To Dr. Brian Kensley
With the compliments of KIM

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Revision of the East Asian species of *Crangon* (Decapoda: Caridea: Crangonidae)

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***Abstract.*—Based on several type specimens and material collected from various localities, the East Asian species of *Crangon* are revised. *C. affinis* De Haan, 1849, *C. propinquus* Stimpson, 1860, *C. dalli* Rathbun, 1902a, *C. hakodatei*, Rathbun, 1902b, *C. cassiope* De Man, 1906, *C. amurensis* Brashnikov, 1907 and *C. uritai* new species are recognized. *C. affinis* is given full specific status. A neotype is designated for *C. propinquus*. *C. septemspinosa* forma *amurensis* and *C. septemspinosa* forma *anivensis* are assigned to *C. amurensis*. The taxonomic status of *C. dalli*, *C. hakodatei* and *C. cassiope* is clarified by the examination of the type specimens and/or topotypic specimens. Each species is diagnosed and illustrated. *C. uritai*, which had been confused with *C. affinis*, is fully described and illustrated. Affinities and distribution of these seven species are discussed and a key is provided.**

Introduction

Shrimps of the genus *Crangon* Fabricius, 1798 are characterized by one median gastric spine on the carapace, a single arthrobranch on the third maxilliped and one ventral spine on the merus of the first pereopod (Christoffersen, 1988). Nineteen species and subspecies in the genus have been described (Rathbun, 1904; De Man, 1920; Zarenkov, 1965; Kuris & Carlton, 1977; Holthuis, 1980).

Crangon species commonly occur in the littoral and sublittoral areas of cold and temperate regions of the Northern Hemisphere. They are one of the most abundant and most important components of the coastal soft bottom communities, and are a prey or a predator of flatfishes (Seikai *et al.*, 1993; Mori, 1998; Minami, 1998).

Although 12 nominal taxa have been reported from East Asian waters (De Man, 1920; Holthuis, 1980), their taxonomic status is very unsettled as species are easily confused with each other. A thorough revision of *C. affinis* De Haan, 1849 and related taxa has long been awaited (Hayashi, 1976; Holthuis, 1980; Komai, 1994). Very recently, the neotype of *C. affinis* was designated as the first step of the revision of the East Asian *Crangon* (Hayashi & Kim, 1998).

The present study reviews *Crangon affinis* and related species based on materials collected from various East Asian localities, several type specimens and material deposited at European and American museums. The following seven species, including a new one, are recognized: *C. affinis* De Haan, 1849, *C. propinquus* Stimpson, 1860, *C. dalli* Rathbun, 1902a, *C. hakodatei*, Rathbun, 1902b, *C. cassiope* De Man, 1906, *C. amurensis* Brashnikov, 1907 and *C. uritai* new species.

Confusion on *C. affinis* species complex has been partly clarified as a result of the designation of a neotype. The specific status of *C. propinquus* Stimpson is also obscure. The original description is short and ambiguous. The types may be no longer extant (Evans, 1967) so a neotype should be established. *C. dalli* is comparatively well defined by having paired longitudinal dorsal carinae on the sixth abdominal somite, for which it was

once assigned to the subgenus *Steiracrangon* Kinahan, 1862 (Kuris & Carlton, 1977). The examination of the syntypes of *C. hakodatei* Rathbun, 1902b and *C. cassiope* De Man, 1906 reveals that they are valid species. *C. septemspinosa*, reported from the Russian Far East (Derjugin & Kobjakova, 1935; Kobjakova, 1936; 1937; 1958a; Vinogradov, 1947), are now assigned to *C. amurensis*. *Crangon uritai* new species, is common in shallow waters and had been previously confused with *C. affinis*. The new species is most closely related to the European *C. crangon* (Linnaeus, 1758) in general morphology, but the thoracic sternum is armed with a blunt process in *C. uritai* instead of the acute spine found in *C. crangon*.

The species recognized from East Asian waters are summarized as follows.

1) *Crangon affinis* De Haan, 1849

2) *Crangon propinquus* Stimpson, 1860

3) *Steiracrangon orientalis* var. *longicauda* forma *pacifica* Czerniavsky, 1884
= *Crangon propinquus* Stimpson, 1860

4) *Crangon vulgaris* sensu Bate, 1888
= *Crangon affinis* De Haan, 1849

5) *Crangon vulgaris* var. *shidlovskii* Ostroumoff, 1896
= *Crangon propinquus* Stimpson, 1860

6) *Crangon dalli* Rathbun, 1902a

7) *Crangon crangon* sensu Rathbun, 1902b
= *Crangon amurensis* Brashnikov, 1907

8) *Crangon hakodatei* Rathbun, 1902b

9) *Crangon propinquus* sensu Rathbun, 1902b
= *Crangon affinis* De Haan, 1849

10) *Crangon alaskensis* sensu Rathbun, 1904 (in part: from Kurile Islands)
= *Crangon propinquus* Stimpson, 1860

11) *Crangon consobrinus* De Man, 1906
= *Crangon affinis* De Haan, 1849

12) *Crangon cassiope* De Man, 1906

13) *Crangon septemspinosa* var. *propinqua* sensu Brashnikov, 1907
= *Crangon propinquus* Stimpson, 1860

14) *Crangon septemspinosa* forma *amurensis* Brashnikov, 1907
= *Crangon amurensis* Brashnikov, 1907

15) *Crangon septemspinosa* forma *anivensis* Brashnikov, 1907
= *Crangon amurensis* Brashnikov, 1907

16) *Crangon septemspinosa* sensu Derjugin & Kobjakova, 1935
= *Crangon amurensis* Brashnikov, 1907

17) *Crangon crangon* sensu Liu, 1955
= *Crangon uritai* new species

18) *Crangon affinis* sensu Liu, 1955
= *Crangon hakodatei* Rathbun, 1902b

Materials and Methods

Specimens examined in this study are deposited in the institutions indicated by the following abbreviations: CBM, Natural History Museum and Institute, Chiba (with a code of ZC); HUMZ, Laboratory of Marine Zoology, Faculty of Fisheries, Hokkaido University (with a code of C); MNHN, Muséum national d'Histoire naturelle, Paris; NFU, National Fisheries University, Shimonoseki; NHM, the Natural History Museum, London; PUIZ, Invertebrate Zoology Laboratory, Department of Marine Biology, Pukyong National University; RMNH, Nationaal Natuurhistorisch Museum, Leiden; USNM, National Museum of Natural History, Smithsonian Institution, Washington, D.C.

The following *Crangon* species collected from the other areas were examined and compared with East Asian species.

Crangon crangon: 2 ♂ (8.0, 8.0 mm), 10 ♀ (6.6–12.0 mm), coll. T. Kikuchi, Vrouwenpolder, Baymouth of Oosterschelde (Rhine delta), 29 Oct 1985, NFU 530-2-1925.

Crangon crangon: 4 ovig. ♀ (12.1–16.8 mm), coll. K. Hayashi, market in Paris, 17 Aug 1992, NFU 530-2-1926.

Crangon septemspinosa: 2 ♂ (7.8, 10.5 mm), 14 ♀ (9.1–14.5 mm), coll. W. H. Dall, Chamisso Harbor, Eschscholtz Bay, Alaska, 9–15 m, det. Rathbun (1904),

USNM 23534.

Crangon septemspinosa: 2 ovig. ♀ (11.3, 11.6 mm), no definite locality, det. M. J. Rathbun, MNHN Na 1147.

Crangon alaskensis: 5 ♂ (8.8–9.2 mm), 3 ♀ (10.0–11.0 mm), 39 ovig. ♀ (9.5–13.8 mm), *Albatross* sta. 3230, Bristol Bay, Alaska, 6 m, det. Rathbun (1904), USNM 26512.

In the systematic account, species are arranged chronologically. The diagnosis and illustrations are provided for each species. *Crangon uritai*, new species, is given a full description. Some characters are separately given by sex in the diagnosis since the members of the genus show sexual dimorphism in such characters as the thickness and length of the antennular flagellum, the length of the scaphocerite, the sixth abdominal somite and the telson and the armature of the thoracic sternum.

The carapace length (CL) was measured from the posterior margin of the orbit to the mid-dorsal posterior margin of the carapace; the rostrum length (RL) from the rostrum apex to the level of the posterior margin of the orbit; the scaphocerite length (SL) along the lateral margin from the distolateral spine to the posterior end of the lateral margin; and in the first pereopod the longest palm length and the broadest palm width were measured. The size of specimens is indicated by their carapace length (CL) in mm.

Systematics

Crangon affinis De Haan, 1849

Figs. 1, 2

Crangon affinis De Haan, 1849: 183 [type locality: Japan]; Bate, 1888: 484, pl. 86, figs. 1-3; Ortmann, 1890: 531; Fujino & Miyake, 1970: 265, fig. 9; Holthuis & Sakai, 1970: 293 (list); Kim, 1976: 144 (in part); Toriyama & Hayashi, 1982: 89; Hayashi & Kim, 1998: 711, figs. 1, 2.

Crangon vulgaris – Bate, 1888: 484. Not *Crangon vulgaris* Fabricius, 1789.

Crangon crangon affinis – Ortmann, 1895: 180 (in part); Doflein, 1900: 325 (in part).

?*Crangon crangon affinis* – Doflein, 1902: 642.

Crangon propinquus – Rathbun, 1902b: 42. Not *Crangon propinquus* Stimpson, 1860.

Crangon consobrinus De Man, 1906: 401 [type locality: Inland Sea of Japan]; 1907: 405, pl. 31, figs. 16-19; Parisi, 1919: 90.

Crangon (*Crangon*) *affinis* – De Man, 1920: 249 (list, in part); Kim & Park, 1972: 205 (in part); Kim, 1977: 298, pl. 54, fig. 60, text figs. 127, 128 (in part) (= *Crangon uritai* new species); Kuris & Carlton, 1977: 553 (list); Kim, 1985: 68 (in part).

Crangon (*Crangon*) *consobrina* – De Man, 1920: 250 (list).

Crago affinis – Yasuda, 1956: 7, 8, 64, unnumbered fig., text figs. 27, 28; Maekawa, 1961: 172.

Not *Crangon affinis* – Urita, 1942: 30 (= *Crangon propinquus* Stimpson, 1860); Liu, 1955: 60, pl. 22, figs. 5–8 (= *Crangon hakodatei* Rathbun, 1902b); Kubo, 1965: 622, fig. 1003 (= *Crangon uritai* new species); Komai *et al.*, 1992: 195 (= *Crangon amurensis* Brashnikov, 1907 and *Crangon propinquus* Stimpson, 1860).

Not *Crangon* (*Crangon*) *affinis* – Hayashi, 1976: 15 (= *Crangon uritai* new species).

?*Crangon* (*Crangon*) *affinis* – Balss, 1914: 63.

?*Crangon affinis* – Yokoya, 1930: 541; 1933: 32; 1939: 274, fig. 8; Nishimura, 1939: 383; Sato, 1957: 86 (list); Miyake, 1961a: 9 (list); 1961b: 168 (list); Miyake *et al.*, 1962: 124 (list); Kurata, 1964: 38, figs. 1–33 (larvae); Funada, 1966: 86 (list); Harada, 1968: 82 (list); Kikuchi, 1968: 180 (list); Igarashi, 1969: 9, pl. 9, fig. 26a, b, pl. 17, fig. 53; Kosaka, 1970: 59; Takeda, 1972: 25 (larvae); Motoh, 1972: 46, pl. 13, figs. 1-3; Sakamoto & Hayashi, 1977: 1263; Fujino, 1978: 25 (list); Horikoshi *et al.*, 1979: 49 (list); Yamashita & Shiota, 1980: 1; Holthuis, 1980: 148; Kojima & Hanabuchi, 1981: 45 (list); Ohta, 1983: 230; Ogawa *et al.*, 1983: 237 (list); Natsukari & Iwasaki, 1987: 1; Seikai *et al.*, 1993: 321.

?*Crago affinis* – Yamauchi, 1965: 907, figs. 4-6 (larvae).

Type material.—Neotype, ovig. ♀ (8.3 mm), Yokosuka, 5–20 fms, NHM 1888.22 (Hayashi & Kim, 1998).

Material examined.—**Korea.** Daedo Island, Hadong, 20 m, beam trawl, 25 Feb 1996, coll. Y. R. An, 1 ♂ (5.3 mm), 18 ♀

(6.5–8.1 mm), PUIZ 11. – Off Samchônpo, 15–20 m, collected with *C. hakodatei*, trawl, 28 Feb 1997, coll. S. H. Kim, 1 ♂ (4.9 mm), 1 ♀ (9.0 mm), 1 ovig. ♀ (8.1 mm), PUIZ 12. – Off Gori, mud, trawl, Nov 1987, coll. S. Y. Hong, 4 ♀ (7.2–8.9 mm), PUIZ 13. – Off Gori, trawl, 5 Jan 1996, coll. Y. R. An, 2 ♂ (6.8, 7.5 mm), 1 ♀ (7.7 mm), 17 ovig. ♀ (7.0–12.0 mm), PUIZ 14.

Pacific coast of Japan. Tokyo Bay, 35°20.00′–35°23.50′N, 139°40.43′–139°46.10′E, 17–31 m, beam trawl, 21 Oct 1997, coll. J. Ueda, 3 ♀ (5.3–5.9 mm), 5 ovig. ♀ (5.1–5.9 mm), NFU 530-2-1927. – Neotype, Yokoska [Yokosuka], 5–20 fms, coll. HMS *Challenger*, referred to *C. vulgaris* by Bate (1888), ovig. ♀ (8.3 mm), NHM 1888.22. – Collected with neotype, 1 ovig. ♀ (9.1 mm), 1 ♀ (5.0 mm), NHM 1888.22. – Oosezaki, Suruga Bay, 90-101 m, beam trawl, 22 Sep 1974, 3 ♀ (4.1–4.6 mm), NFU 530-2-1928. – Mikawa Bay, 10-20 m, coll. T. Okutani, 3 juvs (3.5–4.1 mm), NFU 530-2-1929. – Ise Bay, 3 ♂ (6.1–6.6 mm), 4 ovig. ♀ (8.6–9.5 mm), NFU 530-2-1930. – Kii Strait, 30 Jan 1989, coll. S. Ueno, 2 ♀ (6.0, 7.3 mm), 2 ovig. ♀ (7.7, 7.8 mm), NFU 530-2-1931. – Off Tokushima City, Kii Strait, 20 m, 28 Apr 1990, coll. Y. Ueda, 3 ♂ (6.3–6.5 mm), 2 ♀ (9.0, 9.4 mm), NFU 530-2-1932. – Tosa Bay, 92 m, beam trawl, 8 Aug 1971, coll. M. Toriyama, 4 ♀ (5.1–6.0 mm), NFU 530-2-1933. – Tosa Bay, 4 Jun 1977, 8 ♀ (7.6–9.0 mm), 6 ovig. ♀ (7.4–9.0 mm), NFU 530-2-1934. – Beppu Bay, cover net, 21 Jul 1976, coll. M. Toriyama, 2 ♀ (5.8, 8.7 mm), 3 ovig. ♀ (5.6–9.2 mm), NFU 530-2-1935. – Tarumizu, Kagoshima Bay, 19 Dec 1976, coll. Kagoshima Prefectural Fisheries Experimental Station, 4 ♀ (8.1–10.1 mm), 2 ovig. ♀ (8.3, 10.4 mm), NFU 530-2-1936. – Kagoshima Bay, Jun 1977, coll. Kagoshima Prefectural Fisheries Experimental Station, 1 ♂ (4.8 mm), 2 ♀ (7.1, 7.5 mm), 1 ovig. ♀ (8.3 mm), NFU 530-2-1937. – Nishisakurajima Strait, Kagoshima Bay, 19 Sep 1995, coll. *Kyo-Maru*, 1 ♂ (6.0 mm), 5 ♀ (6.2–8.0 mm), 2 ovig. ♀ (9.8, 10.0 mm), NFU 530-2-1938. – Off Tarumizu, Kagoshima Bay, 200 m, 21 Nov 1995, coll. *Harue-Maru*, 1 ♂ (6.0 mm), 1 ♀ (7.7 mm), 3 ovig. ♀ (7.0–8.6 mm), NFU 530-2-1939.

Seto Inland Sea. Holotype of *C. consobrinus* De Man, 1906, ovig. ♀ (9.9 mm), NHM 1907.4.27.13. – Bay of Kobé, *Challenger* sta. 233, 34°39′N, 135°14′E, 8 fms, 17 May 1875, referred to *C. affinis* by Bate (1888), 8 ovig. ♀ (10.0–11.0 mm), NHM 1888.22. – *Challenger* sta. 233a, 34°38′N, 135°1′E, 50 fms, 19 May 1875, referred to *C. affinis* by Bate (1888), 4 ovig. ♀ (9.9–10.9 mm), NHM 1888.22. – *Challenger* sta. 233b, 34°18′N, 133°35′E, 15 fms, 26 May 1875, referred to *C. affinis* by Bate (1888), 1 ♂ (7.3 mm), 3 ovig. ♀ (10.0–11.0 mm), NHM 1888.22. – Off Osaka City, Osaka Bay, 12 m, mud, small trawl, 22 Feb 1996, coll. K. Ariyama, 2 ♂ (6.5, 7.0 mm), 3 ♀ (10.0–10.5 mm), NFU 530-2-1940. – Harimanada Sea, 20–40 m, small trawl, Jan 1989, coll. K. Yokogawa, 1 ♂ (6.8 mm), 3 ovig. ♀ (8.9–9.5 mm), NFU 530-2-1941. – Off Kawanoe, Hiuchinada Sea, 30 m, mud, shrimp trawl, 20 Jul 1995, coll. Y. Hanamura, 1 ovig. ♀ (11.2 mm), NFU 530-2-2029. – Off Kawanoe, Hiuchinada Sea, 30 m, mud, shrimp trawl, 15 Jun 1996, coll. Y. Hanamura, 1 ♀ (11.0 mm), NFU 530-2-2030. – Miyakubo, Hiuchinada Sea, 30 m, collected with *C. cassiope*, sand, shrimp trawl, 13 Mar 1996, coll. Y. Hanamura, 1 ♀ (9.6 mm), NFU 530-2-2031. – Toukijima Island, small sailing trawl, 2 Mar 1935, coll. Mukaishima Marine Laboratory, 2 ♂ (6.9, 9.0 mm), NFU 530-2-1942. – Touwa Town, Oshima Island, 5 juvs (3.0–4.1 mm), NFU 530-2-1943. – Off Iwakuni, Jun 1976, coll. N. Takai, 4 ovig. ♀ (9.1–11.0 mm), NFU 530-2-1944. – Off Odoguchi, Shimonoseki, trawl, 15 May 1982, coll. K. Hayashi, 1 ♀ (8.3 mm), 17 ovig. ♀ (7.1–10.5 mm), NFU 530-2-1949.

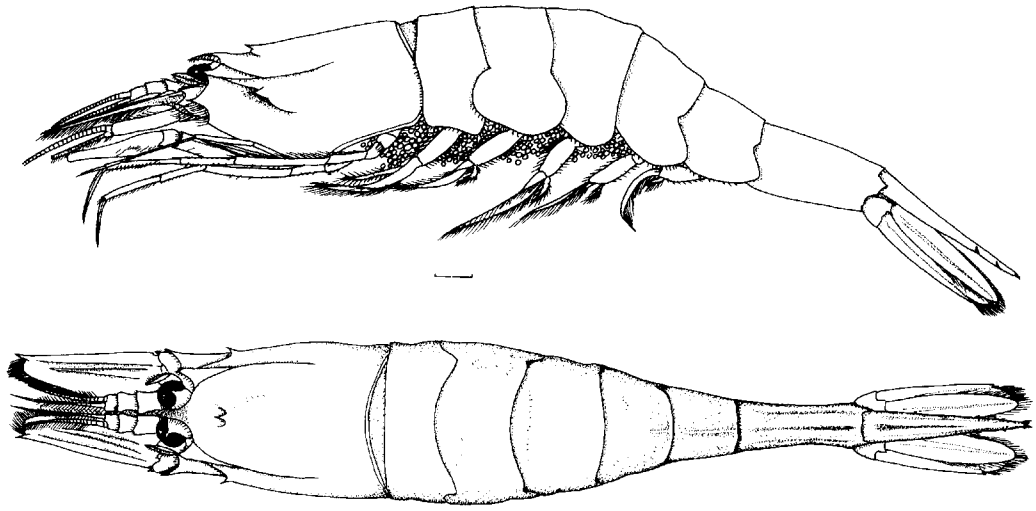

Fig. 1. *Crangon affinis* De Haan, 1849, ovigerous female (9.5 mm, NFU 350-2-1941) from Harimanada Sea, Seto Inland Sea, Japan; entire animal in lateral view (above) and dorsal view (below). Scale = 2 mm.

NW coast of Kyushu. Genkainada Sea, 85 m, 26 Mar 1982, coll. H. Misu, 2 ovig. ♀ (7.4, 8.4 mm), NFU 530-2-1947. – Dokai Bay, Fukuoka Prefecture, 13 Mar 1989, coll. M. Yamada, 1 ♂ (6.5 mm), 5 ♀ (7.8–10.0 mm), NFU 530-2-1946. – Oomura Bay, Nagasaki Prefecture, 20 m, shrimp trawl, 14 May 1998, coll. Y. Natsukari, 4 ovig. ♀ (8.9–1.0 mm), PUIZ 45.

East China Sea. trawl, 30 Oct 1976, coll. *Nansei-Maru*, 2 ♂ (5.3, 6.5 mm), 1 ♀ (7.6 mm), 4 ovig. ♀ (7.1–8.8 mm), NFU 530-2-1945.

Japanese coast of the Sea of Japan. Off Yoshimi, Shimonoseki, Genkainada Sea, Jun 1992, 1 ♂ (6.4 mm), 6 ♀ (5.5–9.6 mm), 3 ovig. ♀ (7.8–9.4 mm), NFU 530-2-1948. – Yuya Bay, Yamaguchi Prefecture, shrimp trawl, 24 Apr 1976, coll. K. Kojima, 2 ♂ (4.1, 4.2 mm), 2 ♀ (4.7, 4.8 mm), 2 ovig. ♀ (5.4, 5.6 mm), 2 juvs (3.0, 3.1 mm), NFU 530-2-1950. – Hatakejima, Yuya Bay, Yamaguchi Prefecture, shrimp trawl, 25 May 1976, coll. K. Kojima, 2 ♀ (6.1, 9.4 mm), 9 ovig. ♀ (8.6–9.5 mm), NFU 530-2-1951. – Kakehuchi, Yuya Bay, Yamaguchi Prefecture, shrimp trawl, 16 Nov 1976, coll. K. Kojima, 10 ♀ (4.6–7.4 mm), 1 ovig. ♀ (6.9 mm), NFU 530-2-1952. – Toyama Bay, small trawl, 3 Aug 1976, coll. N. Horii, 5 ♀ (5.9–8.1 mm), NFU 530-2-1953. – Toyama Bay, collected with *C. uritai*, 1 ovig. ♀ (9.7 mm), NFU 530-2-1954. – Off Niigata, 120 m, trawl, 30 Nov 1978, coll. H. Itano, 1 ♂ (6.7 mm), 1 ♀ (8.7 mm), NFU 530-2-1955.

Tsugaru Strait. Aomori, summer 1900, coll. D. S. Jordan and J. O. Snyder, referred to *C. propinquus* by Rathbun (1902b), 3 ♀ (11.6–12.6 mm), USNM 26335. – Off Kamiiso, Hakodate Bay, 5-10 m, collected with *C. cassiope*, dredge, 1 Apr 1991, coll. S. Goshima, 2 ovig. ♀ (7.5, 8.0 mm), NFU 530-2-1956.

Diagnosis.—Integument pubescent. Rostrum usually reaching distal margin of cornea, 0.20–0.29 times as long as carapace, directed forward or slightly descending, subacute at tip. Carapace with median gastric spine arising from about 0.20 of carapace length. Third abdominal

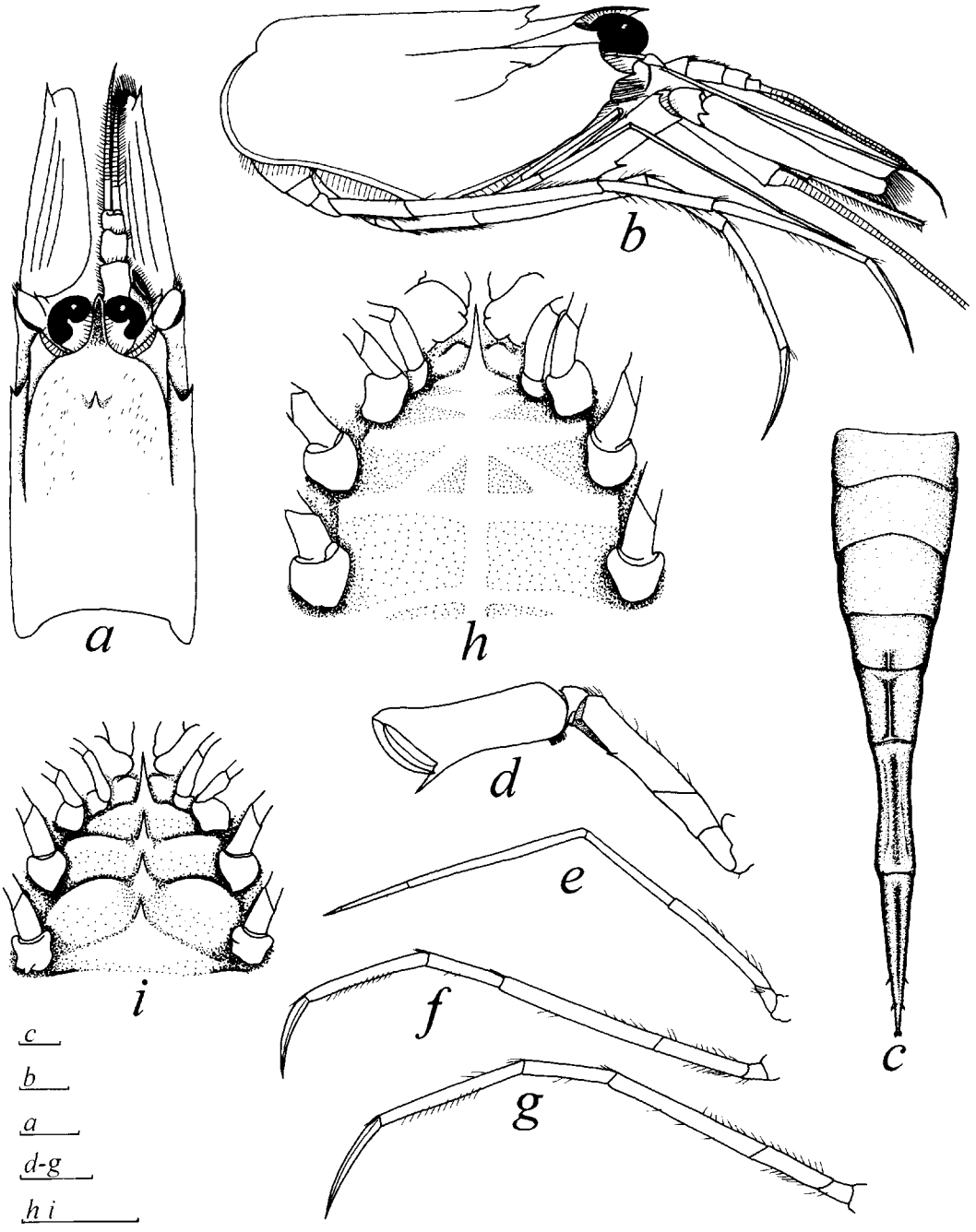

Fig. 2. *Crangon affinis* De Haan, 1849; *a*, *c–h*, ovigerous female (8.9 mm, PUIZ 14) from off Gori, Korea; *b*, female (10.0 mm, NFU 350-2-1936) from Tarumizu, Kagoshima Bay, Japan; *i*, male (7.5 mm, PUIZ 14) from off Gori, Korea: *a*, carapace and anterior cephalic appendages, dorsal, left antennule omitted; *b*, carapace and cephalothoracic appendages, lateral; *c*, abdominal somites and telson, dorsal; *d*, left first pereopod, flexor; *e*, left third pereopod, lateral; *f*, left fourth pereopod, lateral; *g*, left fifth pereopod, lateral; *h*, *i*, thoracic sternum, ventral, setae omitted. Scales = 2 mm.

somite without mid-dorsal carina, fourth somite with trace of mid-dorsal carina on posterior half; fifth somite with low but distinct mid-dorsal carina; sixth somite flattened or slightly grooved dorsally and with median groove ventrally, 0.71–0.87 times as long as carapace in males, 0.58–0.84 times in females. Telson with shallow median groove dorsally, 0.94–1.13 times as long as carapace in males, 0.82–1.02 times in females. Scaphocerite 0.85–0.96 times as long as carapace in males, 0.78–0.92 times in females. Third maxilliped with subdistal clump of 4–6 (mostly 5) spines on ventral surface of antepenultimate segment. First pereopod with palm 3.11–4.05 times longer than broad. Third pereopod with carpus 1.90–2.60 times longer than distal two segments combined in adults, 1.53–1.80 times in juveniles. Fourth and fifth pereopods moderately long and slender; dactylus 1.03–1.46 times as long as carpus in fourth, 0.94–1.67 times in fifth. Fifth thoracic sternite (between coxae of second pereopods) with acute median spine in ovigerous females.

Size.—Males 4.1–9.0 mm, females 4.1–11.0 mm, ovigerous females 5.1–12.0 mm, juveniles 3.0–4.1 mm.

Distribution.—Yellow Sea, northeastern part of the East China Sea, coast of Honshu and Seto Inland Sea, Japan (De Haan, 1849; Bate, 1888; Ortmann, 1890; Rathbun, 1902b; De Man, 1906; 1907; Yasuda, 1956; Fujino & Miyake, 1970; Kim, 1977; Toriyama & Hayashi, 1982; Hayashi & Kim, 1998; present study); 5–200 m.

Variations.—The rostrum is slightly variable in direction, from slightly descending (Fig. 1) to straight (Fig. 2*b*). The third maxilliped, fourth and fifth pereopods vary in length, reaching to or beyond the blade of the scaphocerite (Figs. 1, 2*b*).

The carpus of the third pereopod becomes proportionally longer with growth. The ratio of carpus length/length of the distal two segments combined changes from 1.53–1.80 in juveniles to 1.90–2.35 in adults.

Parasites.—The following females were infected with an unidentified bopyrid: two (7.1, 8.0 mm, PUIZ 11) from Daedo, Hadong, Korea; one (7.8 mm, NFU 530-2-1934) from Tosa Bay, Japan; one (8.7 mm, NFU 530-2-1935) from Beppu Bay, Japan; two (7.1, 7.5 mm, NFU 530-2-1937) from Kagoshima Bay, Japan; one (9.4 mm, NFU 530-2-1951) from Yuya Bay, Japan; and two (9.6 mm, NFU 530-2-1948; 8.3 mm, NFU 530-2-1949) from off Shimonoseki, Japan.

Remarks.—Recently the neotype of *Crangon affinis* De Haan, 1849 was designated by Hayashi & Kim (1998), who reexamined the specimens referred to as *Crangon vulgaris* and *C. affinis* by Bate (1888), *C. propinquus* by Rathbun (1902b) and the holotype of *C. consobrinus* De Man, 1906. These specimens proved to belong to the same species.

The following material identified as *C. affinis* was reexamined. Specimens from Tosa Bay (NFU 530-2-1933 & -1934) reported by Toriyama & Hayashi (1982) actually represent *C. affinis*. Hayashi's (1976) material from Sado Islands (NFU 530-2-1999) is referable to *C. uritai*, new species. Ten specimens from Hokkaido (HUMZ-C 380) reported by Komai *et al.* (1992) are found to contain two species, *C. amurensis* and *C. propinquus*.

Parisi (1919) reported two species, *C. consobrinus* De Man from Tokyo Bay and *C. crangon* Linnaeus from Yokohama and Enoshima on the central Pacific coast of Japan. Although his material was not examined, *C. consobrinus* is thought to be a *Crangon* with a carinated abdomen and *C. crangon* with the smooth abdomen. The present material indicates that only two species, *C. affinis* which has a mid-dorsal carina on the abdomen and *C. uritai* new species, which has no carina on the abdomen, are present in the region. Parisi's (1919) *C. consobrinus* and *C. crangon*, therefore, seem to be referable to *C. affinis* and *C. uritai*, respectively.

In their ecological study of the Seto Inland Sea, Yasuda (1956) and Maekawa (1961) dealt with two species identified as *Crago affinis* and *Crago cassiope*. The present study shows that three species, *C. affinis*, *C. cassiope* and *C. uritai* occur in the area. Judging from the locality and his figures (Yasuda, 1956: p. 8, unnumbered figures), which depict the anterior part of the carapace in dorsal view, Yasuda's (1956) identification of *Crago affinis* was correct. There is still a possibility that his *Crago cassiope* consisted of two species, *Crangon cassiope* and *C. uritai*. Although there is no information on morphology, Maekawa's (1961) identification seems to be the same as Yasuda's (1956).

Fujino & Miyake (1970) reported *Crangon affinis* from the East China Sea and Yellow Sea. Although they found that the shape of the rostrum is variable in their material, their specimens seem to be referable to the true *C. affinis* because the fifth abdominal somite has a dorsal carina in the shape of a thin line and the sixth abdominal somite is slightly grooved dorsally and ventrally.

The given dimensions of Urita's (1942) *C. affinis* from Sakhalin suggest that it is probably *C. propinquus* because of the relatively longer scaphocerite (0.80 times as long as the carapace) and the relatively robust palm (2.50 times as long as width) of the first pereopod of a female. Liu (1955) reported *C. affinis* from northern China. The description and figures, however, show that his species is probably not *C. affinis* but *C. hakodatei* (see "Remarks" of *C. hakodatei*). There is no doubt that *C. affinis* described by Kubo (1965) represents *C. uritai* (see "Remarks" of *C. uritai*). *Crangon affinis* reported from Korea (Kim & Park, 1972; Kim, 1976; 1977; 1985) seems to have been mixed with *C. uritai*. The figure given by Kim (1977: fig. 127) shows that the sixth abdominal somite and telson slightly are grooved dorsally.

Balss (1914) considered that *C. propinquus* Stimpson, 1860, *C. hakodatei* Rathbun, 1902b, *C. consobrinus* De Man, 1906 and *C. cassiope* De Man, 1906 were synonymous with *C. affinis*. His opinion has been followed by Japanese authors (e.g., Yokoya, 1930; 1933; Urita, 1942; Igarashi, 1969; Fujino & Miyake, 1970). *Crangon affinis*, therefore, was listed subsequently without sufficient information on morphology (Yokoya, 1930; 1933; 1939; Nishimura, 1939; Sato, 1957; Miyake, 1961a; 1961b; Miyake *et al.*, 1962; Funada, 1966; Harada, 1968; Kikuchi, 1968; Igarashi, 1969; Kosaka, 1970; Motoh, 1972; Sakamoto & Hayashi, 1977; Fujino, 1978; Horikoshi *et al.*, 1979; Yamashita & Shiota, 1980; Kojima & Hanabuchi, 1981; Ohta, 1983; Ogawa *et al.*, 1983; Natsukari & Iwasaki, 1987; Seikai *et al.*, 1993). It is impossible, however, to identify the species reported by these authors without the reexamination of their specimens. Material from the same or nearby localities from which the authors collected their material, not always consisted of a single species. Furthermore, the common species in shallow waters around Japan is not always *C. affinis*. As some species of *Crangon* occur sympatrically, it is difficult to determine the specific status of the previously described larvae under the name of *Crangon* (or *Crago*) *affinis* (cf. Kurata, 1964; Yamauchi, 1965; Takeda, 1969).

Crangon propinquus Stimpson, 1860

Figs. 3, 4

Crangon propinquus Stimpson, 1860: 25 [type locality: northern Japan] (in part); Komai *et al.*, 1992: 195.

Steiracrangon orientalis var. *longicauda* forma *pacifica* Czerniavsky, 1884: 74 [type locality: Sakhalin].

Crangon vulgaris var. *shidlovskii* Ostroumoff, 1896: 75 [type locality: Vladivostok].

Crangon alaskensis – Rathbun, 1904: 114 (in part).

Crangon septemspinosa var. *propinqua* – Brashnikov, 1907: 84; Derjugin &

Kobjakova, 1935: 142; Kobjakova, 1936: 190, 202, 212 (list); 1937: 93, 94 (list); 1958a: 221, 229, 244; 1958b: 253; 1959: 70; 1967: 238.

Crangon (Crangon) alaskensis – De Man, 1920: 249 (list, in part).

Crangon (Crangon) crangon var. *shidlovskii* – De Man, 1920: 250 (list).

Crangon (Crangon) orientalis – De Man, 1920: 250 (list, in part)

Crangon (Crangon) propinquus – De Man, 1920: 250 (list).

Crangon affinis – Urita, 1942: 30; Komai *et al.*, 1992: 195 (in part). Not *Crangon affinis* De Haan, 1849.

Crangon septemspinosa morpha *propinqua* – Vinogradov, 1947: 91; 1950: 217, fig. 79.

?*Crangon propinquus* – Miyake *et al.*, 1962: 124.

Not *Crangon propinquus* – Rathbun, 1902b: 42 (= *Crangon affinis* De Haan, 1849).

Type material.—It may have been lost (Evans, 1967). The ovigerous female (11.4 mm; NFU 530-2-1960) from Lake Saroma, Hokkaido is designated the neotype of *C. propinquus* (see "Remarks" below).

Material examined.—**Pacific coast of Japan.** Akkeshi Bay, 16 Sep 1990, coll. T. Minami, 1 ♀ (12.4 mm), 1 ovig. ♀ (10.8 mm), NFU 530-2-1957. – Off Katsurakoi, Kushiro, 36 m, 3 Oct 1989, coll. J. Sasaki, 1 ♂ (8.2 mm), 11 juvs (2.0–4.1 mm), PUIZ 46. – Off Tomakomai, 17 Dec 1984, coll. Y. Hanamura, 1 ovig. ♀ (15.1 mm), NFU 530-2-2032. – Off Date City, Uchiura Bay, Jun 1982, coll. Y. Hanamura, 5 ♂ (4.9–8.5 mm), 1 ♀ (8.5 mm), 6 ovig. ♀ (8.7–15.9 mm). NFU 530-2-2033. – Off Sawara, Uchiura Bay, 20 m, 14 Oct 1993, coll. J. Sasaki, 6 ♂ (4.7–8.8 mm), 6 ♀ (5.1–12.8 mm), 3 juvs (3.9–4.0 mm), PUIZ 47. – Off Usujiri, 5–10 m, dredge, 14 Nov 1989, coll. T. Komai, 2 ♀ (11.5, 13.0 mm), NFU 530-2-1958. – Usujiri, 25 m, dredge, 30 Apr 1992, coll. T. Komai, 1 ovig. ♀ (9.2 mm), NFU 530-2-1959.

Japanese coast of the Sea of Okhotsk. Lake Saroma, Hokkaido, beam trawl, 13 Apr 1990, 1 ovig. ♀ (11.4 mm), NFU 530-2-1960. – Collected with NFU 530-2-1960, 1 ovig. ♀ (12.2 mm), CBM-ZC 5133. – Odaitou, light collecting, collected with *C. amurensis*, referred to *C. affinis* by Komai *et al.* (1992), 30 May 1988, 3 ♂ (9.0–10.0 mm), 1 ♀ (6.0 mm), HUMZ-C 380.

Russian Far East. Olga Bay, subtidal, beach seine, collected with *C. amurensis*, 18 Aug 1994, coll. M. Yabe, 2 ovig. ♀ (12.9, 14.6 mm), CBM-ZC 2442. – Off Kurile Islands, *Albatross* sta. 3652, 14 fms, referred to *C. alaskensis* by Rathbun (1904), 4 ♂ (9.1–10.6 mm), USNM 26511.

Diagnosis.—Integument partially pubescent. Rostrum usually reaching mesial distal margin of eyestalk, 0.15–0.20 times as long as carapace, directed forward, rounded distally. Carapace with median gastric spine arising from about 0.25 of carapace length. Third abdominal somite without mid-dorsal carina; fourth somite with faint mid-dorsal carina; fifth somite with low mid-dorsal carina; sixth somite flattened or slightly grooved dorsally, with median groove ventrally, 0.68–0.74 times as long as carapace in males, 0.62–0.72 times in females. Telson flattened or slightly grooved dorsally, 0.93–1.05 times as long as carapace in males, 0.87–0.98 times in females. Scaphocerite 0.79–0.84 times as long as carapace in males, 0.74-0.83 times in females. Third maxilliped with subdistal clump of 4–5 (mostly 5) spines on ventral surface of antepenultimate segment. First pereopod with palm 2.46–3.00 times longer than broad. Third pereopod with carpus 1.41–1.87 times as long as distal two segments combined. Fourth and fifth pereopods relatively robust; dactylus 0.80–1.03 times as long as carpus in fourth, 0.82–1.13 times in fifth. Fifth thoracic sternite with acute median spine in ovigerous females.

Size.—Males 4.7–10.6 mm, females 5.1–13.0 mm, ovigerous females 9.2–15.9 mm, juveniles 2.0–4.1 mm.

Distribution.—Northern part of the Sea of Japan, Sea of Okhotsk and northern part of the Pacific coast of Japan

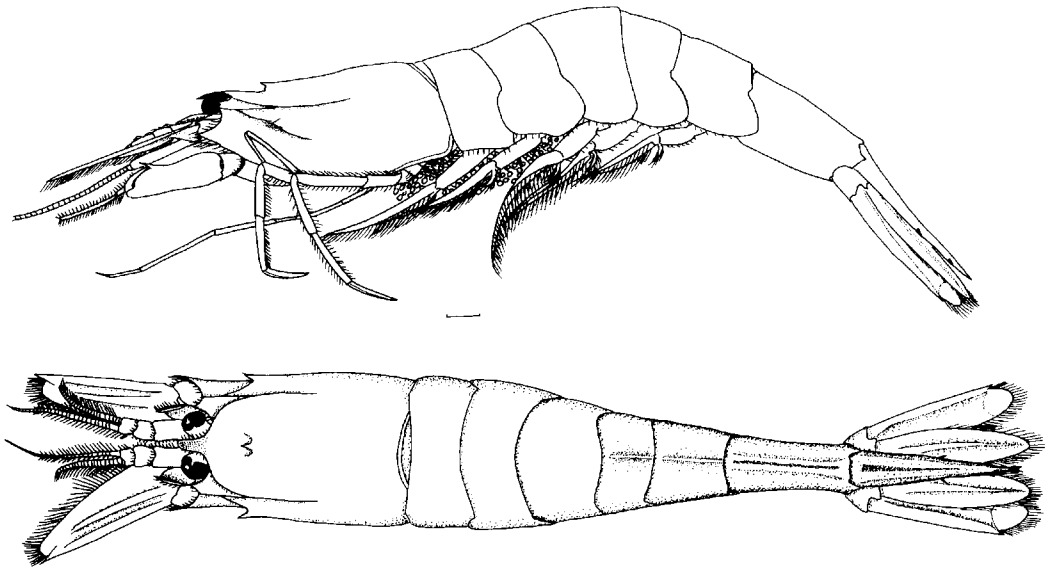

Fig. 3. *Crangon propinquus* Stimpson, 1860, neotype, ovigerous female (11.4 mm, NFU 530-2-1960) from Lake Saroma, Hokkaido, Japan; entire animal in lateral view (above) and dorsal view (below). Scale = 2 mm.

(Stimpson, 1860; Czerniavsky, 1884; Ostroumoff, 1896; Brashnikov, 1907; Urita, 1942; Vinogradov, 1947; Komai *et al.*, 1992; present study); intertidal to 36 m (Vinogradov, 1947; present study).

Remarks.—*Crangon propinquus* was described from "prope oras boreales Japoniae" by Stimpson (1860). The original description is very short and obscure in parts and the types may be no longer extant (Evans, 1967). The type specimens have "abdominis segmento quarto (et interdum tertio quoque) in adultis carinato" (Stimpson, 1860). In northern Japanese waters, a carina on the fourth abdominal somite is present in two species but the carinated third somite is only found on one of them. The present material examined does not show variation of the carina on the third somite. There is no doubt, therefore, that Stimpson's description surely based on two species: one had a carina on the fourth somite; the other had the carinated third and fourth somites. The former should be referred to the true *C. propinquus* Stimpson and the latter is *C. hakodatei* Rathbun. An ovigerous female specimen (11.4 mm; NFU 530-2-1960) from Lake Saroma, Hokkaido, Japan has been selected as the neotype of *C. propinquus*. A duplicate specimen (12.2 mm) collected with the neotype is deposited in CBM (code with catalogue no. ZC 5133).

Czerniavsky (1884) described *Steiracrangon orientalis* var. *longicauda* forma *pacifica* based on a single specimen from Sakhalin. Ostroumoff (1896), who questioned its validity, described a new variety, *Crangon vulgaris* var. *shidlovskii*, based on three specimens from Vladivostok and Aniva Bay, Sakhalin. After the examination of the type of Czerniavsky's (1884) taxon and five additional specimens from Tatar Strait and Terpeniya Bay, Sakhalin, Brashnikov (1907) concluded that Czerniavsky's (1884) taxon and Ostroumoff's (1895) taxon were conspecific with *C. septemspinosa* var. *propinqua* Stimpson, 1860, based on the presence of a low blunt median carina on

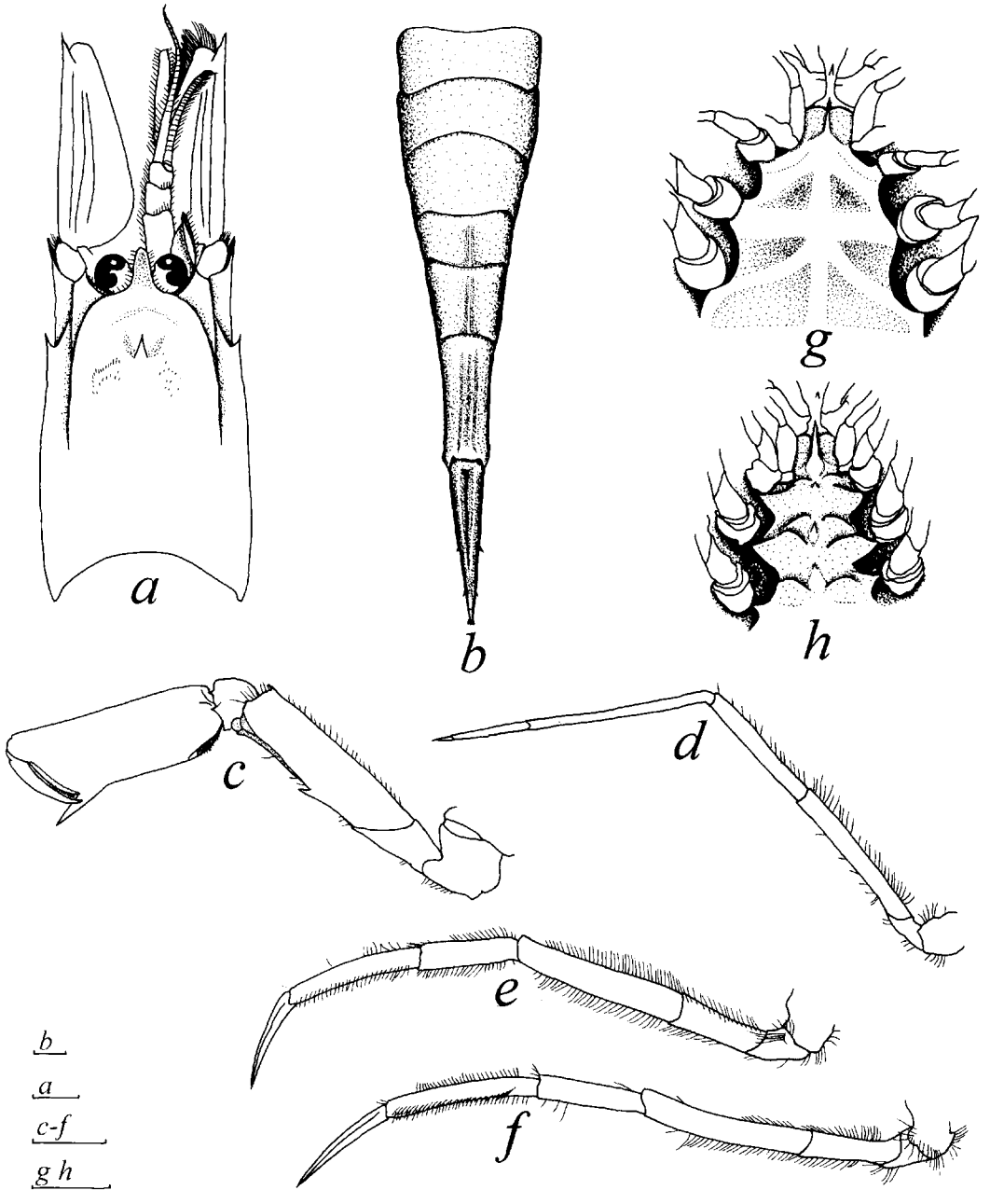

Fig. 4. *Crangon propinquus* Stimpson, 1860; *a–g*, neotype, ovigerous female (11.4 mm, NFU 350-2-1960) from Lake Saroma, Hokkaido, Japan; *h*, male (10.0 mm, HUMZ-C 380) from off Odaitou, Hokkaido, Japan: *a*, carapace and anterior cephalic appendages, dorsal, left antennule omitted; *b*, abdominal somites and telson, dorsal; *c*, left first pereopod, flexor; *d*, left third pereopod, lateral; *e*, left fourth pereopod, lateral; *f*, left fifth pereopod, lateral; *g*, *h*, thoracic sternum, ventral, setae omitted. Scales = 2 mm.

the fourth and fifth somites in both taxa. Although no types of the two Russian varienties were examined, the present study supports Brashnikov's (1907) conclusion.

Derjugin & Kobjakova (1935), Vinogradov (1947, 1950) and Kobjakova (1958a, 1958b, 1959, 1967) reported *C. septemspinosa* var. *propinqua* or *C. septemspinosa* morpha *propinqua* from the Sea of Japan and the Sea of Okhotsk. These records from the Russian Far East seem to represent *C. propinquus*, judging from the localities and depths (intertidal to 35 m).

The specimens of *C. alaskensis* reported from off the Kurile Islands by Rathbun (1904) have been examined. They proved to be not *C. alaskensis* Lockington, 1877 but *C. propinquus*. *C. propinquus* closely resembles the eastern North Pacific *C. alaskensis* in having a relatively longer rostrum (about 0.15–0.20 times as long as the carapace), the third maxilliped usually bearing a clump of 5 small spines on the antepenultimate segment, the moderately stout palm of the first pereopod (about 2.50–3.00 times as long as width) and a thoracic sternite that is provided with an acute spine on the fifth somite in ovigerous females. *C. propinquus*, however, differs from *C. alaskensis* in having a slightly descending and broader rostrum, a fourth somite that is furnished with a faint low mid-dorsal carina (versus without a carina) and a relatively shorter (0.74–0.83 times as long as the carapace versus 0.79–0.88 times) and broader (2.54–2.78 times as long as width versus 2.67–3.00 times) scaphocerite in females.

As mentioned above, *C. affinis* reported from Sakhalin by Urita (1942) seems to be referrable to the present species. Miyake *et al.* (1962) listed *C. hakodatei* and *C. propinquus* from Niigata but neither identification could be confirmed with certainly. Komai *et al.* (1992) reported *C. affinis* and *C. propinquus* from Odaitou and Akkeshi, Hokkaido, respectively. These specimens were reexamined. Some of the Odaitou specimens (HUMZ-C 380) and all of the Akkeshi specimens (NFU 530-2-1957) proved to belong to *C. propinquus*.

Crangon dalli Rathbun, 1902

Figs. 5, 6

Crangon dalli Rathbun, 1902a: 889 [type locality: off Cape Seniavin, Alaska]; 1904: 119, fig. 60; Brashnikov, 1907: 84, fig. 6; Balss, 1914: 63; Yokoya, 1933: 33; Derjugin & Kobjakova, 1935: 142 (list); Kobjakova, 1936: 190, 191, 201, 212, 224; 1937: 93, 94, 139; Yokoya, 1939: 276; Urita, 1942: 31; Vinogradov, 1947: 92; 1950: 217, fig. 80; Kobjakova, 1955: 150, pl. 37, fig. 1; 1958a: 221, 229, 244; 1958b: 253; 1959: 70; Igarashi, 1969: 9, pl. 10, fig. 27, pl. 17, fig. 54; Kim & Park, 1972: 206, pl. 5, fig. 1; Kim, 1976: 145; Kosaka, 1979: 185; Horikoshi *et al.*, 1979: 49; Butler, 1980: 99, unnumbered fig.; Komai *et al.*, 1992: 195; Komai, 1994: 96.

Crangon (*Crangon*) *dalli* – De Man, 1920: 250 (list).

Crago dalli – Makarov, 1941: 135.

Crangon ralli (sic) – Zarenkov, 1965: 1762, fig. 1.

Crangon (*Neocrangon*) *dalli* – Kim, 1977: 300, pl. 30, fig. 63, text figs. 126, 131, 132.

Crangon (*Steiracrangon*) *dalli* – Kuris & Carlton, 1977: 553 (list).

Type material.—Holotype, ovig. ♀, (16.2 mm), Alaska, 30 fms, USNM 25244 (not examined).

Material examined.—**Korean coast of the Sea of Japan.** 36°43′N, 129°31′E, 110 m, mud, trawl, 2 Nov 1995, coll. J. H. Choi, 1 ovig. ♀ (16.6 mm), PUIZ 15. – 36°12′N, 129°29′E, 51 m, sandy mud, collected with *C. hakodatei*, trawl, 2 Nov 1995, coll. J. H. Choi, 1 ovig. ♀ (13.0 mm), PUIZ 16. – 36°56′N, 129°37′E, 100 m, mud, trawl, 5 Nov 1995, coll. J. H. Choi, 2 ♂ (11.2, 12.8 mm), 1 ♀ (12.7 mm), PUIZ 17. – 35°28′N, 129°36′E, 130 m, mud, trawl, 6 Nov 1995, coll. J. H. Choi, 2 ♀

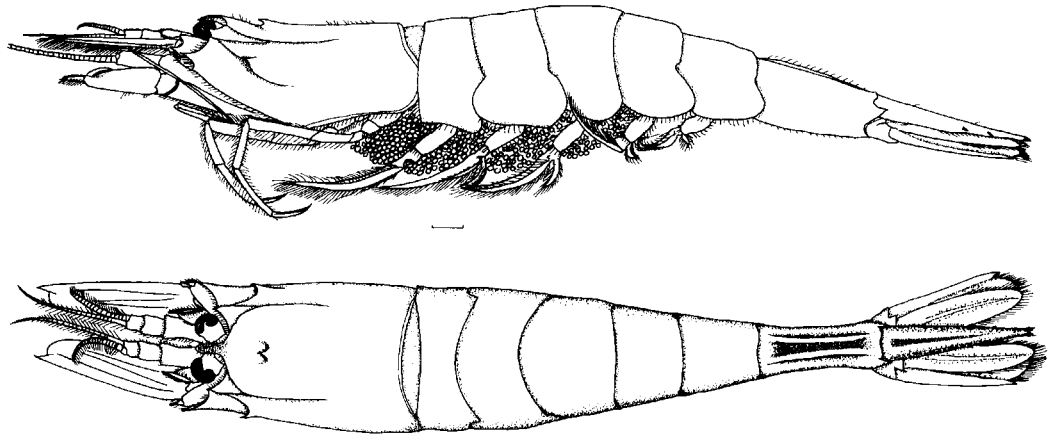

Fig. 5. *Crangon dalli* Rathbun, 1902, ovigerous female (11.5 mm, PUIZ 49) from off Shirito, Kushiro, Hokkaido, Japan; entire animal in lateral view (above) and dorsal view (below). Scale = 2 mm.

(16.8, 18.0 mm), PUIZ 18. – 35°36′N, 129°30′E, 47 m, mud, collected with *C. hakodatei*, trawl, 18 Mar 1996, coll. J. H. Choi, 1 ♀ (12.8 mm), PUIZ 19. – 35°16′N, 129°34′E, 120 m, collected with *C. hakodatei*, trawl, 19 Mar 1996, coll. J. H. Choi, 1 ovig. ♀ (13.0 mm), PUIZ 20.

Japanese coast of the Sea of Japan. Off northeastern Tsushima Island, 35°42′N, 130°18′E, 165 m, soft mud, collected with *C. hakodatei*, trawl, 18 Sep 1995, coll. S. Ueno, 1 ♂ (12.1 mm), 1 ♀ (12.2 mm), NFU 530-2-1961.

Pacific coast of Japan. Akkeshi Bay, 30 m, 19 Apr 1990, coll. Y. Hanamura, 1 ovig. ♀ (14.0 mm), NFU 530-2-2044. – Off Shiriba, Kushiro, Hokkaido, 57 m, 15 May 1991, coll. J. Sasaki, 2 ♂ (9.9, 11.1 mm), 2 ♀ (4.5, 15.2 mm), PUIZ 48. – Off Shirito, Kushiro, Hokkaido, 36 m, 29 Jul 1991, coll. J. Sasaki, 2 ovig. ♀ (11.5, 14.9 mm), PUIZ 49. – Off Konbumori, Kushiro, Hokkaido, 60 m, 29 Jul 1991, coll. J. Sasaki, 3 ♂ (7.9–9.0 mm), PUIZ 50.

Alaska. Off Khondonbine Islands, *Albatross* sta. 3284, 25 fms, 10 ♂ (8.1–10.7 mm), 1 ♀ (10.4 mm), 19 ovig. ♀ (10.4–15.2 mm), USNM 26619. – Off Cape Seniavin, *Albatross* sta. 3288, 15 fms, 10 ♀ (10.3–13.8 mm), 15 ovig. ♀ (10.1–13.2 mm), USNM 26623.

Diagnosis.—Integument pubescent. Rostrum usually reaching distal margin of cornea, 0.16–0.22 times as long as carapace, directed forward, rounded distally. Carapace with median gastric spine arising from about 0.25 of carapace length. Third to fifth abdominal somites without median carina; sixth somite with two blunt submedian carinae dorsally and median groove ventrally, 0.67–0.84 times as long as carapace in males, 0.62–0.80 times in females. Telson with median groove dorsally, 0.86–0.98 times as long as carapace in males, 0.87–1.00 times in females. Scaphocerite 0.79–0.94 times as long as carapace in males, 0.78–0.90 in females. Third maxilliped with subdistal clump of 5–7 (mostly 6) spines on ventral surface of antepenultimate segment. First pereopod with palm 2.24–2.91 times longer than broad. Third pereopod with carpus 1.46–2.10 times longer than distal two segments combined. Fourth and fifth pereopods relatively robust; dactylus 0.92–1.21 times as long as carpus in

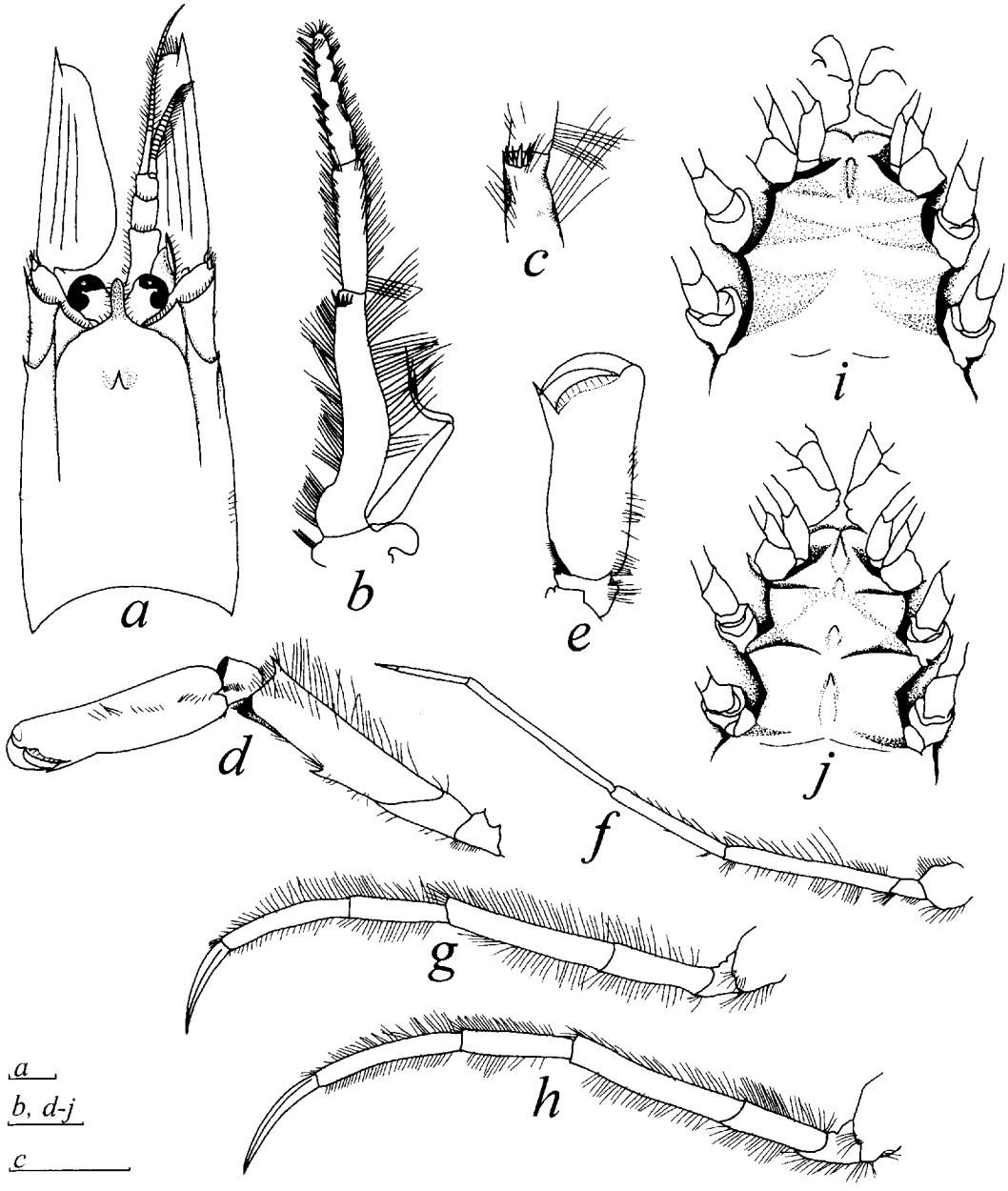

Fig. 6. *Crangon dalli* Rathbun, 1902; *a–i*, ovigerous female (11.5 mm, PUIZ 49) from Shirito, Kushiro, Hokkaido, Japan; *j*, male (11.1 mm, PUIZ 48) from Shiriba, Kushiro, Hokkaido, Japan: *a*, carapace and anterior cephalic appendages, dorsal, left antennule omitted; *b*, left third maxilliped, ventral; *c*, same, anterior part of antepenultimate segment, ventral; *d*, left first pereopod, lateral; *e*, same, chela, flexor; *f*, left third pereopod, lateral; *g*, left fourth pereopod, lateral; *h*, left fifth pereopod, lateral; *i, j*, thoracic sternum, ventral, setae omitted. Scales = 2 mm.

fourth, 0.92–1.23 times in fifth. Fifth thoracic sternite with median tubercle in ovigerous females.

Size.—Males 7.9–12.8 mm, females 4.5–18.0 mm, ovigerous females 10.1–16.6 mm.

Distribution.—Northern North Pacific from Puget Sound to the Sea of Japan (Rathbun, 1902; Balss, 1914; Yokoya, 1933; 1939; Derjugin & Kobjakova, 1935; Kobjakova, 1936; Makarov, 1941; Urita, 1942; Vinogradov, 1950; Kim, 1977; Kosaka, 1979; Horikoshi *et al.*, 1979; Butler, 1980; present study); Chukchi Sea, (Vinogradov, 1950); subtidal to 630 m (Kobjakova, 1936).

Remarks.—The distinct submedian carinae on the sixth abdominal somite clearly separate *Crangon dalli* from the other species in East Asian waters. Kinahan (1862) actually divided the genus *Crangon* into two subgenera, *Crangon* and *Steiracrangon* using this character. Kuris & Carlton (1977) revived the subgeneric division proposed by Kinahan (1862) and they assigned *C. dalli* to the subgenus *Steiracrangon*. Christoffersen (1988) considered that the subgeneric division proposed by Kuris and Carlton (1977) was invalid because the definition was based on a symplesiomorphic character state and produced paraphyletic grade-groups in the cladistic classification of Crangonidae, such as the 'convex group' of Kuris and Carlton (1977). The subgenus *Steiracrangon* is not accepted in the present study following Christoffersen's (1988) conclusion.

East Asian specimens agree well with the topotypic specimens examined as well as the original and subsequent descriptions of *C. dalli* given by Rathbun (1902a; 1904) and Butler (1980). Butler (1980) indicated that a slight concavity of the ventral margin of the fifth abdominal pleuron was also diagnostic for this species. The present study, however, found that the ventral margin is rather variable from slightly concave to slightly convex.

Crangon hakodatei Rathbun, 1902

Figs. 7, 8

Crangon propinquus Stimpson, 1860: 25 (in part).

Crangon hakodatei Rathbun, 1902b: 42, fig. 15 [type locality: Hakodate, Hokkaido, Japan]; Kim, 1976: 145; Komai *et al.*, 1992: 195 (list).

Crangon (Crangon) hakodatei – De Man, 1920: 250 (list); Kim, 1977: 297, pl. 30, fig. 61, text fig. 129; 1985: 68.

Crago hakodatei – Urita, 1926: 429.

Crangon affinis – Liu, 1955: 60, pl. 22, figs. 5–8. Not *Crangon affinis* De Haan, 1849.

Crangon nigricauda – Kim & Park, 1972: 206, pl. 5, fig. 2. Not *Crangon nigricauda* Stimpson, 1856.

?*Crangon hakodatei* – Miyake *et al.*, 1962: 124 (list).

Type material.—Syntypes, 1 ♂ (7.8 mm), 2 ♀ (8.2, 8.9 mm), Hakodate, Hokkaido, USNM 26156 (see "Material examined").

Material examined.—**Yellow Sea.** Taechôn, Korea, winged stow net on anchor, 29 Mar 1995, coll. H. K. Cha, 12 ♂ (8.0–9.9 mm), 2 ♀ (8.9, 9.0 mm), 4 ovig. ♀ (8.0–12.0 mm), PUIZ 21. – Sikdo Island, Puan, Korea, collected with *C. cassiope*, winged stow net on anchor, 29 Mar 1995, coll. H. K. Cha, 2 ♂ (8.9, 10.0 mm), PUIZ 22. – Yongdo Island, Youngkwang, Korea, winged stow net on anchor, 24 Apr 1995, coll. H. K. Cha, 1 ovig. ♀(12.9 mm), PUIZ 23. – Yongdo Island, Youngkwang, Korea, winged stow net on anchor, 7 Dec 1995, 13 ♂ (7.0–10.1 mm), 5 ♀ (10.8–13.0 mm), PUIZ 24. – Japanese Fisheries Section 129, 35°50′–36°00′N, 123°50′–124°00′E, trawl, Autumn 1986, coll. Seikai National Fisheries Research Institute, 4 ♂ (7.8–11.0 mm), 6 ♀(9.0–14.8 mm), 1 ovig. ♀ (15.0 mm), NFU 530-2-1962. – Japanese Fisheries Section 324, 33°00′–33°50′N, 123°50′–124°00′E, trawl, 29 Sep 1989, coll. Seikai National Fisheries Research Institute, 2 ♂ (6.0, 10.0 mm), 2 ♀(9.0, 11.9 mm), NFU 530-2-2034. – Japanese Fish-

eries Section 160, 35°00′–35°50′N, 122°00′–122°50′E, trawl, 29 Jan 1991, coll. Seikai National Fisheries Research Institute, 2 ♀(10.5, 10.6 mm), 1 ovig. ♀ (12.9 mm), NFU 530-2-2035. – Japanese Fisheries Section 159, 35°50′–36°00′N, 122°00′–122°50′E, trawl, 15 Sep 1993, coll. Seikai National Fisheries Research Institute, 2 ♂ (6.9, 9.3 mm), 2 ♀(13.9, 14.0 mm), NFU 530-2-2036.

Korean coast of the northeastern East China Sea. Off Samchônpo, 10 m, trawl, 10 Jan 1997, coll. S. H. Kim, 2 ♀ (15.0, 15.2 mm), PUIZ 25. – Off Samchônpo, 15–20 m, trawl, collected with *C. affinis*, 28 Feb 1997, coll. S. H. Kim, 2 ♂ (8.8, 9.2 mm), 9 ♀(9.0–12.2 mm), 2 ovig. ♀(10.1, 14.2 mm), PUIZ 26. – Hansan Island, 30–40 m, trawl, 22 Jun 1988, coll. S. Y. Hong, 1 ovig. ♀ (12.5 mm), PUIZ 27. – Hansan Island, 30–40 m, trawl, 16 Sep 1988, coll. S. Y. Hong, 2 ♀ (5.0, 7.2 mm), PUIZ 28. – Hansan Island, 30–40 m, trawl, 26 Jun 1992, coll. S. Y. Hong, 4 ♂ (5.1–7.1 mm), 13 ♀ (5.0–12.3 mm), 4 juvs (3.1–4.1 mm), PUIZ 29.

Korean coast of the Sea of Japan. 36°12′N, 129°29′E, 51 m, sandy mud, collected with *C. dalli*, trawl, 2 Nov 1995, coll. J. H. Choi, 3 ♀ (13.9–14.2 mm), PUIZ 30. – 35°36′N, 129°30′E, 47 m, mud, collected with *C. dalli*, trawl, 18 Mar 1996, 1 ♂ (7.9 mm), 1 ♀ (11.0 mm), PUIZ 31. – 35°26′N, 129°28′E, 75 m, mud, trawl, 18 Mar 1996, 1 ♂ (12.5 mm), 1 ♀ (14.1 mm), PUIZ 32. – 35°16′N, 129°34′E, 120 m, collected with *C. dalli*, trawl, 18 Mar 1996, 2 ♂ (8.8, 10.4 mm), 1 ♀ (10.0 mm), 1 ovig. ♀ (12.9 mm), PUIZ 33. – Off Gori, trawl, 5 Jan 1996, coll. Y. R. An, 2 ♂ (8.0, 8.1 mm), 2 ♀ (8.0, 8.1 mm), 1 ovig. ♀ (10.0 mm), PUIZ 34. – Off Gori, trawl, Jul 1996, 9 ♂ (7.3–12.2 mm), 9 ♀ (7.9–12.8 mm), PUIZ 35.

Japanese coast of the Sea of Japan. Tsukumo Bay, Ishikawa Prefecture, 1 May 1973, 1 ♂ (5.9 mm), NFU 530-2-1963. – Off western Tsushima Island, 34°38′N, 129°10′E, 153–204 m, 31 Mar 1978, coll. H. Itou, 5 ♀ (11.0–15.2 mm), NFU 530-2-1964. – Off NW Tsushima Island, 33°38′N, 129°10′E, 153–204 m, trawl, 31 May 1978, 5 ♀ (9.9–14.1 mm), HUMZ-C 371. – Off NE Tsushima Island, 35°42′N, 130°18′E, 165 m, soft mud, collected with *C. dalli*, trawl, 18 Sep 1995, coll. S. Ueno, 2 ♀ (10.7, 16.9 mm), NFU 530-2-1965. – Miwa, Toyama Bay, stationary net, 5 Apr 1976, coll. N. Horii, 1 ovig. ♀ (15.0 mm), NFU 530-2-1966. – Miwa, Toyama Bay, stationary net, May 1976, 2 ♀ (14.3, 18.4 mm), NFU 530-2-1967. – Hijikata, Toyama Bay, 250 m, hand trawl, 19 Apr 1976, coll. N. Horii, 1 ♂ (11.9 mm), NFU 530-2-1968. – Off Niigata, 120 m, 30 Nov 1978, coll. H. Itano, 3 ♂ (6.0–8.0 mm), 6 ♀ (6.8–12.8 mm), NFU 530-2-1969. – Off Sakata, Yamagata Prefecture, 43–45 m, 1 ♀ (13.2 mm), NFU 530-2-1970.

Tsugaru Strait. Hakodate, Hokkaido, syntypes of *C. hakodatei* Rathbun, 1902b, 1 ♂ (7.8 mm), 2 ♀ (8.2, 8.9 mm), USNM 26156.

Pacific coast of Japan. Hachinohe, Aomori Prefecture, 10 m, collected with *C. uritai*, beam trawl, 8 ♀ (5.9–8.6 mm), HUMZ-C 566.

Japanese coast of the Sea of Okhotsk. Off Oumu, Hokkaido, 44°35.66′N, 143°03.71′E, 44 m, 22 Aug 1996, coll. J. Sasaki, 2 ♂ (9.0, 9.0 mm), 1 ♀ (11.5 mm), 1 ovig. ♀ (16.0 mm), PUIZ 51.

Diagnosis.—Integument pubescent. Rostrum usually reaching distal margin of cornea, 0.17–0.24 times as long as carapace, directed forward, rounded distally. Carapace with median gastric spine arising from about 0.20 of carapace length. Third to fifth abdominal somites with blunt mid-dorsal carina; sixth somite with median groove dorsally and ventrally, 0.62–0.66 times as long as carapace in males, 0.56–0.66 times in females. Telson with median groove dorsally, 0.89–0.99 times as long as carapace in

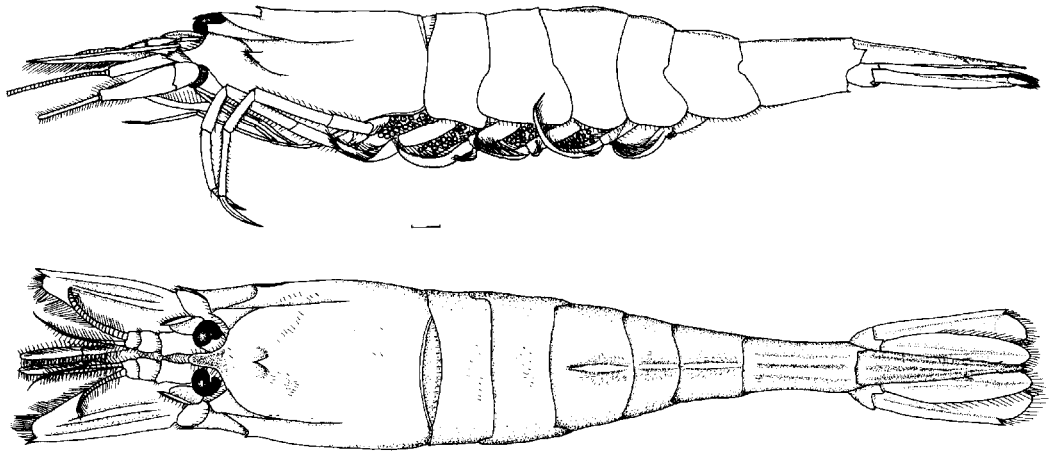

Fig. 7. *Crangon hakodatei* Rathbun, 1902, ovigerous female (12.9 mm, PUIZ 33) from the Korean coast of the Sea of Japan; entire animal in lateral view (above) and dorsal view (below). Scale = 2 mm.

males, 0.88–0.92 times in females. Scaphocerite 0.74–0.83 times as long as carapace in males, 0.69–0.82 times in females. Third maxilliped with subdistal clump of 4–6 (mostly 5) spines on ventral surface of antepenultimate segment. First pereopod with palm 2.32–2.93 times longer than broad. Third pereopod with carpus 1.56–2.18 times longer than distal two segments combined. Fourth and fifth pereopods relatively robust; dactylus 0.83–1.10 times as long as carpus in fourth, 0.91–1.12 times in fifth. Fifth thoracic sternite with acute median spine in ovigerous females.

Size.—Males 5.1–12.5 mm, females 5.0–18.4 mm, ovigerous females 8.0–16.0 mm, juveniles 3.1–4.1 mm.

Distribution.—Yellow Sea, northern part of the East China Sea, Sea of Japan, northern part of the Pacific coast of Japan and southern part of the Sea of Okhotsk (Rathbun, 1902b; Urita, 1926; Liu, 1955; Kim & Park, 1972; Kim, 1976; 1977; 1985; present study); 10–250 m.

Abnormality.—The rostrum usually reaches or slightly overreaches the distal margin of the cornea (0.17–0.24 times as long as carapace; Figs. 7, 8*a*). In a female (14.1 mm, NFU 530-2-1962) from the Yellow Sea, it exceptionally does not reach the distal margin of the cornea (0.12 times as long as carapace; Fig. 8*b*).

The antepenultimate segment of the third maxilliped mostly bears a subdistal clump of 4–6 (mostly 5) spines on the ventral surface. In two females (10.0 mm, NFU 530-2-1969; 18.4 mm, NFU 530-2-1967) from off Niigata and Miwa, Toyama Bay, respectively, it exceptionally bears a subdistal clump of 9 spines on the left side.

Remarks.—Three of the eight syntypes of *Crangon hakodatei*, that consist of one male and two females from Hakodate, Hokkaido, were reexamined. Unfortunately, they were not in good condition. The cephalothorax was detached from the abdomen in all three specimens. The male and smaller female were missing several cephalothoracic appendages and the larger female was mutilated. These types, however, retain the abdominal features well, which are the most important in the species identification.

C. hakodatei is readily separated from

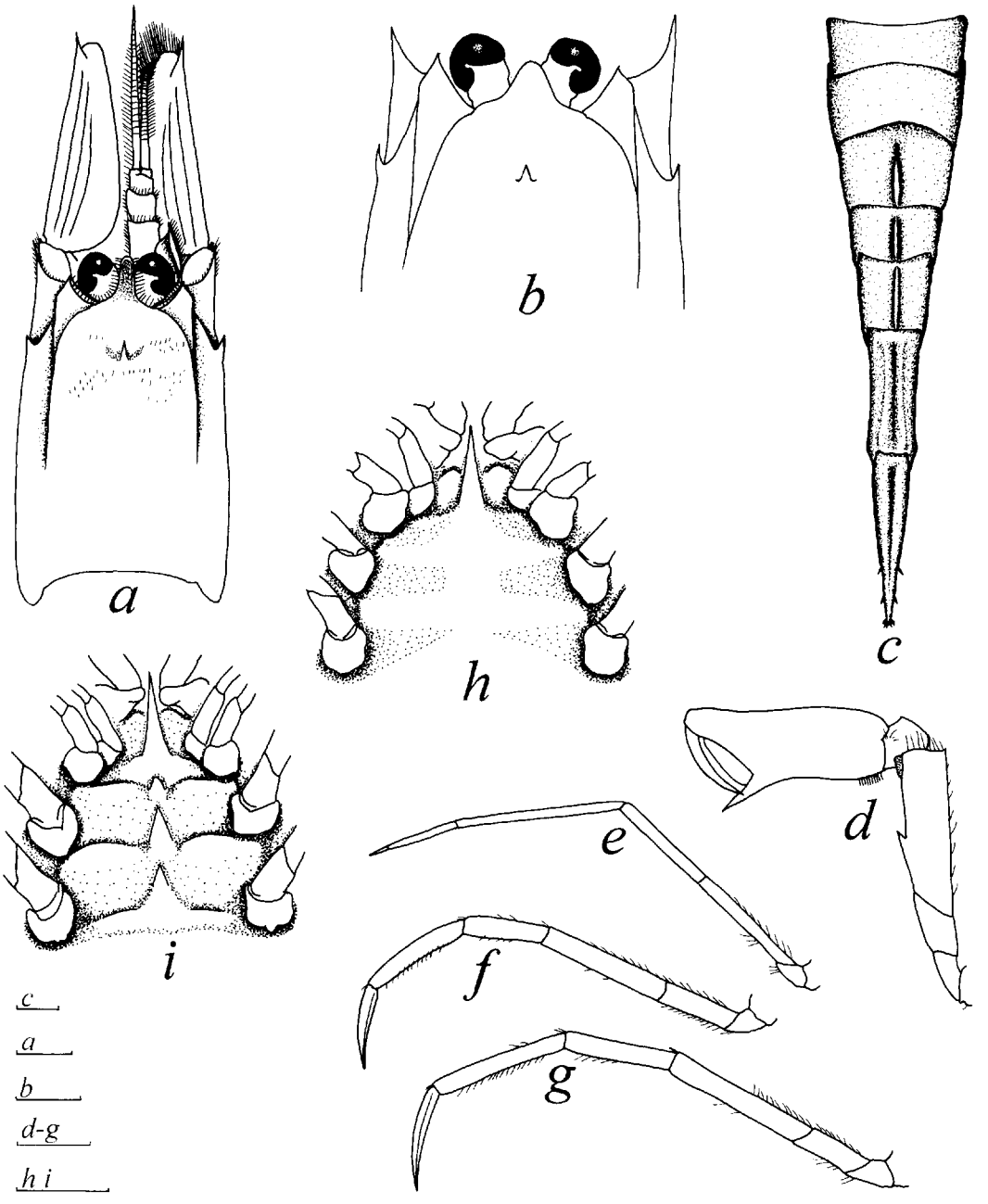

Fig. 8. *Crangon hakodatei* Rathbun, 1902; *a*, *c–h*, ovigerous female (10.0 mm, PUIZ 34) from off Gori, Korea; *b*, female (14.1 mm, NFU 350-2-1962) from the Yellow Sea; *i*, male (8.4 mm, PUIZ 35) from off Gori, Korea: *a*, carapace and anterior cephalic appendages, dorsal, left antennule omitted; *b*, anterior part of carapace and eyes, dorsal; *c*, abdominal somites and telson, dorsal; *d*, left first pereopod, flexor; *e*, left third pereopod, lateral; *f*, left fourth pereopod, lateral; *g*, left fifth pereopod, lateral; *h*, *i*, thoracic sternum, ventral, setae omitted. Scales = 2 mm.

other species by a high, blunt median dorsal carina on the third to fifth abdominal somites.

As mentioned in the account for *C. propinquus*, there is little doubt that the types of *C. propinquus* contained two species, *C. propinquus* and *C. hakodatei*.

Urita (1926) and Kim (1977) recognized that *C. hakodatei* was distinct from other related species in having the median carina on the third to fifth abdominal somites. Liu's (1955) *C. affinis* from northern China is referred to *C. hakodatei* because he clearly mentioned the presence of the median carina on the third to fifth abdominal somites. *C. nigricauda* from Korea (Kim & Park, 1972) was later reidentified as *C. hakodatei* by Kim (1976). Miyake *et al.* (1962) recorded *C. hakodatei* from Niigata, but they did not substantiate the specific status.

Crangon cassiope De Man, 1906

Figs. 9, 10

Crangon cassiope De Man, 1906: 402 [type locality: Inland Sea of Japan]; 1907: 406, pl. 32, figs. 20-25; Liu, 1955: 59, pl. 22, figs. 1–4.

Crangon (*Crangon*) *cassiope* – De Man, 1920: 250 (list).

?*Crago cassiope* – Yasuda, 1956: 8, 65, unnumbered fig., fig. 29; Maekawa, 1961: 172.

Type material.—Syntypes, 2 ovig. ♀ (10.3, 10.9 mm), Seto Inland Sea, NHM 1907.4.27.14-15 (see "Material examined").

Material examined.—**Korea.** Sikdo Island, Puan, collected with *C. hakodatei*, winged stow net on anchor, 29 Mar 1995, coll. H. K. Cha, 1 ♂ (5.6 mm), 3 ♀ (5.0–6.6 mm), 1 ovig. ♀ (7.0 mm), PUIZ 36. – Hamduck, Jeju Island, 5–10 m, *Zostera* bed, small trawl, 10 Jun 1994, coll. J. N. Kim, 1 ♀ (6.7 mm), 8 juvs (2.1–4.0 mm), PUIZ 37.

Seto Inland Sea. Syntypes, 2 ovig. ♀ (10.3, 10.9 mm), NHM 1907.4.27.14-15. – Bisan Strait, small trawl, 17 Jan 1989, coll. K. Yokogawa, 3 ♂ (5.9–6.6 mm), 1 ♀ (7.6 mm), 3 ovig. ♀ (8.7–10.2 mm), NFU 530-2-1971. – Bisan Strait, small trawl, 21 Jan 1989, coll. K. Yokogawa, 2 ♂ (6.2, 7.1 mm), 2 ovig. ♀ (9.7, 11.7 mm), NFU 530-2-1972. – Bisan Strait, small trawl, 11 May 1989, coll. K. Yokogawa, 2 ♂ (6.2, 7.1 mm), 2 ovig. ♀ (9.7, 11.7 mm), NFU 530-2-1973. – Miyakubo, Hiuchinada Sea, 30 m, sand, shrimp trawl, 21 Dec 1995, coll. Y. Hanamura, 1 ♂ (6.5 mm), 2 ♀ (7.7, 8.0 mm), NFU 530-2-2037. – Miyakubo, Hiuchinada Sea, 30 m, sand, collected with *C. affinis*, shrimp trawl, 13 Mar 1996, coll. Y. Hanamura, 2 ♂ (7.0, 8.4 mm), 4 ♀ (9.6–11.2 mm), 2 ovig. ♀ (9.5, 10.0 mm), NFU 530-2-2038. – Touyo City, Hiuchinada Sea, 1.5–2 m, fine sand, collected with *C. uritai*, 1 Jul 1998, coll. Y. Hanamura, 1 ♀ (9.9 mm), NFU 530-2-2039.

Japanese coast of the Sea of Japan. Yoshimi, Shimonoseki, 1 m, skin diving, 3 May 1989, 1 ♀ (14.3 mm), NFU 530-2-1974. – Yuya Bay, Yamaguchi Prefecture, 2 m, collected with *C. uritai*, shrimp trawl, 9 Jun 1983, coll. K. Kojima, 1 ovig. ♀ (12.2 mm), NFU 530-2-1975. – Tango Sea, Kyoto Prefecture, 4–7 m, 18 Jun 1971, 1 ♂ (4.5 mm), 1 ♀ (5.7 mm), 1 ovig. ♀ (11.0 mm), NFU 530-2-1976.

Tsugaru Strait. Off Kamiiso, Hakodate Bay, 5–10 m, collected with *C. affinis*, dredge, 1 Apr 1991, coll. S. Goshima, 1 ovig. ♀ (9.4 mm), NFU 530-2-1977.

Russian Far East. Kalevala Bay, 42°31.9′N, 130°50.0′E, subtidal, collected with *C. uritai*, beach seine, 18 Aug 1994, coll. M. Yabe, 1 ♀ (5.8 mm), CBM-ZC 2458. – Gorshkov Bay, 42°40′N, 131°13′E, subtidal, beach seine, 18 Aug 1994, coll. M. Yabe, 4 ovig. ♀ (7.1–8.0 mm), CBM-ZC 2463. – Tzoitsy Bay, sandy and rocky bottom, collected with *C. amurensis* and *C. uritai*, beach seine, 29 Aug 1994, coll. M. Yabe, 1 ♂ (5.2 mm), 10 ♀ (4.8–9.0 mm), 5 ovig. ♀ (7.9–9.0 mm), 2 juvs (3.1, 4.0 mm), NFU 530-2-1978.

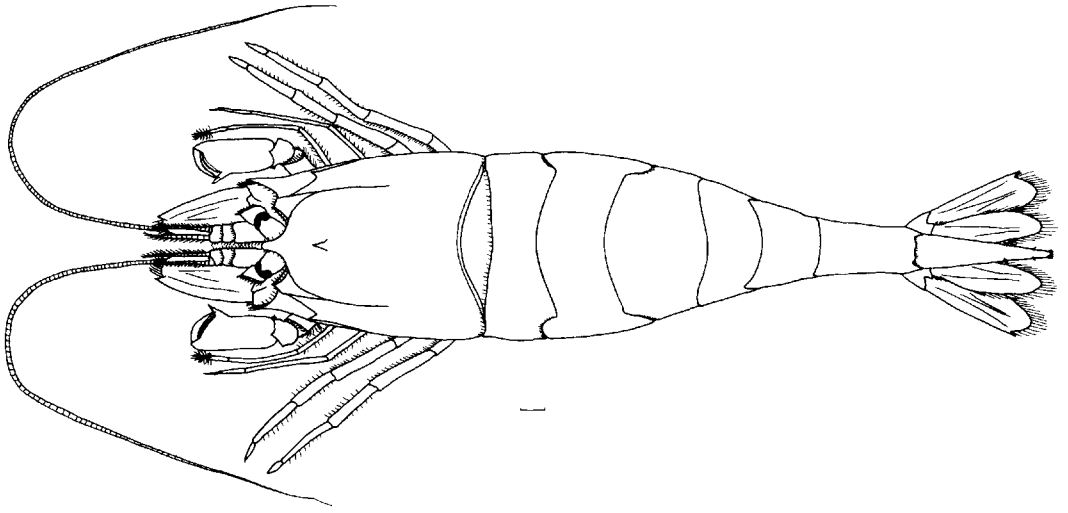

Fig. 9. *Crangon cassiope* De Man, 1906, ovigerous female (14.3 mm, NFU 350-2-1974) from Yoshimi, Shimonoseki, Japan; entire animal in dorsal view. Scale = 2 mm.

Diagnosis.—Integument naked. Rostrum usually not extending beyond mesial distal margin of eyestalk, 0.13–0.19 times as long as carapace, directed forward, rounded distally. Carapace with median gastric spine arising about 0.20 of carapace length. Third to fifth abdominal somites without median carina; sixth somite not grooved dorsally or ventrally, 0.66–0.79 times as long as carapace in males, 0.62–0.75 times in females. Telson without median groove dorsally, 1.03–1.08 times as long as carapace in males, 0.79–0.94 times in females. Scaphocerite 0.77–0.87 times as long as carapace in males, 0.67–0.79 times in females. Third maxilliped with subdistal clump of 4–6 (mostly 6) spines on ventral surface of antepenultimate segment. First pereopod with palm 2.04–2.73 times longer than broad. Third pereopod with carpus 1.29–1.60 times longer than distal two segments combined. Fourth and fifth pereopods moderately short and robust; dactylus 0.66–0.90 times as long as carpus in fourth, 0.54–0.90 times in fifth. Fifth thoracic sternite with median tubercle in ovigerous females.

Size.—Males 4.5–8.4 mm, females 4.8–14.3 mm, ovigerous females 7.0–12.2 mm, juveniles 2.1–4.0 mm.

Distribution.—Yellow Sea, northern part of the East China Sea, central and southern the Sea of Japan, Tsugaru Strait and Seto Inland Sea (De Man, 1906; 1907; Liu, 1955; present study); 1.5–30 m.

Parasites.—The following specimens from the Seto Inland Sea were infected with an unidentified bopyrid: one female (9.9 mm, NFU 530-2-2039) from Touyo City, Hiuchinada Sea; one male (8.4 mm, NFU 530-2-2038) from Miyakubo, Hiuchinada Sea.

Remarks.—The syntypes of *Crangon cassiope* are two ovigerous females from the Seto Inland Sea. The smaller specimen is still in good condition. The other specimen is damaged: the cephalothorax is detached from the abdomen, the distal parts of both antennular flagella are missing and the left antenna, third maxilliped and fifth pereopod had been removed, probably for examination.

Crangon cassiope is a good species that is distinguished from the other species of

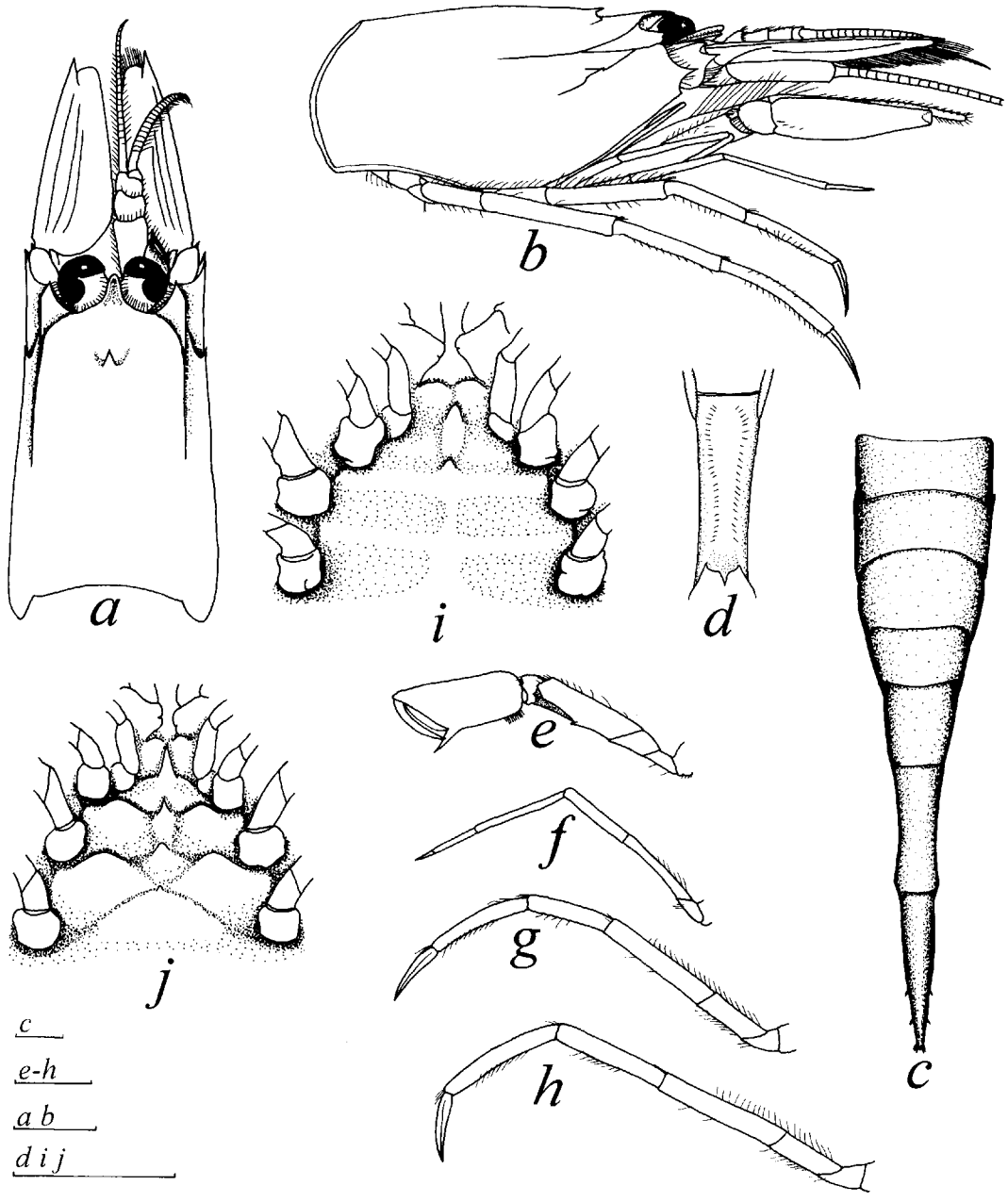

Fig. 10. *Crangon cassiope* De Man, 1906; *a–i*, ovigerous female (7.0 mm, PUIZ 36) from Puan, Korea; *j*, male (5.6 mm, PUIZ 36) from Puan, Korea: *a*, carapace and anterior cephalic appendages, dorsal, left antennule omitted; *b*, carapace and cephalothoracic appendages, lateral; *c*, abdominal somites and telson, dorsal; *d*, sternite of sixth abdominal somite, ventral; *e*, left first pereopod, flexor; *f*, left third pereopod, lateral; *g*, left fourth pereopod, lateral; *h*, left fifth pereopod, lateral; *i, j*, thoracic sternum, ventral, setae omitted. Scales = 2 mm.

the East Asian *Crangon* by the rounded sternite of the sixth abdominal somite, a tubercle on the thoracic sternum in the ovigerous female, the smallest palm length/width ratio of the first pereopod and the smallest dactylus/carpus of the fourth and fifth pereopods (see Tables 1 and 2). It has been treated as a junior synonym of *C. affinis*, however (cf. Balss, 1914; Yokoya, 1930; Urita, 1941; Igarashi, 1969; Fujino & Miyake, 1970).

Liu (1955) examined material from the coast of northern China and recognized that *C. cassiope* was separated from other congeners of East Asia by having rounded abdominal somites and the sixth somite without median groove on the ventral surface.

As mentioned above, *Crago cassiope* from the Seto Inland Sea reported by Yasuda (1956) and Maekawa (1961) seems to be *Crangon cassiope* or *C. uritai* since both are known from the same region and share a similar shape of the anterior part of body.

Crangon amurensis Brashnikov, 1907
Figs. 11, 12

Crangon crangon – Rathbun, 1902b: 42. Not *Crangon crangon* Linnaeus, 1758.

Crangon septemspinosa forma *amurensis* Brashnikov, 1907: 76 [type locality: Amur River Estuary, Russian Far East].

Crangon septemspinosa forma *anivensis* Brashnikov, 1907: 76 [type locality: Amur Bay, Sakhalin].

Crangon septemspinosa – Derjugin & Kobjakova, 1935: 142; Kobjakova, 1936: 190, 191, 202, 212 (list); 1937: 138; 1958a: 244 (list); Vinogradov, 1947: 91; 1950: 217, fig. 78. Not *Crangon septemspinosa* Say, 1818.

Crangon affinis – Komai *et al.*, 1992: 195 (in part).

Type material.—The type may be deposited at the Zoological Institute, Russian Academy of Science, St. Petersburg, but it was not located.

Material examined.—**Hokkaido, Japan.** Odaitou, Sea of Okhotsk coast of Hokkaido, light collecting, 30 Apr 1988, 4 ♀ (7.6–12.0 mm), 2 ovig. ♀ (11.7, 11.8 mm), NFU 530-2-1984. – Odaitou, Sea of Okhotsk coast of Hokkaido, light collecting, collected with *C. propinquus*, referred to *C. affinis* by Komai *et al.* (1992), 30 May 1988, 3 ♂ (6.8–7.4 mm), 1 ♀ (11.7 mm), 2 ovig. ♀ (9.3, 12.5 mm), HUMZ-C 380. – Furen Lake, Nemuro Bay, 26 Jul 1991, coll. Y. Hanamura, 4 ♂ (5.1–6.1 mm), 5 ♀ (4.9–5.4 mm), NFU 530-2-2040. – Hakodate, Tsugaru Strait, coll. *Albatross*, referred to *C. crangon* by Rathbun (1902b), 6 ♂ (7.0–8.0 mm), 13 ♀ (9.0–13.7 mm), USNM 28506. – Oohama Beach, Ishikari Bay, intertidal, fine sand, 27 Aug 1989, coll. Y. Hanamura, 1 ♂ (6.3 mm), 3 ♀ (4.7–7.7 mm), NFU 530-2-2041.

Russian Far East. Srednya Bay, 1 m, *Phyllospadix* bed, beach seine, 24 Aug 1994, coll. M. Yabe and K. Ikeya, 3 ♂ (5.3–6.1 mm), 7 ♀ (6.0–9.5 mm), 2 ovig. ♀ (9.0, 9.4 mm), NFU 530-2-1979. – Srednya Bay, 42°38.6′N, 131°12.4′E, seagrass bed, beach seine, 27 Aug 1994, coll. M. Yabe, 2 ♀ (10.0, 13.0 mm), NFU 530-2-1980. – Ostrovok Falsiuy Cape, 42°27.2′N, 131°47.0′E, beach seine, collected with *C. uritai*, 30 Aug 1994, coll. M. Yabe, 4 ♀ (10.0–13.3 mm), NFU 530-2-1981. – Tzoitsy Bay, sandy and rocky bottom, beach seine, collected with *C. cassiope* and *C. uritai*, 29 Aug 1994, coll. M. Yabe, 2 ♂ (4.8, 5.9 mm), 3 ♀ (6.0–8.5 mm), NFU 530-2-1982. – Olga Bay, subtidal, beach seine, collected with *C. propinquus*, 18 Aug 1994, coll. M. Yabe, 1 ♀ (10.1 mm), 1 ovig. ♀ (10.9 mm), CBM-ZC 5135. – Piltum Bay, Sakhalin, 7 m, beam trawl, 22 Jul 1995, coll. M. Yabe, 1 ♂ (9.5 mm), 3 ♀ (9.8–15.8 mm), 1 ovig. ♀ (15.0 mm), NFU 530-2-1983.

Diagnosis.—Integument naked. Rostrum usually not extending beyond mesial distal margin of eyestalk, 0.13–0.19 times as long as carapace, directed for-

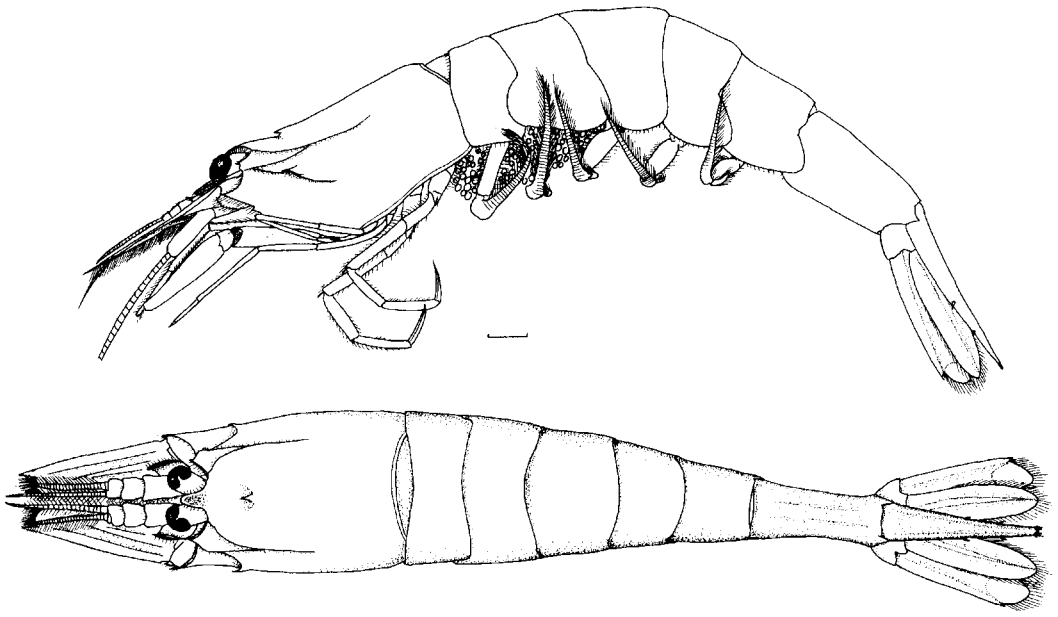

Fig. 11. *Crangon amurensis* Brashnikov, 1907, ovigerous female (10.1 mm, CBM-ZC 5135) from Olga Bay, Russian Far East; entire animal in lateral view (above) and dorsal view (below). Scale = 2 mm.

ward, rounded distally. Carapace with median gastric spine arising from about 0.20 of carapace length. Third to fifth abdominal somites without median carina; sixth somite flattened or slightly grooved dorsally and with median groove ventrally, 0.73–0.82 times as long as carapace in males, 0.65–0.77 times in females. Telson slightly grooved dorsally, 0.88–1.06 times as long as carapace in males, 0.86–1.01 times in females. Scaphocerite 0.80–0.91 times as long as carapace in males, 0.71–0.81 times in females. Third maxilliped with subdistal clump of 3–5 (mostly 4) spines on ventral surface of antepenultimate segment. First pereopod with palm 2.56–3.14 times longer than broad. Third pereopod with carpus 1.60–1.84 times longer than distal two segments combined. Fourth and fifth pereopods relatively robust; dactylus 0.88–1.11 times as long as carpus in fourth, 0.86-1.13 times in fifth. Fifth thoracic sternite with acute median spine in ovigerous females.

Size.—Males 4.8–9.5 mm, females 4.7–15.8 mm, ovigerous females 9.0–15.0 mm.

Distribution.—Northern part of the Sea of Japan, Tsugaru Strait and Sea of Okhotsk (Rathbun, 1902b; Brashnikov, 1907; Kobjakova, 1936; Vinogradov, 1947; present study); intertidal–27 m (Vinogradov, 1947; present study).

Remarks.—Brashnikov (1907) described two new forms, *C. septemspinosa* forma *amurensis* and *C. septemspinosa* forma *anivensis* from the Russian Far East. Brashnikov's (1907) two new forms have the following common features: the fourth and fifth abdominal somites are smooth and convex on the dorsal surface, the rostrum is relatively short (0.12–0.14 times of the carapace) and the scaphocerite has a narrow lamina and long distolateral spine. He also considered that *C. septemspinosa* forma *amurensis* differs from *C. septemspinosa* forma

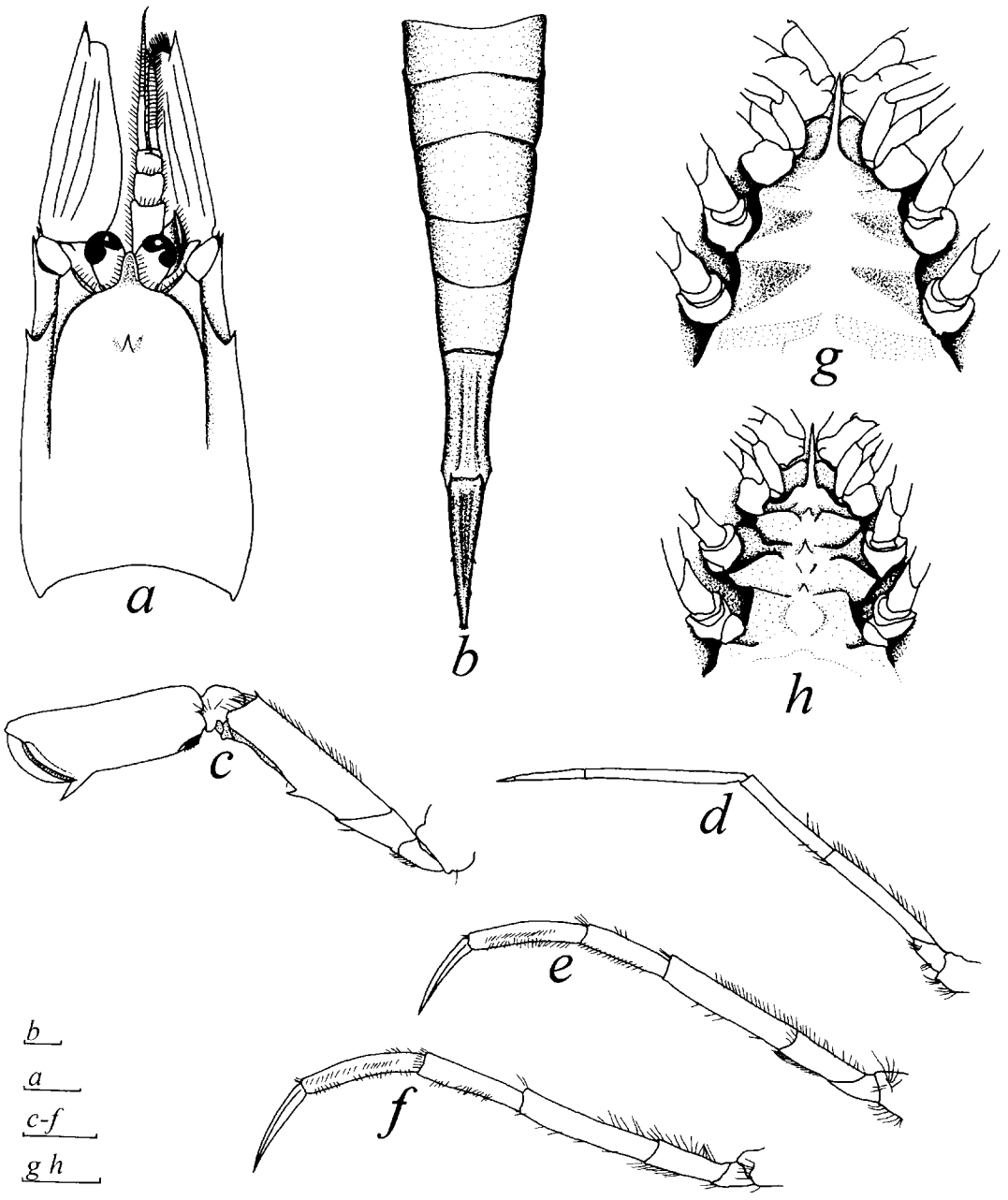

Fig. 12. *Crangon amurensis* Brashnikov, 1907; *a–g*, ovigerous female (10.1 mm, CBM-ZC 5135) from Olga Bay, Russian Far East; *h*, male (9.5 mm, NFU 530-2-1983) from Piltum Bay, Sakhalin, Russia: *a*, carapace and anterior cephalic appendages, dorsal, left antennule omitted; *b*, abdominal somites and telson, dorsal; *c*, left first pereopod, flexor; *d*, left third pereopod, lateral; *e*, left fourth pereopod, lateral; *f*, left fifth pereopod, lateral; *g*, *h*, thoracic sternum, ventral, setae omitted. Scales = 2 mm.

anivensis in having a longer chela of the first pereopod (0.50–0.55 times versus 0.49 times as long as the carapace) and a shorter sixth abdominal somite (0.64–0.67 times versus 0.73 times as long as the carapace) in females.

Although the type specimens of *C. septemspinosa* forma *amurensis* and *C. septemspinosa* forma *anivensis* were not examined, the present specimens from various localities, including those referred to *C. crangon* by Rathbun (1902b), agree well with Brashnikov's (1907) species. The characters of Brashnikov's (1907) two forms are also almost included in the range of the following individual variation of the present material: the chela of the first pereopod is 0.47–0.56 times as long as the carapace and the sixth abdominal somite is 0.65–0.77 times as long as the carapace in females. The two forms, therefore, should be placed under the name of *C. amurensis*, which has a page precedence over *C. anivensis*.

Crangon amurensis is closely related to the European *C. crangon* and Alaskan *C. septemspinosa* in that they all lack any sculpture on the abdomen and have a relatively short rostrum. *C. amurensis*, however, is distinguished from *C. crangon* and *C. septemspinosa* by having an intermediate position between them in the shape of the scaphocerite. In *C. amurensis*, the distolateral spine is shorter or longer than the distal width of the blade. On the other hand, the distolateral spine is as long as or longer than the distal width of the blade in *C. septemspinosa*, while it is usually shorter in *C. crangon*. The distal portion of the blade is wider in *C. amurensis* than in *C. septemspinosa* and narrower than in *C. crangon*. Furthermore, the scaphocerite is most slender in *C. septemspinosa*, broadest in *C. crangon* and intermediate in *C. amurensis*. The ratios of length/width of the scaphocerite are as follows: 2.84–2.95 in *C. septemspinosa*, 2.31–2.48 in *C. crangon* and 2.36–2.83 in *C. amurensis*. Moreover, *C. amurensis* differs from *C. septemspinosa* in having a more stout palm of the first pereopod: 2.56–3.14 times as long as broad in *C. amurensis*, while it is 2.80–3.28 times in *C. septemspinosa*.

Derjugin & Kobjakova (1935), Kobjakova (1937) and Vinogradov (1947, 1950) followed Brashnikov's (1907) identification and reported *C. septemspinosa* from various localities of the Russian Far East. Although the specimens reported by Russian authors were not available, *C. septemspinosa* of these authors seems to be conspecific with *C. amurensis* because of similar localities and depth (4–27 m).

Komai *et al.* (1992) referred ten specimens from Odaitou, Hokkaido to *C. affinis* (HUMZ-C 380). The specimens, which were reexamined, consisted of two species: six specimens of the present species and four specimens of *C. propinquus*.

Crangon uritai new species

Figs. 13–16

Crago sp. – Urita, 1926: 429.

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

Crangon affinis – Kubo, 1965: 622, fig. 1003. Not *Crangon affinis* De Haan, 1849.

Crangon (*Crangon*) *affinis* – Hayashi, 1976: 15; Kim, 1977: 298, pl. 54, fig. 60, text figs. 127, 128 (in part). Not *Crangon affinis* De Haan, 1849.

?*Crago cassiope* – Yasuda, 1956: 8, 65, unnumbered fig., fig. 29; Maekawa, 1961: 172.

Material examined.—Holotype: Dadaepo, Pusan, Korea, 1 m, sand, hand net, 22 Jul 1996, coll. M. H. Kim, ovig. ♀ (7.1 mm), PUIZ 38.

Paratypes: **Korea.** Sinjin Island, Taean, 4 m, SCUBA, 3 Aug 1996, coll. J. H. Choi, 1 ♂ (3.9 mm), 2 ♀ (4.1, 5.0 mm), 4 juvs (2.0–3.5 mm), PUIZ 39. – Mokpo, 23 Apr 1988, coll. S. Y. Hong, 2 ovig. ♀ (8.2, 9.0 mm), NFU 530-2-2043. – Youngsan River Estuary, trawl, 23 Apr 1988, coll. S.

Y. Hong, 1 ovig. ♀ (9.0 mm), PUIZ 40. – Nakdong River Estuary, sandy mud, shrimp trawl, Jun 1988, coll. S. Y. Hong, 4 ovig. ♀ (6.8–7.6 mm), PUIZ 41. – Nakdong River Estuary, sandy mud, shrimp trawl, 22 Nov 1988, coll. S. Y. Hong, 2 ♀ (6.9, 7.0 mm), PUIZ 42. – Collected with holotype, 2 ♂ (4.2, 4.7 mm), 9 ♀ (4.0–6.0 mm), 10 ovig. ♀ (4.8–6.5 mm), PUIZ 43. – Gwanganri, Pusan, sand, 13 Jun 1988, coll. S. Y. Hong, 3 ♀ (5.2–6.9 mm), PUIZ 44.

Pacific coast of Japan. Uchiura Bay, Hokkaido, 1 ♀ (9.5 mm), 15 ovig. ♀ (7.5–10.0 mm), HUMZ-C 524. – Hachinohe, Aomori Prefecture, 10 m, beam trawl, 14 Sep 1988, 7 ♂ (6.0–9.9 mm), 9 ♀ (6.6–9.0 mm), 9 ovig. ♀ (9.1–11.0 mm), HUMZ-C 566. – Kanehama, Miyako Bay, Iwate Prefecture, intertidal, 1 m, hand net, 13 Jun 1987, coll. T. Komai, 3 ♀ (5.9–9.5 mm), 2 ovig. ♀ (7.9, 9.2 mm), HUMZ-C 99. – Off Watari, Sendai Bay, Miyagi Prefecture, 24 m, sledge net, 24 Feb 1992, coll. H. Yamada, 4 ♀ (10.9–11.9 mm), 3 ovig. ♀ (11.0–11.3 mm), NFU 530-2-1985. – Torinoumi, Miyagi Prefecture, 3 m, intertidal, sledge net, 14 Apr 1992, coll. H. Yamada, 3 ♂ (5.0–6.3 mm), 3 ♀ (8.9–10.1 mm), 6 ovig. ♀ (9.5–11.7 mm), NFU 530-2-1986. – Chigusa Beach, Futtu, Chiba Prefecture, intertidal, hand net, Oct 1996, coll. T. Komai, 1 ♂ (4.1 mm), 4 ovig. ♀ (4.5–6.0 mm), CBM-ZC 3525. – Hakkeijima, Yokohama, Tokyo Bay, intertidal, sledge net, 19 Jul 1993, coll. J. Ueda, 6 ♂ (4.7–5.5 mm), 5 ♀ (5.8–9.7 mm), 7 ovig. ♀ (7.0–9.6 mm), NFU 530-2-1987. – Katsuura River Estuary, Tokushima Prefecture, 20 Apr 1990, coll. Y. Ueta, 1 ♂ (4.4 mm), 3 ♀ (5.3–6.1 mm), 1 ovig. ♀ (8.0 mm), NFU 530-2-1988.

Kyushu. Off Oozai, Beppu Bay, small shrimp trawl, 24 May 1978, coll. K. Ogawa, 5 ovig. ♀ (5.2–8.0 mm), NFU 530-2-1989. – Tsuyazaki Beach, Fukuoka Prefecture, 1 m, sand, hand net, 17 Jul 1982, coll. T. Hamano, 2 ovig. ♀ (5.1, 7.3 mm), NFU 530-2-1990.

Seto Inland Sea. Touyo City, Hiuchinada Sea, 1.5–2 m, fine sand, collected with *C. cassiope*, 1 Jul 1998, coll. Y. Hanamura, 3 ♂ (3.1–3.6 mm), 1 ♀ (3.5 mm), 2 ovig. ♀ (7.0, 8.9 mm), NFU 530-2-2042.

Japanese coast of the Sea of Japan. Yoshimi, Shimonoseki, 9 May 1976, 1 ovig. ♀ (10.2 mm), NFU 530-2-1991. – Yoshimi, Shimonoseki, 1 m, skin diving, 16 Jun 1989, 1 ovig. ♀ (5.3 mm), NFU 530-2-1992. – Yuya Bay, Yamaguchi Prefecture, 2 m, shrimp trawl, collected with *C. cassiope*, 9 Jun 1983, coll. K. Kojima, 1 ovig. ♀ (7.2 mm), NFU 530-2-1993. – Yuya Bay, Yamaguchi Prefecture, 2 m, shrimp trawl, 23 Jun 1983, coll. K. Kojima, 4 ♂ (3.6–4.1 mm), 2 ♀ (3.4, 3.5 mm), NFU 530-2-1994. – Yuya Bay, Yamaguchi Prefecture, shrimp trawl, 27 Feb 1989, coll. K. Kojima, 6 ♂ (4.7–6.2 mm), 7 ovig. ♀ (10.0–12.0 mm), NFU 530-2-1995. – Yuya Bay, Yamaguchi Prefecture, shrimp trawl, 14 Mar 1989, 2 ♂ (5.0, 5.0 mm), 3 ovig. ♀ (8.0–8.6 mm), NFU 530-2-1996. – Yuya Bay, Yamaguchi Prefecture, shrimp trawl, 11 May 1989, 1 ♂ (5.2 mm), 12 ovig. ♀ (8.3–11.4 mm), NFU 530-2-1997. – Toyama Bay, collected with *C. affinis*, small trawl, coll. N. Horii, 1 ♂ (5.2 mm), 2 ovig. ♀ (9.0, 9.2 mm), NFU 530-2-1998. – Mano Bay, Sado Island, Niigata Prefecture, 7 m, *Zostera marina* bed, dredge, 28 Jul 1975, referred to *C. affinis* by Hayashi (1976), 1 ♀ (6.0 mm), NFU 530-2-1999. – Off Akita Power Plant, Akita Prefecture, 23 Apr 1975, coll. M. Toriumi, 6 ovig. ♀ (10.6–12.5 mm), NFU 530-2-2000.

Tsugaru Strait. Yusima, Aomori Bay, 10 m, sandy mud, 19 Jun 1963, coll. H. Sando, 1 ovig. ♀ (8.5 mm), NFU 530-2-2001.

Russian Far East. Kalevala Bay, 42°31.9′N, 130°50.0′E, subtidal, collected with *C. cassiope*, 18 Aug 1994, coll. M. Yabe, 3 ovig. ♀ (4.8–5.9 mm), CBM-ZC 5134. – Ostrovok Falsiuy Cape,

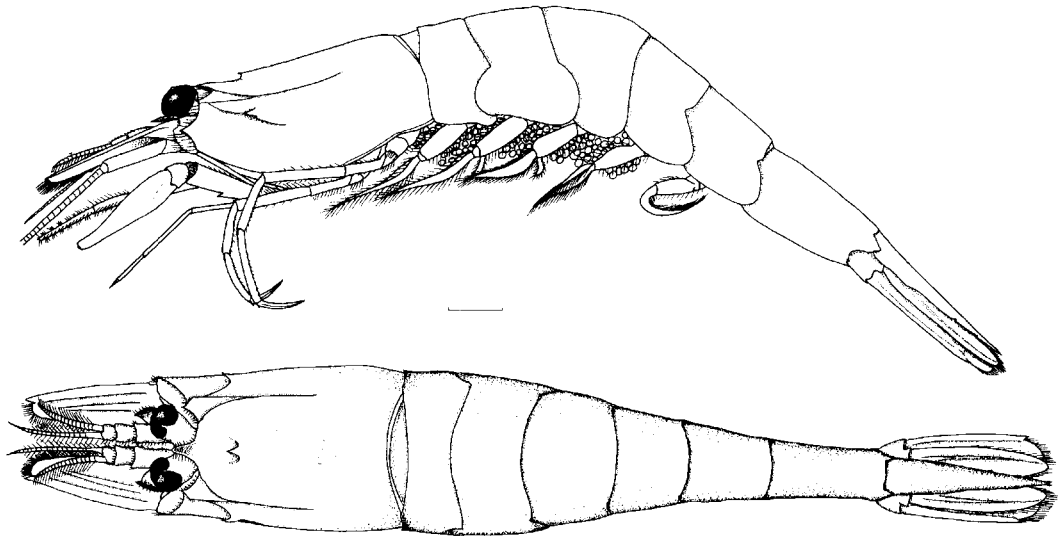

Fig. 13. *Crangon uritai* new species, paratype, ovigerous female (6.5 mm, PUIZ 43) from Dadaepo, Pusan, Korea; entire animal in lateral view (above) and dorsal view (below). Scale = 2 mm.

42°27.2′N, 131°47.0′E, beach seine, collected with *C. amurensis*, 30 Aug 1994, coll. M. Yabe, 1 ovig. ♀ (7.0 mm), NFU 530-2-2002. – Tzoitsy Bay, sandy and rocky bottom, collected with *C. cassiope* and *C. amurensis*, beach seine, 29 Aug 1994, coll. M. Yabe, 1 ♀ (5.5 mm), 1 ovig. ♀ (6.0 mm), NFU 530-2-2003.

Diagnosis.—Integument naked. Rostrum usually not extending beyond mesial distal margin of eyestalk, 0.12–0.20 times as long as carapace, directed forward or slightly descending, rounded distally. Carapace with median gastric spine arising from anterior about 0.20 of carapace length. Third to fifth abdominal somites without median carina; sixth somite with median groove ventrally, but without submedian carinae or median groove dorsally, 0.74–0.78 times as long as carapace in males, 0.64–0.73 times in females. Telson without median groove dorsally, 0.87–1.02 times as long as carapace in males, 0.81–0.91 times in females. Scaphocerite 0.74–0.90 times as long as carapace in males, 0.64–0.77 times in females. Third maxilliped with subdistal clump of 3–4 (mostly 4) spines on ventral surface of antepenultimate segment. First pereopod with palm 2.65–3.33 times longer than broad. Third pereopod with carpus 1.43–2.05 times longer than distal two segments combined. Fourth and fifth pereopods relatively robust; dactylus 0.89–1.19 times as long as carpus in fourth, 0.88–1.13 times in fifth. Fifth thoracic sternite with median tubercle in ovigerous females.

Description of females.—Body depressed (Fig. 13). Integument naked, not particularly firm.

Rostrum usually not extending beyond mesial distal margin of eyestalk, 0.12–0.20 times as long as carapace, triangular, straight or slightly descending, concave dorsally, rounded at apex, with fine marginal setae (Fig. 14*a*). Carapace with median gastric spine on anterior about 0.20 length of carapace; hepatic spine supported by short carina; moderately strong antennal, strong branchiostegal and weak pterygostomial spines present;

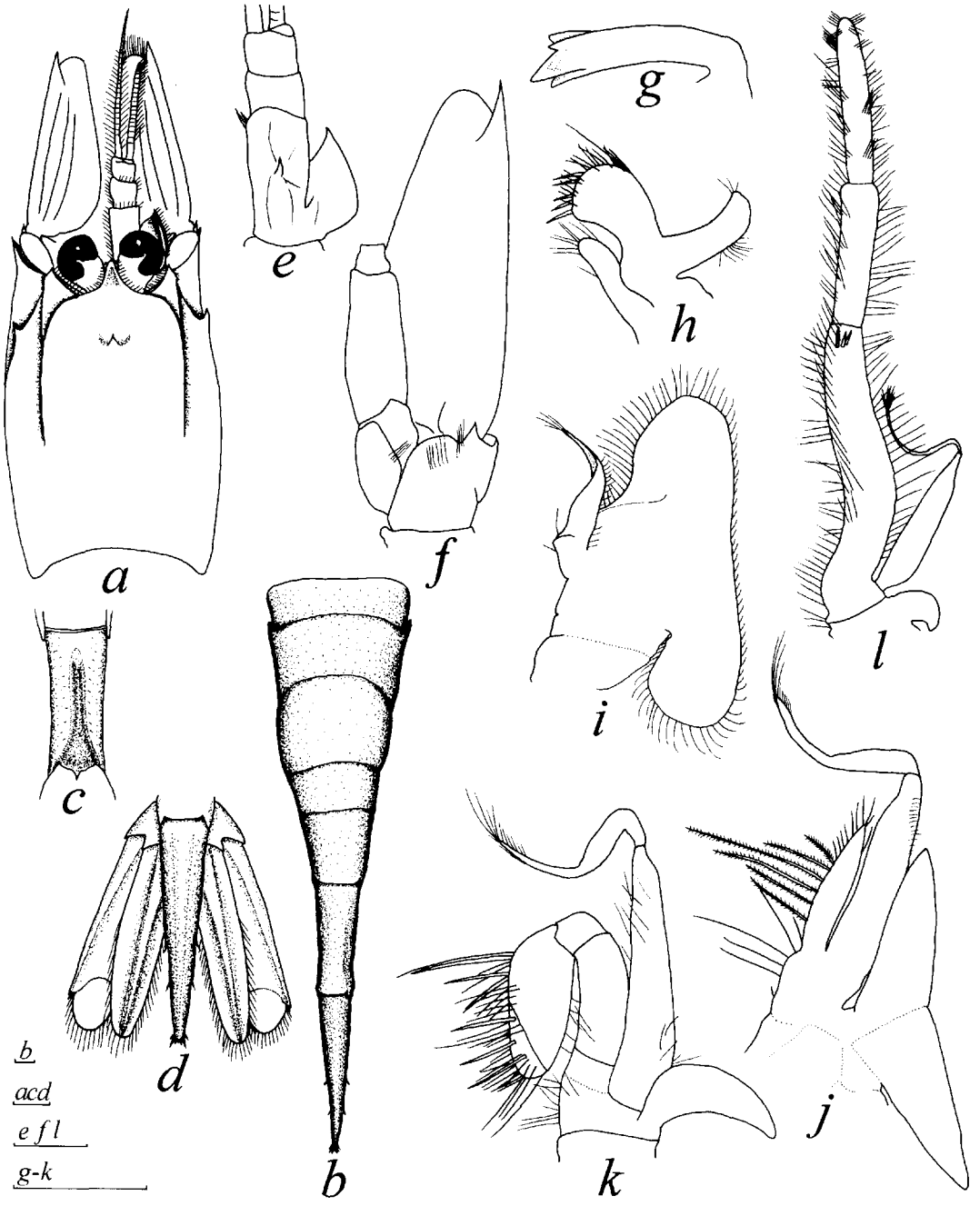

Fig. 14. *Crangon uritai* new species, holotype, ovigerous female (7.1 mm, PUIZ 38) from Dadaepo, Pusan, Korea. Appendages dissected from left side: *a*, carapace and anterior cephalic appendages, dorsal, left antennule omitted; *b*, abdominal somites and telson, dorsal; *c*, sternite of sixth abdominal somite, ventral; *d*, telson and uropods, dorsal; *e*, antennule, ventral, flagella and setae omitted; *f*, antenna, ventral, flagellum and setae omitted; *g*, mandible, external; *h*, maxillule, external; *i*, maxilla, external; *j*, first maxilliped, external; *k*, second maxilliped, external; *l*, third maxilliped, flexor. Scales = 1 mm.

postorbital carina defined, overreaching midlength of carapace; ventral margin of carapace forming weak lobe at base of second pereopod (Figs. 13, 14*a*).

All abdominal somites rounded dorsally (Figs. 13, 14*b*). Sixth somite 0.64–0.73 times as long as carapace; posterolateral process pointed; sternum grooved, with anal spine (Fig. 14*c*). Telson rounded dorsally, gradually tapering to sharp point, 0.81–0.91 times as long as carapace, with 3 pairs of lateral spines, anteriormost pair situated at anterior 0.60 of telson; posterior margin with 2 pairs of spines, outer pair longer than inner (Figs. 13, 14*b*, *d*).

Eye with cornea well developed, having small dorsal tubercle; eyestalk with distoventral spine (Fig. 14*a*).

Antennule depressed, with peduncle reaching near midlength of scaphocerite. Proximal segment longer than distal two segments combined, with two subdistal spines on mesial margin; ventromedial ridge with acute spine. Stylocerite wide, subtriangular at base; lateral margin slightly rounded, slightly sulcate laterally, terminating in acute apex, falling slightly short of anterior margin of proximal segment. Second and distal segments subequal in length. Outer flagellum slender, falling slightly short of blade of scaphocerite. Inner flagellum more slender than outer flagellum, reaching beyond blade of scaphocerite (Fig. 14*a*, *e*).

Antenna with scaphocerite 0.64–0.77 times as long as carapace, lateral margin slightly convex, distolateral spine slightly curved inward, exceeding rounded blade. Basicerite with distolateral spine. Carpocerite reaching midlength of scaphocerite (Fig. 14*a*, *f*). Flagellum as long as body.

Mouthparts similar to typical crangonid form. Mandible simple, composed only of strongly curved molar process, divided distally into 4 teeth (Fig. 14*g*). Maxillule with proximal endite rounded distally, with several setae on distal margin; distal endite curved inward, distal margin widely subtruncate with 5 strong spines and sparse setae; palp slightly curved, pointed distally, with some apical setae (Fig. 14*h*). Maxilla with vestigial endites; palp spatulate, with several apical setae; scaphognathite with subtriangular anterior lobe, posterior lobe narrower and rounded, with posterior setae slightly longer than mesial setae (Fig. 14*i*). First maxilliped with endite completely reduced; endopod elongate, reaching beyond anterior margin of epipod with long lateral plumose setae; exopod longer than endopod, with moderately curved lash; epipod large, distinctly bilobed, each lobe subtriangular (Fig. 14*j*). Second maxilliped with endopod compressed; dactylus attached diagonally to propodus, with 3 strong spines on proximal half of mesial margin and dense setae on distomesial margin; propodus with 2 strong spines and several setae on subdistomesial margin; exopod with well developed lash; epipod well developed, sickle-shaped (Fig. 14*k*). Third maxilliped reaching beyond distolateral spine of scaphocerite; ultimate segment slightly longer than penultimate; antepenultimate segment with subdistal clump of 3–4 (mostly 4) spines on ventral surface; exopod well developed, with moderately curved lash; epipod rudimentary (Fig. 14*l*); arthrobranch present.

First pereopod subchelate, nearly reaching blade of scaphocerite; palm moderately stout, 2.65–3.33 times as long as broad, cutting edge moderately oblique; movable finger not overreaching base of fixed finger when closed; carpus short, with two distolateral spines; merus with strong spine on middle of mesial margin and weak spine on dorsodistal margin (Figs. 15*a*, 16*b*). Second pereopod slender, chelate; movable finger about 0.40 times as long as palm, both fingers setose (Fig. 15*b*). Third pereopod slightly more slen-

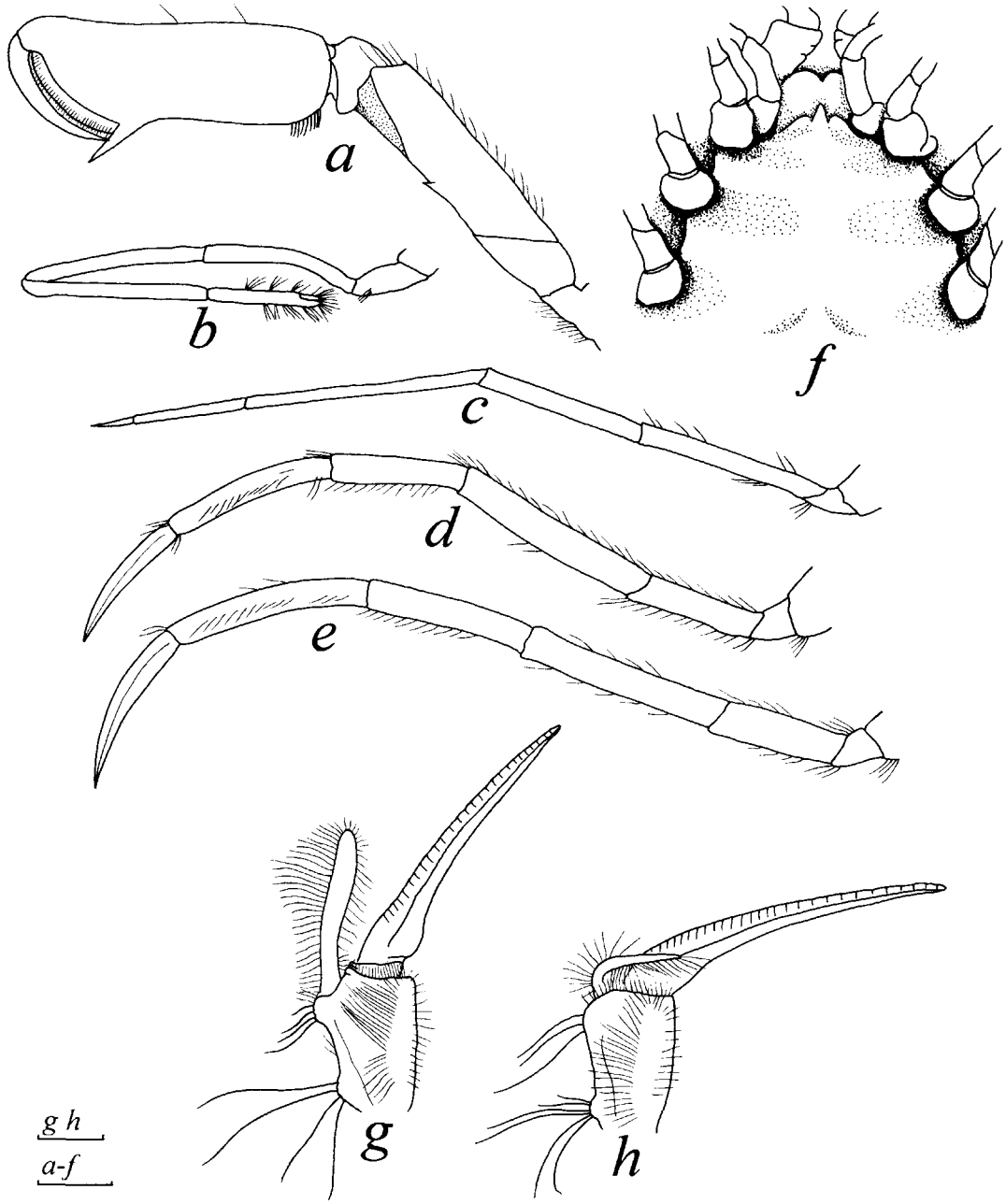

Fig. 15. *Crangon uritai* new species, holotype, ovigerous female (7.1 mm, PUIZ 38) from Dadaepo, Pusan, Korea. Appendages dissected from left side: *a*, first pereopod, flexor; *b*, second pereopod, lateral; *c*, third pereopod, lateral; *d*, fourth pereopod, lateral; *e*, fifth pereopod, lateral; *f*, thoracic sternum, ventral, setae omitted; *g*, first pleopod, ventral; *h*, second pleopod, ventral. Scales = 1 mm.

der than second, reaching distal margin of palm of first pereopod; carpus 1.43–2.05 times as long as dactylus and propodus combined, becoming longer with growth (Fig. 15*c*). Fourth pereopod more robust than third, reaching two-thirds length of scaphocerite; dactylus subspatulate, moderately curved, 0.66–0.91 times as long as propodus, 0.89–1.19 times as long as carpus; flexor margin of propodus setose; merus with row of setae on both flexor and extensor margins (Fig. 15*d*). Fifth pereopod similar to fourth, reaching midlength of scaphocerite; dactylus 0.70–0.95 times as long as propodus, 0.88–1.13 times as long as carpus; merus less setose than that of fourth (Fig. 15*e*).

Pleurobranchs on fourth to eighth thoracic somites inclined anteriorly.

Branchial formula as follows:

	Maxillipeds			Pereopods				
	1	2	3	1	2	3	4	5
Pleurobranchs	–	–	–	1	1	1	1	1
Arthrobranchs	–	–	r	–	–	–	–	–
Podobranchs	–	–	–	–	–	–	–	–
Epipods	1	1	r	–	–	–	–	–
Exopods	1	1	1	–	–	–	–	–

r: rudimentary.

Sculpture and armament of thoracic sternum varying greatly with growth; in juveniles fifth to eighth thoracic somites convex each with median spine, transverse sutures separating sixth to eighth somites distinct; in mature but non-ovigerous specimens fifth to eighth somites slightly convex each with subacute median tubercle; in ovigerous females posterior part of thoracic somites concave, with median tubercle on fifth somite only, transverse sutures indicating sixth to eighth somites very obscure (Fig. 15*f*). Abdominal sternites each with acute median spine in immature specimens.

First pleopod with endopod changing in relative length and setation with growth; comparative length against exopod increasing from about 0.20 (4.4 mm) to 0.50 (9.0 mm); setation longer in ovigerous females than in non-ovigerous females, but naked in immature specimens (Fig. 15*g*). Second pleopod with endopod tapering distally, strongly curved laterally, about 0.25 of exopod length (Fig. 15*h*). Protopods with mesial margin slightly concave medially, bearing setae at disto- and proximo-lateral corners in large specimens (Fig. 15*g*, *h*). Appendix interna absent on all pleopods.

Uropod reaching posterior end of telson; exopod slightly shorter than endopod, with small spine just mesial to acute posterolateral spine (Fig. 15*d*).

Dimorphism.—Males differ from females as follows.

Body more slender than in females. Sixth abdominal somite 0.74–0.78 times as long as carapace. Telson 0.87–1.02 times as long as carapace. Outer antennular flagellum more stout and longer than in females, exceeding distal end of scaphocerite (Fig. 16*a*). Scaphocerite 0.74–0.90 times as long as carapace (Fig. 16*a*).

Thoracic sternum convex with moderately strong median spine on fifth somite and weak median spines on sixth to eighth somites; transverse sutures separating sixth to eighth somites distinct (Fig. 16*c*). Abdominal sternites each with acute median spine.

First pleopod tapering distally; endopod curved laterally, about 0.20 of exopod length (Fig. 16*d*). Second pleopod with endopod longer than appendix masculina with numerous mesial and marginal setae (Fig. 16*e*, *f*). Protopods with mesial medial margin slightly convex (Fig. 16*d*, *e*).

Size.—Males 3.1–9.9 mm, females 3.4–11.9 mm, ovigerous females 4.5–12.5 mm, juveniles 2.0–3.5 mm.

Distribution.—Yellow Sea, northern part of the East China Sea, central and southern part of the Sea of Japan, Seto

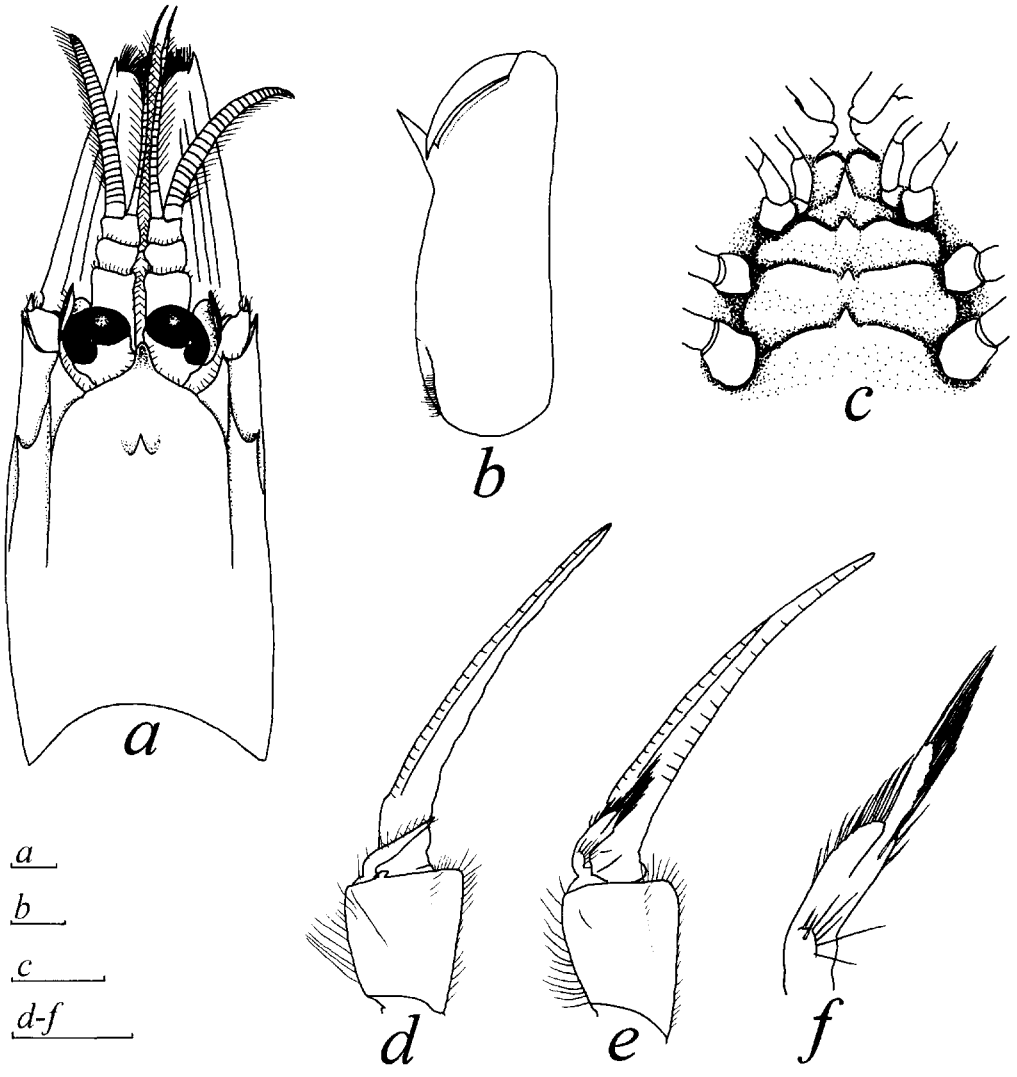

Fig. 16. *Crangon uritai* new species; *a*, paratype, male (7.0 mm, HUMZ-C 566) from Hachinohe, Japan; *b*, paratype, ovigerous female (11.4 mm, NFU 350-2-1997) from Yuya Bay, Japan; *c-f*, paratype, male (4.7 mm, PUIZ 43) from Dadaepo, Pusan, Korea: *a*, carapace and anterior cephalic appendages, dorsal; *b*, left first chela, flexor; *c*, thoracic sternum, ventral, setae omitted; *d*, left first pleopod, ventral; *e*, left second pleopod, ventral; *f*, same, endopod and appendix masculina. Scales = 1 mm.

Inland Sea, central and southern Pacific coasts of Japan, (Urita, 1926; Liu, 1955; present study); intertidal to 24 m.

Variations.—The palm of the first pereopod varies from having a moderately oblique cutting edge and straight flexor margin (Fig. 15*a*) to a more oblique cutting edge and concave flexor margin (Fig. 16*b*).

The carpus of third pereopod becomes proportionally longer with growth. The ratio of carpus length/length of the distal two segments combined changes from 1.43 in 4.7 mm to 2.05 in 11.3 mm.

Parasites.—A female (9.5 mm, HUMZ-C 99) from Miyako Bay infested by an uni-

dentified bopyrid.

Etymology.—This species is named for the late Mr. Tomoye Urita, who first recognized the present form as distinct from other congeners.

Remarks.—The present new species is very similar to *Crangon crangon* in the absence of a median carina on the abdominal somites, the presence of a median groove on the ventral surface of the sixth abdominal somite and having a relatively broad scaphocerite. It differs from the European species by the following morphological features. In the ovigerous females, the fifth thoracic sternite is armed with a blunt process in *C. uritai*, instead of an acute spine in *C. crangon*. The third maxilliped distinctly overreaches the distolateral spine of the scaphocerite in *C. uritai*, while it only reaches the distal margin of the blade in *C. crangon*. The antepenultimate segment of the third maxilliped is usually armed with a subdistal clump of four spines on the ventral surface in *C. uritai*, instead of three spines in *C. crangon*.

As mentioned in the account for *C. affinis* above, *C. crangon* reported by Parisi (1919) from Yokohama and Enoshima, Japan seems to be referable to the present new species. Urita (1926) compared *Crago* sp. from Tsingtao, China with *Crangon affinis* and *C. cassiope*. Although the description is brief, his *Crago* sp. surely represents *Crangon uritai*. He mentioned the absence of a mid-dorsal abdominal carina and the presence of a ventral median groove on the sixth abdominal somite. Liu's (1955) description and figures of *C. crangon* from northern China quite agree with the present species, especially in the presence of a blunt median process on the fifth thoracic sternite in ovigerous females. Kubo's (1965) illustration of *C. affinis* also appears very similar to this species. His account was rather general, but the illustration may have been based on a specimen of *C. uritai*.

A female (NFU 530-2-1999) from Mano Bay, Sado Island, which was referred to *C. affinis* by Hayashi (1976), proved to be *C. uritai*. As mentioned above, Yasuda's (1956) and Maekawa's (1961) *Crago cassiope* from the Seto Inland Sea and Kim's (1977) *Crangon affinis* from Korea appear to have consisted of one or more species, including the present new species.

Discussion

Differentiation of species

The seven species of the genus *Crangon* recognized here have long been confused with each other (Holthuis, 1980). Most of them have been misidentified as *C. affinis*. The reliable characters to differentiate the seven species are discussed in Tables 1 and 2.

The Atlantic *C. crangon*, and Alaskan *C. septemspinosa* and *C. alaskensis* were once reported from East Asian waters (Rathbun, 1902b; 1904; Brashnikov, 1907; Liu, 1955). They are clearly different from the East Asian congeners. Although *C. dalli* is known from both sides of the North Pacific, the remaining species have their characteristic features in East Asian waters.

The rostrum shape is useful in the recognition of some species, although it shows some variation in some of the species (Figs. 1, 2*b*, 8*a*, *b*). In *C. affinis* (Fig. 2*a*) it usually reaches the distal margin of the cornea and has a subacutely pointed apex, while *C. cassiope* (Fig. 10*a*), *C. amurensis* (Fig. 12*a*) and *C. uritai* (Figs. 14*a*, 16*a*) have a shorter rostrum that usually does not reach the mesial distal margin of the eyestalk as well as a rounded apex. The rostrum is similar in *C. propinquus* (Fig. 4*a*), *C. dalli* (Fig. 6*a*) and *C. hakodatei* (Fig. 8*a*). It usually reaches the distal margin of the cornea and the apex is rounded.

The sculpture on the abdominal somites and telson is most important in

species recognition. *Crangon dalli* (Fig. 5) is the unique species in having two distinct dorsal submedian carinae on the sixth somite. In *C. hakodatei* (Fig. 8*c*), the third to fifth somites have a blunt mid-dorsal carina and the sixth somite and telson have a median groove. All abdominal somites and telson of both *C. cassiope* (Fig. 10*c*) and *C. uritai* (Fig. 14*b*) are rounded dorsally. *Crangon cassiope* (Fig. 10*d*) is unique in not having a grooved sternite in the sixth somite. *Crangon affinis* (Fig. 2*c*) and *C. propinquus* (Fig. 4*b*) have a low but distinct mid-dorsal carina on the fifth somite and a shallow dorsal median groove on the sixth somite and telson. The fourth somite in *C. affinis* has a trace of a mid-dorsal carina on the posterior half (Fig. 2*c*), while a faint mid-dorsal carina is present in *C. propinquus* (Fig. 4*b*). The anterior five somites are rounded dorsally and the sixth somite and telson are flattened or slightly grooved in *C. amurensis* (Fig. 12*b*).

The thoracic sternum shows a specific character in ovigerous females (Table 1). *Crangon dalli* (Fig. 6*i*), *C. cassiope* (Fig. 10*i*) and *C. uritai* (Fig. 15*f*) have a median blunt process on the fifth thoracic sternite, while *C. affinis*, *C. propinquus*, *C. hakodatei* and *C. amurensis* have an acute spine (Figs. 2*h*, 4*g*, 8*h*, 12*g*). Although the length of the spine is rather variable, it is usually the longest in *C. amurensis* (Fig. 12*g*), the shortest in *C. propinquus* (Fig. 4*g*) and intermediate in *C. affinis* (Fig. 2*h*) and *C. hakodatei* (Fig. 8*h*). The males and nonovigerous females usually have a moderately long median spine on the fifth sternite and a short median spine or subacute tubercle each on sixth to eighth sternites. These spines are usually longer in *C. affinis* (Fig. 2*i*), *C. propinquus* (Fig. 4*h*), *C. hakodatei* (Fig. 8*i*) and *C. amurensis* (Fig. 12*j*) than in *C. dalli* (Fig. 6*j*), *C. cassiope* (Fig. 10*j*) and *C. uritai* (Fig. 16*c*), though slightly variable in length.

The scaphocerite is always longer in males than in females in all species. The comparison between scaphocerite length and carapace length is also useful in species recognition (Table 2): it is the highest in *C. affinis* and *C. dalli*, the lowest in *C. cassiope* and *C. uritai* and intermediate in the other three species.

As indicated by previous authors (Ortmann, 1895; Rathbun, 1902a; 1902b; 1904; Kuris & Carlton, 1977; Butler, 1980), proportions of the palm of the first pereopod provide less discrete but notable differences in species recognition (Table 2). The palm is most robust in *C. cassiope* (Fig. 10*e*) and most slender in *C. affinis* (Fig. 2*d*), while it is intermediate in the other five species (Figs. 4*c*, 6*e*, 8*d*, 12*c*, 15*a*).

The comparative length of each segment of the last three pereopods is useful in the recognition of some species (Table 2). The ratio of dactylus length to carpus length in the fourth and fifth pereopods displays more noticeable differences than the comparative length of the carpus of the third pereopod (Table 2). These ambulatory pereopods are the longest in *C. affinis* (Fig. 2*e*, *f*, *g*) and shortest in *C. cassiope* (Fig. 10*f*, *g*, *h*). The other five species are intermediate with similar lengths (Figs. 4*d*, *e*, *f*, 6*f*, *g*, *h*, 8*e*, *f*, *g*, 12*d*, *e*, *f*, 15*c*, *d*, *e*).

The largest specimens in all speices are always females. The maximum size of females is distinctive in some species (Table 1). The largest females are found in *C. dalli* and *C. hakodatei* (more than 18.0 mm in CL), while the smallest belong to *C. affinis* and *C. uritai* (less than 12.5 mm in CL). Females of *C. propinquus*, *C. cassiope* and *C. amurensis* are intermediate in size, 15.9 mm, 14.3 mm and 15.8 mm in CL, respectively.

The ventral surface of the antepenultimate segment of the third maxilliped is armed with a subdistal clump of spines (Figs. 6*b*, *c*, 14*l*,). The number of spines is useful in the recognition of some species, though the character is somewhat vari-

Table 1. Comparison of the distinctive characters of seven species of the genus *Crangon* from East Asia.

Species	Largest size in CL (mm)	RL/CL	Abdominal somites	Dorsal surface of telson	Spines on antepenultimate segment of 3rd maxilliped	Armature of thoracic sternum of ovig. female
C. affinis	12.0 ♀ 9.0 ♂	0.20–0.29	3rd rounded dorsally 4th carinate dorsally on posterior half 5th carinate dorsally 6th grooved dorsally, ventrally	grooved	4–6, mostly 5	acute spine
C. propinquus	15.9 ♀ 10.6 ♂	0.15–0.20	3rd rounded dorsally 4th faintly carinate dorsally 5th carinate dorsally 6th grooved dorsally, ventrally	grooved	4–5, mostly 5	acute spine
C. dalli	18.0 ♀ 12.8 ♂	0.16–0.22	3rd to 5th rounded dorsally 6th with 2 blunt submedian carinae dorsally	grooved	5–7, mostly 6	tubercle
C. hakodatei	18.4 ♀ 12.5 ♂	0.17–0.24	3rd to 5th carinate dorsally 6th grooved dorsally, ventrally	grooved	4–6, mostly 5	acute spine
C. cassiope	14.3 ♀ 7.1 ♂	0.13–0.19	3rd to 5th rounded dorsally 6th rounded dorsally, ventrally	rounded	4–6, mostly 6	tubercle
C. amurensis	15.8 ♀ 9.5 ♂	0.13–0.19	3rd to 5th rounded dorsally 6th flattened or grooved dorsally, and grooved ventrally	rounded	3–5, mostly 4	acute spine
C. uritai	12.5 ♀ 9.9 ♂	0.12–0.20	3rd to 5th rounded dorsally 6th rounded dorsally, and grooved ventrally	rounded	3–4, mostly 4	tubercle

Table 2. Meristic characters of seven species of *Crangon* from East Asia. The ranges with the mean and number of individuals examined in parentheses are given for each species.

Species	SL/CL	First palm length/width	Length of carpus/distal two segments combined of 3rd pereopod	Dactylus/carpus length of 4th pereopod	Dactylus/carpus length of 5th pereopod
C. affinis	0.78–0.92 (0.86; 17) ♀	3.11–4.05	1.90–2.60	1.03–1.46	0.94–1.67
	0.85–0.96 (0.90; 8) ♂	(3.52; 14)	(2.11; 14)	(1.18; 15)	(1.16; 16)
C. propinquus	0.74–0.83 (0.80; 11) ♀	2.46–3.00	1.41–1.87	0.80–1.03	0.82–1.13
	0.79–0.84 (0.82; 5) ♂	(2.76; 14)	(1.75; 10)	(0.94; 9)	(0.97; 10)
C. dalli	0.78–0.90 (0.84; 45) ♀	2.24–2.91	1.46–2.10	0.92–1.21	0.92–1.23
	0.79–0.94 (0.85; 18) ♂	(2.59; 33)	(1.78; 34)	(1.02; 23)	(1.04; 23)
C. hakodatei	0.69–0.82 (0.77; 19) ♀	2.32–2.93	1.56–2.18	0.83–1.10	0.91–1.12
	0.74–0.83 (0.80; 9) ♂	(2.62; 18)	(1.79; 18)	(1.00; 14)	(0.99; 14)
C. cassiope	0.67–0.79 (0.71; 14) ♀	2.04–2.73	1.29–1.60	0.66–0.90	0.54–0.90
	0.77–0.87 (0.82; 10) ♂	(2.46; 15)	(1.44; 11)	(0.79; 15)	(0.71; 14)
C. amurensis	0.71–0.81 (0.76; 22) ♀	2.56–3.14	1.60–1.84	0.88–1.11	0.86–1.13
	0.80–0.91 (0.84; 8) ♂	(2.94; 22)	(1.74; 14)	(0.99; 20)	(0.99; 20)
C. uritai	0.64–0.77 (0.67; 36) ♀	2.65–3.33	1.43–2.05	0.89–1.19	0.88–1.13
	0.74–0.90 (0.81; 13) ♂	(2.91; 29)	(1.68; 21)	(1.06; 27)	(1.05; 27)

able and it overlaps in some cases (Table 1): 4–6, mostly 5, in *C. affinis* and *C. hakodatei*; 4–5, mostly 5, in *C. propinquus*; 5–7, mostly 6, in *C. dalli*; 4–6, mostly 6 in *C. cassiope*; 3–5, mostly 4, in *C. amurensis*; and 3–4, mostly 4, in *C. uritai*.

Key to the East Asian species of *Crangon* [Adult]

1. Sixth abdominal somite with 2 distinct dorsal submedian carinae ..... *C. dalli* Rathbun, 1902

1. Sixth abdominal somite without distinct submedian carinae 2

2. Fifth abdominal somite with mid-dorsal carina 3

2. Fifth abdominal somites without mid-dorsal carina 5

3. Third to fifth abdominal somites with blunt mid-dorsal carina. [Palm of first pereopod 2.32–2.93 times as long as broad. Carpus of third pereopod 1.56–2.18 times as long as distal two segments combined] ..... *C. hakodatei* Rathbun, 1902

3. Third abdominal somite without mid-dorsal carina 4

4. Fourth abdominal somite with faint mid-dorsal carina. Palm of first pereopod 2.46–3.00 times as long as broad. Carpus of third pereopod 1.41–1.87 times as long as distal two segments combined ..... *C. propinquus* Stimpson, 1860

4. Fourth abdominal somite with trace of mid-dorsal carina on posterior half. Palm of first pereopod 3.11–4.05 times as long as broad. Carpus of third pereopod 1.90–2.35 times as long as distal two segments combined ..... *C. affinis* De Haan, 1849

5. Sixth abdominal somite and telson rounded dorsally. Thoracic sternum with tubercle in ovigerous females 6

5. Sixth abdominal somite and telson flattened or slightly grooved dorsally. Thoracic sternum with acute median spine in ovigerous females. [Palm of first pereopod 2.56–3.14 times as long as broad] ..... *C. amurensis* Brashnikov, 1907

6. Sixth abdominal somite rounded ventrally. Palm of first pereopod 2.04–2.73 times as long as broad. Dactylus of fourth and fifth pereopods 0.54–0.90 times as long as carpus ..... *C. cassiope* De Man, 1906

6. Six abdominal somite grooved ventrally. Palm of first pereopod 2.65–3.33 times as long as broad. Dactylus of fourth and fifth pereopods 0.88–1.19 times as long as carpus ..... *C. uritai* new species

Biogeography

Vertical distribution.—*Crangon propinquus*, *C. cassiope*, *C. amurensis* and *C. uritai* seem to be restricted to depths less than about 40 m. *C. amurensis* and *C. uritai* even occur in the intertidal zone. *C. affinis* and *C. hakodatei* are inhabitants of the continental shelf from sublittoral depths to about 200 m. *C. dalli* has the broadest bathymetric range and extends to the greatest depth (3–630 m).

Geographical distribution. —*Crangon hakodatei* has a relatively wide distribution: the southern Sea of Okhotsk, the northern Pacific coast of Japan, the central and southern parts of the Sea of Japan, the Yellow Sea and the northern East China Sea. *C. dalli* has the widest distribution in the northern North Pacific, from Puget Sound to the Sea of Japan and the Chukchi Sea (Butler, 1980). The remaining five species show a more limited distribution. *C. propinquus* and *C. amurensis* have a restricted distribution in the Sea of Okhotsk, the northern part of the Sea of Japan and the northern Pa-

cific coast of Japan. *C. uritai* and *C. cassiope* show a similar distribution in the Yellow Sea, the northern East China Sea, the central and southern parts of the Sea of Japan and the Seto Inland Sea, but there have been no records of *C. cassiope* from the Pacific coast of Japan. *C. affinis* is restricted to the Yellow Sea (Fujino & Miyake, 1970), the northeastern East China Sea and the coast of Honshu, Japan.

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