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First record of the introduced sand shrimp species *Crangon uritai* (Decapoda: Caridea: Crangonidae) from Newport, Port Phillip Bay, Victoria, Australia

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Three specimens of the crangonid sand shrimp species Crangon uritai *are reported from the muddy intertidal zone of Newport in Port Phillip Bay, Victoria. The discovery of the species in the bay is the first record of the genus* Crangon *from Australian waters and the first report of the East Asian coastal species* Crangon uritai *from the southern hemisphere. Its status as an introduced species is suggested and the likely vector for introduction is discussed. A key to the identification of crangonid shrimp species from Port Phillip Bay is included.*

Keywords: Crustacea, Caridea, Crangonidae, *Crangon*, introduced species, Port Phillip Bay, Victoria, Australia

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INTRODUCTION

The benthic fauna of Port Phillip Bay has been well studied including bay-wide surveys conducted as part of the Port Phillip Bay environmental studies (Poore *et al.*, 1975; Wilson *et al.*, 1998). A thorough report and paper on marine biological invasions of Port Phillip Bay (Hewitt *et al.*, 1999; 2004) described the physical environment, species introductions and the history of shipping and trade. One chapter of the report listed introduced species of soft sediment crustaceans and discussed the potential for translocation of the major groups of taxa (Poore & Storey, 1999). Collections from these surveys are housed in Museum Victoria and include three species of crangonid shrimp, *Philocheras intermedius* (Bate, 1863), *P. obliquus* (Fulton & Grant, 1902), and *P. victoriensis* (Fulton & Grant, 1902). A fourth species *P. flindersi* (Fulton & Grant, 1902) is known from the geographically close Western Port and central and western Bass Strait.

Three specimens of an unfamiliar sand shrimp species were collected from the muddy intertidal zone of Newport, near the mouth of the Yarra River into Port Phillip Bay, in May and June 2008 by the Marine Research Group and brought to the attention of Museum Victoria. Newport is close to Melbourne's major international shipping port at the mouth of the Yarra River. The region is also close to the gas-fired Newport Power Station which discharges warmed cooling water through a channel within 400 m of the sand flats where these shrimps were taken. The cooling water channel is known as the 'warmies' by local fishers. The shrimps were distinct from other species of Crangonidae previously reported from Port Phillip Bay and after comparison with specimens lodged in the Natural History Museum and Institute, Chiba, Japan, have been determined as *Crangon uritai* Hayashi & Kim, 1999.

The genus *Crangon* Fabricius, 1798, represented by 19 species (De Grave *et al.*, 2009), has not previously been recorded from the southern hemisphere and the known distribution of *Crangon uritai* is restricted to coastal and inshore waters of East Asia. Species of the genus *Crangon* commonly occur in littoral and sublittoral areas of cold and temperate regions of the northern hemisphere. Hayashi & Kim (1999) published a review of the East Asian species and believed them to be an abundant and important component of the coastal soft bottom communities as many *Crangon* species are described as prey or predators of flat fish (Seikai *et al.*, 1993; Minami, 1998; Mori, 1998).

Caridean shrimps have pelagic larval stages so there is the potential for them to be taken in with ships' ballast water and transported. Although Poore & Storey (1999) did not find any introduced caridean species in Port Phillip Bay at that time, they did suggest the possibility of this occurring citing that a species of Palaemonidae known from many coasts of the North Pacific, *Palaemon macrodactylus* Rathbun, 1902, has been reported from New South Wales (Pollard & Hutchings, 1990; Poore, 2004).

MATERIALS AND METHODS

The examined material remains deposited in Museum Victoria (NMV) and the Natural History Museum and Institute, Chiba (CBM). The measurement provided is of the

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postorbital carapace length (cl) measured from the level of the posterior margin of the orbit to the midpoint of the postero-dorsal margin of the carapace.

SYSTEMATICS

Family CRANGONIDAE Haworth, 1825
Genus *Crangon* Fabricius, 1798
Crangon uritai Hayashi & Kim, 1999
(Figures 1–4)

Crago sp. Urita, 1926: 429.

Crangon crangon. Parisi, 1919: 90; Liu, 1955: 58, pl. 21, figures 1–10. Not *Crangon crangon* Linnaeus, 1758.

Crangon affinis. Kubo, 1965: 622, figure 60, text figures 127 & 128 (in part); Miyake, 1982: 71, pl. 24, figure 4. Not *Crangon affinis* De Haan, 1849.

?*Crango cassiope*. Yasuda, 1956: 8, 65, unnumbered figure, figure 29; Maekawa, 1961: 172.

Crangon uritai. Hayashi & Kim, 1999: 86, figures 13–26; Cha *et al.*, 2001: 148–149, unnumbered figure.

MATERIAL EXAMINED

Australia: Victoria, Greenwich Bay, Newport (37°51′S 144°53′E), collected using hand sieve in muddy intertidal zone by B. Hall, 8 May 2008, NMV J46548 (1 female, cl 3.8 mm); same locality, collected by hand and sieved from among filamentous *Chlorophyta*, and *Heterozostera nigricaulis* Kuo, 2005 by V. Stajsic and J Eichlert, 8 June 2008, NMV J58308 (2 females, cl 6.1, 6.3 mm).

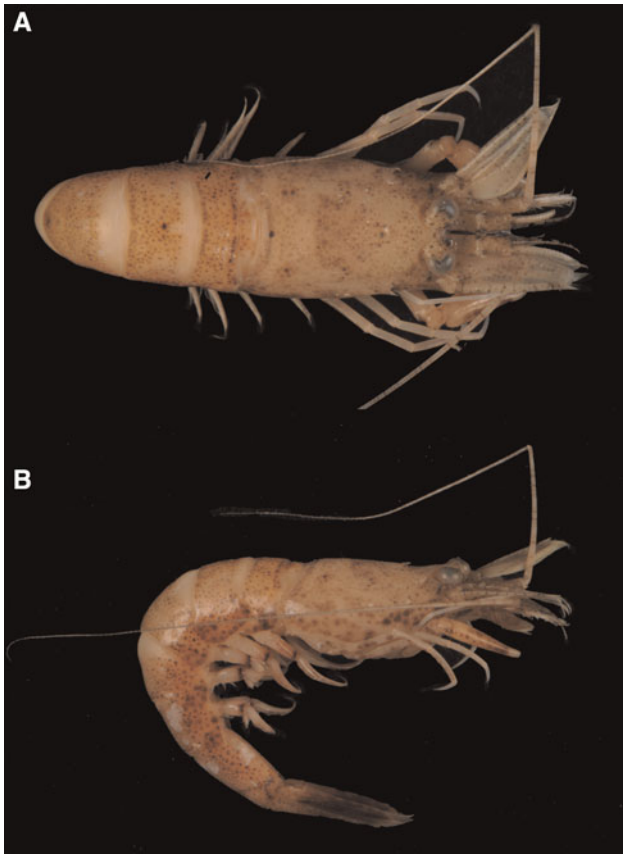

Fig. 1. *Crangon uritai* Hayashi & Kim, 1999, NMV J58308. (A) Dorsal view; (B) lateral view, taken of preserved specimen. Photographs: D. Staples, Museum Victoria.

Japan: Iwate Prefecture, Ohtsuchi Bay, Shirahama, 2 m, sand bottom, sledge, coll. I. Takeuchi, 15 May 1995, CBM-ZC 5242 (1 female, cl 8.2 mm; 1 ovigerous female, cl 9.3 mm); Chiba Prefecture, Boso Peninsula, Katsuura, Yoshio, subtidal, sand bottom, beach seine, coll. E. Nishi, 29 July 1995, CBM-ZC 5246 (7 males, cl 4.5–6.3 mm; 10 ovigerous females, cl 7.0–10.8 mm).

COMPARATIVE MATERIAL EXAMINED

Crangon crangon (Linnaeus, 1758). England: Sussex, Orwell estuary, 51°59.043′N 01°16.004′E, subtidal, coll. S. De Grave and C. Asheley, CBM-ZC 9559 (8 males, cl 7.0–8.0 mm; 2 females, cl 9.0, 10.1 mm; 2 ovigerous females, cl 8.5, 11.0 mm).

TYPE LOCALITY

Dadaepo, Pusan, Korea, 1 m.

ABBREVIATED DESCRIPTION OF AUSTRALIAN SPECIMENS

Rostrum (Figure 2A) only reaching to mid-length of eyes, about 0.15 of carapace length, narrowing distally to rounded apex; carapace (Figure 2A) with median gastric spine arising from anterior about 0.20 of carapace length; hepatic spine arising slightly anterior to median gastric spine; hepatic groove distinct; antennal spine slightly falling short of or reaching rostral distal margin; branchiostegal spine reaching to level of distal corneal margin; orbital margin with distinct cleft; longitudinal suture extending from base of antennal spine to midlength of carapace.

Thoracic sternum is nearly flat, not depressed below; sternite 5 (Figure 2B) with short median spine only reaching anterior margin of transverse keel on sternite 4; sternite 6 with small median tubercle.

Abdominal somites 3–5 (Figure 2C) without median carina; abdominal somite 6 with shallow median groove ventrally (Figure 2D), without even trace of submedian carinae or median groove dorsally; pleura unarmed. Telson without median groove dorsally.

Antennular peduncle (Figure 2A) reaching mid-length of antennal scale; stylocerite abruptly tapering distolaterally in small acute spine. Antennal scale (Figure 2A) 0.7–0.8 of carapace length, about 2.6 times longer than wide; lateral margin nearly straight; distolateral spine distinctly overreaching rounded distal lamella (Figure 2E).

Maxilliped 3 reaching or slightly overreaching distal margin of lamella of antennal scale, bearing subdistal clump of 4 spines on ventral surface of antepenultimate segment (Figure 2F).

Pereopod 1 with palm about 3.0 times longer than wide; cutting edge moderately oblique (Figure 2G); merus with ventral spine arising at mid-length of ventral margin. Pereopod 2 chelate, subequal in length to pereopods 3–5, fully flexed at articulation between merus and carpus. Pereopod 3 slender, overreaching pereopod 1. Pereopod 4 (Figure 2H) with dactylus 0.8–0.9 times as long as propodus. Pereopod 5 similar to pereopod 4.

Colour in life: body light sandy-brown with darker brown speckled spots on dorsal surface of carapace, abdomen, chela and walking legs. Spots on pleura are darker and denser.

DISTRIBUTION

Natural geographical range includes the Yellow Sea, northern part of the East China Sea, central and southern part of the Sea

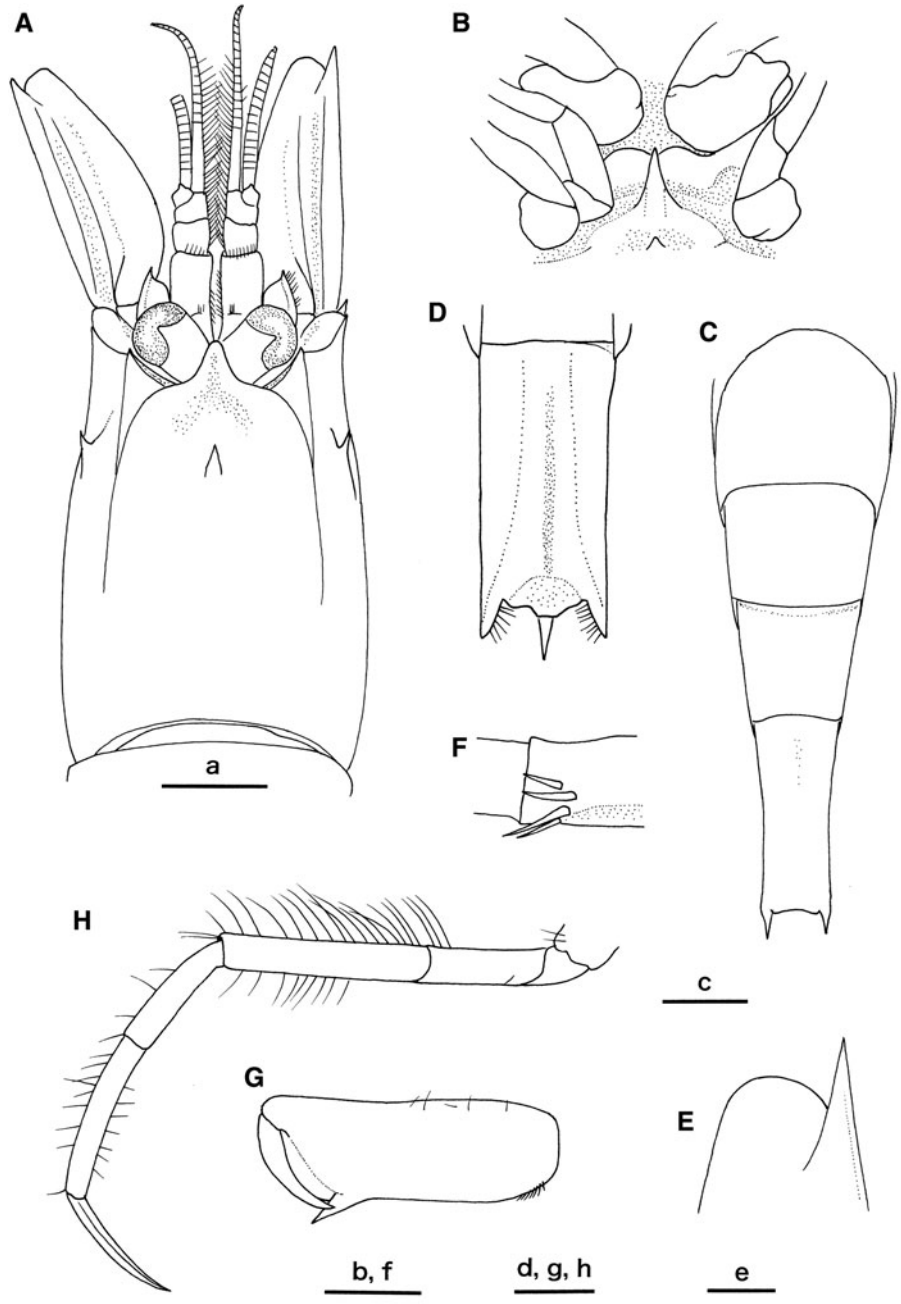

Fig. 2. *Crangon uritai* Hayashi & Kim, 1999, female (carapace length 6.3 mm), NMV J58308. (A) Carapace and cephalic appendages, dorsal view (setae partially omitted); (B) thoracic sternites 4 and 5, and coxae of pereopods 1–3, ventral view (setae omitted; left second pereopod detached); (C) abdominal somites 3–6, dorsal view; (D) abdominal somite 6, ventral view; (E) distal part of right antennal scale, dorsal view; (F) distal part of ventral surface of antepenultimate segment of maxilliped 3; (G) subchela of left pereopod 1, ventral view; (H) left pereopod 4, lateral view. Scale bars: 2 mm for a, c; 1 mm for b–d, g, h; 0.5 mm for e, f.

of Japan, and Japanese mainland (southern Hokkaido to Kyushu); intertidal to 24 m (Hayashi & Kim, 1999). The present discovery from Port Phillip Bay, Australia, is considered to be an artificial introduction from East Asian waters.

REMARKS

As noted by Hayashi & Kim (1999), *Crangon uritai* is morphologically very similar to *C. crangon*. *Crangon septemspinosa* Say, 1818, known with certainty from the northern part of the Gulf of St Lawrence to east Florida, is also similar to these two species. Shared characters among the three species include: all abdominal somites are rounded dorsally, without trace of a mid-dorsal carina on the third to fifth somites or of submedian carinae or a mid-dorsal groove on the sixth somite; the sixth somite has a shallow median groove on the ventral surface. *Crangon uritai* can be distinguished from *C. crangon* and *C. septemspinosa* by the weak armature of the thoracic sternite 5. In non-spawning female of *C. uritai*, the median spine on the fifth thoracic sternite is relatively short, only reaching the anterior margin of the transverse keel on the fourth sternite; this sternal spine is reduced to a minute tubercle in spawning females. In

Fig. 3. *Crangon uritai* Hayashi & Kim, 1999, NMV J58308, image of live animal taken *in situ*. Photograph: John Eichler.

C. crangon the median spine on the sternite 5 distinctly overreaches the transverse keel on the fourth sternite even in spawning females (this study). Squires (1990) noted that this sternite has a strong spine in *C. septemspinosa*, although details remain unclear. Subdistal spines on the ventral surface of the antepenultimate segment of maxilliped 3 are four or five in *C. uritai*, but two or three in *C. crangon*. Furthermore, *C. septemspinosa* appears different from *C. uritai* and *C. crangon* in the subtruncate, rather than rounded, distal lamella of the antennal scale (Squires, 1965) and the much shorter maxilliped 3 that far falls short of the distal margin of the antennal scale (Williams, 1965, 1984; Squires, 1990), rather than slightly falling short of or reaching beyond it in *C. uritai* and *C. crangon*.

The present three Australian specimens closely agree with *Crangon uritai* in the diagnostic features mentioned above, and are identified with the species with little hesitation.

Crangon uritai can be distinguished from other crangonid species known from intertidal sediments of Port Phillip Bay by traits that define the genus *Crangon*, such as pereopod 2 being chelate and subequal in length to other pereopods, a single arthrobranch on maxilliped 3 and one ventral spine on the merus of pereopod 1. It can further be distinguished from species of *Philocheras* by the armature of the dorsal carapace surface and rostrum shape (cf. Figure 4).

KEY TO SPECIES OF CRANGONIDAE OF PORT PHILLIP BAY AND WESTERN PORT, VICTORIA

1. Pereopods 2 subequal in length to other pereopods .... *Crangon uritai* Hayashi & Kim, 1999 [Port Phillip Bay]
— Pereopods 2 much shorter than other pereopods .... *Philocheras* 2
2. Carapace with 3 mid-dorsal teeth including epigastric tooth ..... *P. victoriensis* (Fulton & Grant, 1902) [Port Phillip Bay and Western Port]
— Carapace with 1 or 2 mid-dorsal teeth including epigastric tooth 3
3. Carapace with 1 mid-dorsal tooth (epigastric tooth) .... *P. flindersi* (Fulton & Grant, 1902) [Western Port]
— Carapace with 2 mid-dorsal teeth including epigastric tooth 4
4. Carapace with longitudinal row of small teeth posterior to orbit ..... *P. intermedius* (Bate, 1863) [Port Phillip Bay]
— Carapace without longitudinal row of small teeth posterior to orbit ..... *P. obliquus* (Fulton & Grant, 1902) [Port Phillip Bay]

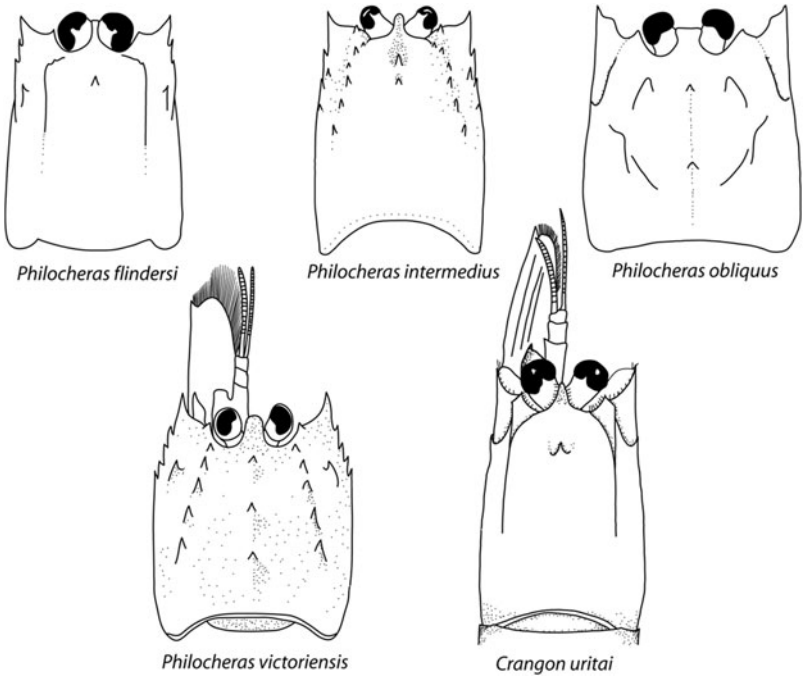

Fig. 4. Carapace (dorsal view) of species of Crangonidae reported from Port Phillip Bay and nearby waters. *Philocheras flindersi* redrawn from Poore (2004: figure 36g); *P. intermedius* redrawn from Poore (2004: figure 36h); *P. obliquus* redrawn from Poore (2004: figure 36i); *P. victoriensis* redrawn from Poore (2004: figure 36c); *Crangon uritai* redrawn from Hayashi & Kim (1999: figure 13).

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