

Observations on *Metanephrops neptunus* (Bruce, 1965) (Crustacea: Astacidea: Nephropidae) from the Pratas Islands, South China Sea

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Abstract.— The Neptune lobster, *Metanephrops neptunus* (Bruce, 1965), is reported from 300–600 m depths off the Pratas Islands southwest of Taiwan in the South China Sea. Seven males and three ovigerous females were captured in July 2019. Key morphological features and internal structures are described, with particular attention to the chelae, mandibles, gills, cephalothoracic and abdominal sculpturing, and gastric mills. The red-and-white coloration is described and illustrated from fresh specimens. The geographic range, depth of occurrence, stomach contents, and fecundity of the species are also noted.

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Key words: *distribution, gastric mill, gill, morphology, red-headed lobster, stomach contents*

■ Introduction

In July 2019, we were able to obtain several deep-sea lobsters of a species that has been attracting the attention of fishermen in Keelung, northern Taiwan. These lobsters, bought at a fish market in Keelung, belong to the little-known species *Metanephrops neptunus* (Bruce, 1965), also called the “Neptune lobster” or, in Australia, “Neptune’s scampi”. Its Taiwanese vernacular name is “jinsigao” and its Mandarin name translates as “red-headed lobster”.

The original description of *M. neptunus* was based on two specimens whose state of maturity was unknown, and morphological information on adult individuals of the species is still needed (Bruce, 1965). Biological information of any sort concerning *M. neptunus* is scarce despite its possible importance for fisheries.

The new material, comprising ovigerous females and similarly sized, presumably adult, males, is from deep water in the Pratas Islands (Dongsha Islands in Mandarin). These islands

consist of one emergent and two submerged atolls in the northern South China Sea. They are under the control of the Republic of China (Taiwan) and in part comprise the Dongsha Marine National Park (Dai, 2004). The present specimens were taken from waters outside the protected area. Based on these specimens, we provide an illustrated description of systematically important parts of the external and internal morphology of *M. neptunus*, including the mandibles, gills, and gastric mill, as well as color photographs. The stomach contents, which can provide significant clues as to diet and feeding habits, were also recorded, along with fecundity and egg size.

■ Materials and Methods

Ten specimens of *Metanephrops neptunus* were bought at the Zhengbin Fishing Harbor in Keelung, Taiwan, by MCH on 17 July 2019. According to information from fishermen, coupled with the GPS record of the fishing vessel involved, these lobsters were captured in wa-

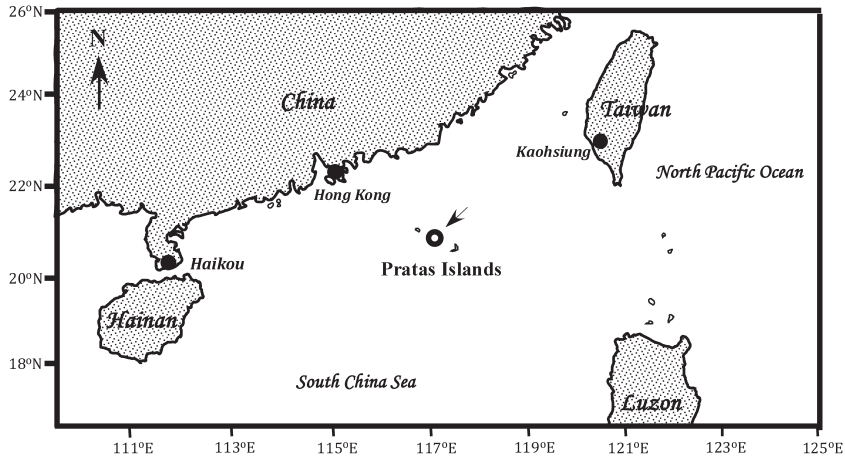


Fig. 1. Map of Taiwan and the Pratas Islands. The sampling site of *Metanephrops neptunus* is indicated by the arrowed circle (○).

ters of the Pratas Islands about 430 km southwest of Kaohsiung, Taiwan (Fig. 1). They were preserved on ice on board the ship and then stored at -20°C in the laboratory. This allowed us to observe the fresh body color.

The gastric mills, mandibles, and gills of one ovigerous female (CL = 105.4 mm) were dissected and illustrated according to Hobbs (1987, 1988) and Grown & Richardson (1990). Digital photographs of dissected body parts were taken using a stereoscopic dissecting microscope (SMZ1500, Nikon, Tokyo, Japan) equipped with a CCD system connected to a computer with imaging software (NIS element D, Nikon, Tokyo, Japan). Prints of these photographs were traced with a pen to produce hand stippling drawings (software Adobe Illustrator CC), which were then scanned and arranged into the figure plates presented here.

Measurements and abbreviations in the text are as follows: TL—total body length (from anterior tip of rostrum to posterior end of telson), AL—abdomen length, CL—cephalothorax length (from posterior margin of eye socket to posterior end of median line of carapace) (Szaniawska et al., 2005). The specimens are deposited in the National Taiwan Museum, Taipei (TMCD). The morphological terminology used in this paper was adopted from Brös-

ing (2010) and Morgan (1986, 1997).

■ Taxonomy

Superfamily **Nephropoidea** Dana, 1852

Family **Nephropidae** Dana, 1852

Genus ***Metanephrops*** Jenkins, 1972

Metanephrops neptunus (Bruce, 1965)

Figs. 2–5

Nephrops neptunus Bruce, 1965: 274, pls 13–15 (type-locality: South China Sea).

Metanephrops neptunus: Jenkins, 1972: 171.–Chan and Yu, 1987: 184.–Macpherson, 1990: 299.–Holthuis, 1991: 76, figs. 148–149.

Material examined

Three ovigerous females (TMCD003316, 003319, and 003321), CL respectively 105.4, 104.9, and 120.8 mm, TL respectively 245.8, 249.0, and 274.8 mm, whole wet weight respectively no data, 374.4, and 410.9 g; TMCD003316 dissected to observe mandibles, gills, and gastric mill. Seven males (TMCD3317, 3318, 3320, 003322–003325), CL 88.3–126.8 mm, TL 227.8–288.3 mm, wet weight 255.5–505.7 g (Table 1). All specimens collected between North Vereker Bank and Pratas Island by bottom trawl by Keelung-based fishing vessel “Jin Ruiyi 37” in northern South China Sea

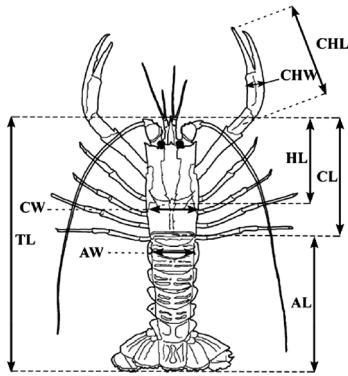
Table 1. Scheme of measurements taken from *M. neptunus*. (length: mm, weight: gram)

ID number	Sex	TL	AL	CL	HL	CW	AW	CHL	CHW	CHH	Weight
TMCD003316	female	245.8	130.4	105.4	79.8	52.2	46.3	98.9	12.6	no data	no data
TMCD003317	male	227.8	139.5	88.3	57.6	51.5	44.9	104	13.2	19.3	316.7
TMCD003318	male	228.5	128.8	99.7	70.1	47.5	38.2	108.2	13	17.5	255.5
TMCD003319	female	249	144.1	104.9	67.8	62.5	55.8	107	12.1	19.5	374.4
TMCD003320	male	252.7	143.1	109.6	76.1	58	46.1	123.3	14.2	17.9	320.7
TMCD003321	female	274.8	154	120.8	83.1	55.8	47.1	111.2	14.9	19.9	410.9
TMCD003322	male	255.5	143.3	112.2	79.5	50.8	44.1	125	15.5	20.9	272.4
TMCD003323	male	288.3	161.5	126.8	89.7	60.1	48.8	151.5	19	24.9	505.7
TMCD003324	male	263.6	159.2	104.4	73.5	56.8	48.9	95.9	14.1	19.4	405.8
TMCD003325	male	238.2	133.2	105	77.5	50.9	42.8	102.6	11.5	16.1	293.9

unit: mm

unit: gram

TL: total body length, AL: abdomen length, CL: cephalothorax length, HL: cephalothorax length from the tip of the rostrum to cervical groove, CW: cephalothorax width, AW: abdomen width, CHL: chela length, CHW: chela width, CHH: chela height (Szaniawska *et al.*, 2005).



(20°43'00"N, 116°42'00"E), at 300–600 m depth on 27 June 2019 (purchased on 17 July 2019).

Description (TMCD003316 and TMCD003317)

Carapace and eyes: Dorsal surface of carapace spinulose (Fig. 2A, B), carapace rather uniformly spinulose, postrostral carinae each with three teeth and region between postrostral carinae densely spinulose (Fig. 2B, C). Supra-orbital spine followed by strong toothed ridge extending almost to post-cervical groove. Posterior part of carapace with several longitudinal carinae. Antennal spine in most specimens followed by strong carina.

Abdomen: Surface of abdominal tergites conspicuously sculptured; raised parts of dorsal

surface smooth and naked; second to fifth somites with marked dorsomedian carina flanked by pair of conspicuous longitudinal grooves (Fig. 2A, D). Distinct carinae separating abdominal tergites bilaterally from corresponding pleura. Fifth abdominal somite with no distinct spines on bilateral carinae separating tergite from pleura. Dorsomedian carina of sixth abdominal somite without submedian spines. Spine in middle of lateral margin of sixth abdominal somite short, its tip far from posterolateral margin of somite.

First pereiopods (large chelipeds): Left and right first chelipeds similar in size and shape, with palm of chela distinctly longer than wide. Chelae heavily ridged and spinulose, without large spines; no prominent basal spine on outer edge of movable finger. Inner margin of merus weakly spinulose (Fig. 2A, E).

Gastric mill: Zygocardiac teeth (Fig. 3A–C) with single lateral cusp on anterior lateral side, five corneous zygocardiac teeth on dorsal surface. Among gastric mill ossicles (Fig. 4D–F), urocardiac ossicle with two large bosses on posterior margin.

Mandibles: Sharp and corneous blade-like incisor ridge of right mandible with single large tubercle, molar ridge with two very weak processes (Fig. 3G–J).

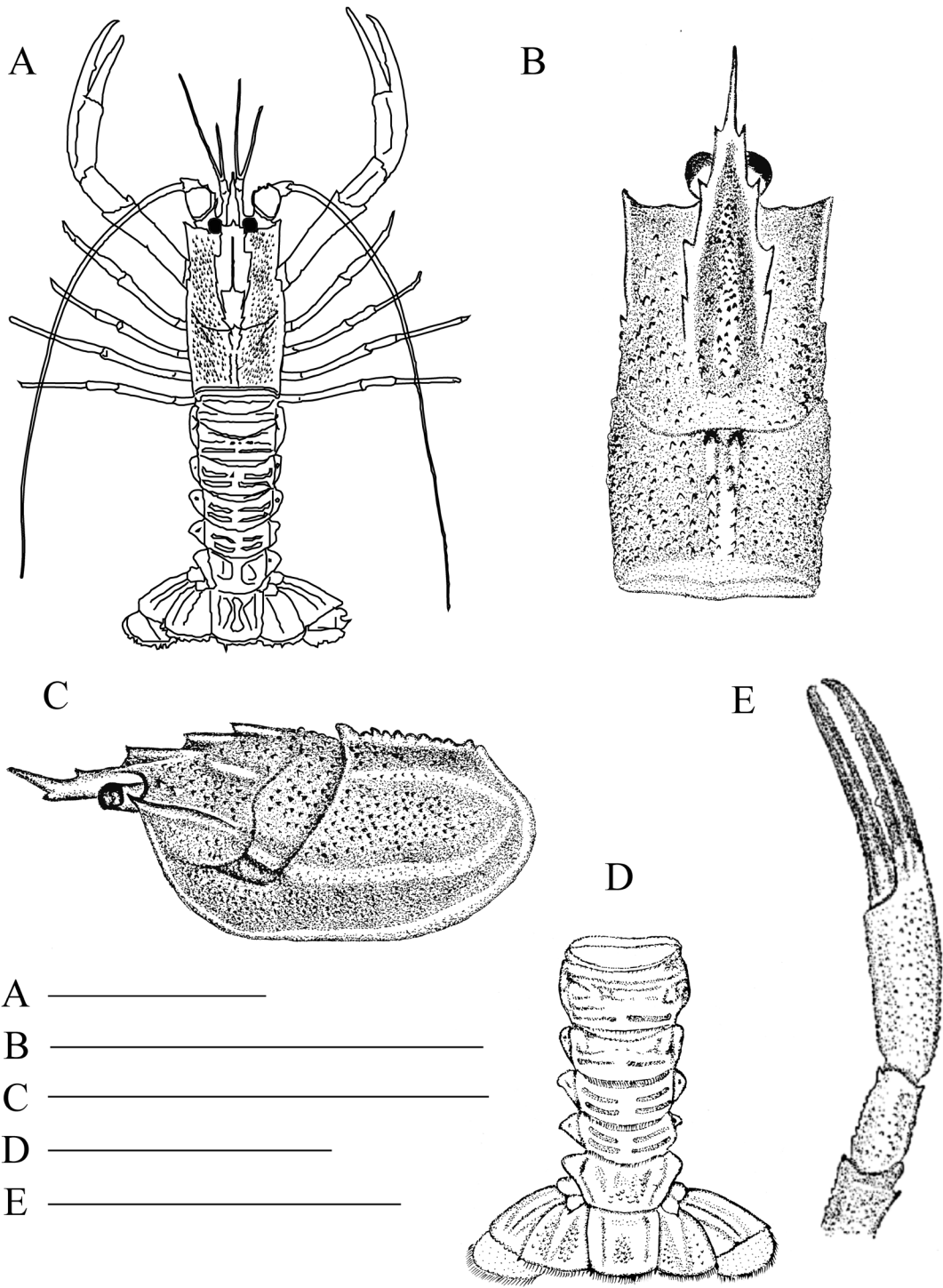


Fig. 2. *Metanephrops neptunus* (female, TMCD003316, CL = 105.4 mm). A, dorsal view of entire body; B, dorsal view of carapace; C, lateral view of carapace; D, dorsal view of abdomen; E, dorsal view of cheliped (first pereiopod). Scale bars: 5 cm.

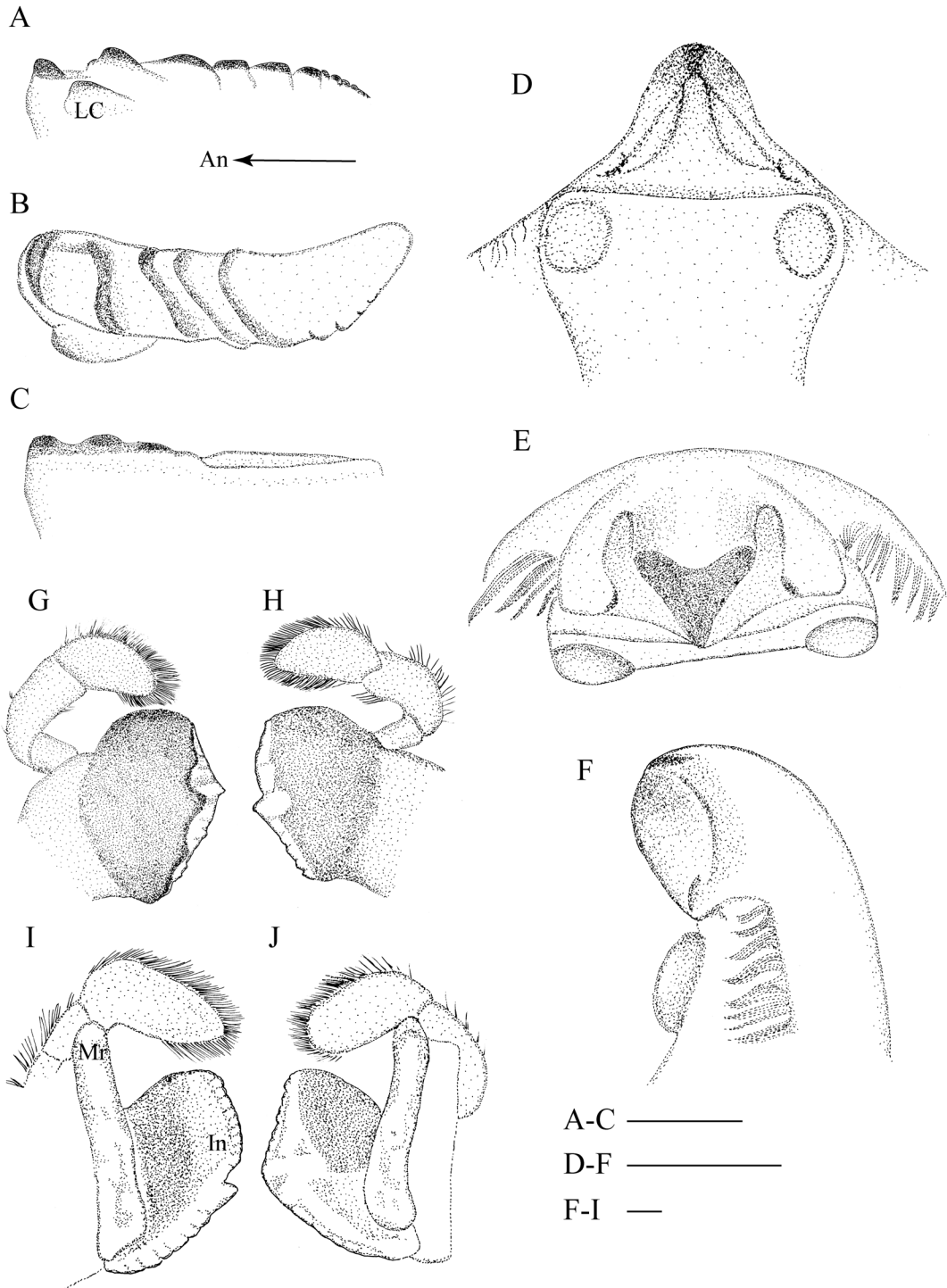


Fig. 3. Gastric mill and mandible of female *Metanephrops neptunus* (female, TMCD003316, CL = 105.4 mm). A, lateral view of zygocardiac ossicle; B, dorsal view of zygocardiac ossicle; C, mesial view of zygocardiac ossicle; D, caudal view of urocardiac ossicle; E, ventral view of urocardiac ossicle; F, lateral view of urocardiac ossicle; G–H, ventral views of mandibles; I–J, proximal views of mandibles. An: anterior; In: incisor ridge; LC: lateral cusp; Mr: molar ridge; scale bars: 2 mm.

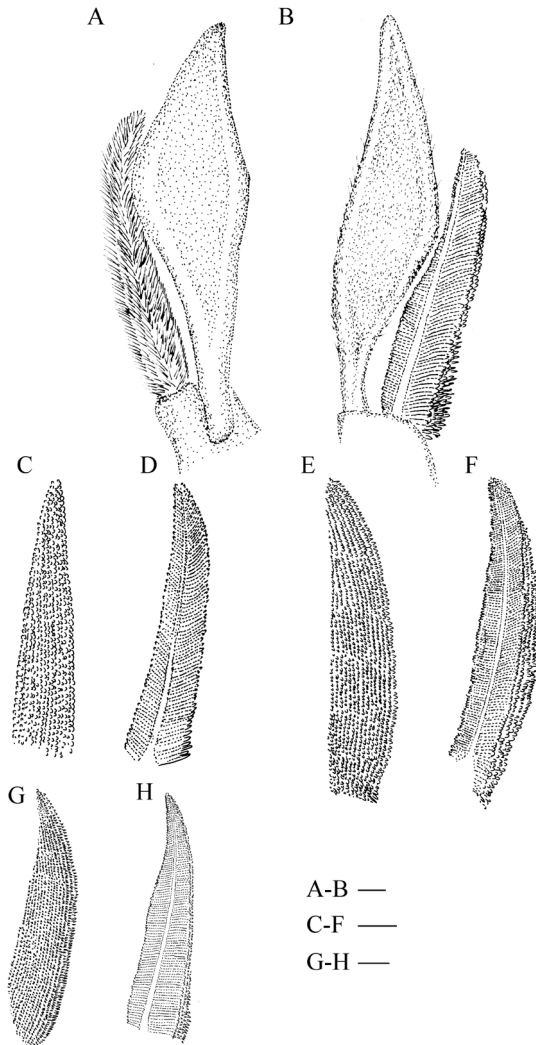


Fig. 4. Gills of female *Metanephrops neptunus* (female, TMCD003316, CL = 105.4 mm). A, lateral view of podobranch on 4th pereiopod; B, mesial view of podobranch on 4th pereiopod; C, lateral view of anterior arthrobranch on 4th pereiopod; D, mesial view of anterior arthrobranch on 4th pereiopod; E, lateral view of arthrobranch on 4th pereiopod; F, mesial view of arthrobranch on 4th pereiopod; G, lateral view of pleurobranch on 4th pereiopod; H, mesial view of pleurobranch on 4th pereiopod. Scale bars: 2 mm.

Gills: Podobranchs (Fig. 4A, B) consisting of flat, blade-like lamella with no filaments and shaft covered with fine filaments on its lateral side. Lateral sides of arthrobranchs (Fig. 4C–F) and pleurobranchs (Fig. 4G, H) covered with longitudinal rows of short, solid filaments of

similar length.

Identification

The number of recognized species (including fossil species) of *Metanephrops* has increased from 14 to 18 since the erection of the genus in 1972. According to the World Register of Marine Species (WoRMS, 2020), the superfamily Nephropoidea currently includes 17 genera. Among these, *Metanephrops* currently contains *M. andamanicus* (Wood-Mason, 1892), *M. arafurensis* (De Man, 1905), *M. armatus* Chan & Yu, 1991, *M. australiensis* (Bruce, 1966), *M. binghami* (Boone, 1927), *M. boschmai* (Holthuis, 1964), *M. challengerii* (Balss, 1914), *M. formosanus* Chan & Yu, 1987, *M. japonicus* (Tapparone-Canefri, 1873), *M. mozambicus* Macpherson, 1990, *M. rubellus* (Moreira, 1903), *M. sagamiensis* (Parisi, 1917), *M. sibogae* (de Man, 1916), *M. sinensis* (Bruce, 1966), *M. taiwanicus* (Hu, 1983), *M. thomsoni* (Bate, 1888), *M. velutinus* Chan & Yu, 1991, and *M. neptunus*. Members of this genus are conventionally divided into four species-groups, viz., the *arafurensis*, *atlanticus*, *binghami*, and *japonicus* groups (De Man, 1916; Yaldwyn, 1954; Jenkins, 1972; Chan & Yu, 1987; Holthuis, 1991; Tshudy et al., 2007). *Metanephrops neptunus* belongs to the *arafurensis*-group together with *M. arafurensis* and *M. australiensis*. All three species share a spiny carapace; weakly carinate, finely granulate, spiny chelipeds with an angulate outer margin; one or two deep transverse furrows on the dorsal surface of the pleonal terga; and uropods with a spinulose dorsal surface. According to Holthuis (1991), a rather uniformly spinulose carapace and a heavily spinulose region between the postrostral carinae are the key characters that distinguish *M. neptunus* from these two congeners. The present specimens display these features and are therefore identified as *M. neptunus*.

Remarks

Sahlmann et al. (2011) examined the mouth-

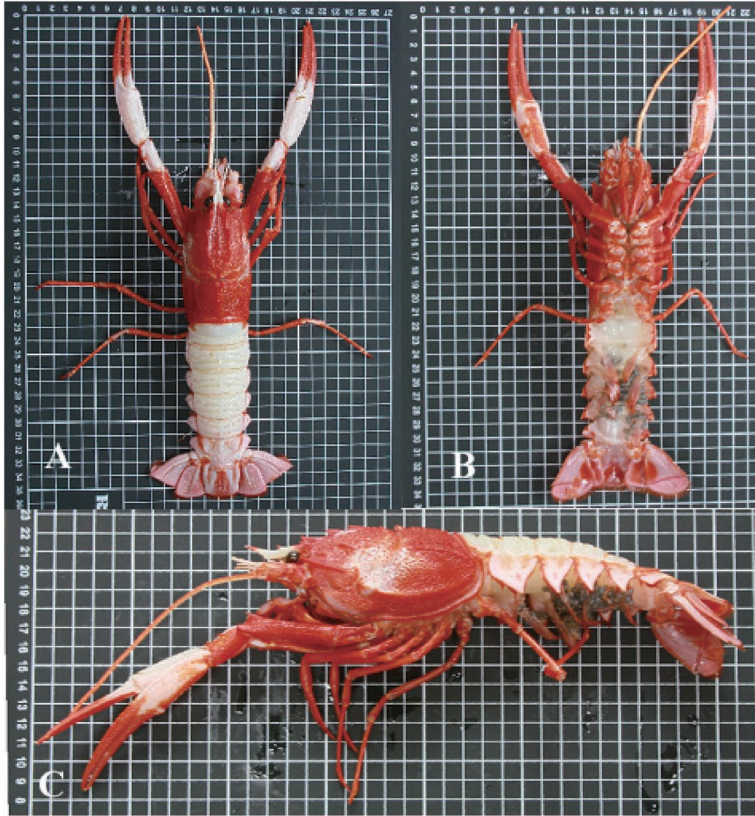


Fig. 5. *Metanephrops neptunus* (female, TMCD003316, CL = 105.4 mm) from the Pratas Islands, photographs showing after thawing coloration: A, dorsal view; B, ventral view; C, lateral view.

parts of *Puerulus angulatus* (Bate, 1888) and *M. formosanus* Chan and Yu, 1987 by scanning electron microscopy. Both were similar, but both mandibles of *M. armatus* and *M. formosanus* had two differently sized and weak molar processes. The present study confirmed the presence of two weak molar process in *M. neptunus* as well (Fig. 3I–J). Also, *Nephrops norvegicus* (L.) have similar mandible (Farmer, 1974).

Coloration

Fresh specimens of both males and females displayed almost the same body coloration, with a basically red cephalothorax and milky-white abdomen (Fig. 5). The eyes were black. The proximal third of the fingers as well as the palm of the chela were milky-white in the oth-

erwise red first chelipeds—just as in a female Indonesian (Kai Islands) specimen of this species studied by Chan (1997)—and the second and third chelipeds and posterior two pairs of walking legs are red. In a previous study, Chan (1997) showed that the dorsal red coloration of the body is variable in *M. neptunus*. The chela coloration in *M. neptunus* is different from that of the all-red first chelae of *M. arafurensis* (Chan, 1997).

Geographic range

Like the present specimens, the Holotype specimen of *M. neptunus* was collected in the South China Sea close to Pratas Island (19°25.5'N114°07.5'E to 19°22.0'N114°11.0'E; 7 January 1964) (Bruce, 1965). Thereafter it has been recorded from several localities in the

South China Sea and Western Australia (Holthuis, 1991) as well as from Philippine waters in the Sulu Sea and from Indonesia's Tanimbar and Kai Islands and Makassar Strait (Chan, 1997).

Habitat depth

The present material were collected from the seabed at 300–600 m depth. Bruce (1965) description the temperature was 5.13°C at a depth of 812 m. Holthuis (1991) type series of *Metanephrops neptunus* was captured at depths of 300–800 m, where the water temperature was approximately 5–11.9°C. The known depth range of *M. neptunus* is 300–940 m, but it is most commonly found at depths of 500–800 m (Chan, 1997).

Stomach contents

The stomach contents of the dissected specimen of *M. neptunus* were dominated by inorganic sediment and detritus, with a few remains of benthic polychaetes, nematodes, and crustaceans. The gut contents of *M. formosanus* and *M. armatus*, as reported by Sahlmann et al. (2011), were similar each other and consisted of animal tissue (crustaceans, fish, and bivalves) and a large amount of inorganic sediment. The stomach contents of *M. neptunus* are, therefore, similar to those of *M. formosanus* and *M. armatus*.

Fecundity

The numbers and size of the eggs carried by the three ovigerous females were similar. The one examined in detail (TMCD003316, TL = 245.8 mm) was carrying 24 dark green, non-eyed, spherical eggs of 2.3–3.8 mm in diameter (mean \pm SD = 3.23 \pm 0.23 mm).

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