南西水研研報 (Bull. Nansei Natl. Fish. Res. Inst.), No.29 : 1-18 (1996)

Deepwater Caridean Shrimps of the Families Nematocarcinidae, Stylodactylidae, Pandalidae and Crangonidae (Crustacea: Decapoda) from Western Australia

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This paper reports on 20 species of deepwater caridean shrimps of the families Nematocarcinidae, Stylodactylidae, Pandalidae and Crangonidae collected from Western Australia. Among them, six species are new to the Australian fauna including, *Nematocarcinus productus, N. tenuirostris, Stylodactylus licinus, Heterocarpus longirostris, H. tricarinatus,* and *Parapontophilus gracilis junceus.*

Key words: Crustacea, Decapoda, Caridea, Namatocarcinidae, Stylodactylidae, Pandalidae, Crangonidae, W Australia.

Over the past ten years, the CSIRO Division of Fisheries has conducted exploratory surveys of the deepwater fauna of Western Australia which have produced several interesting crustacean collections. Part of the survey results, in particular those from a cruise in 1991 by the CSIRO research vessel FRV *Southern Surveyor*, were recently published in our first paper in this series which reported on 19 species of the caridean families Oplophoridae and Pasiphaeidae from the area, and on a lophogastridan mysid (Mysidacea), included as an appendix (Hanamura and Evans 1994). This paper, the second in the series, reports on 20 species of the caridean families Nematocarcinidae, Stylodactylidae, Pandalidae, and Crangonidae, and provides keys to species, including those previously recorded from Western Australia. Each species is accounted for systematically except for those listed in parentheses, which are well documented in earlier literature. The general survey and collection details outlined in our first paper apply here also.

Most of the specimens used in this study are deposited in the CSIRO Division of Fisheries in Hobart, Tasmania. A few are at the Northern Territory Museum of Arts and Sciences (NTM) in Darwin.

Carapace length (cl; mm) is used as standard for all species and is measured between the orbital and posterodorsal margins of the carapace.

SYSTEMATIC ACCOUNT

Family Nematocarcinidae

Genus ***Nematocarcinus*** A. Milne Edwards

Key to the species of *Nematocarcinus* of Western Australia

1. Rostrum extending distinctly beyond end of antennular peduncle ·····2
- Rostrum not reaching end of antennular peduncle ·····3
2. Dorsal teeth on rostrum proper with 3-6 more widely spaced than others; ventral margin of 6th abdominal somite with tuberculate swelling near posterior end ·· ·····*N. tenuirostris*

- Dorsal teeth of rostrum proper equally spaced; ventral margin of 6th abdominal somite without noticeable tuberculate swelling near posterior end ..... *N. productus*

3. Dorsal rostral teeth closely but subequally spaced ..... *N. gracilis*
- Dorsal rostral teeth increasingly widely spaced anteriorly ..... *N. undulatipes*

Nematocarcinus gracilis Bate, 1888

Nematocarcinus gracilis Bate, 1888: 815, pl. 132, fig. 8; De Man, 1920: 90, pl. 8, fig. 21a-h, pl. 9, fig. 21; Chace, 1986: 71, fig. 38; Burukovsky, 1991: 44.

Occurrence. — FRV "Southern Surveyor": - Stn. 94, 34° 57.3'S, 114° 29.0'E, 900-958 m, 18 Feb. 1991, 1 female (19.9 mm in cl).

Distinguishing features. — Rostrum nearly straight, reaching end of 2nd antennular peduncle segment, armed dorsally with 23 movable, closely spaced teeth, and ventrally with single tooth near distal end. Cervical groove deep at midpoint of carapace. Dorsal margin of 3rd abdominal somite slightly produced posteriorly. Pleuron of 5th somite with small, sharp posteroventral spine. Sixth abdominal somite slightly more than twice as long as 5th; ventral margin smooth, without noticeable tuberculate swelling near posterior end.

Distribution. — Indo-West Pacific. Previously recorded in Australia from the eastern coast (Kensley *et al.* 1987).

Nematocarcinus productus Bate, 1888 (Fig. 1)

Nematocarcinus productus Bate, 1888: 810, pl. 132, fig. 5; Chace, 1986: 72, fig. 39; Allen & Butler, 1994: 430.

Nematocarcinus ensifer var. *producta*: De Man, 1920: 76, pl. 8, figs. 18, 18a.

Occurrence. — FRV "Southern Surveyor": - Stn. 92, 34° 12.8'S, 114° 07.7'E, 1225-1240 m, 17 Feb. 1991, 1 ovig. female (25.5 mm).

Distinguishing features. — Rostrum (Fig. 1) nearly straight, directed slightly upwards and extending distinctly beyond end of antennular peduncle, armed dorsally with at least 25 teeth, the basal 14 of which being closely spaced including 8 posterior to orbital margin. Dorsal margin of 3rd abdominal somite slightly produced posteriorly. Pleuron of 5th somite with small, sharp posteroventral spine. Sixth somite 2.28 times as long as 5th, ventral margin without tuberculate swelling near posterior end. Telson slightly shorter than 6th somite, armed with 4 (right), and 6 (left) dorsolateral spines.

Remarks. — Although the rostrum of the specimen examined is broken off distally, the shape and spination of the remaining part (Fig. 1), are similar to those of *N. productus*

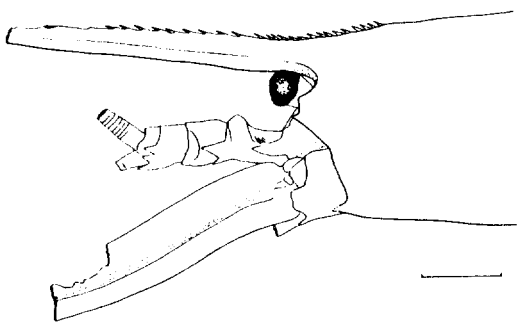

Fig. 1. *Nematocarcinus productus* Bate, 1888, ovig. female cl 25.5 mm: anterior part of body. Scale represents 5 mm.

Bate, 1888, *N. tenuipes* Bate, 1888, and *N. intermedius* Bate, 1888. Chace (1986) suggested the latter two species to be junior synonyms of the former, whereas Burukovsky (1991) appears to have considered all three species to be distinct, differentiating the latter two by variation in rostral spination. Although there remains some doubt about whether *N. tenuipes* and *N. intermedius* are indeed variations of a polymorphic *N. productus*, the specimen described here is allocated to *N. productus*. Further collections of Western Australian specimens are required to clarify their true identity.

Distribution. — The Philippine-Indonesian region, Mid-Pacific Mountains.

Nematocarcinus tenuirostris Bate, 1888

Nematocarcinus tenuirostris Bate, 1888: 817, pl. 132, fig. 10; Chace, 1986: 74, fig. 40; Burukovsky, 1991: 44, fig. 2 (5-7).

Nematocarcinus tenuirostris var. *sibogae*: De Man, 1920: 79, pl. 8, fig. 19-19d.

Occurrence: — FV "Territory Pearl": - Stn. S8, 13° 17'S, 122° 21'E, 600-740 m, 25 Jan. 1988, B. Wallner coll., 1 ovig. female (30.4 mm) (NTM Cr 07192); - Stn. C1, 29° 05'S, 113° 41'E, 880 m, 25 Jan. 1988, B. Wallner coll., 1 ovig. female (?) (NTM Cr 007187). — FRV "Southern Surveyor": - Stn. 2, 20° 16.5'S, 113° 13.5'E, 913-914 m, 23 Jan. 1991, 11 males (20.2-25.3 mm), 5 females (19.3-23.1 mm), 16 ovig. females (24.0-27.0 mm), 1 ex (?); - Stn. 11, 21° 54.1'N, 113° 40.7'E, 1100-1158 m, 24 Jan. 1991, 4 ovig. females (27.3-29.8 mm); - Stn. 20, 23° 44.8'S, 112° 35.3'E, 612-623 m, 26 Jan. 1991, 3 males (23.4-26.1 mm), 1 female (30.1 mm), 1 ovig. female (27.6 mm), 1 ex (?); - Stn. 22, 23° 59.5'S, 111° 54.1'E, 1061-1071 m, 27 Jan. 1991, 4 ovig. females (27.1-28.5 mm); - Stn. 23, 24° 09.6'S, 111° 39.5'E, 1293-1320 m, 27 Jan. 1991, 1 male (29.5 mm), 1 female (?), 1 ovig. female (29.8 mm); - Stn. 24, 24° 30.2'S, 111° 50.9'E, 892-905 m, 28 Jan. 1991, 1 ovig. female (ca. 23.5 mm); - Stn. 32, 25° 41.2'S, 111° 30.9'E, 1115-1125 m, 29 Jan. 1991, 3 males (24.0-25.1 mm); - Stn. 35, 26° 05.9'S, 111° 46.7'E, 874-882 m, 30 Jan. 1991, 1 female (22.9 mm), 2 ovig. females (27.1, 28.1 mm); - Stn. 47, 27° 32.8'S, 112° 15.2'E, 998-1009 m, 31 Jan. 1991, 1 male (26.5 mm), 1 ovig. female (26.7 mm), 1 ex (27.9 mm).

Distinguishing features. — Rostrum nearly straight or slightly curved dorsally and extending distinctly beyond end of antennular peduncle, armed dorsally with 8-11 teeth, sparcely distributed anteriorly including 3-6 posterior to orbital margin, and ventrally with a single tooth slightly anterior to distal tooth of dorsal series. Dorsal margin of 3rd abdominal somite slightly produced posteriorly. Pleuron of 5th somite with small, sharp posteroventral spine. Sixth somite 2.11-2.25 times as long as 5th, ventral margin with tuberculate swelling near posterior end. Telson 1.05-1.17 times as long as 6th somite, armed with 7-9 dorsolateral spines on each side.

Remarks. — The tuberculate swelling situated near the posterior end of the 6th abdominal somite is well developed in the material examined, and appears to be a reliable feature to distinguish this species from *N. undulatipes* and other *Nematocarcinus* species from Western Australia.

Distribution. — Indo-West Pacific. New to the Australian fauna.

Nematocarcinus undulatipes Bate, 1888

Nematocarcinus undulatipes Bate, 1888: 801, pl. 130; De Man, 1920: 83, pl. 8, fig. 20-20h; Chace, 1986: 76, figs. 41, 42; Hayashi, 1986: 91, 256, fig. 51; Burukovsky, 1991: 44; Takeda & Hanamura, 1994: 15, figs. 6, 7a,b, d-f,e.

Occurrence. — FV "Territory Pearl": - Stn. C1, 29° 05'S, 113° 41'E, 880 m, 3 Feb. 1988, B. Wallner coll., 1 ovig. female (26.9 mm) (NTM Cr 007187). — FRV "Southern Surveyor": - Stn. 2, 20° 16.5'S, 113° 13.5'E, 913-914 m, 23 Jan. 1991, 1 male (22.7 mm), 11 ovig. females (23.5-27.1 mm); - Stn. 24, 24° 30.2'S, 111° 50.9'E, 905-992 m, 28 Jan. 1991, 1 male (23.5 mm), 1 ovig. female (27.9 mm); - Stn. 35, 26° 05.9'S, 111° 46.7'E, 874-882 m, 30 Jan. 1991, 2 males (20.2, 23.5 mm), 1 female (19.5 mm), 5 ovig. females (ca. 22.5-ca. 30 mm).

Distinguishing features. — Rostrum extending barely to end of antennular peduncle, armed dorsally with 8-12 teeth, somewhat sparcely distributed anteriorly including 3-6 posterior to orbital margin, and ventrally unarmed or with a single tooth near distal end. Dorsal margin of 3rd abdominal somite slightly produced posteriorly. Pleuron of 5th somite with small, sharp posteroventral spine. Sixth abdominal somite slightly more than twice as long as 5th, ventral margin almost smooth, without marked tuberculate swelling near posterior end. Telson 1.07-1.13 times as long as 6th somite, armed with 6-10, commonly 6-7, spines on each side.

Distribution. — Indo-Pacific. Previously recorded in Australia from off the east coast (Kensley *et al.* 1987).

Family Stylodactylidae

Genus ***Stylodactylus*** A. Milne Edwards

Key to the species of *Stylodactylus* of Western Australia

1. Third abdominal somite with 2-4 spines at posterodorsal mardin; 2nd antennular peduncle segment elongated and longer than 1st ·····(*S. brucei*)
- Third abdominal somite without spines at posterodorsal margin; 2nd antennular peduncle segment not elongated and shorter than 1st·····2
2. Supraorbital spine small; pleura of 4th and 5th abdominal somites with posteroventral spine·····*S. licinus*
- Supraorbital spine well developed; pleura of 4th and 5th abdominal somites without posteroventral spine···(*S. multidentatus*)*

* According to Cleva (1994), the Western Australian *S. multidentatus* is allocated to the subspecies *S. multidentatus multidentatus* Cleva.

Stylodactylus licinus Chace, 1983

Stylodactylus licinus Chace, 1983: 14; fig. 6; Cleva, 1990: 87, figs. 3a-j, 18f,g; - 1994: 58; Takeda & Hanamura, 1994: 17, fig. 8a.

Occurrence. — FRV "Southern Surveyor": - Stn. 3, 20° 07.8'S, 112° 55.1'E, 854-868 m, 23 Jan. 1991, 1 ovig. female (16.5 mm).

Distinguishing features. — Rostrum slightly curved upwards and extending distinctly beyond end of antennal scale, armed dorsally with more than 30 teeth, and ventrally with at least 21 teeth. Carapace with small supraorbital spine, but lacking secondary spines below branchiostegal spine. Pleura of 4th and 5th abdominal somites with sharp posteroventral spine. Articulation between merus and ischium of 4th pereopod indistinctly fused, while that of 5th pereopod distinctly

articulated. Dactyli of posterior 3 pereopods 3.65, 4.15, and 7.08 times as long as propodi, respectively.

Distribution. — The Philippine-Indonesian region, New Caledonia, Fiji, and the Chesterfield Islands. New to the Australian fauna.

Family Pandalidae

Genus ***Heterocarpus*** A. Milne Edwards

Key to the species of *Heterocarpus* of Western Australia

1. Postantennal carina long and continuous from antennal spine to near posterior end of carapace 2
- Postantennal carina short, ending just posterior to antennal spine 4
2. Carapace with cardiolateral carina on posterior half 3
- Carapace without cardiolateral carina on posterior half; 3rd abdominal somite with sharp dorsal spine at midpoint; telson with 4 pairs of dorsolateral spines ..... *H. woodmasoni*
3. Length of unarmed portion of dorsal margin greater than half carapace length; marked red patch in branchiocardiac region of carapace in fresh specimens, but no patch on 3rd abdominal somite ..... *H. hayashii*
- Length of unarmed portion of dorsal margin less than half carapace length; marked red patch absent in branchiocardiac region of carapace, but present on 3rd abdominal somite in fresh specimens ..... *H. sibogae*
4. Third abdominal somite, at least, with posteromedial spine 5
- Third abdominal somite without postero medial spine 6
5. Fourth and 5th abdominal somites ending in posteromedial spine ..... *H. dorsalis*
- Fourth and 5th abdominal somites not ending in posteromedial spine ... *H. longirostris*
6. Branchiostegal spine longer than antennal spine; dorsal margin of rostrum unarmed on distal half ..... (*H. laevigatus*)
- Branchiostegal spine shorter than antennal spine; dorsal margin of rostrum entirely toothed 7
7. Lateral carina of rostrum indistinct on portion anterior to eye; postorbital carina curved obliquely upwards near midpoint ..... *H. gibbosus*
- Lateral carina of rostrum distinct throughout length; postorbital carina curved abruptly upwards near midpoint .. .. *H. tricarinatus*

Heterocarpus dorsalis Bate, 1888

Heterocarpus dorsalis Bate, 1888: 630, pl. 111; De Man, 1920: 171, pl. 15, fig. 43; Chace, 1985: 22, fig. 13d; Hayashi, 1986: 117, 267, fig. 74; Hanamura & Takeda, 1987: 107; Crosnier, 1988: 62, figs. 2, 3; Wadley & Evans, 1991: 16, 2 figs.; Takeda & Hanamura, 1994: 20.

Occurrence. — FV "Territory Pearl": - Stn. C1, 29° 05'S, 113° 41'E, 880 m, 3 Feb. 1988, B Wallner coll., 1 female (28.2 mm) (NTM Cr 007182); - Stn S9, 13° 06'S, 122° 18'E, 25 Jan. 1988, B. Wallner coll., 1 female (24.1 mm), 4 ovig. females (21.9-30.1 mm) (NTM Cr 006993), 2 ovig. females (27.0, 30.4 mm) (NTM Cr 007184). — FRV "Southern Surveyor": - Stn. 3, 20° 07.8'S, 112° 55.1'E, 854-868 m, 23 Jan. 1991, 2 females (18.3, ca. 19 mm); - Stn. 4, 20° 55.4'S, 112° 51.5'E, 1128-1139 m, 23 Jan. 91, 1 male (ca. 20 mm), 2 females (ca. 20, 20.6 mm), 1 ovig. female (21.1 mm); - Stn. 13, 22° 28.8'S, 113° 12.4'E, 1258-1305 m, 25 Jan. 1991,1 ovig. female (24.0 mm); - Stn.

22, 23° 59.5'S, 111° 54.1'E, 1061-1071 m, 27 Jan. 1991, 1 male (19.8 mm); - Stn. 35, 26° 05.3'S, 111° 46.7'E, 874-882 m, 30 Jan. 1991, 1 ovig. female (28.0 mm); - Stn. 49, 28° 04.1'S, 112° 42.6'E, 853-854 m, 1 Feb. 1991, 1 ovig. female (25.2 mm).

Distinguishing features. — Rostrum curved slightly upwards and extending beyond antennal scale, armed dorsally with 9-13 teeth including 2-3 teeth posterior to orbital margin, and ventrally with 11-13 teeth. Carapace with dorsal lateral carina between orbital and posterior margins; postbranchiostegal carina from hepatic spine to posterior margin; postantennal carina absent; branchiostegal spine extending as far as, or slightly beyond, end of antennal spine. Abdomen with first 2 somites dorsally rounded, 3rd to 5th somites dorsally carinate and ending in dorsomedial spine, 6th somite slightly grooved middorsally.

Distribution. — Indo-West Pacific. Previously recorded in Australia from the NW continental slope (Hanamura and Takeda 1987, Wadley and Evans 1991).

Heterocarpus gibbosus Bate, 1888

Heterocarpus gibbosus Bate, 1888: 634, pl. 112, fig. 2; De Man, 1920: 163, pl. 14, fig. 39; Chace, 1986: 29, figs. 13f, 17; Hanamura & Takeda, 1987: 107; Chan & Yu, 1987: 54, pl. 1, figs. a-c; Crosnier, 1988, figs. 6b,c, pl. 4, figs. c, d; Wadley & Evans, 1991: 17, 2 figs.

Occurrence. — RV "Territory Pearl": - Stn. A 11, 9° 35'S, 129° 28'E, 360-395 m, 18 Jan. 1988, 1 female (25.3 mm) (NTM Cr 006996); - Stn. T1, 11° 33'S, 124° 58'E, 413-420 m, 20 Jan. 1988, 1 male (37.5 mm), 1 female (43.6 mm) (NTM Cr 007188).

Distinguishing features. — Rostrum curved upwards, extending beyond end of antennal scale, armed dorsally with 9 teeth including 5-6 posterior to orbital margin, and ventrally with 8 teeth; lateral rostral carina indistinct, extending anteriorly just beyond eye. Dorsal crest highly arched. Postorbital carina well developed and curved obliquely upwards near midpoint; postbranchiostegal carina extending posteriorly along 2/3 of carapace length before diminishing. First 2 abdominal somites rounded dorsally, 3rd with blunt and wide carina, 4th and 5th rounded, and 6th nearly flattened dorsally.

Distribution. — Indo-West Pacific. Previously recorded in Australia from the NW continental slope (Hanamura and Takeda 1987, Wadley and Evans 1991).

Heterocarpus hayashii Crosnier, 1988 (Fig. 2)

Heterocarpus hayashii Crosnier, 1988: 81-83, figs. 4b, 5b, pl. 1, fig. d, Pl. 3 figs. c-e; Wadley & Evans, 1991: 18, 2 figs.

Heterocarpus sibogae: Chace, 1985: 36 (part; fig. 20); Hayashi, 1986: 119, 268, fig. 76; Chan & Yu, 1987: 57 (part; pl. 2, fig. c).

Occurrence. — FRV "Southern Surveyor": - Stn. 6, 21° 37.5'S, 113° 55.6'E, 328 m, 24 Jan. 1991, 1 male (25. 0 mm).

Distinguishing features. — Rostrum broken off in specimens examined, but 5 rostral teeth present posterior to orbital margin. Carapace (Fig. 2) with dorsal margin unarmed over more than 50% of carapace length; short cardiolateral carina present; postorbital carina entirely absent; postantennal carina continuous from antennal spine to near

posterior carapace margin; marked red patch present in branchiocardiac region in fresh specimens. First 2 abdominal somites dorsally carinate, 3rd and 4th ending in posteromedial spine, with the former slightly longer than on 4th; 3rd abdominal somite without red patch in fresh specimens.

Remarks. — In addition to the obvious natural color difference, Crosnier (1988) suggested that this species differs from *H. sibogae* in having a) lower dorsal carinae on the first two abdominal somites, and b) subequality in dorsomedial spine length on the 3rd and 4th somites, the latter being shorter. However, in other, particularly preserved, material examined, these diagnostic features proved unreliable, due either to individual variation in, or as a result of damage or wear to, the physical features concerned.

With the kind cooperation of the senior author's colleagues, several fresh *Heterocarpus* specimens, attributable to either *H. hayashii* or *H. sibogae*, were obtained for comparison from Tosa Bay, SW Japan. Careful measurement showed that specimens with no red patch on the 3rd abdominal somite (*H. hayashii*: N=10, cl 23.1-37.2 mm) were unarmed along 51.9-58.9% (average ± S.D.: 54.8 ± 2.49) of the dorsal carapace length, whereas in specimens with the red patch (*H. sibogae*: N=17, cl 24.8-36.6 mm), the unarmed propotion was 43.5-49.0% (average ± S.D.: 47.1 ± 1.79). Statistically, these mean values are highly significant ($p < 0.001$), and appear to be consistent in both adolescents and adults.

Furthermore, limited observation revealed another possible differentiating characteristic between the species, being the angle at which the dorsal margin of carapace ends posteriorly. In *H. sibogae* the angle appears somewhat more acute than that in its congener (cf. figs. 2 and 3 in the present study; also Chace 1985, figs. 18 and 20; Wadley and Evans 1991, color plates on pp. 18 and 19).

Distribution. — Indo-West Pacific. Previously recorded in Australia from the east coast (see Crosnier 1988) and off Western Australia (Wadley and Evans 1991).

Heterocarpus longirostris MacGilchrist, 1905

Heterocarpus longirostris MacGilchrist, 1905:

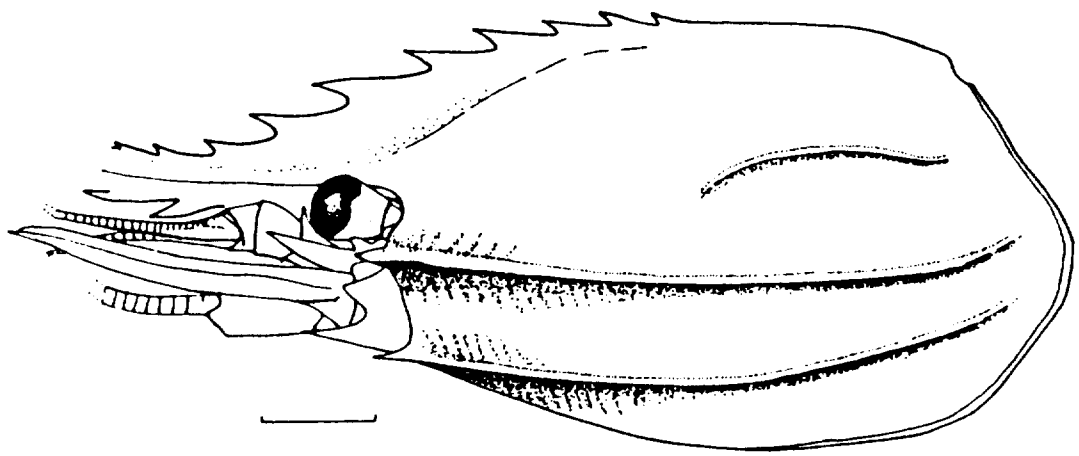

Fig. 2. *Heterocarpus hayashii* Crosnier, 1988, male cl 25.0 mm: anterior part of body. Scale represents 5 mm.

237; Chace, 1985: 35; Crosnier, 1988: 78.
Heterocarpus facetus Zarenkov *in* Zarenkov & Khodokina, 1981: 83, fig. 1.

Occurrence. — FV "Territory Pearl": - Stn. S9, 13° 06'S, 122° 18'E, 900-1000 m, 25 Jan. 1988, B. Wallner coll., 1 female (45.2 mm), 1 ovig. female (47.5 mm) (NTM Cr 007183).

Distinguishing features. — Rostrum broken off in specimens examined, but 4 rostral teeth present posterior to orbital margin. Postorbital carina well developed; postantennal carina very short; postbranchiostegal carina extending almost to posterior margin of carapace. First 2 abdominal somites rounded dorsally, 3rd carinate and ending in posteromedial spine, 4th and 5th somites bluntly carinate, and 6th very bluntly carinate dorsally.

Distribution. — Indo-West Pacific. New to the Australia fauna.

Heterocarpus sibogae De Man, 1917
(Fig. 3)

Heterocarpus sibogae De Man, 1917: 283; - 1920: 169, pl. 14, fig. 42; Chace, 1985: 36 (part; figs. 13m, 18, 19); Chan & Yu, 1987: 57 (part; pl. 2, fig. d); Hanamura & Takeda, 1987: 107; Crosnier, 1988: 79, fig. 5c, pl. 1, fig. c, pl. 3, figs. a,b; Wadley & Evans, 1991: 19, 2 figs.; Takeda & Hanamura, 1994: 21.

Occurrence. — FV " Dampier Pearl": - Stn. 3, locality and Depth Unknown, 13 July 1988, M Saches coll., 1 female (30.7 mm). — FV "Thata": - Stn. FO 86-6, 10° 28'S, 134° 14'E, ?60 m, 28 Apr. 1986, T. McCguigan & T. Ward coll., 1 ovig. female (32.6 mm) (NTM Cr 007163). — FV "Territory Pearl": - Stn. A1, 9° 51'S, 130° 00'E, 220-255 m, 16 Jan. 1988, 1 male (31.2 mm); -Stn. A2, 9° 49'S, 130° 07'E, 260-280 m, 16 Jan. 1988, B. Wallner coll., 2 males (28.8, 32.7 mm) (NTM Cr 007179) and 1 male (34.8 mm) (NTM Cr 007180).

Distinguishing features. — Rostrum curved upwards and extending beyond end of antennal scale, armed dorsally with, most commonly, 16-17 teeth including 4-5 posterior to orbital margin, and ventrally with 11-12 teeth. Carapace (Fig. 3) with dorsal margin unarmed over less than 50% of carapace length; short cardiolateral carina

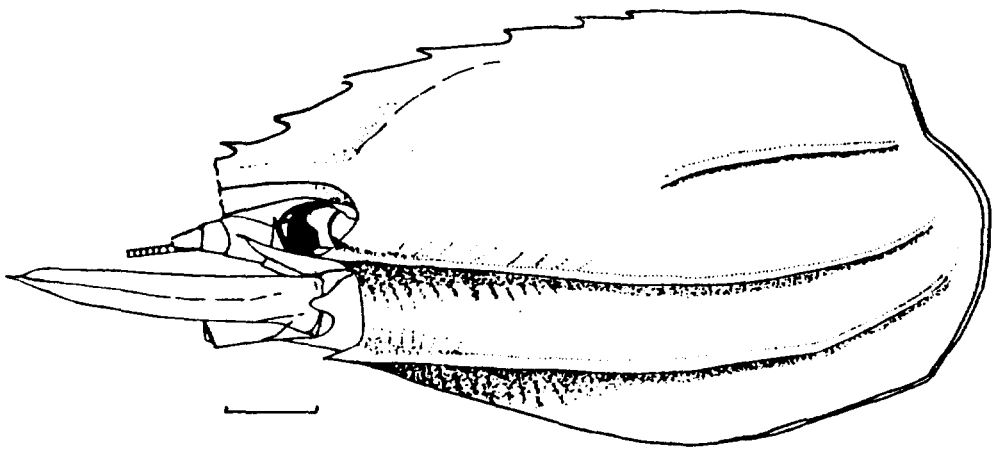

Fig. 3. *Heterocarpus sibogae* De Man, 1917, female cl 30.7 mm: anterior part of body. Scale represents 5 mm.

present; postorbital carina absent; postantennal carina continuous from antennal spine to near posterior carapace margin; red patch absent in branchiocardiac region in fresh specimens. First 2 abdominal somites with high carina, 3rd and 4th ending in posteromedial spines of approximately equal length. Third abdominal somite with red patch in fresh specimens.

Remarks. — Distinctions between *H. sibogae* and *H. hayashii* can be found under the "*Remarks*" section for the latter.

There is some slight doubt as to the identity of specimens from Stns. A1 and A2 (NTM Cr 007180 and 007188) as these were originally sorted into specimens having no red patch on the abdomen, as in *H. hayashii.* However, three factors led us to consider them as *H. sibogae*: a) the absence of a red abdominal patch is inconclusive as patches often fade quickly after capture, b) the presence of well developed dorsal carinae on the first two abdominal somites is consistent with all the other specimens examined, and c) the relative lengths of the dentate and unarmed portions of the dorsal carapace margin agree with those of *H. sibogae.*

Distribution. — Indo-Pacifc. Previously recorded from off Western Australia (Hanamura and Takeda 1987, Wadley and Evans 1991).

Heterocarpus tricarinatus Alcock and Anderson, 1894

Heterocarpus tricarinatus Alcock & Anderson, 1894: 154; Alcock & McArdle, 1901, pl. 51, fig. 1; De Man, 1920: 161, pl. 13, fig. 38a-d, pl. 14, fig. 38; Chace, 1985: 41, fig. 13o; Crosnier, 1988: 84, fig. 6d, pl. 4, figs. e-h; Lee, 1990: 127, figs. 2-7, pl. 1.

Heterocarpus tricarinatus tricarinatus Crosnier, 1988: 84, fig. 6d, pl. 4, figs. e-f.

Heterocarpus tricarinatus angustus Crosnier, 1988: 84, pl. 4, figs. g-h.

Occurrence. — FRV "Southern Surveyor": - Stn. 12, 22° 00.5'S, 113° 06.4'E, 1460-1700 m, 25 Jan. 1991, 1 female (39.3 mm); - Stn. 13, 22° 28.6'S, 113° 12.4'E, 1258-1305 m, 25 Jan. 1991, 4 males (34.5-37.2 mm), 7 females (ca. 26.5-41.1 mm), 3 ovig. females (ca. 32-38.5 mm); - Stn. 23, 24° 09.6'S, 111° 39.5'E, 1293-1320 m, 1 female (34.4 mm).

Distinguishing features. — Rostrum curved slightly upwards but sometimes straight, and extending beyond end of antennal scale, armed dorsally with 12-14 teeth including 5-6 posterior to orbital margin, and ventrally with 8-9 teeth; lateral carina distinct throughout rostral length. Postorbital carina curved upwards rather abruptly near midpoint. Postbranchiostegal carina indistinct posterior to near midpoint of carapace. First 2 abdominal somites rounded dorsally, 3rd with low and wide carina, 4th and 5th bluntly carinate, and 6th rounded dorsally.

Remarks. — Crosnier (1988) divided *H. tricarinatus* into two subspecies based on the width of the dorsal carina on the 3rd abdominal somite. He proposed *H. t. tricarinatus*, with a carina generally 0.4 times the total length of that somite, to represent the western Indian Ocean, and *H. t. angustus*, with a carina 0.25-0.3 times the somite length, to represent the Philippine-Indonesian region. However, Lee (1990) noted this relative value to be about 0.35 in Taiwanese specimens — an intermediate value between those for Crosnier's subspecies.

Carina measurements in Western Australian specimens showed the relative widths to be 0.27-0.35 (average: 0.30). Although this

tends to indicate that they are *H. t. angustus,* we feel that, until more material is collected to support Crosnier's view, it is prudent to recognize the existence of one nominal species, at least for the Indo-West Pacific region.

Distribution. — Indo-West Pacific. New to the Australian fauna.

Heterocarpus woodmasoni Alcock, 1901

Heterocarpus Wood-masoni Alcock, 1901: 108; De Man, 1920: 156, pl. 13, fig. 36.

Heterocarpus wood-masoni : Alcock & McArdle, 1901, pl. 51, fig. 2.

Heterocarpus woodmasoni: Chace, 1985: 42, fig. 13q; Chan & Yu, 1987: 55, pl. 1, fig. d; Hanamura & Takeda, 1987: 108; Kensley *et al.,* 1987: 313; Crosnier, 1988, fig. 1i-l; Wadley & Evans, 1991: 20, 2 figs.

Not *Heterocarpus woodmasoni*: Calman, 1939: 204. (= *H. calmani*)

Occurrence. — FV "Dampier Pearl": - Stn. Shot I, locality and depth unknown, 16 July 1988, M. Sachse coll., 1 male (32.2 mm).

Distinguishing features. — Rostrum curved slightly upwards, and extending beyond end of antennal scale, armed dorsally with 9 teeth including 2 posterior to orbital margin, and ventrally with 8 teeth; postrostral part slightly convex, but not forming distinct hump. Carapace with cardiolateral and postorbital carinae entirely absent; postantennal carina continuous from antennal spine to near posterior carapace margin. First abdominal somite rounded dorsally and with pair of low dorsolateral tubercles, 2nd somite flattened dorsally, 3rd to 5th somites more or less carinate, 3rd bearing acute spine near midpoint of dorsum, 6th with pair of dorsal carinae; pleuron of 5th somite with small posteroventral spine. Telson with 4 pairs of dorsolateral spines in addition to distal series.

Distribution. — Eastern part of the Indian Ocean and the Western Pacific. Previously recorded in Australia from the east coast (Kensley *et al.* 1987) and off Western Australia (Hanamura and Takeda 1987, Wadley and Evans 1991).

Genus ***Plesionika*** Bate

Chace (1985) noted that morphological similarity between species of the genera *Plesionika* and *Parapandalus* is such that the single taxonomic feature used to distinguish between the two — the presence or absence of epipods on anterior pereopods — is, by itself, not sufficiently reliable. While some taxonomists have since continued to separate the genera (Timofeew 1993, Holthuis 1993), this paper adopts Chace's single genus concept, and follows Chan and Crosnier (1991).

Key to the species of *Plesionika* of Western Australia

1. Epipods absent on pereopods ·····2
- Epipods present on anterior 4 pereopods ·····3
2. Ventral teeth of rostrum relatively widely spaced, with 8-11 teeth situated above antennal scale·····*P. grandis*
- Ventral teeth of rostrum quite narrowly spaced, with 14-20 teeth situated above antennal scale·····*P. quasigrandis*
3. Posterior dorsal rostral teeth bluntly barbed distally ·····(*P. pumila*)
- Posterior dorsal rostral teeth tapered distally ·····4
4. Third abdominal somite with posteromedian spine recurved upwards ····· ·····(*P. reflexa*)

- Third abdominal somite unarmed posteromedially ·····5
5. Telson with 4 pairs of dorsolateral spines, excluding distal pair ·····6
- Telsno with 3 pairs of dorsolateral spines, excluding distal pair ·····7
6. Three to 5 teeth of dorsal rostral series situated posterior to orbital margin; pleuron of 4th somite with posteroventral spine; exopod of uropod as long as endopod ·····(*P. bifurca*)
- Seven to 10 teeth of dorsal rostral series situated posterior to orbital margin; pleuron of 4th somite without posteroventral spine; exopod of uropod shorter than endopod ·····(*P. spinidorsalis*)
7. Second pair of pereopods noticeably unequal in length ·····8
- Second pair of pereopods subequal in length ·····9
8. Third abdominal somite compressed and dorsally carinate; dorsolateral spine of antennal scale barely reaching distal margin of lamella ·····(*P. unidens*)
- Third abdominal somite rounded dorsally; distolateral spine of antennal scale not reaching distal margin of lamella ·····(*P. lophotes*)
9. Pleuron of 4th somite with posteroventral spine; dorsal margin of rostrum with closely spaced teeth throughout length ·····*P. indica*
- Pleuron of 4th somite without posteroventral spine ·····10
10. Dorsal margin of rostrum armed with a few teeth on anterior half ····(*P. ocellus*)
- Dorsal margin of rostrum unarmed on anterior half·····11
11. Posterior teeth of dorsal rostral series movable; eye without ocellus ···*P. alcocki*
- Posterior teeth of dorsal rostral series immovable; eye with ocellus ·····12
12. Anteriormost tooth of dorsal rostral series based distinctly anterior to distal end of antennular peduncle; maximum carapace length less than 15 mm ····· ·····(*P. parvimartia*)
- Anteriormost tooth of dorsal rostral series based just above or posterior to distal end of antennular peduncle; maximum carapace length exceeding 20 mm or more·····13
13. Eye kidney-shaped; orbital margin distinctly concave posterodorsally····· ·····*P. semilaevis*
- Eye not kidney-shaped; orbital margin nearly straight or weakly concave posterodorsally ·····14
14. Posterior teeth of dorsal rostral series somewhat sparcely spaced; postrostral carina moderately high; exopod of 3rd pleopod usually at least 0.8 times as long as carapace·····*P. orientalis*
- Posterior teeth of dorsal rostral series quite narrowly spaced; postrostral carina relatively low; exopod of 3rd pleopod 0.70-0.78 times as long as carapace ····· ·····*P. martia*

Plesionika alcocki (Anderson, 1896)

(Fig. 4)

Pandalus alcocki Anderson, 1896: 92.

Pandalus (Plesionika) alcocki: Alcock & McArdle, 1901, pl. 52, figs. 2,4.

Plesionka alcocki: Chace, 1985: 55; Hayashi, 1986: 81, 270, fig. 81; Kensley *et al.*, 1987: 313.

Occurrence. — FV "Territory Pearl": - Stn. S8, 13° 17'S, 122° 21'E, 600-740 m, 25 Jan. 1988, B. Wallner coll., 1 female (19.1 mm), 1 ovig. female (25.0 mm).

Distinguishing features. — Rostrum curved upwards, and extending distinctly beyond

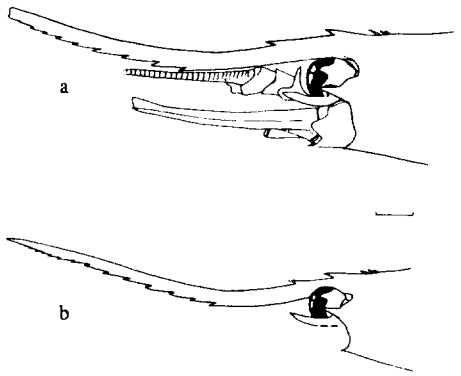

Fig. 4. *Plesionika alcocki* (Anderson, 1896), anterior part of body: a) ovig. female cl 25.0 mm; b) female cl 19.0 mm. Scale represents 5 mm.

end of antennal scale, armed dorsally with 5 teeth on basal crest including 3 small closedly spaced teeth posterior to orbital margin, and ventrally with 15 teeth. Orbital margin evenly concave posteriorly, and convex ventrally; antennal spine extending adjacent to posterior two-fifths of cornea. Abdomen rounded dorsally, 3rd somite with posterior margin slightly produced posteriorly, 6th somite slightly less than twice as long as 5th somite. Pleuron of 4th somite rounded posteroventrally, that of 5th with spine. Telson as long as 6th abdominal somite. Antennal scale slightly less than 0.8 times as long as carapace. Epipods present on anterior 4 pereopods.

Distribution. — Indo-West pacific. Previously known in Australia from the east coast (Kensley *et al.* 1987).

Plesionika grandis Doflein, 1902

Plesionika spinipes var. *grandis* Doflein, 1902: 618, pl. 3, figs. 3-5.

Plesionika grandis: Chace, 1985: 66, figs. 28, 29; Hayashi, 1986: 133, fig. 83; Hanamura & Takeda, 1987: 110, fig. 2a-c; Chan & Crosnier, 1991: 423, figs. 3f, 22.

Occurrence. — FV "Territory Pearl" :- Stn. A1, 9° 51'S, 130° 00'E, 220-255 m, 16 Jan. 1988, B. Wallner coll., 1 ovig. female (19.0 mm) (NTM Cr 007186). — FRV "Southern Surveyor":- Stn. 8, 21° 44.7'S, 113° 52.3'E, 290-320 m, 24 Jan. 1991, 2 females (16.0, 17.0 mm).

Distinguishing features. — Rostrum slightly curved upwards, and extending distinctly beyond end of antennal scale, armed dorsally with about 50 closely spaced teeth along entire length including 5-7 posterior to orbital margin, and ventrally with 27-32 narrowly spaced teeth including 8-11 situated above antennal scale; spacing between posterior 10 ventral teeth corresponding with that of 11-14 dorsal teeth adjacent above. Abdomen rounded dorsally, 6th somite 1.67-1.70 times as long as 5th somite; pleura of 4th and 5th with small posteroventral spine. Telson 1.27-1.32 times as long as 6th somite, with 3 pairs of dorsolateral spines. Antennal scale 0.86-0.97 times as long as carapace. Epipods absent on pereopods.

Distribution. — Indo-West Pacific. Previously recorded in Australia from the NW continental shelf (Hanamura and Takeda 1987).

Plesionika indica De Man, 1917

Plesionika longipes var. *indica* De Man, 1917: 279; - 1920: 121, pl. 10, fig. 25a-g, pl. 11, fig. 25.

Plesionika indica: Chace, 1985: 70, figs. 31, 32; Hanamura & Takeda, 1987: 111; Wadley & Evans, 1991: 21, 2 figs.

Occurrence. — FV "Comac Endeavour": - Stn. WH 85-24, 17° 12'S, 119° 18'E, 435 m, W. Houston coll., 1 male (30.5 mm) (NTM Cr 007199). — FV "Territory Pearl": - Stn. A1,

9°51'S, 130°00'E, 220-255 m, 16 Jan. 1988, B. Wallner coll., 1 ovig. female (29.4 mm) (NTM Cr 007198).

Distinguishing features. — Rostrum slightly curved upwards and extending distinctly beyond end of antennal scale, armed dorsally with at least 28 teeth including 4-5 posterior to orbital margin, and ventrally with more than 17 teeth. Orbital margin noticeably concave posteriorly. Abdomen rounded dorsally, 6th somite 1.71-1.73 times as long as 5th; pleura of 4th and 5th with small posteroventral spine. Telson 1.56-1.65 times as long as 6th somite, armed with 3 pairs of dorsolateral spines. Antennal scale 0.81-0.85 times as long as carapace. Epipods present on anterior 4 pereopods.

Distribution. Indo-West Pacific. Previously recorded in Australia from off the west coast (Hanamura and Takeda 1987, Wadley and Evans 1991).

Plesionika martia (A. Milne Edwards, 1883)

Pandalus martia A. Milne Edwards, 1883, pl. 21.

Plesionika martia: Hanamura, 1989: 63, figs. 9-11.

Occurrence. — FV "Territory Pearl": -Stn. G1, 29° 05'S, 113° 41'E, 880 m, 3 Feb 1988, B. Wallner coll., 1 male (22.5 mm) (NTM Cr 007187). — FRV "Southern Surveyor": - Stn. 36, 26° 14.5'S, 112° 03.2'E, 690-691 m, 30 Jan 1991, 2 males (20.1, 27.5 mm), 5 ovig. females (22.3-26.2 mm). - Stn. 42, 26° 57.0'S, 112° 22.3'E, 666-688 m, 31 Jan 1991, 1 female (26.4 mm), 6 ovig. females (26.0-27.1 mm). - Stn. 43, 27° 05.8'S, 112° 22.9'E, 714 m, 31 Jan. 1991, 1 male (25.0 mm). - Stn. 62, 29° 51.9'S, 114° 11.6'E, 760-770 m, 7 Feb. 1991, 1 ovig. female (22.0 mm). -Stn. 84, 32° 40.4'S, 114° 28.2'E, 960-990 m, 14 Feb. 1991, 1 female (23.9 mm).

Distinguishing features. — Rostrum curved dorsally, and extending distinctly beyond end of antennal scale, armed dorsally with 7-9, commonly 7-8, teeth on proximal part, with anteriormost tooth based above antennular peduncle including 3-5, commonly 3-4, posterior to orbital margin, and ventrally with about 50 teeth or more (examined specimens damaged anteriorly). Postrostral carina moderately developed, ending in gentle slope posteriorly. Orbital margin almost straight or weakly convex posteriorly. Abdomen rounded dorsally, 6th somite 1.87-1.99 times as long as 5th; pleuron of 4th rounded posteriorly, that of 5th with small spine or occasionally narrowly rounded. Telson 0.96-1.06 times as long as 6th abdominal somite. Antennal scale 0.87-0.96 times as long as carapace. Epipods present on anterior 4 pereopods.

Remarks. — Hanamura (1989) noted slight external differences in dorsal rostral teeth development and in metric values of some appendages between specimens from southern Australia and those from SE Atlantic. Specimens from the south-western part of Western Australia have showed a close relationship with the southern Australian population.

With kind permission of the Instituto de Ciencias der Mar, Barcelona, we were able to examine four specimens from the south-east Atlantic and the Mediterranean. Comparison of these specimens (cl 20.0-22.2 mm) with those from Western Australia (cl 20.1- 27.1 mm) revealed a slightly greater length ratio between the merus of the 3rd pleopod and the carapace in the former, being 1.07-1.28, as opposed to 0.97-0.98 in those from Western

Australia. Furthermore, the length ratio between the penultimate and distal segments of the 3rd maxilliped was also greater, being 0.78-0.80, as opposed to 0.85-0.92 in the Australian specimens. Although the dorsal rostral teeth of the Australian population tend to be more developed than the Atlantic population (including the Mediterranean), this feature can not be entirely reliable to distinguish the two populations due to the presence of some intermediate forms.

At this stage, we are not certain if these are specific differences or merely geographic variations, and further world-wide study of the *P. martia* species group is required before clarification is possible.

Distribution. — *P. martia* has been recorded from the Atlantic and southern part of the Indo-West Pacific. The southern Australian population appears to be confined to waters below approximately 25°S.

Plesionika orientalis Chace, 1985

Plesionika martia orientalis Chace, 1985: 84, figs. 38, 39; Hanamura & Takeda, 1987: 111, figs. 3a,b.

Occurrence. — FV "Territory Pearl": - Stn. S7, 13° 26'S, 122° 21'E, 470-540 m, 25 Jan. 1988, B. Wallner coll., 1 ovig. female (26.1 mm) (NTM Cr 007189). — FRV "Southern Surveyor": - Stn. 15, 22° 59.9'S, 113° 14.3'E, 482-544 m, 26 Jan. 1991, 1 ovig. female (27.2 mm).

Distinguishing features. — Rostrum curved upwards, and extending distinctly beyond end of antennal scale, armed dorsally with 6 teeth, distalmost tooth based above end of antennular peduncle including 3 teeth posterior to orbital margin, and ventrally with more than 30 teeth. Postrostral carina moderately developed, ending in gentle slope posteriorly. Orbital margin almost straight or weakly convex posteriorly. Abdomen rounded dorsally, 6th somite 1.81-1.92 times as long as 5th; pleuron of 4th somite rounded posteroventrally, that on 5th with minute spine. Telson 1.15 times as long as 6th somite. Antennal scale about 0.88 (specimen damaged slightly) times as long as carapace. Epipods present on anterior 4 pereopods.

Distribution. — The Philippine-Indonesian region. Previously recorded in Australia from the north-western coast (Hanamura and Takeda 1987).

Plesionika quasigrandis Chace, 1985

Plesionika quasigrandis Chace, 1985: 104, figs. 47, 48; Hanamura & Takeda, 1987: 115, fig. 2d-f; Chan & Crosnier, 1991: 421, figs. 2b, 3c-d.

Occurrence. — FRV "Southern Surveyor": - Stn. 8, 21° 44.7'S, 113° 52.3'E, 290-320 m, 24 Jan. 1991, 1 male (21.4 mm), 1 ovig. female (24.0 mm).

Distinguishing features. — Rostrum slightly curved upwards, and extending distinctly beyond end of antennal scale, armed dorsally with 41-48 closely spaced teeth including 6 posterior to orbital margin, and ventrally with about 35 quite narrowly spaced teeth including 14 above antennal scale; spacing between posterior 10 ventral teeth corresponding with that of dorsal 6-7 teeth adjacent above. Orbital margin truncate posterodorsally and concave posteriorly. Abdomen rounded dorsally, 6th somite 1.81 times as long as 5th; pleura of 4th and 5th somites with posteroventral spine. Telson 1.25 times

as long as 6th somite, and armed with 3 pairs of dorsolateral spines. Antennal scale 0.80 times as long as carapace. Epipods absent on pereopods.

Color. — The color of fresh *P. quasigrandis* specimen is similar to that of P. grandis shown by Chan and Crosnier (1991, fig. 22), apart from the abdomen appearing more transparent, and the redish lateral stripes, found in the latter, being indistinct.

Distribution. — Indo-West Pacific. Previously recorded from the NW continental shelf in Australia (Hanamura and Takeda 1987).

Plesionika semilaevis Bate, 1888

Plesionika semilaevis Bate, 1888: 644, pl. 113, fig. 3; Chace, 1985: 113, figs. 51, 52.
Plesionika martia var. *semilaevis*: De Man, 1920: 116 (part).

Occurrence. — FV "Territory Pearl": - Stn. A1, 9° 51'S, 130° 00'E, 220-255 m, 16 Jan. 1988, B. Wallner coll., 2 males (17.3, 18.0 mm), 1 ovig. female (18.9 mm) (NTM Cr 007185); - Stn. S7, 13° 26'S, 122° 21'E, 470-540 m, 25 Jan. 1988, B. Wallner coll., 1 ovig. female (20.5 mm) (NTM Cr 007191). — FRV "Southern Surveyor": - Stn. 6, 21° 37.5'S, 113° 55.8'E, 328 m, 24 Jan. 1991, 1 male (14.8 mm); Stn. 8, 21° 44.7'S, 113° 52.3'E, 290-320 m, 24 Jan. 1991, 1 ovig. female (16.2 mm); - Stn. 15, 22° 59.9'S, 113° 14.3'E, 482-544 m, 26 Jan. 1991, 3 males (20.4-20.4 mm), 2 ovig. females (-, 21.1 mm); - Stn. 36, 26° 14.5'S, 112° 03.2'E, 690-691 m, 30 Jan. 91, 1 male (16.8 mm).

Distinguishing features. — Rostrum directed obliquely upwards, and extending distinctly beyond end of antennal scale, armed dorsally with 6-8 teeth, commonly 6, on proximal part, with anteriormost tooth based above antennular peduncle, including 2-3 teeth, commonly 2, posterior to orbital margin, and ventrally with 30 teeth or more. Postrostral carina well developed, ending in gentle slope posteriorly. Orbital margin markedly inclined posterodorsally. Abdomen rounded dorsally, 6th somite 2.03-2.18 times as long as 5th; pleuron of 4th somite rounded posteroventrally, that on 5th with minute spine or occasionally narrowly rounded. Telson 0.97-1.07 times as long as 6th abdominal somite. Antennal scale 0.93-1.00 times as long as carapace. Epipods present on anterior 4 pereopods.

Distribution. — The Philippine-Indonesian region. Previously recorded in Australia from the north-western coast (Hanamura and Takeda 1987).

Family Crangonidae
Genus ***Parapontophilus*** Christofferson

Parapontophilus gracilis junceus (Bate, 1888)

Pontophilus junceus Bate, 1888: 491, pl. 88, figs. 2-4.
Pontophilus occidentalis var. *indica* De Man, 1918: 161; - 1920: 264, pl. 20, fig. 63a, pl. 21, fig. 63b-v.
Pontophilus gracilis junceus: Chace, 1984: 52, figs. 20-22; Takeda & Hanamura, 1994: 30.

Occurrence. — FRV "Southern Surveyour": - Stn. 13, 22° 28.8'S, 113° 12.4'E, 1258-1305 m, 25 Jan. 1991, 1 female (9.9 mm).

Distinguishing features. — Rostrum not extending beyond eye and armed with 2 pairs of lateral teeth on basal portion. Carapace with epigastric spine, and single spine just

posterior to midpoint of dorsal margin; lateral surface with 2 spines; short suture extending posteriorly from orbital margin to a point one-third along lateral face of carapace; minute spine present above narrow orbital cleft. Abdomen rounded dorsally, 6th somite twice as long as 5th. Telson slightly longer than 6th abdominal somite, with 2 pairs of lateral spines. Antennal scale 0.73 times as long as carapace.

Distribution. — The Philippine-Indonesian region. New to the Australian fauna.

Acknowledgements

We are most grateful to Dr. A.J. Bruce of the Northern Territory Museum of Arts and Sciences in Darwin, Northern Territory, and Drs. S. Rainer and V. Wadley of the CSIRO Division of Fisheries in Hobart, Tasmania, for allowing us to study interesting shrimp specimens for this study. We thank Dr. H. Horikawa and Mr. H. Sakaji of the Nansei National Fisheries Research Laboratory at Kochi, and Dr. C. Allué of the Instituto Ciencias der Mar, Barcelona, who provided us with comparative specimens of *Heterocarpus sibogae* and *H. hayashii*, and *Plesionika martia*. Finally we thank Prof. K. Hayashi of the National Fisheries University, Shimonoseki for his kind reading the manuscript of this paper.

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西オーストラリア産深海性イトアシエビ，サンゴエビ，タラバエビ，およびエビジャコ科エビ類

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オーストラリア連邦漁業局では最近の10年以上にわたって，同国周辺の深海生物調査を進めてきた。調査の主たる目的は魚類相と潜在資源量の把握にあったが，多くの甲殻類が混獲された。この論文では深海性のイトアシエビ，サンゴエビ，タラバエビ，エビジャコ科のエビ類20種を記載した。この内，次の6種は同海域よりの初出現記録であった：*Nematocarcinus productus, N. tenuirostris, Stylodactylus licinus, Heterocarpus longirostris, H. tricarinatus,* および *Parapontophilus gracilis junceus.*

1995年12月12日受理（Accepted on December 12, 1995）
南西海区水産研究所業績A第41号
(Contribution No. A47 from the Nansei National Fisheries Research Institute)
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