

# Description of two species of *Caprella* (Crustacea: Amphipoda: Caprellidae) from the North Pacific; *C. californica* Stimpson, 1857 and *C. scauroides* Mayer, 1903, with a new appraisal of species ranking for *C. scauroides*

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**Abstract** *Caprella californica* Stimpson, 1857 [sensu lato] is one of the dominant species of *Caprella* spp. (Crustacea: Amphipoda) along the Pacific coast of Mexico to Canada and Japan to Hong Kong, China, and recently widely reported from the Australian coasts. Detailed morphological comparison of *C. californica* [sensu lato] collected from California and the Uwa Sea, Japan, revealed several diagnostic differences, including: (1) the body somites of the former are more slender than those of the latter; (2) in the male of the former, head possesses an anteriorly curved dorsal projection, while in the latter, head possesses a straight, forward-pointing dorsal projection; (3) in the former, pereonite 5 is longer than pereonites 3 and 4, while in the latter, pereonite 5 is the same length as pereonite 3; (4) in the male of the former, propodus of gnathopod 2 has a small apical rectangular projection, while in the latter, the corresponding margin has a large round projection; and (5) in the former, pereopod 7 is slender with the merus and propodus subequal, while pereopod 7 in the latter is robust with the merus shorter than propodus. These differences are indications of species level differences. Thus, we propose *Caprella scauroides* Mayer, 1903 to a species level for the Japanese *C. californica* [sensu lato]. A detailed description with illustrations of *C. californica* [sensu stricto] and *C. scauroides* is provided.

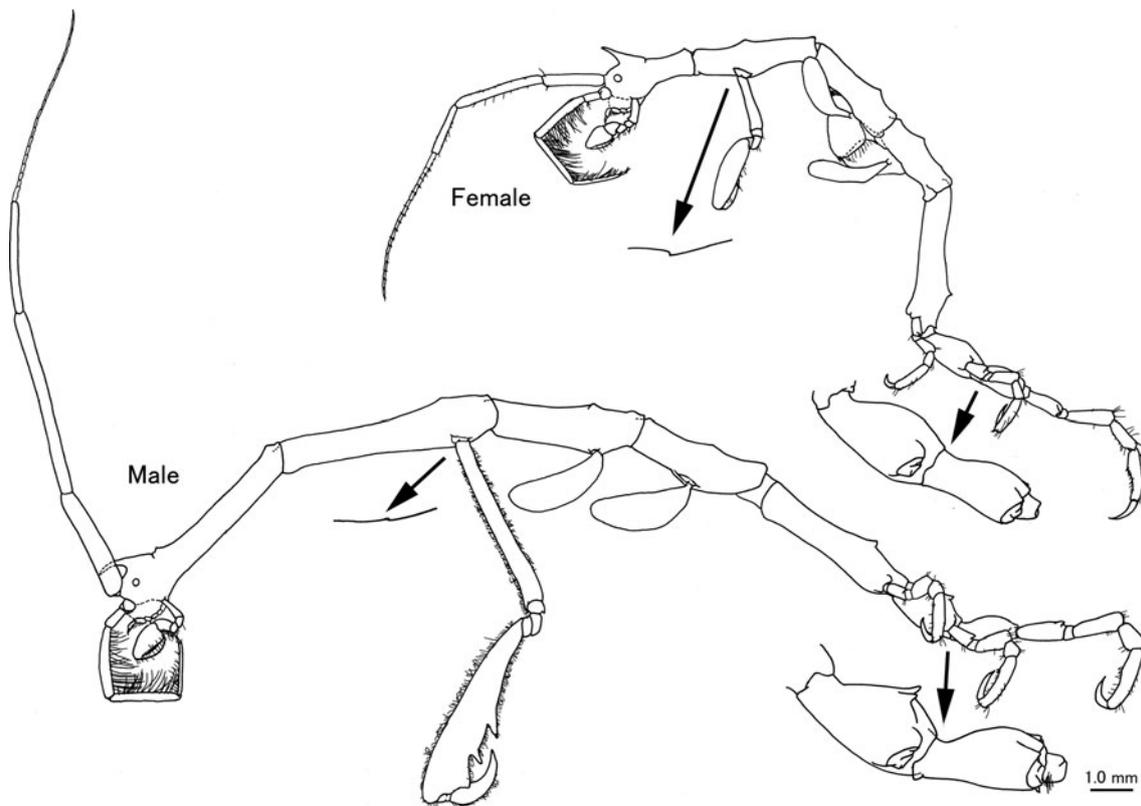
**Keywords** Amphipoda · *Caprella californica* · *Caprella scauroides* · California · Japan · Description · New rank of species level

## Introduction

*Caprella californica* Stimpson, 1857 [sensu lato] was reported from California during the 19th Century as one of the earlier reported species of the genus *Caprella* (Stimpson 1857). Mayer (1890, 1903) recognized 6 “formae” (=varieties), that is, *Caprella scaura* f. *californica* Stimpson from California, *C. scaura* f. *cornuta* Mayer, 1890 from Brazil, *C. scaura* f. *diceros* Mayer, 1890 from Japan, *C. scaura* f. *scauroides* Mayer, 1903 from Hong Kong, China and Japan, *C. scaura* f. *spinirostris* Mayer, 1903 from Chile, and *C. scaura* f. *typica* Mayer, 1890 from Brazil, under *Caprella scaura* Templeton, 1836 originally reported from Mauritius in the south Indian Ocean. According to recent rules of nomenclature, these “formae” are now treated as subspecies, and the nominal subspecies of *C. scaura* from Mauritius, the type locality, should be regarded as *Caprella scaura scaura* Templeton (see Krapp et al. 2006). Utinomi (1947) described *C. scaura hamata* Utinomi, 1947 as the 7th subspecies of *C. scaura* from Japan. Dougherty and Steinberg (1953) revived *C. californica* as a valid species, and McCain and Steinberg (1970) synonymized *C. scaura scauroides* from the western North Pacific and *C. scaura spinirostris* from Chile with *C. californica* [sensu lato]. Laubitz (1970) and Arimoto (1976) followed McCain and Steinberg (1970)’s nomenclature. Thus, *C. californica* [sensu lato] is recognized as widely distributed from the northern and south-eastern Pacific, that is, British Colombia to the Pacific coast of Mexico (e.g., McCain and Steinberg 1970; Laubitz

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**Fig. 1** *Caprella californica* Stimpson, 1857 from San Diego, San Diego County, California, USA. Male “a”, CASIZ 189983, 24.23 mm; female “b”, CASIZ 189984, 15.55 mm

1970; Watling and Carlton 2007), Chile (e.g., McCain and Steinberg 1970), and Japan to Hong Kong, China (e.g., McCain and Steinberg 1970; Arimoto 1976, 1978; Arimoto and Kikuchi 1977; Takeuchi 1999; Aoki and Takeda 2006; Lee and Hong 2009). Moreover, recently, *C. californica* [sensu lato] was widely reported from the Australian coast (Montelli 2010). However, Krapp et al. (2006) suggested the presence of 7 subspecies of *C. scaura* including *Caprella scaura californica*, *Caprella scaura scauroides*, and *Caprella scaura spinirostris*.

Nevertheless, detailed comparisons of these *C. californica* and *C. scaura* complexes have not been reported. Thus, as a first step toward clarification of these complexes, we conducted detailed taxonomic descriptions for *Caprella californica* [sensu lato] deposited at the California Academy of Sciences, California, USA, and those newly collected from the Uwa Sea, southwestern Japan. These described specimens are mature individuals, which possess all somite appendages. The comparison revealed that there are clear differences at the species level. Thus, *C. scauroides* Mayer, 1903 is proposed to be elevated from subspecies to species level, and detailed descriptions of *C. californica* Stimpson, 1857 [sensu stricto] and *C. scauroides* are provided.

Materials examined are deposited in the Australian Museum, New South Wales, Australia, the California Academy of Sciences, California, and the Museum of Comparative Zoology, Harvard University, Massachusetts, USA. Abbreviations used in the present study are as follows: AM, the Australian Museum; CASIZ, the California Academy of Sciences, Invertebrate Zoology; MCZ, the Museum of Comparative Zoology, Harvard University; A, antenna; ABD, abdomen; G, gnathopod; L, left; LL, lower lip; MD, mandible; MX, maxilla; MXP, maxilliped; P, pereopod; R, right; UL, upper lip.

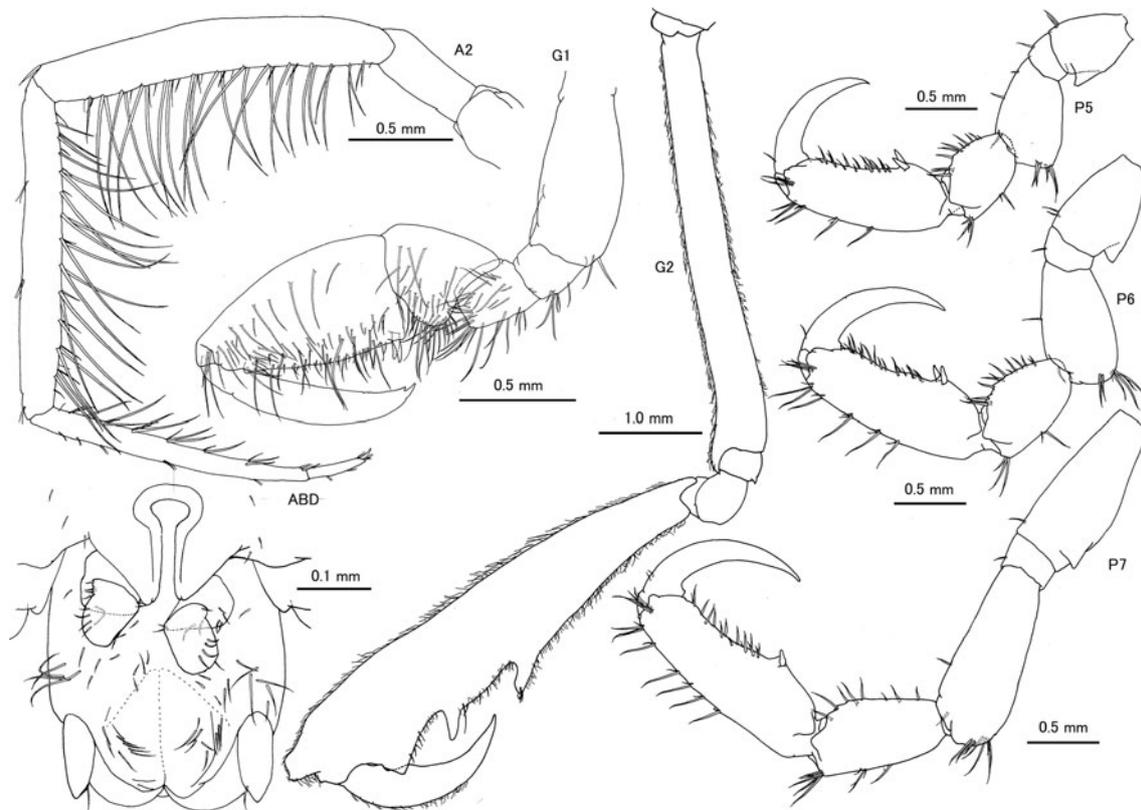
***Caprella californica* Stimpson, 1857 (Figs. 1, 2, 3, 4)**

*Caprella californica* Stimpson, 1857: 513–514; Boeck 1872, 35–37, 48, fig 1; Stimpson 1873, 97; Mayer 1882, 68–69; Dougherty and Steinberg 1953 44, 47; McCain and Steinberg 1970, 14 (in part); Laubitz 1970, 49–53, map fig 5b, fig 15; Martin 1977, 158–159; Watling and Carlton 2007, 624, 627, pl 309a.

*Caprella scaura* [not Templeton, 1836]: Mayer 1890, 70–73 (in part).

*Caprella scaura* f. *californica*: Mayer 1903, 118–119, pl 5 fig 13.

*Caprella scaura californica*: Krapp et al. 2006, 3.



**Fig. 2** *Caprella californica* Stimpson, 1857 from San Diego, San Diego County, California, USA. Male “a”, CASIZ 189983, 24.23 mm, A2, G1, G2, P5, P6 and P7; male “e”, CASIZ 189985, 26.39 mm, ABD

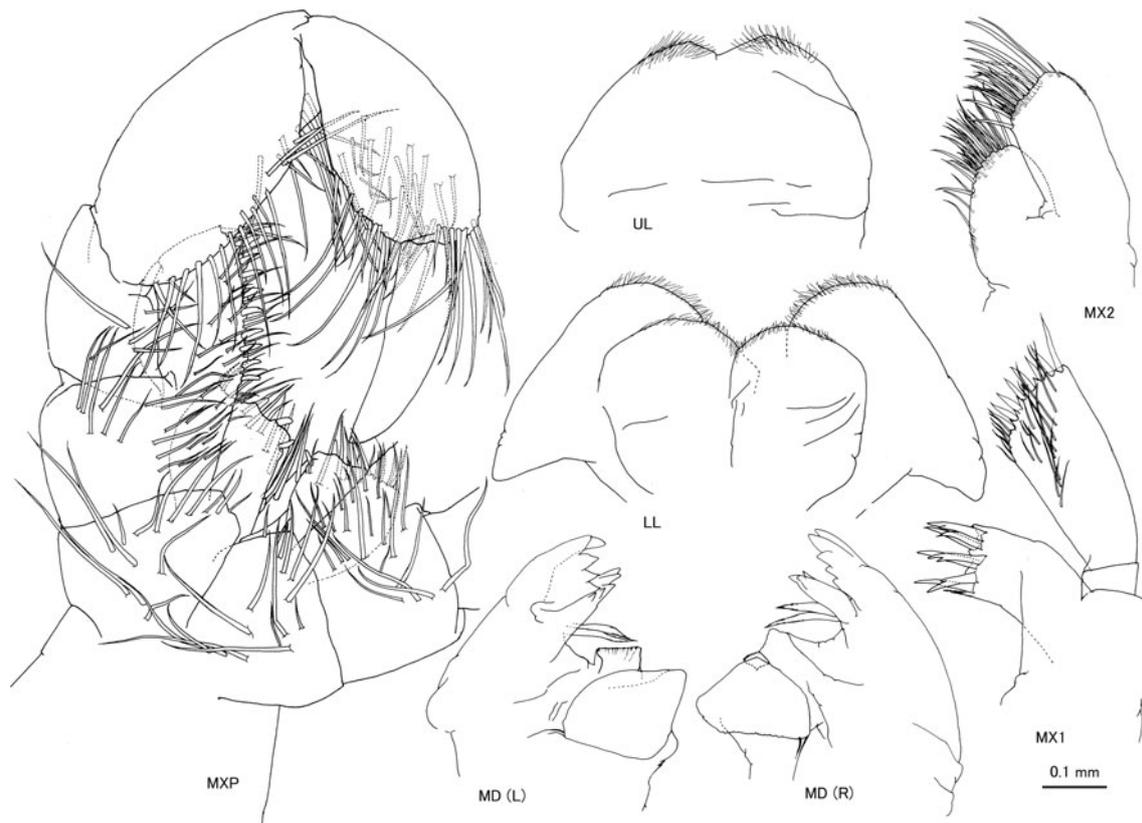
**Material examined** Male “a”, CASIZ 189983, San Diego, San Diego County, California, USA, 16 June 1995, Coll. E.C. Starns; mature female “b”, CASIZ 189984, San Diego, San Diego County, California, USA, 16 June 1995, Coll. E.C. Starns; male “e”, CASIZ 189985, San Diego, San Diego County, California, USA, 16 June 1995, Coll. E.C. Starns; mature female “f”, CASIZ 189986, San Diego, San Diego County, California, USA, 16 June 1995, Coll. E.C. Starns; ca. 15 individuals, CASIZ 189987, San Diego, San Diego County, California, USA, 16 June 1995, Coll. E.C. Starns; 1 male, AM-P.89080 (ex. CASIZ 9785), San Diego, San Diego County, California, USA, 16 June 1995, Coll. E.C. Starns; 1 mature female, AM-P.89081 (ex. CASIZ 9785), San Diego, San Diego County, California, USA, 16 June 1995, Coll. E.C. Starns; 2 males, CASIZ 189988, Hog Island, Tomales Bay, Marin County, California, USA, Mudflat E of Hog Island, 2 April 1971, coll. Schneebeli W, Hansen R and Iverson E.

**Description** Male “a”, CASIZ 189983. Body slender, 24.23 mm in body length. Pereonite 2 longest followed by pereonite 1 and pereonite 5. Head, 1.16 mm and pereonite 1, 4.09 mm; head and pereonite 1 partially fused; head with an anteriorly curved dorsal projection; eye, distinctive; pereonite 1 with a small anterodorsal projection and a

dorsodistal projection. Pereonite 2, 5.26 mm with a small dorsal projection from 1/4 of posterior end and a minute ventral projection between gnathopod 2; height  $0.25 \times$  length. Pereonite 3, 3.67 mm with a small mid-dorsal projection and a dorsodistal projection. Pereonite 4, 3.16 mm with a small mid-dorsal projection and dorsolateral projection. Pereonite 5, 4.09 mm with a mid-dorsal projection. Pereonite 6, 1.58 mm with a pair of mid-dorsal projections. Pereonite 7, 1.21 mm with a pair of dorsodistal projections.

**Antenna 1**,  $0.65 \times$  body length; peduncular article 2 longest,  $1.7 \times$  article 1; article 3 subequal with article 1; flagellum with 20 articles, proximal article composed of 3 articles. **Antenna 2**,  $0.4 \times$  antenna 1; peduncular article 2 to flagellum article 1 with swimming setae.

**Upper lip** notched, wider than long, forming a pair of rounded projections, and finely setose. **Lower lip** well developed. **Mandible** left incisor with 5 teeth followed by lacina mobilis with 5 teeth and 2 accessory setal rows; molar well developed with a large flake-like projection and a small seta. **Mandible** right incisor with 5 teeth followed by lacina mobilis with 3 teeth and 2 accessory setal rows; molar well developed with a small molar flake and a small seta. **Maxilla 1** outer plate with 7 stout apical setal-teeth;



**Fig. 3** *Caprella californica* Stimpson, 1857 from San Diego, San Diego County, California, USA. Male “a”, CASIZ 189983, 24.23 mm

palp biarticulate; article 2,  $5 \times$  article 1 with a row of slender to robust marginal setae and 2 rows of lateral setae. *Maxilla 2* inner plate oval with 2 rows of apical setae; outer plate with 2 rows of apical setae. *Maxilliped* lateral to basal margin densely setose; basal endite (inner plate) round with 3 stout teeth and a row of lateral setae; ischial endite (outer plate) subequal to inner plate with a row of apical setae; palp 4 articulate; article 2 longest, setose on inner margin; article 3,  $0.8 \times$  article 4, setose on lateral to apical margin; palp article 4 (dactylus) falcate.

**Pereon** *Gnathopod 1*; basis subequal to propodus with 2 posterodistal setae; merus to carpus setose; propodus subtriangular,  $2 \times$  width, and densely setose on palm and lateral margin; palm begins near posterior margin with a pair of strong proximal spines; dactylus slightly curved distally.

*Gnathopod 2* begins  $1/8$  along posterior margin of pereonite 2; basis subequal to pereonite 2, with dense fine setae on lateral parts and an anterodistal triangular projection; propodus subequal with basis and  $4 \times$  width; dorsal surface slightly convex and finely setose with a small rectangular apical projection; palm finely setose; proximal projection with a robust seta from  $3/5$  of proximal end; mid-palmar projection followed by a sinus and a small

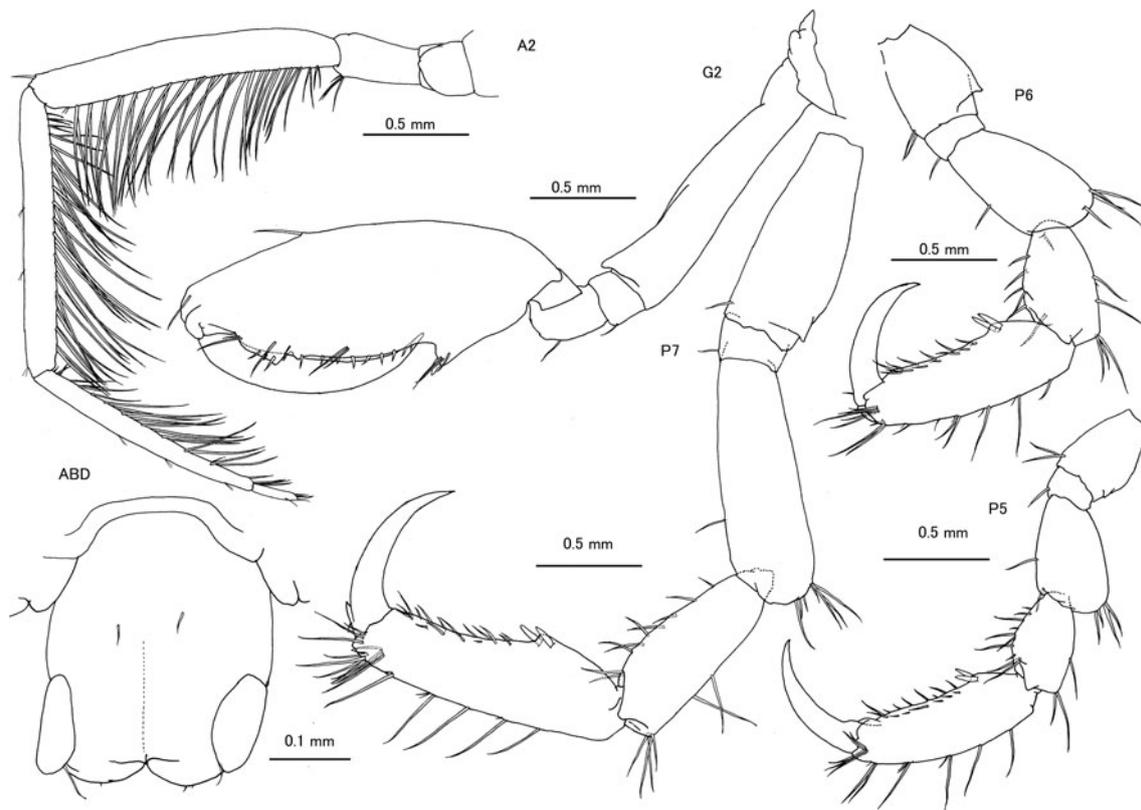
triangular projection; dactylus falcate, finely setose on lateral part.

*Gill 3* oval,  $2 \times$  width and  $0.75 \times$  pereonite 3. *Gill 4* similar to gill 3.

*Pereopods 5 to 7* slender; pereopod 5, basis with a distal triangular projection; merus  $1.5 \times$  basis and  $0.5 \times$  propodus, laterally expanded with several setae; carpus subequal to basis; propodus  $2 \times$  basis, with a pair of stout proximal setae and ca. 10 pair of setae on palm; dactylus falcate. *Pereopod 6* longer,  $1.3 \times$  pereopod 5. *Pereopod 7* elongated, especially, basis, merus and carpus,  $1.5 \times$  pereopod 6 and  $2 \times$  pereopod 5; merus  $1.2 \times$  basis and subequal to propodus.

**Pleon** [Based on male “e”, CASIZ 189985, 26.39 mm] *Uropod 1* uniramus with 4 lateral setae. *Uropod 2* uniramus with an apical seta. Telson round.

**Female “b”**, CASIZ 189984 Body length, 15.55 mm. Pereonite 5 longest followed by pereonite 2. Head, 1.03 mm and pereonite 1, 1.13 mm; head with an anterior forward-pointing dorsal projection; eye distinctive; pereonite 1 with a small dorsodistal projection; pereonite 2, 2.94 mm with a small mid-dorsal projection and a minute ventral projection between gnathopod 2; pereonite 3, 2.52 mm with a mid-dorsal projection; pereonite 4,



**Fig. 4** *Caprella californica* Stimpson, 1857 from San Diego, San Diego County, California, USA. Female “b”, CASIZ 189984, 15.55 mm, A2, G1, G2, P5, P6 and P7; female “f”, CASIZ 189986, 14.90 mm, ABD

2.06 mm with a mid-dorsal projection and a minute dorso-distal projection; pereonite 5, 3.42 mm, with a mid-dorsal projection; pereonite 6, 1.42 mm; pereonite 7, 1.03 mm. *Antenna 1*  $0.6 \times$  body length; peduncular article 2 longest; flagellum with 19 articles, proximal article composed of 3 articles. *Antenna 2* slender,  $0.6 \times$  antenna 1.

**Pereon** *Gnathopod 2* begins  $2/5$  along anterior margin of pereonite 2; basis  $2/3 \times$  pereonite 2 with an anterodistal triangular projection; carpus triangular; propodus subequal with basis and  $2.5 \times$  width; dorsal surface convex with 2 setae; palm scarcely setose; proximal projection with a robust seta from  $2/5$  of proximal end; mid-palmar projection followed by a minute sinus and a small triangular projection; dactylus falcate.

**Pleon** [female “f”, CASIZ 189986, 14.90 mm] A seta instead of Uropod 1. Uropod 2 with an apical seta.

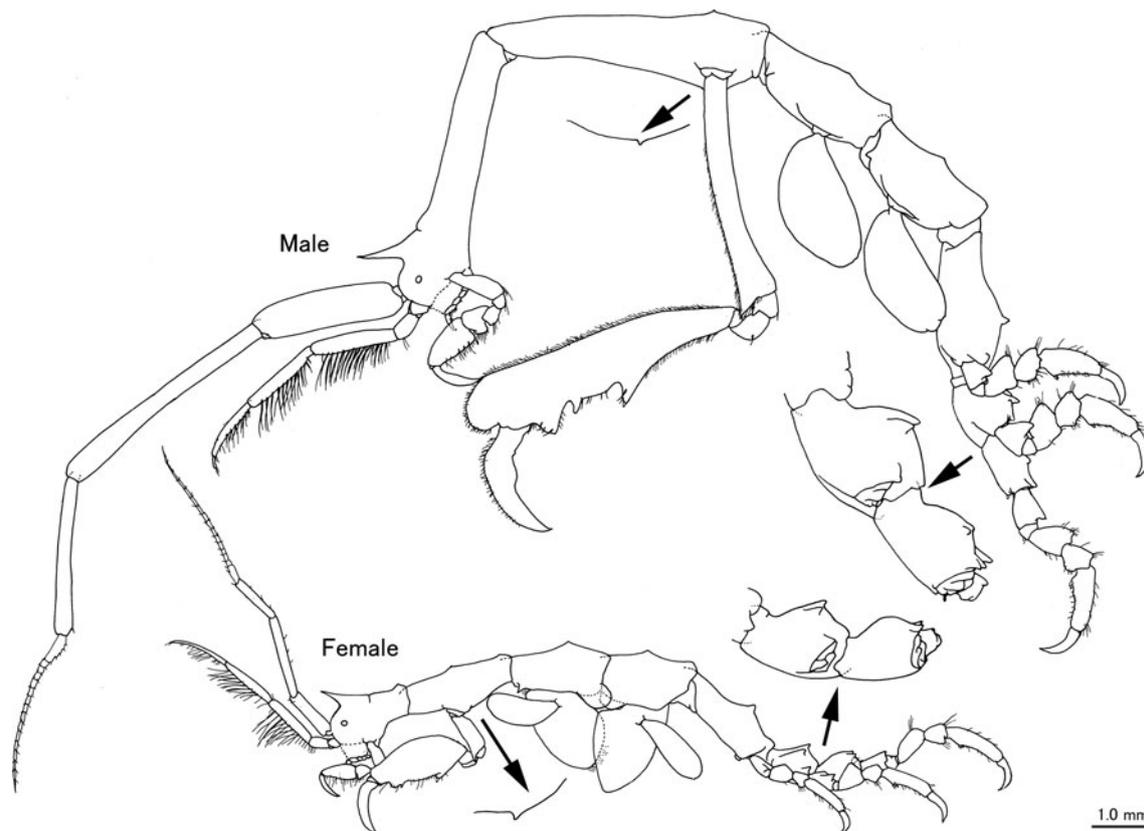
**Distribution** Type locality: California, USA.

Other records: British Columbia, Canada; Friday Harbor, Washington State, USA; Magdalena Bay and Cape San Lucas, Mexico.

**Remarks** *Caprella californica* [sensu lato] is one of the oldest species among the genus *Caprella*, originally reported from California in the 19th Century by Stimpson

(1857). Mayer (1890) synonymized *C. californica* [sensu lato] with *C. scaura* f.  $\delta$  from Hong Kong, China. However, in Mayer (1903), *C. californica* [sensu lato] was treated as *C. scaura* f.  $\xi$  *californica*, one of the 6 formae for *C. scaura*. Dougherty and Steinberg (1953) moved *C. californica* from subspecies to species level. McCain and Steinberg (1970) synonymized *C. scaura scauroides* from the western North Pacific and *C. scaura spinirostris* from Chile with *C. californica* [sensu lato] without legitimate reasons. Laubitz (1970) has provided the only sufficient description and illustrations for *C. californica* [sensu lato] from California.

The present description and illustrations for *C. californica* [sensu stricto] agree closely with those of Laubitz (1970) in: (1) the head of male possesses the anteriorly curved dorsal projection, (2) in the male, pereonite 5 is longer than pereonites 3 and 4, and (3) in the male, pereopod 7 is slender, and the merus is subequal in length with the propodus. As written in the remarks on *C. scauroides*, the difference between *C. californica* [sensu lato] from California and *C. californica* [sensu lato] from the Uwa Sea should be attributed to differences at the species level. Thus, *C. californica* [sensu lato] from California is described here as *C. californica* [sensu stricto] and



**Fig. 5** *Caprella scauroides* Mayer, 1903 from the Uwa Sea, southwestern Japan. Male “c”, AM-P.89082, 18.36 mm; female “d”, AM-P.89083, 9.49 mm

*C. californica* [sensu lato] from the Uwa Sea is described as *C. scauroides*, a new rank of species (see remarks on *C. scauroides*).

*Caprella californica* [sensu stricto] is one of the most studied species of Caprellidea along the Pacific coast of the USA (see Saunders 1966; Keith 1969, 1971; Caine 1977; Page et al. 2006; Sirota and Hovel 2006; Carr et al. 2011). Carr et al. (2011) studied the epifaunal communities in eelgrass (*Zostera marina* Linnaeus, 1753) beds in San Francisco Bay, California. Of the five stations they studied, *C. californica* was the dominant species of *Caprella* spp. at Richardson Bay, near the entrance channel of San Francisco Bay. Caine (1977) categorized the feeding modes of the Caprellidea into 5 categories, that is, browsing, filter-feeding, predation, scavenging, and scraping. Feeding in *C. californica* is dominated by filter-feeding and scraping. *Caprella californica* prefers the bryozoan *Bugula neritina* (Linnaeus, 1758) over the red alga *Polysiphonia pacifica* Hollenberg, 1942 and a green alga (genus *Viva*), while *C. equilibra* Say, 1818 showed no preference between *B. neritina* and *P. pacifica* (Keith 1971). The preference of *C. californica* for *B. neritina* is based on its cryptic adaptations to that substrate.

***Caprella scauroides* Mayer, 1903 (Figs. 5, 6, 7, 8) (Japanese name: Togewarekara-modoki)**

*Caprella californica*: McCain and Steinberg 1970, 14 (in part); Arimoto and Kikuchi 1977, 91–92, fig 1b; Takeuchi 1995, 199, fig 21–181; Takeuchi 1999, 7; Aoki and Takeda 2006, 67; Lee and Hong 2009, 318; Montelli 2010, 726, fig 1.

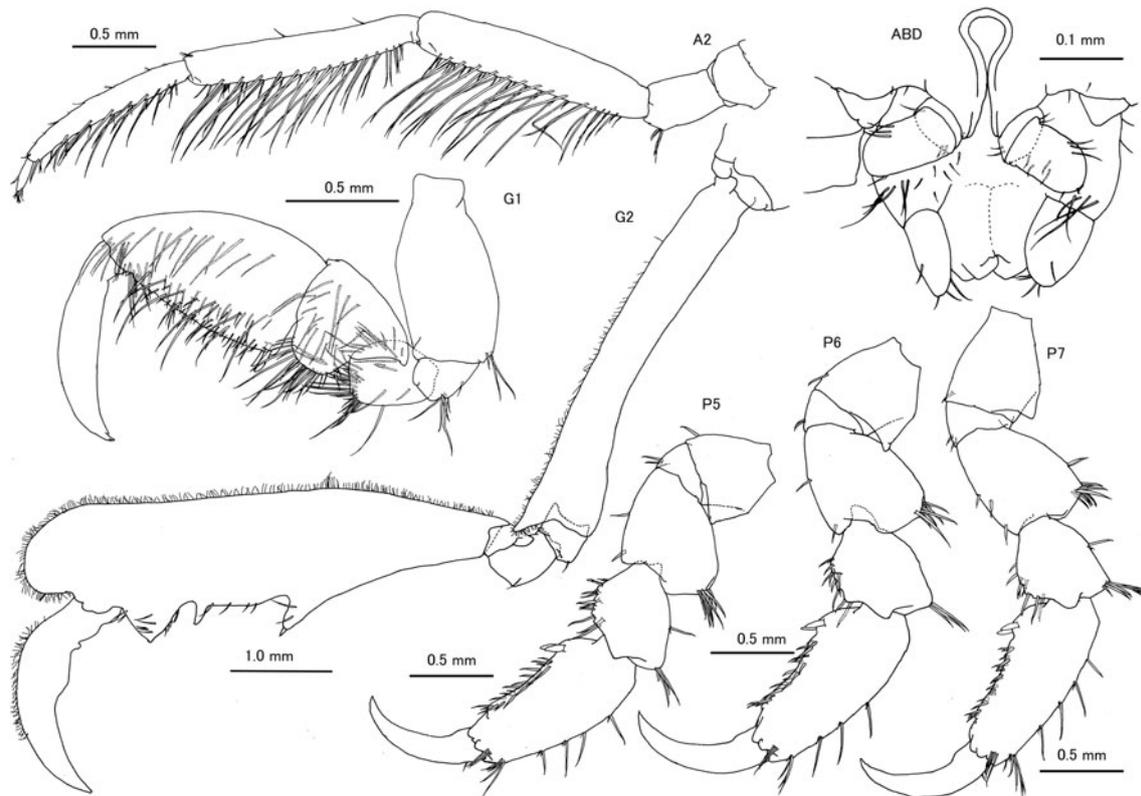
*Caprella (Spinicephara) californica*: Arimoto 1976, 139–146, figs 75–77; Arimoto 1978, 27.

*Caprella scaura* f.  $\delta$  (?): Mayer 1890, 72, pl 4 figs 43–44.

*Caprella scaura* f. *scauroides* Mayer, 1903: 118–119, pl 5 figs 16–18; Utinomi 1947, 77.

*Caprella scaura scauroides*: Krapp et al. 2006, 3.

**Material examined** Male “c”, AM-P.89082, 33°11'N, 132°28'E, off Yusu, Uwajima in the Uwa Sea, Japan, pearl oyster aquaculture facility, 16 May 2006, coll. Takeuchi I; mature female “d”, AM-P.89083, 33°11'N 132°28'E, off Yusu, Uwajima in the Uwa Sea, Japan, pearl oyster aquaculture facility, 16 May 2006, coll. Takeuchi I; male “g”, AM-P.89084, 33°11'N 132°28'E, off Yusu, Uwajima in the Uwa Sea, Japan, pearl oyster aquaculture facility, 16 May



**Fig. 6** *Caprella scauroides* Mayer, 1903 from the Uwa Sea, southwestern Japan. Male “c”, AM-P.89082, 18.36 mm, A2, G1, G2, P5, P6 and P7; male “g”, AM-P.89084, 16.44 mm, ABD

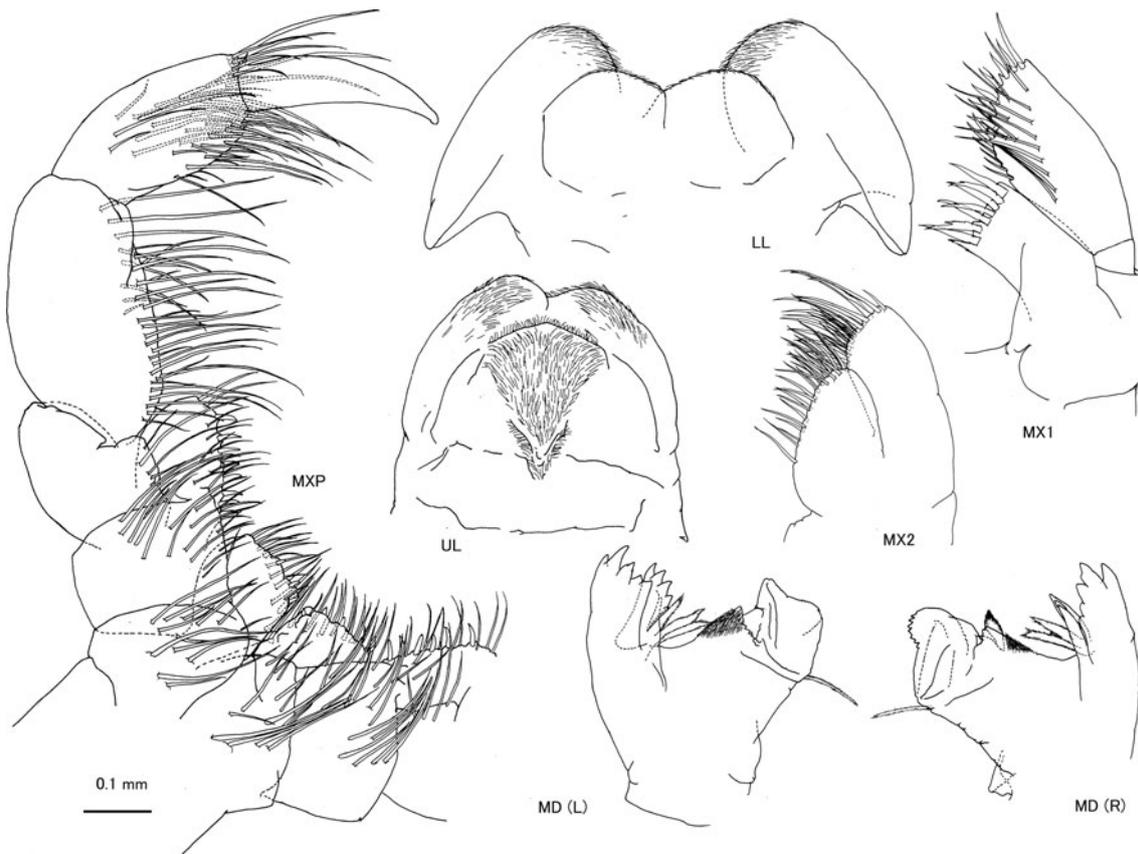
2006, coll. Takeuchi I; mature female “h”, AM-P.89085, 33°11′N 132°28′E, off Yusu, Uwajima in the Uwa Sea, Japan, pearl oyster aquaculture facility, 16 May 2006, coll. Takeuchi I; ca. 15 individuals, AM-P.89086, 33°11′N 132°28′E, off Yusu, Uwajima in the Uwa Sea, Japan, pearl oyster aquaculture facility, 16 May 2006, coll. Takeuchi I; 1 male, MCZ-126757, 33°11′N 132°28′E, off Yusu, Uwajima in the Uwa Sea, Japan, pearl oyster aquaculture facility, 16 May 2006, coll. Takeuchi I; 1 mature female, MCZ-126758, 33°11′N 132°28′E, off Yusu, Uwajima in the Uwa Sea, Japan, pearl oyster aquaculture facility, 16 May 2006, coll. Takeuchi I; ca. 20 individuals, MCZ-126759, 33°11′N 132°28′E, off Yusu, Uwajima in the Uwa Sea, Japan, pearl oyster aquaculture facility, 16 May 2006, coll. Takeuchi I.

**Description** Male “c”, AM-P.89082. Body robust, 18.36 mm in body length. Pereonite 2 longest followed by pereonite 1. Head, 0.98 mm and pereonite 1, 3.49 mm; head and pereonite 1 partially fused; head with a forward-pointing dorsal projection; eye distinctive. Pereonite 2, 4.70 mm with a small mid-dorsal projection from 1/5 of posterior end, and a small ventral projection between gnathopod 2; height 1/3 × length. Pereonite 3, 2.48 mm with a small mid-dorsal projection and a dorsodistal

projection and anterolateral projection. Pereonite 4, 2.19 mm with a small mid-dorsal projection and anterolateral projection. Pereonite 5, 2.59 mm with a mid-dorsal projection. Pereonite 6, 0.96 mm with 1 and a pair of mid-dorsal projections. Pereonite 7, 0.96 mm with a pair of mid-dorsal projections and a pair of dorsodistal projections.

*Antenna 1*, 0.65 × body length; peduncular article 1 robust; article 2 longest, 1.7 × article 1; article 3, 1.1 × article 1; flagellum with 17 articles, proximal article composed of 4 articles. *Antenna 2*, 0.4 × antenna 1; peduncular article 2 to flagellum article 1 with swimming setae.

*Upper lip* notched, wider than long, forming a pair of rounded projections, and finely setose. *Lower lip* well developed. *Mandible* left incisor with 5 teeth followed by lacina mobilis with 5 teeth and 3 accessory setal rows; molar well developed with a large flake-like projection and a long seta. *Mandible* right incisor with 5 teeth followed by lacina mobilis with 3 teeth and 2 accessory setal rows; molar well developed with a small molar flake and a long seta. *Maxilla 1* outer plate with 7 stout apical setal-teeth; palp biarticulate; article 2, 5 × article 1 with a row of slender to robust marginal setae and 2 rows of lateral setae. *Maxilla 2* inner plate oval with 2 rows of apical setae; outer



**Fig. 7** *Caprella scauroides* Mayer, 1903 from the Uwa Sea, southwestern Japan. Male “c”, AM-P.89082, 18.36 mm

plate with 2 rows of apical setae. *Maxilliped* lateral to basal part setose; basal endite (inner plate) round with 2 stout teeth and a row of apical setae; ischial endite (outer plate) subequal to inner plate with a rows of stout apical setae; palp 4 articulate; article 2 longest, setose on inner margin; article 3,  $0.8 \times$  article 4, setose on lateral to apical margin; palp article 4 (dactylus) falcate.

**Pereon** *Gnathopod 1*; basis subequal with propodus with 3 posterodistal setae; merus to carpus densely setose; propodus subtriangular,  $2 \times$  width and densely setose on palm and lateral margin; palm begins near posterior margin with a pair of strong proximal spines; dactylus slightly curved distally.

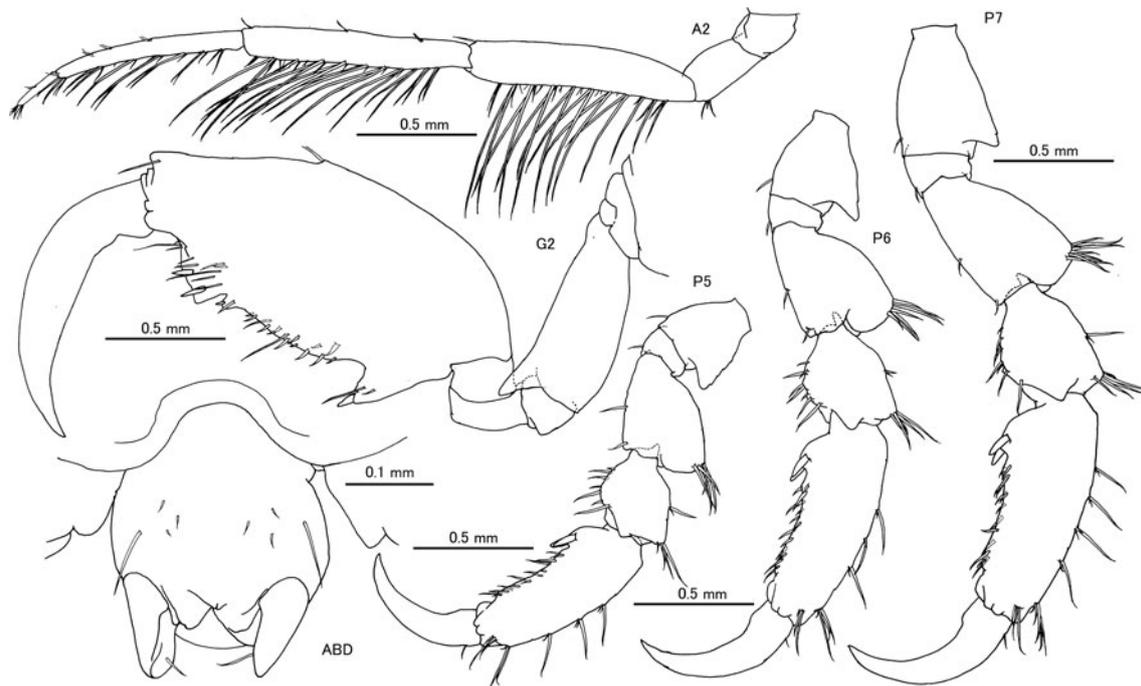
*Gnathopod 2* begins  $1/5$  along posterior margin of pereonite 2; basis subequal with pereonite 2, with dense fine setae and an anterodistal triangular projection; propodus subequal to basis and  $3 \times$  width; dorsal surface with dense fine setae and a large round apical projection; palm scarcely setose; proximal projection with a robust seta from  $1/2$  of proximal end; mid-palmar projection followed by a sinus and a large triangular projection; dactylus falcate, finely setose on dorsal margin.

*Gill 3* oval  $1.5 \times$  width and subequal to length of pereonite 3. *Gill 4* similar to gill 3.

*Pereopods 5 to 7* stout; pereopod 5, basis with a distal triangular projection; merus  $1.2 \times$  basis and  $0.6 \times$  propodus, laterally expanded with several setae; carpus  $0.8 \times$  merus; propodus  $2 \times$  carpus with a pair of stout setae and ca. 10 pair of setae on palm; dactylus falcate. *Pereopod 6* slightly longer,  $1.1 \times$  pereopod 5. *Pereopod 7* subequal to pereopod 6; merus  $1.5 \times$  basis and  $0.7 \times$  propodus.

**Pleon** [Based on male “g”, AM-P.89084, 16.44 mm] *Uropod 1* uniramus with 7 lateral setae. *Uropod 2* uniramus with an apical seta.

**Female** “d”, AM-P.89083. Body length, 9.49 mm. Pereonite 2 longest followed by pereonite 3. Head length, 0.85 mm and pereonite 1, 0.62 mm; head with a forward-pointing projection; eye distinctive; pereonite 1 with a small dorsodistal projection; pereonite 2, 1.82 mm with a small mid-dorsal projection, a small dorsodistal projection and a ventral projection between gnathopod 2; pereonite 3, 1.69 mm with a mid-dorsal projection and anterolateral projection; pereonite 4, 1.43 mm with a mid-dorsal projection and dorsodistal projection; pereonite 5, 1.59 mm, with a mid-dorsal projection; pereonite 6, 0.78 mm with 1 and a pair of mid-dorsal projections; pereonite 7, 0.70 mm with a pair of anterodorsal projections. *Antenna 1*



**Fig. 8** *Caprella scauroides* Mayer, 1903 from the Uwa Sea, southwestern Japan. Female “d”, AM-P.89083, 9.49 mm, A2, G1, G2, P5, P6 and P7; female “h”, AM-P.89085, 10.32 mm, ABD

0.6 × body length; peduncular article 2 longest; flagellum with 17 articles, proximal article composed of 2 articles. *Antenna 2* slender, 0.6 × antenna 1.

**Pereon** *Gnathopod 2* begins 2/5 along anterior margin of pereonite 2; basis 0.5 × pereonite 2 with an anterodistal triangular projection; carpus triangular; propodus 1.5 × basis and 2.5 × width; dorsal surface convex with 2 setae with a small apical triangular projection; palm scarcely setose; proximal projection with 1 robust seta from 1/4 of proximal end; small mid-palmar projection followed by a small sinus and a triangular projection; dactylus falcate.

**Pleon** [Based on female “h”, AM-P.89085, 10.32 mm]. Provided with 1 long seta followed by 3 small setae instead of uropod 1. Uropod 2 with an apical seta.

**Distribution** Type locality: Hong Kong, China.

Other records: Aomori Prefecture to Kyoto Pref. along the coast of the Sea of Honshu Island, Seto Inland Sea, Fukuoka Pref. to Kumamoto Pref. of western coast of Kyushu Island, and Chiba Pref. to Miyazaki Pref. along the Pacific coast of Honshu, Shikoku and Kyushu Islands, Japan. South Jeolla Province (Jeollanam-do), Korea. Yellow Sea. The Port of Cairns, Queensland, Sydney Harbour, New South Wales, Hobsons Bay, Victoria, and Cockburn Sound, Western Australia, Australia.

**Remarks** Mayer (1890) briefly described an unnamed forma (“forma δ (?)” in the caption of Plate 4) differing

from *C. scaura* f. *typica* and *C. scaura* f. *diceros*, based on specimens collected from Hong Kong, China. Later, Mayer (1903) named this forma *Caprella scaura* f. *scauroides* with the description and the lateral view figures of 2 males and 1 mature female. The characteristics of male *C. californica* [sensu lato] from the Uwa Sea agree well with those of the larger male *C. scaura* f. *scauroides* in Mayer (1903; Plate 5 Fig. 18) in (1) the body somites are stout; (2) head possesses the straight, forward-pointing dorsal projection; (3) the propodus of gnathopod 2 possesses a round apical projection; (4) gills are oval, and (5) pereonite 5 is almost the same length as pereonites 3 and 4. The characteristics of mature females *C. californica* [sensu lato] from the Uwa Sea also agree favorably with *C. scaura* f. *scauroides* as illustrated in Mayer (1903; Plate 5 Fig. 16).

The present study indicated that *C. californica* [sensu lato] from the Uwa Sea, Japan, differs from *C. californica* [sensu lato] from California in the following characteristics:

1. The body somites of *C. californica* [sensu lato] from the Uwa Sea are more robust than *C. californica* [sensu lato] from California in both sexes. The height of pereonite 2 in male *C. californica* [sensu lato] from the Uwa Sea is 1/3, while it is 1/4 in *C. californica* [sensu lato] from California.
2. Male *C. californica* [sensu lato] from the Uwa Sea possess a straight, forward-pointing dorsal projection,

while those from California possess an anteriorly curved dorsal projection.

3. In male *C. californica* [sensu lato] from the Uwa Sea, the propodus of gnathopod 2 possesses a round apical projection, while the California specimen has a rectangular apical projection.
4. In male *C. californica* [sensu lato] from the Uwa Sea, pereonite 5 is the same length as pereonites 3 and 4, while in the California specimen, pereonite 5 is longer than pereonites 3 and 4. In females, pereonite 2 is the longest among the body somites of *C. californica* [sensu lato] from the Uwa Sea, while in the California form pereonite 5 is the longest.
5. In male *C. californica* [sensu lato] from the Uwa Sea, pereonite 7 has a pair of mid-dorsal projections, while in the California specimen, pereonite 7 has no mid-dorsal projections.
6. In the Uwa Sea form, pereopods 6 and 7 are robust and slightly longer compared with pereopod 5; pereopod 7 is 1.3 times longer than pereopod 5 in males. The merus of pereopod 7 is shorter than the propodus. Conversely, in the California specimen, pereopods 6 and 7 are slender and much longer than pereopod 5; pereopod 7 is 2 times longer than pereopod 5 in males. The merus of pereopod 7 is the same length as the propodus.

Takeuchi (1989) described the body somites and appendages of each instar of 4 species of *Caprella* reared in the laboratory. He revealed that the characteristics of antennae 1, 2, and pereopods 5–7 are rather stable in both sexes and growth stages, compared with other characteristics including the ratio of each pereonite length and gnathopod length to the body length. The difference between *C. californica* [sensu lato] from the Uwa Sea and *C. californica* [sensu lato] from California should be attributed to differences at the species level. Thus, *C. californica* [sensu lato] from California is described as *C. californica* [sensu stricto] (see remarks on *C. californica*) and *C. californica* [sensu lato] from the Uwa Sea was described as *C. scauroides* Mayer, 1903, a new rank of species.

*Caprella californica* [sensu lato] was one of the dominant species of the genus *Caprella* along the coast of Japan. Arimoto (1976) reported that *C. californica* [sensu lato] distributed from the western part of Kyushu to the Tsugaru Strait along the coasts of the Sea of Japan, Seto Inland Sea coasts and the southeast part of Kyushu to Tateyama Bay along the Pacific coasts of Japan, and the middle of the Yellow Sea. *C. californica* [sensu lato] was listed as one of the dominant species of *Caprella* spp. from Amakusa, western Kyushu (Aoki 1999) and as one of the dominant epifaunal species on the gorgonian *Melithaea flabellifera* (Kükenthal, 1908) at the Izu Peninsula, central Japan

(Kumagai and Aoki 2003). In 2001, the usage of *Caprella* spp. to monitor temporal and spatial changes of butyltin concentrations in shallow water ecosystems was proposed (Takeuchi et al. 2001). The butyltin concentrations in seawater and *Caprella* spp. from the Uwa Sea and Uranouchi Bay, where the dominant industry is aquaculture, was equal to or significantly higher than samples from the western part of the Seto Inland Sea, a major, heavy-industrial area in western Japan (Murai et al. 2005). *Caprella californica* [sensu lato] was one of the dominant species of *Caprella* spp. in this survey. Matsuo et al. (2010) also reported the occurrence of *C. californica* [sensu lato] as the dominant species of *Caprella* spp. inhabiting fish and pearl oyster aquaculture facilities along the coasts of the Uwa Sea during a survey on nitrogen loading from fish aquaculture facilities. *Caprella californica* [sensu lato] in the above studies should henceforth be regarded as *C. scauroides*.

*Caprella californica* [sensu lato] was recently reported from the Australian coast (Montelli 2010). *C. californica* [sensu lato] was first recorded from Sydney Harbour, New South Wales in 2002, and Cockburn Sound, Western Australia, Hobsons Bay, Victoria, and the Port of Cairns, Queensland. Based on the lateral view photograph of a male (Montelli 2010; p 726), the Australian *C. californica* [sensu lato] is more similar to *C. scauroides* from the Uwa Sea, Japan, than to *C. californica* [sensu stricto] from California in robust body somites, the straight, forward-pointing dorsal projection on the head, round apical projection on the propodus of gnathopod 2, and the similar lengths of pereonites 3, 4 and 5.

Mayer (1890) briefly described *C. scaura* f. *spinirostris*, supplying figures of the head and propodus of gnathopod 2. Mayer (1903) reported the presence of a projection in the ventral face of pereonite 2 in small males and paired projections on pereonite 5 on old males of *C. scaura* f. *spinirostris*. Krapp et al. (2006) also mentioned that *C. scaura spinirostris* has a ventral spine, unlike *C. scaura diceros*, *C. scaura cornuta* and *C. scaura typica*. As written in the Introduction, McCain and Steinberg (1970) synonymized *C. scaura* f. *spinirostris* with *C. californica* [sensu lato]. Guerra-García and Thiel (2001) reported “*Caprella scaura*” from Coquimbo, northern-central Chile, which is the type locality of *C. scaura* f. *spinirostris*. They simply described that “*C. scaura*” from Coquimbo possesses the ventral projection between gnathopod 2 on pereonite 2. While the characteristics of gnathopod 2 and pereonite 5 are unclear, their description indicates that “*C. scaura*” from Coquimbo might actually be *C. scaura* f. *spinirostris*. Nevertheless, in the synonym list for “*C. scaura*” in Guerra-García and Thiel (2001) “*C. californica*” and *C. scaura* f. *spinirostris* was not included. Thus, further detailed studies with descriptions and figures are necessary

before the taxonomic status of “*Caprella scaura*” from Coquimbo, Chile can be clarified.

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