surface sparsely granulate, distolateral margin spinose; shallow longitudinal median groove; ischium and basis demarcated by faint groove. Merus slightly shorter than ischium; length 2.2 × width (excluding spines); tapering distally to rounded apex; surface and margins spinulate. Dactylus, propodus and carpus spinulate. Exopod sparsely granulate, spinulate, distally overreaching endopod merus.

Chelipeds (pereopod 1) equal in size and ornamentation, sparsely setose. Merus finely and sparsely granulate, with few small sines distally. Carpus sparsely granulate; distally and dorsally spinose. Propodus palm surfaces sparsely spinulate and granulate, longest spines along dorsal margin; ventral margin irregularly spinose, not extending onto pollex. Dactylus slightly longer than dorsal palm length; proximal half spinose; outer surface with faint longitudinal carina, occlusal surfaces of dactylus and pollex irregularly crenulate, with slight gape when fingers closed.

Pereopods 2 and 3, sparsely setose, flexor and extensor margins variously spinose, other surfaces sparsely granulate; longest spines on extensor margin of carpus; merus extensor margin with distal spines, otherwise unarmed, flexor margin spinose on proximal half; dactyli broadly curved, unarmed, with longitudinal rib. Pereopod 3 longest, merus 0.86 pcl (female);dactylus shorter than combined length of propodus and carpus.

Pereopods 4 and 5 finely and sparsely granulate, few spines; longer than pereopod 3 merus (female); propodus distoextensor margin unarmed; dactylus markedly shorter than propodus, falcate, with corneous apex and 2 or 3 (usually 3) obliquely inclined, corneous spines on flexor margin. Pereopod 5 merus, when folded against carapace, reaching anterior 1/4 of carapace.

Thoracic sternite 3 pentagonal, width 2.0–2.1 × length; proximal lateral margins slightly divergent posteriorly to subparallel; surface sparsely granulate. Margins of sternites 4 and 5 granulate.

Abdomen granulate and minutely spinose, most prominent on somites 2 and 3, very sparsely ornamented on somites 4 and 5. Pleotelson subtriangular, without trace of demarcation between somite 6 and telson; sparsely granulate; apex bluntly obtuse; width 2.0–2.3 × length.

Egg diameter 1.08 mm; up to 13 eggs carried.

Etymology. Derived from the Latin adjective, *espinosus*, alluding to the minimal spination or ornamentation on the carapace.

Remarks. *Cymonomus espinosus* is distinctive in the genus for its minimal carapace granulation and spination, having groups of widely spaced granules or spinules, but otherwise being smooth (Fig. 18A). Except for *C. mariveneae* Ahyong & Ng, 2009, from the Philippines, the carapace in all other species of the genus is granulate or spinose over the entire

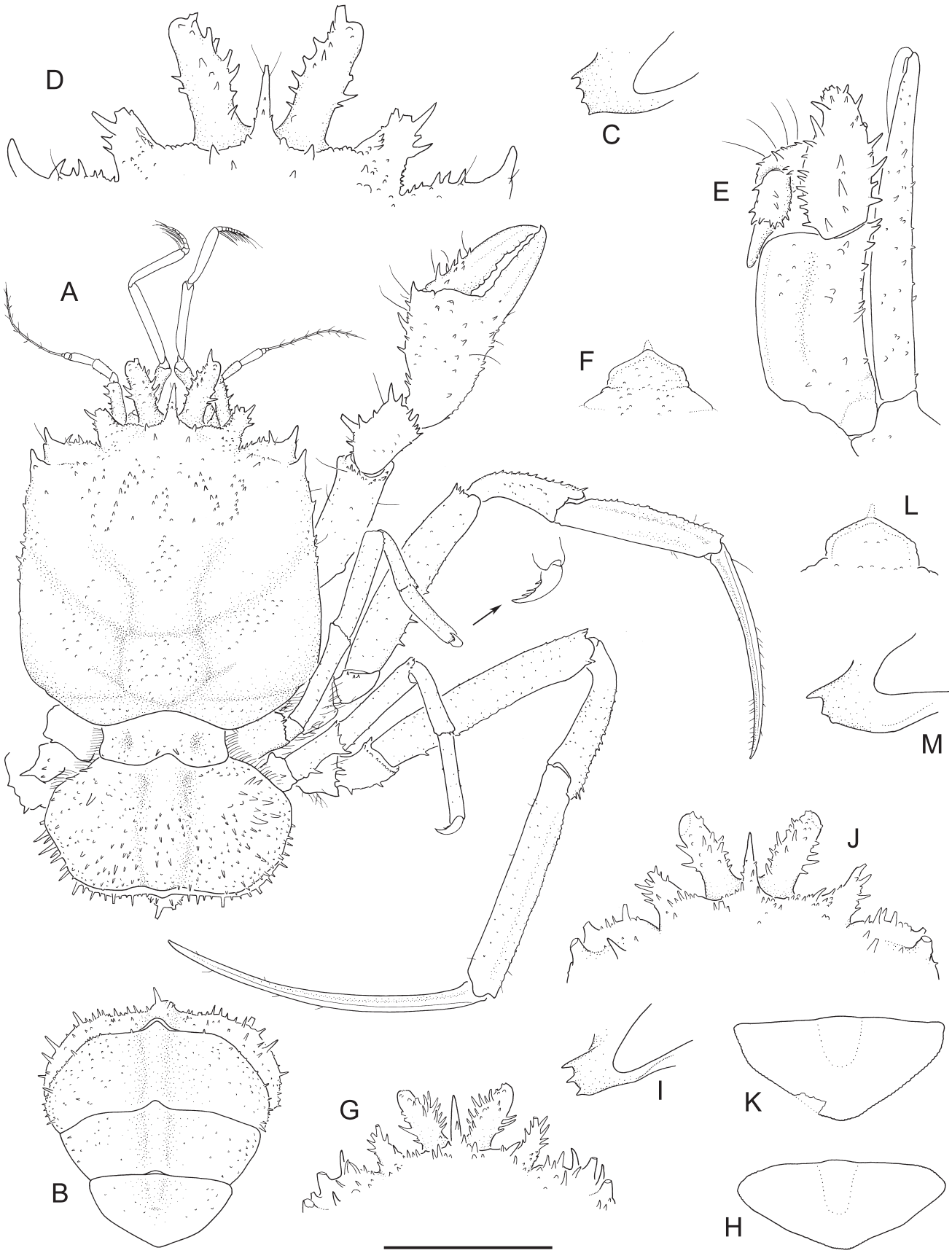

Figure 18. *Cymonomus espinosus* sp. nov. *(A–F)* female holotype, off Two Rocks, Western Australia, cl 3.9 mm, pcl 3.4 mm, cw 3.5 mm, NMV J55982; *(G–I)* female paratype, cl 4.1 mm, pcl 3.6 mm, cw 3.7 mm, SE Victoria, NMV J52178; *(J–M)* female paratype, cl 4.4 mm, pcl 3.8 mm, cw 4.2 mm, Tasmania, NMV J58198. *(A)* dorsal habitus; *(B)* posterior abdomen; *(C, I, M)* left epistomial lobe mesial to base of antenna; *(D, G, J)* anterior carapace; *(E)* left maxilliped 3; *(F, L)* thoracic sternite 3; *(G)* fronto-orbital region; *(H, K)* pleotelson. Scale: A, B, G = 2.0 mm; C, I, M = 0.5 mm; D–F, G, H, J–L = 1.0 mm.

surface. *Cymonomus mariveneae*, however, is readily distinguished from *C. espinosus* by its possession of globular stalked tubercles (Ahyong & Ng, 2007: fig. 6A), rather than simple granules or spinules on the carapace margins and pereopods (Fig. 18A).

Cymonomus espinosus belongs to the *C. bathamae* group (see account of *C. bathamae*) of which it closely resembles *C. bathamae* Dell, 1971, *C. brevis* sp. nov., and *C. confinis* sp. nov., sharing the combination of fixed, distinctly divergent eyestalks and having the anterior carapace margin mesial to the anterolateral spines sloping posteriorly inwards. Aside from the minimal carapace spination, *C. espinosus* differs from *C. brevis* sp. nov., *C. confinis* sp. nov. and *C. bathamae* Dell, 1971, in its markedly less spinose pereopods 2 and 3 extensor margins, especially on the propodus, being weakly serrate rather than having a row of distinct spines (Fig, 18A); *C. espinosus* differs from *C. confinis* in the longer maxilliped 3 exopod, which distinctly overreaches the merus (Fig. 18E) (versus three-fourths the merus length in *C. confinis*; Fig. 12E), and the minimal ornamentation of the cheliped palm (Fig. 18A) (strongly spinose in *C. confinis*; Fig. 12A).

The examined specimens are mature females, the smallest (holotype, pcl 3.4 mm) being ovigerous. The paratypes of *C. espinosus*, both from southeastern Australia, have more pronounced eye and anterior carapace spines (Fig. 18G, J) than the holotype from southwestern Australia (Fig. 18A, D). These differences might reflect the wide geographic separation, but might also be allometric effects given smaller size of the holotype. Unfortunately, the walking legs are intact only in the holotype. The pleotelson width is usually twice the length (Fig, 18B, K) but proportionally wider in one specimen from off Victoria (width 2.3 × length, ovigerous female, pcl 3.6 mm, NMV J52178; Fig. 18H). Variation is also evident in the armature of the multidentate mesial lobe at the base of the antennular articulation: one distinct anterior spine is always present, followed by two (paratypes) or three projections (holotype), variously developed spines or low denticles (Fig. 18C, I, M).

Distribution. Southern Australia from Victoria, Tasmania and Western Australia (Fig. 19); 260–410 m.

Figure 19. *Cymonomus espinosus* sp. nov., distribution.

Cymonomus kapala Ahyong & Brown, 2003

Figs 20, 21

Cymonomus kapala Ahyong & Brown, 2003: 1364–1368, 1373, figs 1–2.—Poore, 2004: 318, fig. 93c.—Ng *et al.*, 2008: 32.

Holotype: AM P26639, ovigerous female (cl 3.0 mm, pcl 2.6 mm, cw 3.2 mm), off Long Reef, New South Wales, Australia, 33°46'S 151°43'E, 176 m, coarse sand and shell, dredge, K77-23-01, FRV *Kapala*, coll. D. Brown, 5 December 1977. **Paratypes**: AM P62849, 2 ovigerous females (cl 2.9 mm, pcl 2.5 mm, cw 3.2 mm; cl 3.1 mm, pcl 2.6 mm, cw 3.2 mm), type locality; AM P62850, 1 male (cl 2.5 mm, pcl 2.1 mm, cw 2.6 mm), type locality.

Description*:* Carapace quadrate, almost square, lateral margins subparallel; regions distinct; lower pterygostomian region swollen; anterior and anterolateral surfaces with few long, fine setae, other surfaces almost glabrous. Carapace regions demarcated, each densely covered with rounded tubercles; anterolateral and lateral surfaces with rounded or globular tubercles and granules, club-shaped or stalked, sometimes with minute apical point; tubercles largest on lateral and anterolateral surfaces; lateral branchial margin with large, smooth, hemispherical boss. Fronto-orbital margin (excluding rostrum and lateral projections) not advanced beyond anterolateral margins; width 0.6 anterior carapace width; outer orbital processes elongate, directed anterolaterally, situated below plane of rostrum, covered with club-shaped or stalked tubercles, slightly shorter than rostrum. Rostrum slender, apex blunt, margins minutely spinulate; longer than half length of eyestalks; 0.13–0.20 pcl.

Eyestalks strongly divergent (about 30° to median axis), margins subparallel for most of length, flattened, indistinguishably fused to frontal margin of carapace, demarcation absent; reaching anteriorly to midlength of antennular peduncle article 2; covered with stalked tubercles; cornea apparently vestigial, not pigmented.

Epistome with small cluster of granules at base of rostrum and small tubercle mesial to base of antennules; with quadrispinose lobe mesial to base of antenna.

Antennular peduncle 0.81 pcl (male), 0.64–0.65 pcl (female); article 1 with blunt, elongate, distal projections; articles 2 and 3 minutely granulate. Antennal articles 1–4 with elongate tubercles; article 5 smooth.

Maxilliped 3 ischiobasis subquadrate, surface sparsely granulate, with globose tubercles; shallow longitudinal sublateral groove; ischium and basis demarcated by faint groove. Merus shorter than ischium; length 2.0 × width (excluding spines); tapering distally to rounded apex; surface sparsely granulate, with globose tubercles, mesial margin spinose, lateral margin with globose tubercles and few spines. Dactylus sparsely granulate. Propodus and carpus sparsely spinulate and tuberculate. Exopod slightly exceeding merus of endopod; spinulate and with globose tubercles.

Chelipeds (pereopod 1) equal in size and ornamentation, sparsely setose; all articles with globose and club-shaped tubercles. Merus with stalked, globose tubercles distally, dorsally and ventrally, and with smaller tubercles proximally. Carpus covered with elongate and globose tubercles. Propodus palm surfaces with small rounded tubercles,

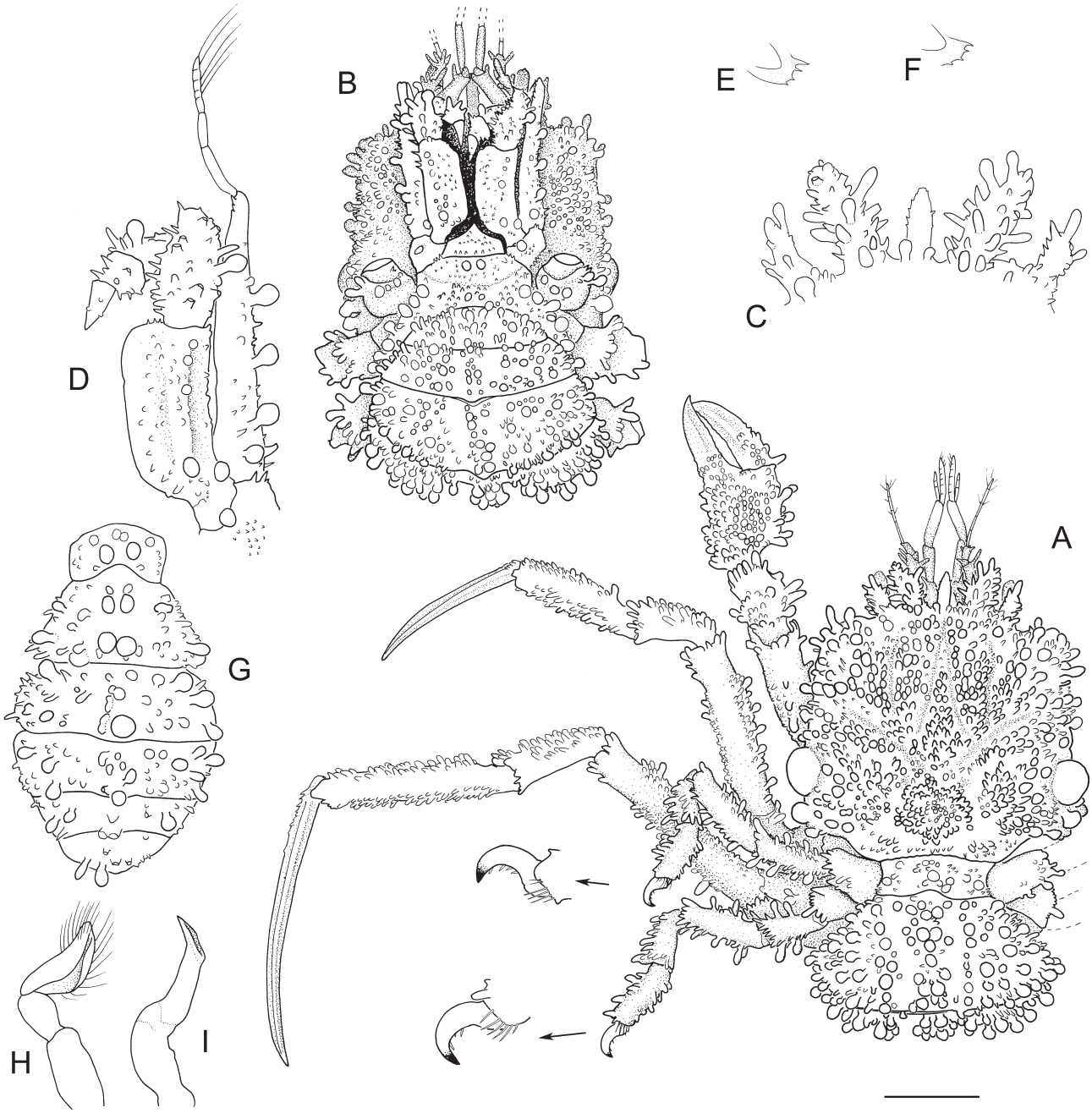

Figure 20. *Cymonomus kapala* Ahyong & Brown, 2003, off Long Reef, New South Wales. *(A–D)* female holotype, cl 3.0 mm, pcl 2.6 mm, cw 3.2 mm, AM P26639. *(E)* ovigerous female paratype, cl 3.1 mm, pcl 2.6 mm, cw 3.2 mm. *(F)* ovigerous female paratype, cl 2.9 mm, pcl 2.5 mm, cw 3.2 mm. AM P62849. *(G–I)* male paratype, cl 2.5 mm, pcl 2.1 mm, cw 2.6 mm, AM P62850. *(A)* dorsal habitus; *(B)* ventral cephalothorax and abdomen; *(C)* fronto-orbital region; *(D)* left maxilliped 3; *(E–F)* right epistomial lobe mesial to base of antenna; *(G)* male abdomen; *(H)* right G1, abdominal view; *(I)* right G2, abdominal view. Scale: A, B, G = 1.0 mm; D, H, I = 0.5 mm; E–F = 0.4 mm. (A–D, G–I modified after Ahyong & Brown 2003: figs 1, 2).

extending onto proximal one-third of pollex; dorsal and ventral margins with larger, elongated and globose tubercles. Dactylus as long as dorsal palm length; with proximal dorsal granules or spinules in addition to small elongated tubercles; occlusal surfaces of dactylus and pollex crenulated or slightly uneven, with distinct gape when fingers closed.

Pereopods 2 and 3 sparsely setose; all articles except for dactylus with globose and club-shaped tubercles; tubercles on merus and propodus most pronounced along extensor and flexor margins, on carpus covering extensor margin; dactylus broadly curved, extensor margin minutely granulate or spinulate proximally, with longitudinal rib. Pereopod 3 longest, merus 1.12 pcl (male), 0.89–0.91 pcl (female); dactylus slightly shorter than combined length of propodus and carpus.

Pereopods 4 and 5 with globose and club-shaped tubercles, and minute spinules, sparsely setose; longer than pereopod 3 merus in both sexes; propodus distoextensor margin unarmed on pereopod 4, with small spine or tubercle on pereopod 5; dactylus slightly longer than half propodus

Figure 21. *Cymonomus kapala* Ahyong & Brown, 2003, distribution.

length, falcate, with corneous apex and 3 or 4 obliquely inclined, corneous spines on flexor margin. Pereopod 5 merus, when folded against carapace, reaching midlength of carapace.

Thoracic sternite 3 pentagonal, about 1.9 × wider than long; lateral margins divergent posteriorly, surface with small globose tubercles and granules, margins of sternites 4 and 5 with large, globose tubercles.

Abdomen covered with globose and club-shaped tubercles, and scattered spinules. Pleotelson without trace of demarcation between somite 6 and telson; broadly rounded; width 2.7 × length (male), 5.4 (female).

Gonopod 1 distal article cannulate, forming copulatory tube, with long setae. Gonopod 2 with articles fused; distomesial margin slightly hollowed, apex acute.

Egg diameter 1.00–1.10 mm.

Remarks. *Cymonomus kapala* is known only from the type material collected from off Long Reef, New South Wales. It belongs to the *C. curvirostris* group, united by the presence of pedunculate, globose tubercles on the carapace and pereopods: *C. curvirostris* Sakai, 1965 (Japan), *C. liui* Ahyong & Ng, 2011 (Philippines), *C. mariveneae* Ahyong & Ng, 2009 (Philippines), and *C. trifurcus* Stebbing, 1920 (South Africa). *Cymonomus kapala* uniquely has a large rounded boss on each branchial margin of the carapace and appears to be most closely related to *C. trifurcus* in having the eyestalks indistinguishably fused to the anterior margin of the carapace. Although not mentioned in the original description, *C. kapala* bears a quadrispinose epistomial lobe at the base of the antennal articulation (Fig. 20E, F). Spination of the epistomial lobe is absent *C. mariveneae*, present in *C. curvirostris* and *C. liui* (Ahyong & Ng, 2017: fig. 3C; Ahyong & Ng, 2011: fig. 3C), and yet to be determined in *C. trifurcus*.

Distribution. Known only from eastern Australia, off Long Reef, New South Wales (Fig. 21); 176 m.

Cymonomus karenae sp. nov.

http://zoobank.org/NomenclaturalActs/74757580-7535-4CE5-8C6F-B53AC51947C2

Figs 22, 23, 30G–H

Holotype: NMV J55663, spent female, pcl 6.3 mm, cw 6.5 mm, Huon 1000 site, Tasmania, 44°07.50–07.88'S 147°14.95–14.98'E, 800–950 m SS02/2007/28.

Description of holotype. Carapace quadrate, almost square, lateral margins subparallel; regions weakly indicated; lower pterygostomian region swollen; surfaces sparsely setose. Anterolateral spine blunt, fusiform, base obscured by smaller, blunt elongate tubercles. Dorsal and lateral surfaces covered with prominent, coarse granules, granules becoming largest and most elongate anterolaterally. Fronto-orbital margin (excluding rostrum and lateral projections) advanced slightly beyond anterolateral margins; 0.6 anterior carapace width; outer orbital processes bluntly pointed, directed anteriorly, slender in lateral view, situated below plane of rostrum, laterally with blunt, elongate granules. Rostrum unknown (broken in holotype).

Eyestalks strongly divergent (about 45° from median axis), flattened, stout, width at midlength exceeding one-third length, fused medially forming compound tubercle, and together fused to carapace below rostral base but demarcated from frontal margin; apices reaching anteriorly to midlength of antennular peduncle article 1; dorsal surface and margins granulate, granules along mesial margin elongate, allantiform to fusiform; cornea well defined, clearly demarcated from adjacent cuticle, transparent, coloured orange in life.

Epistome surface with large compound tubercle below rostral base, longitudinal row of 3 or 4 small tubercles mesial to base of antennule; blunt, irregularly rounded lobe mesial to base of antenna.

Antennular peduncle 0.71 pcl (female); article 1 coarsely granulate laterally; article 2 minutely granulate; article 3 smooth. Antennal articles 1–3 irregularly granulate or minutely spinular; articles 4–5 minutely granulate.

Maxilliped 3 ischiobasis subquadrate, coarsely granulate and minutely spinular distally; longitudinal sublateral groove; ischium and basis demarcated by faint, granulate groove. Merus shorter than ischium; length twice width, tapering distally to rounded apex; surface and margins covered with coarse granules and short, blunt spines. Dactylus minutely granulate. Propodus and carpus coarsely granulate and spinose. Exopod surface granulate; apex reaching almost to end of endopod merus.

Cheliped (pereopod 1) sparsely setose. Merus finely granulate, scattered small spines. Carpus finely granulate, dorsal margin with few short spines. Propodus palm surfaces with fine granules and larger, elongated granules, dorsal and ventral margins irregularly spinulate. Dactylus longer than dorsal palm length; proximal dorsal two-thirds with short spines and granules; with faint longitudinal carina on outer surface, occlusal surfaces of dactylus and pollex crenulate, with minor gape when fingers closed.

Pereopods 2 and 3 sparsely setose. Pereopod 3 longest; merus extensor and flexor margins with coarsely granulate; carpus and propodus extensor and flexor margins coarsely granulate; merus 0.90 pcl (female); dactylus broadly curved, few granules proximally, with longitudinal rib, glabrous, length unknown (broken in holotype). Pereopod 2 merus

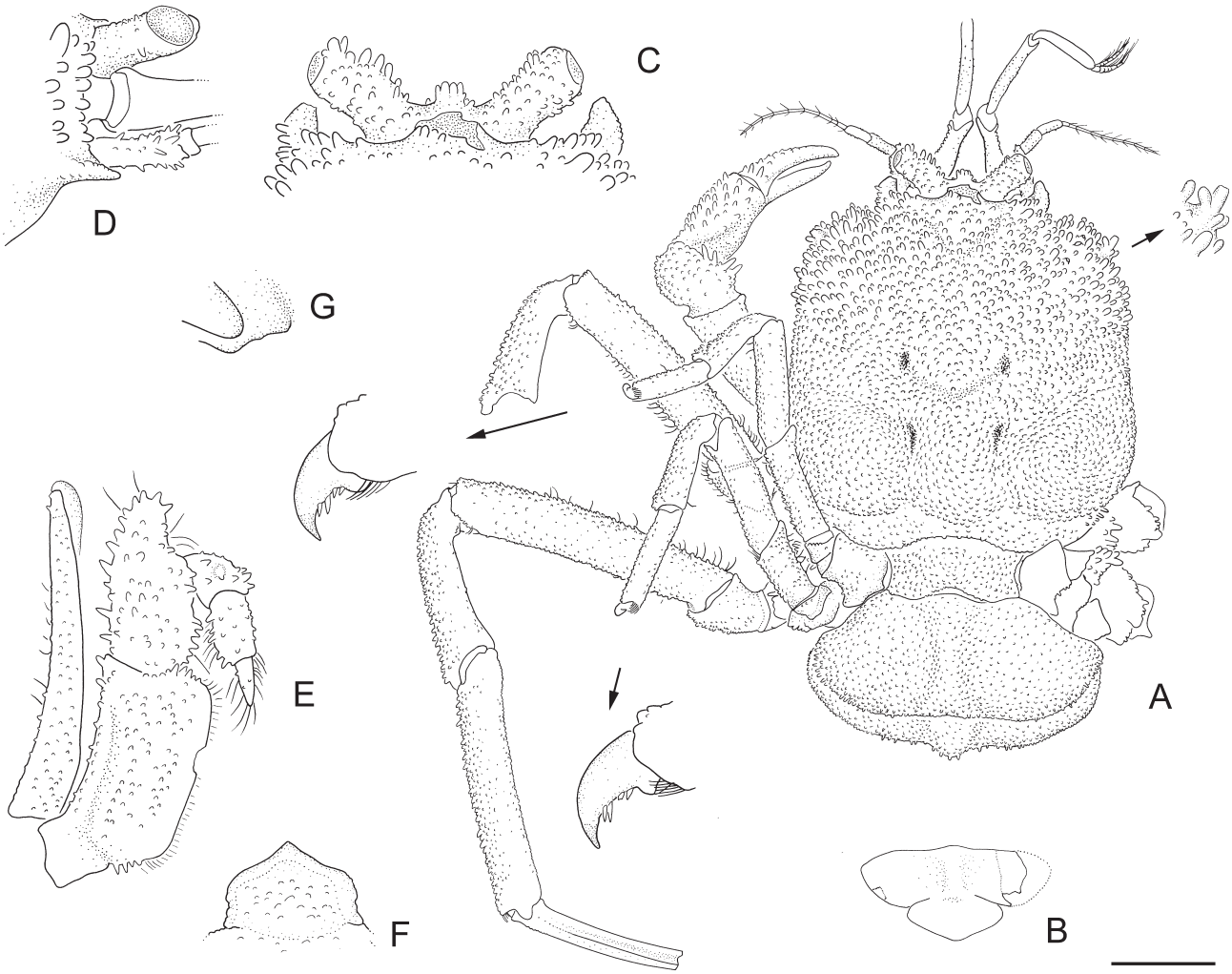

Figure 22. *Cymonomus karenae* sp. nov., female holotype, pcl 6.3 mm, cw 6.5 mm, Huon 1000 site, Tasmania, NMV J55663. *(A)* dorsal habitus; *(B)* abdominal somite 6 and telson; *(C)* fronto-orbital region, dorsal view; *(D)* fronto-orbital region, right lateral view; *(E)* right maxilliped 3; *(F)* thoracic sternite 3; *(G)* right epistomial lobe mesial to base of antenna. Scale: A–B = 2.0 mm; D–F = 1.0 mm; G = 0.5 mm.

and carpus ornamentation similar to pereopod 3; propodus and dactylus unknown in holotype.

Pereopods 4 and 5 granulate, sparsely setose; longer than pereopod 3 merus; propodus distoextensor margin unarmed; dactylus markedly shorter than propodus, falcate, with corneous apex and 4 obliquely inclined, corneous spines on flexor margin. Pereopod 5 merus, when folded against carapace, reaching anterior one-third of carapace.

Thoracic sternite 3 pentagonal, 1.4 × wider than long; lateral margins weakly divergent posteriorly, surface granulate. Margins of sternites 4 and 5 granulate.

Abdomen with margins and surface densely granulate. Pleotelson with somite 6 and telson clearly demarcated by well-defined transverse groove along outer one-third, indistinguishably fused on median one-third; telson obtusely angular, width about twice length.

Etymology. Named for Karen Gowlett-Holmes, for her longstanding contributions to deep water sampling and commitment to specimen photography.

Remarks. *Cymonomus karenae* sp. nov. is remarkable as the only species in the genus having clearly defined corneas (Fig. 22A, C, D, 30G, H), and herein is placed in its own informal species group. The cornea of all other species of *Cymonomus*, although generally smooth, is undifferentiated from the surrounding cuticle and colourless. In *C. karenae* sp. nov., the cornea is transparent, orange in life, and clearly demarcated from the adjacent opaque cuticle, unlike other congeners, in which the presumed corneal surface is smooth but nonetheless opaque or translucent. Chapman (1977) showed that the eyes of *C. bathamae* lack corneal facets and lenses, and as such are capable of photoreception but not image formation. Whether or not the eyes of *C. karenae* sp. nov. are image forming, however, remains to be determined. Corneal facets are not evident on the cornea under light microscopy of the undissected specimen, but ultrastructural examination will be necessary for confirmation. The clearly differentiated cornea in *C. karenae* is also noteworthy in approaching that of species of the American cymonomid genus, *Cymopolus* A. Milne Edwards, 1880, which, based on their pigmented corneas, presumably have functional eyes. Assessment of the significance of the corneal structure in *C. karenae* sp. nov., and whether it possibly reflects a stem-group condition in the genus, must await detailed examination of the eye and determination of the phylogenetic position of the species in the genus.

Unfortunately, the holotype (and only specimen) of *C. karenae* sp. nov. is incomplete, having the rostrum and pereopod 2 and 3 dactyls broken. Despite the incompleteness of the specimen, the unique condition of the eyes, clear dissimilarity to all other congeners, general rarity of *Cymonomus*, and remoteness of the locality of occurrence justify naming the new species herein. *Cymonomus karenae* sp. nov. superficially resembles members of the *C. delli* group in the short, stout, strongly divergent eyestalks (Fig. 22A, C) and partially demarcated telson and abdominal somite 6. In addition to the unique corneal condition, *C. karenae* sp. nov. is readily distinguished from members of the *C. delli* group (represented in the study area by *C. delli* Griffin & Brown, 1976) in having much coarser, more prominent dorsal granulation (Fig. 22A) (versus very finely granular), a longer maxilliped 3 exopod that reaches the distal end of the merus (Fig. 22E) (versus distinctly shorter in *C. delli* group), a blunt, unarmed epistomial lobe mesial to the base of the antennal peduncle (Fig. 22G) (with spine in *C. delli* group), and a broadly angular rather than broadly rounded telson margin (Fig. 22B). Also, the demarcation between the telson and abdominal somite 6 is incomplete: the two segments are indistinguishably fused along the median one-third (Fig. 22B) and clearly demarcated by a groove laterally, rather than having a fully indicated transverse groove (Fig. 14B, J). Although broken near its base, the conformation of the margins of what remains of the rostrum suggests it was well developed and probably longer than the outer orbital processes, if not also the eyes.

Distribution. Presently known only from Huon 1000 site, Tasmania (Fig. 23); 800–950 m.

Figure 23. *Cymonomus karenae* sp. nov., distribution.

Cymonomus soela Ahyong & Brown, 2003

Figs 24, 25, 30E, Tab. 1

Cymonomus soela Ahyong & Brown, 2003: 1368–1371, 1373, figs 3–4.—Poore, 2004: 318, fig. 93a.—Ng *et al.*, 2008: 32.

Holotype: AM P62846, ovigerous female (cl 7.2, pcl 6.4 mm, cw 7.0 mm), off St. Patricks Head, Tasmania, Australia, 41°37.3–39.80'S 148°41.4–40.50'E, 940–990 m, S05/87/06, RV *Soela*, coll. K. Graham, 11 July 1987. **Paratype**: AM P62847, female (cl 7.1 mm, pcl 6.1 mm, cw 6.7 mm), type locality.

Other material examined (all Australia). *Queensland*: NMV J73046, 1 male (cl 5.4 mm, pcl 4.7 mm, cw 5.2 mm), 2 spent females (cl 6.8 mm, pcl 5.9 mm, cw 6.8 mm; cl 7.4 mm, pcl 6.4 mm, cw 7.6 mm), E of Gladstone, 23°35.22–37.02'S 154°11.64–11.68'E, 1013–1093 m, IN2017_V03_121_138, RV *Investigator*, 13 June 2017; NMV J73026, 1 male (cl 5.3 mm, pcl 5.5 mm, cw 5.8 mm), 1 ovigerous female (cl 7.2 mm, pcl 6.4 mm, cw 7.1 mm), off Moreton Bay, 26°57.678–59.478'S 153°50.850–50.808'E, 1071–1138 m, IN2017_V03_104_139, RV *Investigator*, 10 June 2017; NMV J72956, 1 male (cl 5.3 mm, pcl 4.2 mm, cw 4.3 mm), 1 ovigerous female (cl 7.5 mm, pcl 6.3 mm, cw 7.4 mm), E of Burleigh Heads, 28°03.27–05.82'S 154°04.98–04.86'E, 999–1013 m, IN2017_V03_100_149, RV *Investigator*, 9 June 2017; AM P102238, 1 male (cl 5.1 mm, pcl 4.2 mm, cw 4.3 mm, 1 ovigerous female (cl 7.1 mm, pcl 6.1 mm, cw 7.2 mm), 1 spent female (cl 7.6 mm, pcl 6.6 mm, cw 7.5 mm), 1 prespawning female (pcl 5.9 mm, pcl 4.9 mm, cw 5.5 mm), E of Burleigh Heads, 28°03.26–05.82'S 154°04.98–04.86'E, 999–1013 m, IN2017_V03_100_149, RV *Investigator*, 9 June 2017.

New South Wales: AM P101655, 1 male (cl 6.7 mm, pcl 5.7 mm, cw 5.9 mm), E of Newcastle, 33°02'24"S 152°37'18"E, 925–910 m, NZOI stn U219, RV *Tangaroa*, coll. W. Ponder & R. Springthorpe, 9 October 1982; NMV J72987, 2 males (cl 5.3 mm, pcl 4.5 mm, cw 4.7 mm; cl 5.9 mm, pcl 4.9 mm, cw 5.1 mm), 1 prespawning female (cl 5.6 mm, pcl 4.8 mm, cw 5.4 mm), E of Seal Rocks, 32°28.74–30.42'S 152°59.64–59.46'E, 1006–1036 m, IN2017_V03_069_117, RV *Investigator*, 3 June 2017.

Tasmania: SAM C7045, 2 females (cl 8.4 mm, pcl 7.3 mm, cw 8.3 mm; pcl 6.8 mm, cw 7.6 mm), c. 46 nautical miles NE of Babel Island, 39°16.4–16.0'S 148°49.8–49.6'E, 885–935 m, demersal trawl, F.S. No. 50309, FRV *Soela*, 27 April 1989.

South Australia: SAM C12939, 1 female (cl 5.7 mm, pcl 5.1 mm, cw 5.4 mm), Great Australian Bight, 34°42.33'S 132°31.86'E, 980–995 m, beam trawl, IN2015-CO1-114-113, RV *Investigator,* 24 November 2015; AM P102902, 1 male (cl 6.8 mm, pcl 5.7 mm, cw 6.0 mm), Great Australian Bight, 33°30.966–32.256'S 130°15.900–15.540'E, 978–1013 m, IN2015-CO2-382-108, RV *Investigator*; AM P102903, 1 ovigerous female (cl 8.6 mm, pcl 7.2 mm, cw 8.4 mm), 1 prespawning female (cl 5.8 mm, pcl 4.9 mm, cw 5.4 mm), Great Australian Bight, 33°30.966–32.256'S 130°15.900–15.540'E, 978–1013 m, IN2015-CO2-382-107, RV *Investigator*, 15 December 2015; AM P102901, 1 male (cl 7.1 mm, pcl 6.0 mm, cw 6.4 mm), Great Australian Bight, 35°09.162–10.932'S 134°06.54–06.54'E, 965–1077 m, IN2015-CO2-131-127, RV *Investigator*, 15 December 2015.

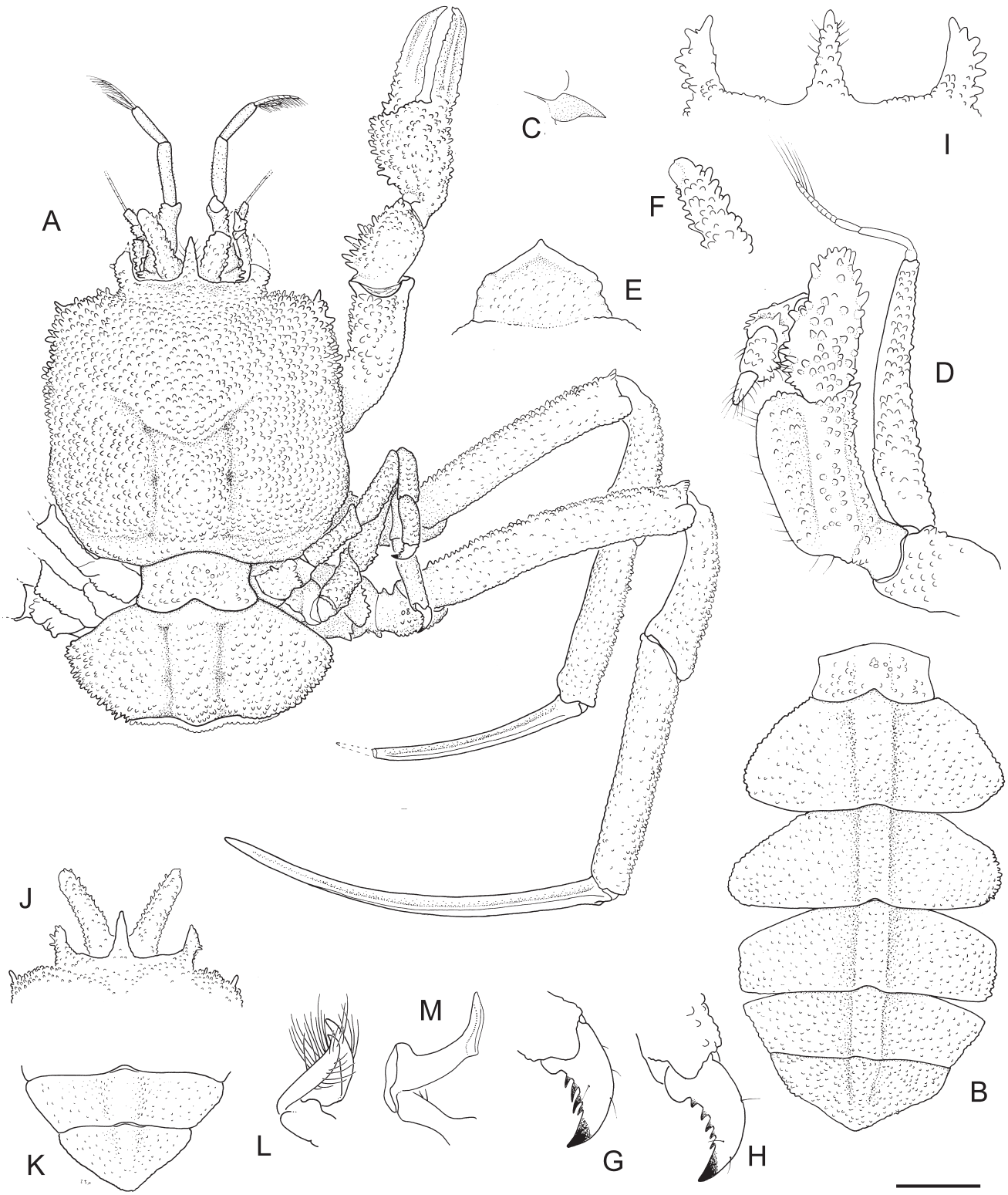

Figure 24. *Cymonomus soela* Ahyong & Brown, 2003. *(A–G)* female holotype, cl 7.4 mm, pcl 6.3 mm, cw 7.1 mm, off St. Patricks Head, Tasmania, AM P62846. *(J–M)* male, cl 6.8 mm, pcl 5.7 mm, cw 6.0 mm, Great Australian Bight, South Australia, AM P102902. *(A)* dorsal habitus; *(B)* abdomen; *(C)* right epistomial spine mesial to base of antenna; *(D)* left maxilliped 3; *(E)* thoracic sternite 3; *(F)* left eye, distal portion; *(G–H)* right P4–5 dactylus; *(I)* frontal margin; *(J)* anterior carapace; *(K)* posterior telson; *(L)* right G1, abdominal view; *(M)* right G2, abdominal view. Scale: A–B = 2.0 mm; C, G, H = 0.5 mm; D–F, I, K–M = 1.0 mm. (A, B, D, F–I modified after Ahyong & Brown 2003: figs 3, 4).

Description. Carapace quadrate, almost square, lateral margins subparallel; regions indistinct; cervical groove indistinct, slightly more pronounced in males than females; lower pterygostomian region swollen; anterior and anterolateral surfaces with few setae, almost glabrous. Anterolateral spine short, blunt, conical, inclined laterally. Dorsal and lateral surfaces entirely covered with rounded granules, with granules becoming slightly larger and more elongate anterolaterally, bluntly conical, not globose. Fronto-orbital margin (excluding rostrum and outer-orbital processes) slightly advanced beyond anterolateral margins, more pronounced in males than females; about 0.6 anterior carapace width; outer orbital processes stout, elongate, directed anteriorly, situated below plane of rostrum, laterally bluntly spinulate, apex acute, half as long to as long as rostrum. Rostrum almost half to half-length of eyestalks; 0.13–0.21 pcl; slender, tapering to acute apex, minutely granulate dorsally and laterally.

Eyestalks divergent (25–30° from median axis), margins subparallel for most of length, slender, flattened, granulate, fused to carapace below rostral base but demarcation distinct, reaching anteriorly almost to end of antennular peduncle article 1; cornea apparently vestigial, not pigmented.

Epistome with small cluster of granules at base of rostrum and blunt tubercle mesial to base of antennules, otherwise smooth; small spine mesial to base of antenna.

Antennular peduncle 1.00–1.10 pcl (male), 0.78–0.90 (female); articles 1 and 2 minutely granulate; article 3 smooth. Antennal articles minutely spinulate or granulate.

Maxilliped 3 ischiobasis subquadrate, granulate; longitudinal sublateral groove; ischium and basis demarcated by faint groove. Merus as long as ischium, length twice width, tapering distally to rounded apex; surface and margins with short, blunt spines. Dactylus unarmed; propodus and carpus spinulate, granulate. Exopod granulate, reaching end of, or slightly overreaching merus of endopod.

Chelipeds (pereopod 1) equal in size and ornamentation, sparsely setose. Merus granulate. Carpus granulate, dorsal margin with prominent conical and allantoid spines flanked by shorter blunt spines. Propodus palm surfaces entirely granulate, dorsal and ventral margins with granules and elongate tubercles, extending onto proximal half of pollex. Dactylus longer than dorsal palm length; dorsal margin with short, blunt, slender spines and granules; with longitudinal carina on outer surface, occlusal surfaces of dactylus and pollex crenulated, with slight gape when fingers closed.

Pereopods 2 and 3 very sparsely setose, almost glabrous; all articles except for dactylus granulate; propodus, carpus and merus with coarsely granulate extensor margins; dactylus broadly curved, smooth, with longitudinal rib. Pereopod 3 longest, merus 1.29–1.47 pcl (male), 1.02–1.26 (female); dactylus about as long as combined length of propodus and carpus.

Pereopods 4 and 5 granulate, unarmed, almost glabrous; shorter than pereopod 3 merus in males, about as long as merus in females; propodus distoextensor margin unarmed; dactylus markedly shorter than propodus, falcate, with corneous apex and 4 or 5 obliquely inclined, corneous spines on flexor margin. Pereopod 5 merus, when folded against carapace, reaching midlength of carapace.

Thoracic sternite 3 pentagonal, 1.7 × wider than long; proximal lateral margins divergent posteriorly; surface granulate. Margins of sternites 4 and 5 granulate.

Abdomen surface finely granulate or minutely spinulate. Pleotelson without trace of demarcation between somite 6 and telson; apex obtuse, blunt; in males, subtriangular, twice 2.0–2.1 × length; in females, pentagonal, width 2.1–2.4 × length.

Gonopod 1 distal article cannulate, forming copulatory tube, with moderately long distal setae. Gonopod 2 with articles fused; distomesial margin slightly hollowed, apex acute.

Egg diameter 1.19–1.31.

Remarks. *Cymonomus soela* closely resembles *C. tesseris* sp. nov. and *C. dianae* sp. nov. (both from Western Australia) and *C. clarki* (eastern New Zealand) in sharing the carapace frontal margin that is only weakly advanced beyond the anterolateral margins in females, eyestalks that are distinctly longer than the rostrum, and well developed outer orbital processes. *Cymonomus soela* differs from *C. tesseris* by the proportional length of the walking legs and antennules (see account of *C. tesseris*). *Cymonomus soela* is readily distinguished from *C. dianae* and *C. clarki* by its smaller anterolateral carapace spines, comparatively thicker eyestalks, almost glabrous rather than distinctly setose anterolateral carapace margins, and the coarser dorsal carapace granulation (Figs 16A, 24A). *Cymonomus soela* further differs from *C. clarki* in the shorter pereopod 5 (Fig. 24A) (merus reaching almost to the midlength rather than anterior one-third of the carapace; Fig. 10A) and from *C. dianae* in the distinctly granulate (Fig. 24A) (rather than smooth or microscopically granulate; Fig. 16A) cheliped palms.

Cymonomus soela was previously known only from Tasmania, but is herein reported from off southeastern Queensland, New South Wales and South Australia (Great Australian Bight). Males of *C. soela* are reported here for the first time. Typical of cymonomids, sexual dimorphism in *C. soela* is evident in the proportionally longer antennular peduncle and walking legs of males. As in *C. dianae* and *C. deforgesi*, mature female *C. soela* have a slightly more inflated carapace than in males rendering the cervical groove less prominent. Similarly, the fronto-orbital margin in males protrudes slightly further forwards (relative to the anterolateral margins) than in females (Fig. 24A, J, 30E).

Figure 25. *Cymonomus soela* Ahyong & Brown, 2003, distribution.

Table 1. Selected morphometric measurements of *Cymonomus soela* Ahyong & Brown, 2003, from Australia (NSW: New South Wales; QLD: Queensland; SA: South Australia; TAS: Tasmania).

	Antennular peduncle length/pcl (male)	Antennular peduncle length/pcl (female)	Pereopod 3 merus length/pcl (male)	Pereopod 3 merus length/pcl (female)
QLD/NSW	1.05–1.10 (n = 7)	0.78–0.90 (n = 7)	1.36–1.47 (n = 7)	1.19–1.26 (n = 7)
TAS	—	0.80–0.81 (n = 2)	—	1.10–1.16 (n = 3)
SA	1.00 (n = 2)	0.78–0.90 (n = 3)	1.29–1.32 (n = 2)	1.02–1.08 (n = 3)

The relatively small series of *C. soela* examined here exhibits apparently near continuous clinal geographic variation in walking leg length (Table 1). As measured by the proportional length of the pereopod 3 merus, the walking legs of females are longest in eastern Australian specimens (1.19–1.26 pcl), of intermediate length in Tasmanian specimens (1.10–1.16 pcl), and shortest in South Australian specimens (1.00–1.08 pcl). A similar trend is evident in males, although male *C. soela* are yet to be collected from Tasmania. Such clinal trends are not known from other species of *Cymonomus*. Moreover, the morphometric range in the pereopod 3 merus length in the present series (male 1.19–1.47 pcl, female 1.00–1.26 pcl) exceeds typical intraspecific variation of about 10% observed in other species reported here and elsewhere (e.g., Ahyong & Ng, 2017). In the absence of clear morphological discontinuities and the lack of males from Tasmania (the intermediate locality), all are treated as conspecific pending further study.

Distribution. Eastern Australia from off southeastern Queensland, New South Wales, Tasmania and South Australia (Great Australian Bight) (Fig. 25); 885–1193 m.

Cymonomus tesseris sp. nov.

http://zoobank.org/NomenclaturalActs/7A75D24A-1B1B-4A64-8767-D165D60370E2

Figs 26, 27

Cymonomus sp. MoV 5001.—Poore *et al.*, 2008: 36 (part, NMV J60743 only).

Holotype: NMV J60743, male (cl 6.6 mm, pcl 5.7 mm, cw 5.9 mm), Perth Canyon, Western Australia, Australia, 31°58.283–57.317'S 115°06.000–06.833'E, 848–1050 m, beam trawl, SS10/2005/071, RV *Southern Surveyor*, coll. R. Wilson, 29 November 2005.

Description of holotype. Carapace quadrate, almost square, lateral margins slightly divergent posteriorly; regions indistinct; cervical groove indistinct; lower pterygostomian region swollen; anterior and anterolateral surfaces with few setae, almost glabrous. Anterolateral spine short, blunt, fusiform, inclined laterally. Dorsal and lateral surfaces entirely covered with minute rounded granules, with granules becoming slightly larger and more elongate anterolaterally, bluntly conical to subglobose. Fronto-orbital margin (excluding rostrum and outer-orbital processes) advanced beyond anterolateral margins; 0.6 anterior carapace width; outer orbital processes stout, elongate, directed anteriorly, situated below plane of rostrum, laterally bluntly spinulate, apex acute, 2/3 rostral length. Rostrum half-length of eyestalks; 0.16 pcl; slender, tapering to acute apex, minutely granulate dorsally and laterally.

Eyestalks divergent (25° from median axis), margins subparallel for most of length, slender, flattened, granulate, granules elongate on mesial margins, fused to carapace below rostral base but demarcation distinct, reaching anteriorly almost to end of antennular peduncle article 1; cornea apparently vestigial, not pigmented.

Epistome with cluster of granules at base of rostrum and blunt, slightly elongated compound tubercle mesial to base of antennules, otherwise smooth; small spine mesial to base of antenna.

Antennular peduncle 0.92 pcl (male); articles 1 and 2 minutely granulate; article 3 smooth. Antennal articles minutely spinulate.

Maxilliped 3 ischiobasis subquadrate, granulate; longitudinal sublateral groove; ischium and basis demarcated by faint groove. Merus as long as ischium, length 2.3 × width, tapering distally to rounded apex; surface and margins with short, blunt spines. Dactylus unarmed; propodus and carpus spinulate. Exopod granulate, reaching beyond carpo-meral articulation but not reaching end of merus of endopod.

Chelipeds (pereopod 1) equal in size and ornamentation, sparsely setose. Merus granulate. Carpus granulate, dorsal margin with prominent conical spines flanked by shorter blunt spines. Propodus palm surfaces entirely granulate, dorsal and ventral margins with granules and elongate tubercles, extending onto proximal half of pollex. Dactylus longer than dorsal palm length; dorsal margin with short, blunt, slender spines and granules; with faint longitudinal carina on outer surface, occlusal surfaces of dactylus and pollex crenulated, with slight gape when fingers closed.

Pereopods 2 and 3 sparsely setose; all articles except for dactylus granulate; propodus, carpus and merus with coarsely granulate extensor margins; dactylus broadly curved, smooth, with longitudinal rib. Pereopod 3 longest, merus 1.16 pcl (male); dactylus as long as combined length of propodus and carpus.

Pereopods 4 and 5 granulate, unarmed, almost glabrous; shorter than pereopod 3 merus (male); propodus distoextensor margin unarmed; dactylus markedly shorter than propodus, falcate, with corneous apex and 4 obliquely inclined, corneous spines on flexor margin. Pereopod 5 merus, when folded against carapace, reaching midlength of carapace.

Thoracic sternite 3 pentagonal, 1.7 × wider than long; proximal lateral margins subparallel; surface sparsely granulate. Margins of sternites 4 and 5 granulate.

Abdomen surface finely granulate or minutely spinulate. Pleotelson without trace of demarcation between somite 6 and telson; pentagonal; distolateral margin straight; apex obtuse, bluntly rounded; width twice length (male).

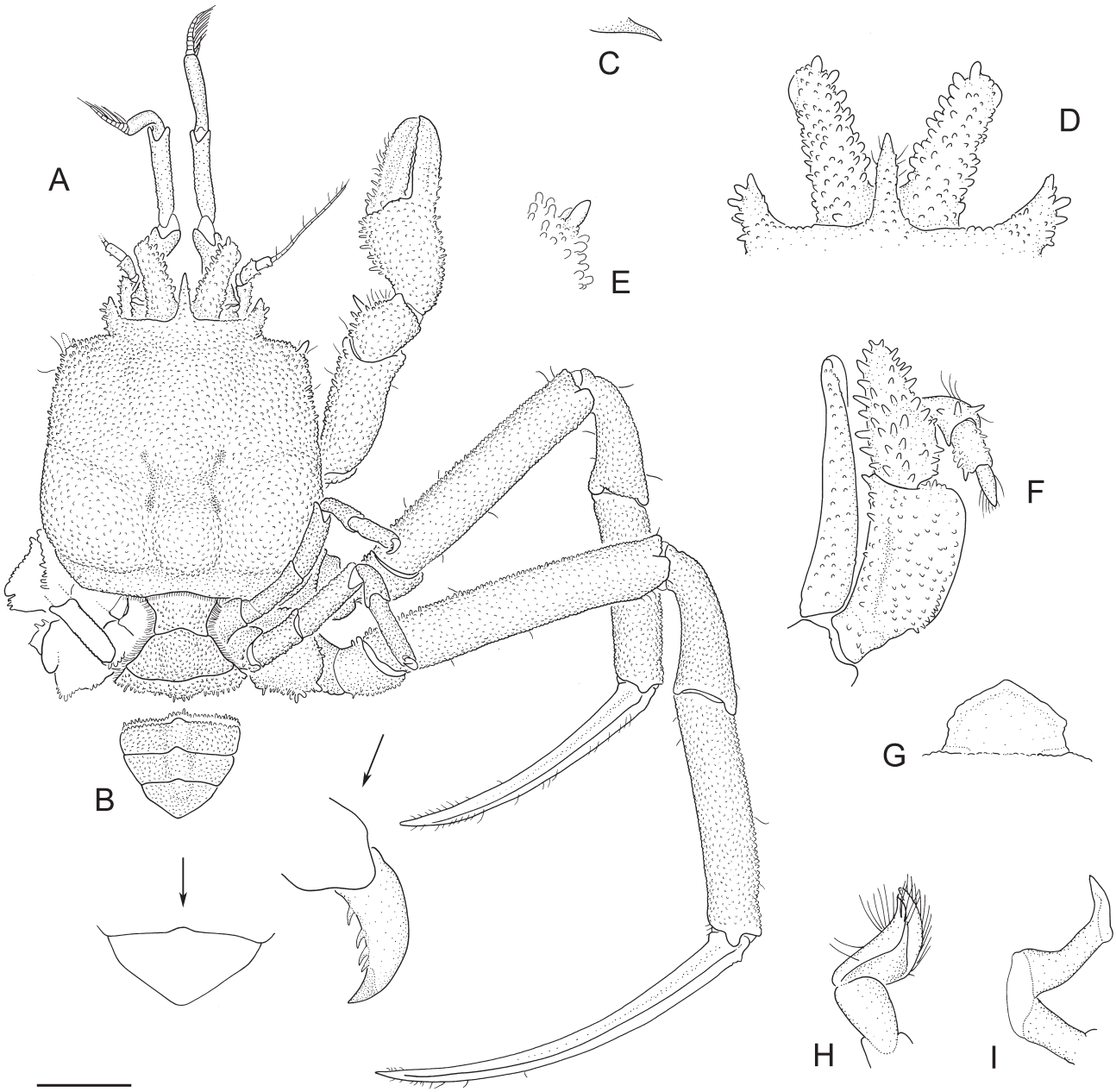

Figure 26. *Cymonomus tesseris* sp. nov., male holotype, cl 6.6 mm, pcl 5.7 mm, cw 5.9 mm, Perth Canyon, Western Australia, NMV J60743. *(A)* dorsal habitus; *(B)* posterior abdomen; *(C)* right epistomial spine mesial to base of antenna; *(D)* fronto-orbital region; *(E)* right anterolateral carapace spine; *(F)* right maxilliped 3; *(G)* thoracic sternite 3; *(H)* right G1, abdominal view; *(I)* right G2, abdominal view. Scale: A–B = 2.0 mm; C = 0.5 mm; D–I = 1.0 mm.

Gonopod 1 distal article cannulate, forming copulatory tube, with moderately long distal setae. Gonopod 2 with articles fused; distomesial margin slightly hollowed, apex acute.

Etymology. From the Greek, *tessera*, four, alluding to the new species being the fourth member of the *C. soela* group from the study area; used as a noun in apposition.

Remarks. *Cymonomus tesseris* sp. nov. is one of four members of the *C. soela* group occurring in New Zealand and Australia, of which it is closest to *C. soela* from southern and eastern Australia. The new species, known only from the Western Australian holotype male, differs from *C. soela* in its proportionally shorter walking legs and antennules. The male pereopod 3 merus proportions of *C. tesseris*, at 1.16 pcl, are similar to those of female *C. soela* (1.00–1.19 pcl) (Figs 24A, 26A), and considerably shorter than in male *C. soela* (1.29–1.47 pcl). Similarly, the proportional length of the male antennules of *C. tesseris* (0.92 pcl) is within the range of female *C. soela* (0.78–0.90) and shorter than in male *C. soela* (1.00–1.10 pcl). Although females of *C. tesseris* are yet to be collected, they can be expected to have proportionally shorter walking legs and antennules than males, and as such would not approach either sex of *C. soela* in these features. *Cymonomus tesseris* was collected together with the similar species, *C. dianae* sp. nov., but is readily distinguished by the same features that distinguish the latter from *C. soela*: smaller anterolateral carapace spines (Fig. 26A), proportionally thicker eyestalks (Fig. 26D), near

Figure 27. *Cymonomus tesseris* sp. nov., distribution.

glabrous versus distinctly setose anterolateral margins of the carapace (Fig. 26A), and the distinctly granulate versus near smooth cheliped palms (Fig. 26A). Additionally, the pereopod 3 merus is proportionally shorter in *C. tesseris* than in *C. dianae* (1.16 pcl vs 1.37–1.47 pcl in males).

Distribution. Presently known only from Perth Canyon, Western Australia (Fig. 27); 848–1050 m.

Cymonomus triplex sp. nov.

http://zoobank.org/NomenclaturalActs/16BBF692-671F-4B10-A966-AC188FB30712

Figs 28, 29, 30F

Cymonomus sp. MoV 5001.—Poore *et al.*, 2008: 36, unnumbered fig. [part, 2 specimens from 401–539 m].—McEnnulty *et al.*, 2011: 183, unnumbered fig. [part].

Holotype: NMV J53917, female (cl 4.3 mm, pcl 3.7 mm, cw 4.2 mm), off Point Hillier, Western Australia, Australia, 35°22.90'S 117°12.42'E, 539 m, beam trawl, SS10/2005/019, RV *Southern Surveyor*, coll. R. Wilson, 22 November 2005. **Paratype**: NMV J53918, female (cl 3.9 mm, pcl 3.4 mm, cw 4.0 mm), Jurien Bay, Western Australia, Australia, 29°52.07–52.43'S 114°23.22–23.88'E, 401–414, beam trawl, SS10/2005/078, RV *Southern Surveyor*, coll. G. Poore, 2 December 2005.

Other material examined. *South Australia*: NMV J68440, 1 ovigerous female (cl 4.0 mm, pcl 4.0 mm, cw 3.5 mm), Great Australian Bight, 35°12.53'S 134°27.05'E, 457 m, beam trawl, SS03/2008/48, RV *Southern Surveyor*, 5 March 2008; AM P103028, 1 ovigerous female (cl 3.8 mm, pcl 3.5 mm, 3.7 mm), Great Australian Bight, 35°02.568–02.268'S 134°04.740–03.960'E, 366.8–409.4 m, beam trawl, IN2015_C02_126_104, RV *Investigator*, 4 December 2015 ("*Cymonomus* sp. MoV 7327").

Description. Carapace quadrate, almost square, lateral margins weakly divergent posteriorly; regions weakly indicated, cervical groove weakly indicated; lower pterygostomian region swollen; anterior and lateral surfaces with few long, fine setae, other surfaces sparsely setose. Anterolateral spine prominent, inclined laterally; similar spine on lateral margin behind anterolateral spine, with shorter spinules, acute granules. Anterior carapace margin mesial to the anterolateral spines sloping posteriorly towards midline, with short spinules, acute granules. Dorsal and lateral surfaces covered with minute granules and spinules, spinules longest on anterior half of carapace. Fronto-orbital margin (excluding rostrum and lateral projections) slightly advanced beyond anterolateral margins; 0.6 anterior carapace width; outer orbital processes sharply triangular, elongate, divergent, directed anterolaterally, situated below plane of rostrum, dorsally and laterally spinulate, apex acute, as long rostrum. Rostrum length slightly exceeding half-length of eyestalks; 0.10–0.15 pcl; slender, spiniform, spinose dorsally and laterally; slightly inclined ventrally.

Eyestalks weakly divergent (5–15° from median axis), slender, tapering, ventrally flattened, slightly movable, not fused to carapace; reaching anterior ¾ of antennular peduncle article 1; dorsal surface and margins granulate and sparsely spinose; cornea apparently vestigial, not pigmented. Epistome with compound tubercle at base of rostrum and 2 or 3 small acute tubercles mesial to base of antennule; without spine mesial to base of antenna.

Antennular peduncle 0.80–0.93 pcl (female); articles 1 and 2 minutely granulate; article 3 smooth. Antennal articles granulate or minutely spinular.

Maxilliped 3 ischiobasis subquadrate, surface and margins sparsely granulate, with scattered acute granules or short spines; shallow longitudinal sublateral groove; ischium and basis demarcated by faint groove. Merus as long as ischium; length 2.6 × width (excluding spines); tapering distally to rounded apex; surface and margins spinulate. Dactylus unarmed. Propodus and carpus spinulate. Exopod granulate, distally overreaching endopod merus.

Chelipeds (pereopod 1) equal in size and ornamentation, sparsely setose. Merus sparsely granulate or minutely spinose. Carpus acutely granulate and spinose, dorsal spines longest. Propodus palm surfaces granulate, dorsal and ventral margins spinose, extending onto pollex. Dactylus longer than dorsal palm length; proximal dorsal margin spinose; outer surface with faint longitudinal carina, occlusal surfaces of dactylus and pollex smooth or irregularly crenulate, with slight gape when fingers closed.

Pereopods 2 and 3 sparsely setose, sparsely granulate; propodus and carpus extensor margins acutely granulate and with short spines, flexor margins unarmed; merus extensor and flexor margins acutely granulate and with short spines; dactylus broadly curved, sparsely granulate proximally, otherwise smooth, without distinct longitudinal rib. Pereopod 3 longest, merus 0.94–1.03 pcl (female); dactylus slightly shorter than combined length of propodus and carpus.

Pereopods 4 and 5 finely granulate, sparsely spinose; longer than pereopod 3 merus (female); propodus distoextensor margin unarmed; dactylus markedly shorter than propodus, falcate, with corneous apex and 2 or 3 obliquely inclined, corneous spines on flexor margin. Pereopod 5 merus, when folded against carapace, reaching anterior 1/4 of carapace.

Thoracic sternite 3 pentagonal, width 1.6–1.9 × length; lateral margins weakly to strongly divergent posteriorly; surface sparsely granulate. Margins of sternites 4 and 5 granulate.

Abdomen granulate, spinose, most prominent on somites 2 and 3, very sparsely ornamented on somites 4 and 5. Pleotelson without trace of demarcation between somite 6

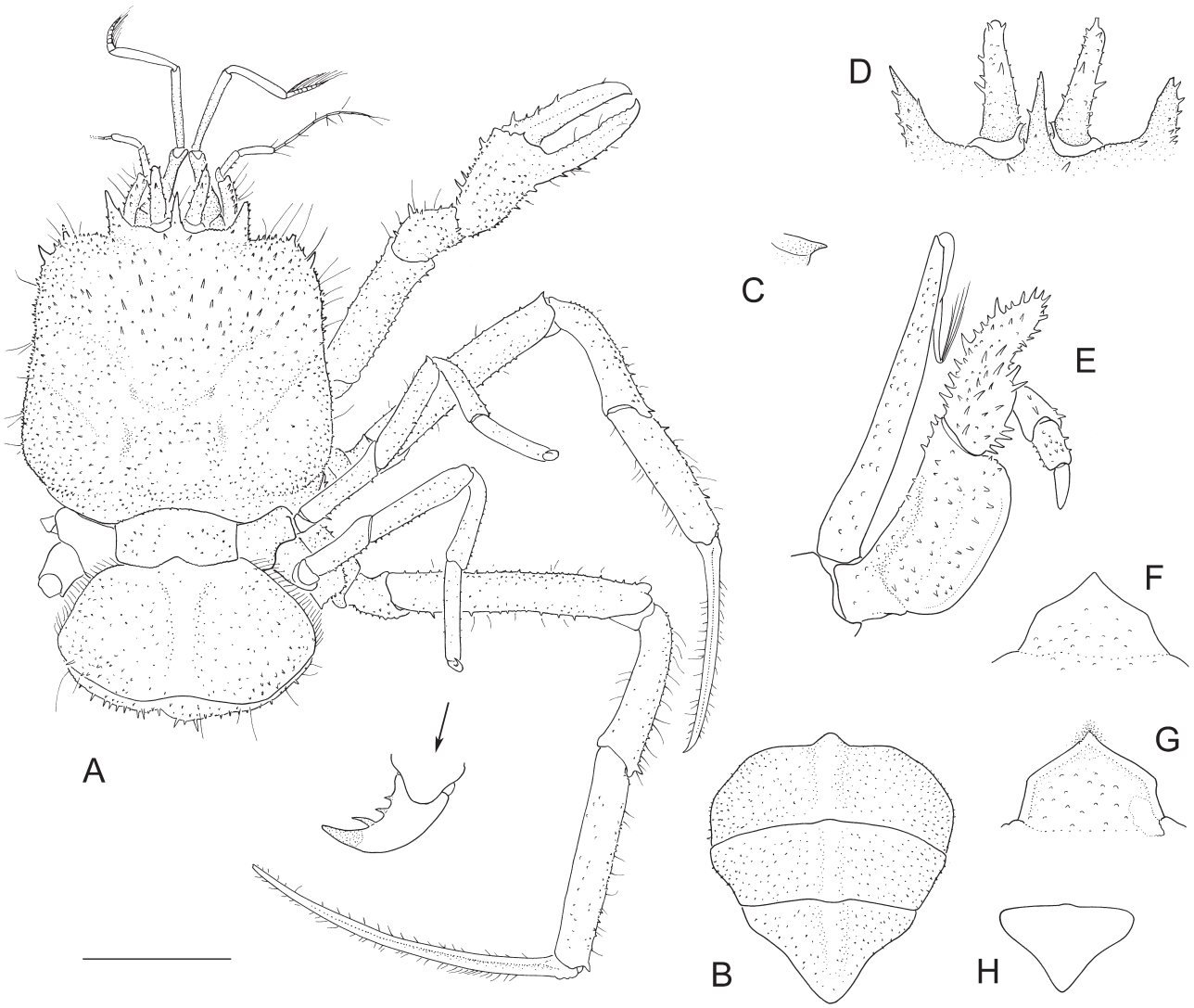

Figure 28. *Cymonomus triplex* sp. nov. *(A–F)* female holotype, cl 4.3 mm, pcl 3.7 mm, cw 4.2 mm, off Point Hillier, Western Australia, NMV J53917. *(G–H)* ovigerous female, cl 3.8 mm, pcl 3.5 mm, cw 3.7 mm, Great Australian Bight, South Australia, AM P103028. *(A)* dorsal habitus; *(B)* posterior abdomen; *(C)* right epistomial spine mesial to base of antenna; *(D)* fronto-orbital region; *(E)* right maxilliped 3; *(F–G)* thoracic sternite 3; *(H)* pleotelson. Scale: A, B, H = 2.0 mm; C = 0.5 mm, D–G = 1.0 mm.

and telson; subtriangular, sparsely granulate; margins slightly concave; apex blunt; width 1.6–1.7 × length (female).

Egg diameter 0.95–1.05 mm.

Etymology. From the Latin, *triplex*, threefold, as the third Indo-West Pacific member of the *C. bathamae* group that has slightly movable, rather than fixed, eyestalks; used as a noun in apposition.

Remarks. *Cymonomus triplex* sp. nov., a member of the *C. bathamae* group, is most closely allied to *C. valdiviae* Lankester, 1903, from East Africa and *C. umitakae* Takeda, 1981, from Japan. These three species differ from other members of the *C. bathamae* group in sharing sharply triangular outer orbital processes that are subequal to rostral length, and weakly divergent, slightly movable eyestalks that are distinctly longer than the rostrum. *Cymonomus triplex* is readily distinguished from *C. umitakae* and *C. valdiviae* in the acutely granulate (with a few small spines) (Fig. 28A) rather than prominently spinose extensor margins of the

Figure 29. *Cymonomus triplex* sp. nov., distribution.

carpus and propodus of pereopods 2 and 3 (Ahyong, 2014: fig. 14A; Ahyong & Ng, 2017: fig. 6A). A fourth species of the *C. bathamae* group having slightly movable eyestalks, *C. guillei* Tavares, 1991, occurs off Brazil; it differs from the Indo-West Pacific members of the group in the rostrum reaching to, or slightly beyond, the distal end of the eyestalks (Tavares, 1991; fig. 7B). Poore *et al.* (2008) and McEnnulty *et al.* (2011) figured the holotype of *C. triplex* in colour as "*Cymonomus* sp. MoV 5001" (Fig. 30F).

Distribution. Great Australian Bight, South Australia, to Jurien Bay, Western Australia (Fig. 29); 367–539 m.

Distributional and bathymetric patterns

The current study more than doubles the known cymonomid fauna of New Zealand and Australia, from six to 14 species. Apart from *C. dianae*, which ranges into southern Indonesia, all other species reported have much more limited distributions: each occurs wholly within the study area and none spans both New Zealand and Australia. The cymonomid faunas of New Zealand and Australia, however, are heterogeneous inasmuch that the species represented variously belong to species groups with wider Indo-West Pacific or worldwide distributions (except for *C. karenae*, in its own species group restricted to Tasmania). Although two New Zealand species have their closest relatives in the region (i.e., *C. aequilonius*/*C. alius*, and *C. bathamae*/*C. brevis*), the morphologically nearest congeners of most species from the study area occur much further afield. Ahyong & Ng (2017) recognised several species groups within the genus, and two others, the *C. bathamae* and *C. soela* groups, are recognized here. Each group is represented in the study area. For instance, the *C. curvirostris* group, whose members otherwise occur in East and Southeast Asia, and South Africa, is represented by *C. kapala* from off New South Wales. *Cymonomus delli*, of the *C. delli* group, is most similar to *C. cognatus* from East Asia and the South China Sea. In the *C. soela* group, *C. dianae* is most similar to *C. deforgesi* from the South China Sea, and *C. soela* and *C. tesseris* from southern Australia are closest to *C. clarki* from New Zealand, which is itself morphologically closest to *C. menziesi* from Chile and Peru. The cognate species, *C. aequilonius* and *C. alius* from New Zealand, are members of the worldwide *C. granulatus* group and appear to be closely allied to *C. japonicus* from Japan. Members of the *C. bathamae* group occur in New Zealand, southern Australia, Japan, East Africa and the southwestern Atlantic.

Notably, bathymetric distributions of species studied here broadly correlate with species groups. Members of the *C. curvirostris* and *C. bathamae* groups are the shallowest occurring, typically at shelf depths of about 150–400 m, though also on the slope down to about 700 m. Members of the *C. delli* and *C. granulatus* groups typically occur from the shelf break to upper slope (usually c. 400–700 m), and those of the *C. soela* group generally occur at the greatest depths, from the mid-lower slope at bathyal depths (usually c. 900–1100 m). The single species of the *C. karenae* group also occurs at lower slope depths (950 m). Wider trends between and within species groups are currently under study and contingent on evaluation of the Atlanto-East Pacific species of *Cymonomus* (under revision by M. Tavares).

Two new species are described from New Zealand and six from Australia. Unfortunately, species of *Cymonomus* are comparatively rare, being typically known from few records, although a number of noteworthy patterns are evident among the New Zealand and Australian species. In New Zealand, all records of *Cymonomus* are from eastern waters, and four of five species occur in one or other of the two adjacent biogeographic provinces, but not both: Cookian (occurring south of East Cape [c. 37°40'S] near the subtropical convergence at the Chatham Rise, in waters under cool-temperate, subantarctic influence) or Aupourian (occurring north of East Cape in waters under warm-temperate influence) (Morton, 2004). Two species pairs (*C. aequilonius*/*C. alius*, *C. brevis*/*C. bathamae*) have one member each in the Aupourian and Cookian provinces, respectively. Only *C. clarki* spans both provinces, and, notably, is the southernmost occurring cymonomid worldwide.

The majority of Australian species and records of *Cymonomus* are from southern temperate waters; only *C. soela* and *C. dianae* range into subtropical and tropical latitudes, respectively. Two species are known only from either the east (*C. kapala*) or west coast (*C. dianae*), and one spans the entire southern Australian coast (*C. delli*). Other Australian species have more limited ranges in southern Australia and four species (*C. kapala*, *C. karenae*, *C. confinis*, *C. tesseris*) are currently known only from their respective type localities, highlighting the need for more intensive sampling. The proportionally few cymonomid records from northern Australia probably reflects lesser deep-water benthic research effort relative to that of southern waters.

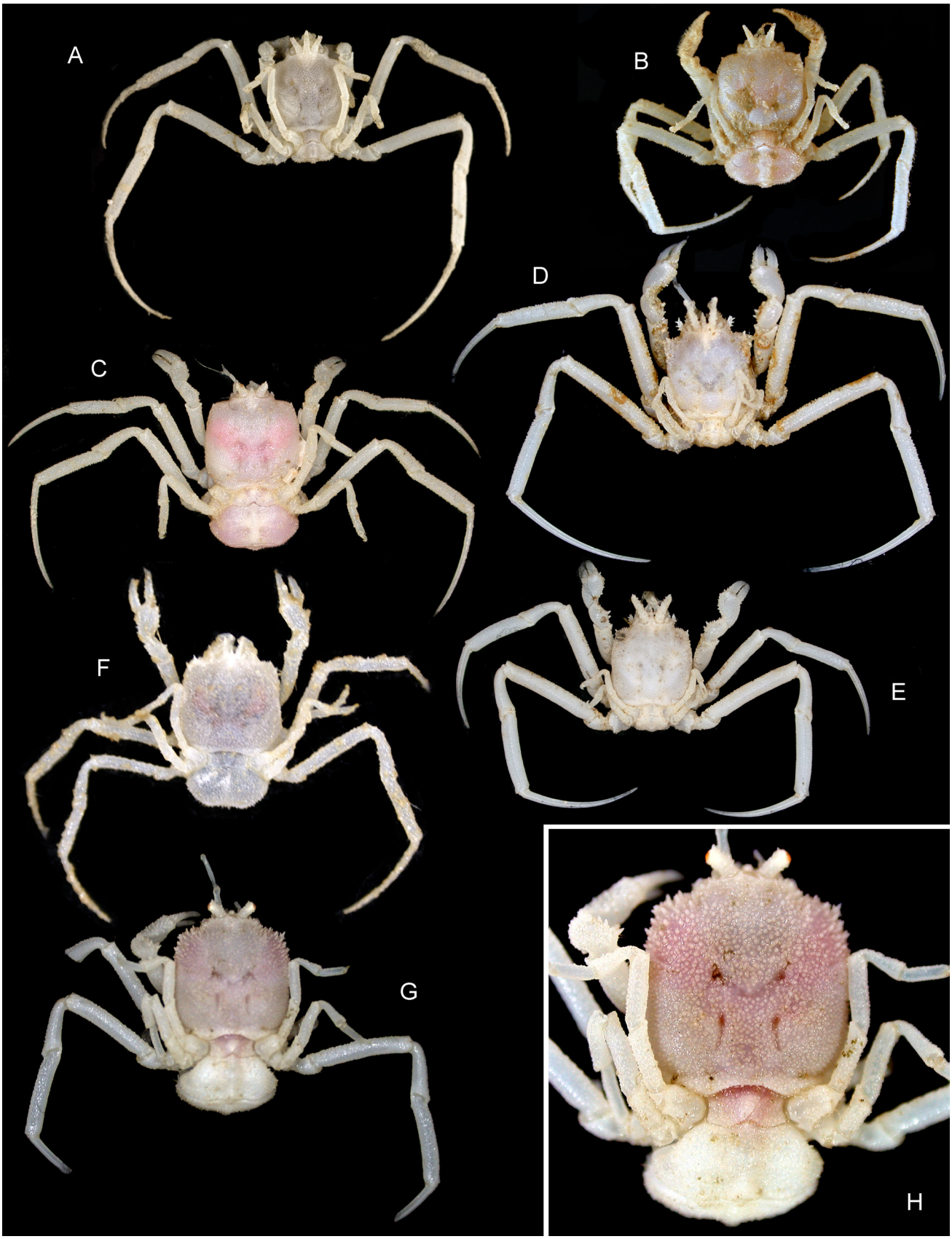

Figure 30. *(A) Cymonomus alius* sp. nov., male paratype, pcl 4.7 mm, cw 4.8 mm, Chatham Rise, New Zealand, TAN0705/24, NIWA 31642; *(B) C. clarki* Ahyong, 2008, ovigerous female paratype, pcl 5.9 mm, cw 6.6 mm, Chatham Rise, New Zealand, TAN0604/118, NIWA 29663; *(C) C. delli* Griffin & Brown, 1976, ovigerous female, pcl 7.2 mm, cw 7.9 mm, Great Australian Bight, South Australia, IN2015_C02-126-127, AM P103089; *(D) C. dianae* sp. nov., male, pcl 5.7 mm, cw 6.1 mm, Perth Canyon, Western Australia, SS10/2005/071, NMV J53916; *(E) C. soela* Ahyong & Brown, 2003, male, pcl 5.7 mm, cw 6.0 mm, Great Australian Bight, South Australia, IN2015-C02-382-108, AM P102902; *(F) C. triplex* sp. nov., female holotype, pcl 3.7 mm, cw 4.2 mm, off Point Hillier, Western Australia, SS10/2005/019, NMV J53917; *(G–H) C. karenae* sp. nov., female holotype, Tasmania, pcl 6.3 mm, cw 6.5 mm, NMV J55663. Photo credits: A–B (C. Marriott, NIWA), C–G (K. Gowlett-Holmes, CSIRO).

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