

# O H M U

OCCASIONAL PAPERS  
OF  
ZOOLOGICAL LABORATORY  
FACULTY OF AGRICULTURE  
KYUSHU UNIVERSITY  
FUKUOKA, JAPAN

---

Vol. 2

August 31, 1969

No. 4

---

Bathypelagic caridean shrimps collected by "Koyo Maru"  
during the International Indian Ocean Expedition<sup>1</sup>

Ken-Ichi HAYASHI and Sadayoshi MIYAKE

The Shimonoseki University of Fisheries took part in the International Indian Ocean Expedition (IIOE) and the training ship "Koyo Maru" of the university carried out two times the survey in the eastern Indian Ocean. In February 1964 was concluded this large survey with many fruitful results. Data of oceanographic observations and exploratory fishings of the survey has been published (Anonymous, 1965). The details of macroplankton, which was collected from many stations by the Isaacs-Kidd midwater trawl and the Indian Ocean standard net, has been unstudied. Of these the bathypelagic caridean shrimps are taxonomically treated herewith. The specimens unless stated otherwise are deposited at the museum of the Shimonoseki University of Fisheries.

The many specimens are referred to the following ten oplophorids and two pandalids.

Family Oplophoridae

*AcanthePHYra smithi* Kemp

*AcanthePHYra sanguinea* Wood-Mason and Alcock

*AcanthePHYra indica* Balss

*Notostomus longirostris* Bate

*Meningodora sibogae* de Man

*Systellaspis debilis* (A. Milne Edwards)

---

<sup>1)</sup> Contributions from the Zoological Laboratory, Faculty of Agriculture, Kyushu University, No. 409.

*Oplophorus spinicauda* A. Milne Edwards  
*Oplophorus spinosus* (Brullé)  
*Oplophorus typus* (H. Milne Edwards)  
*Oplophorus novaezeelandiae* de Man

Family Pandalidae

*Parapandalus zurstrasseni* Balss  
*Heterocarpus ensifer* A. Milne Edwards

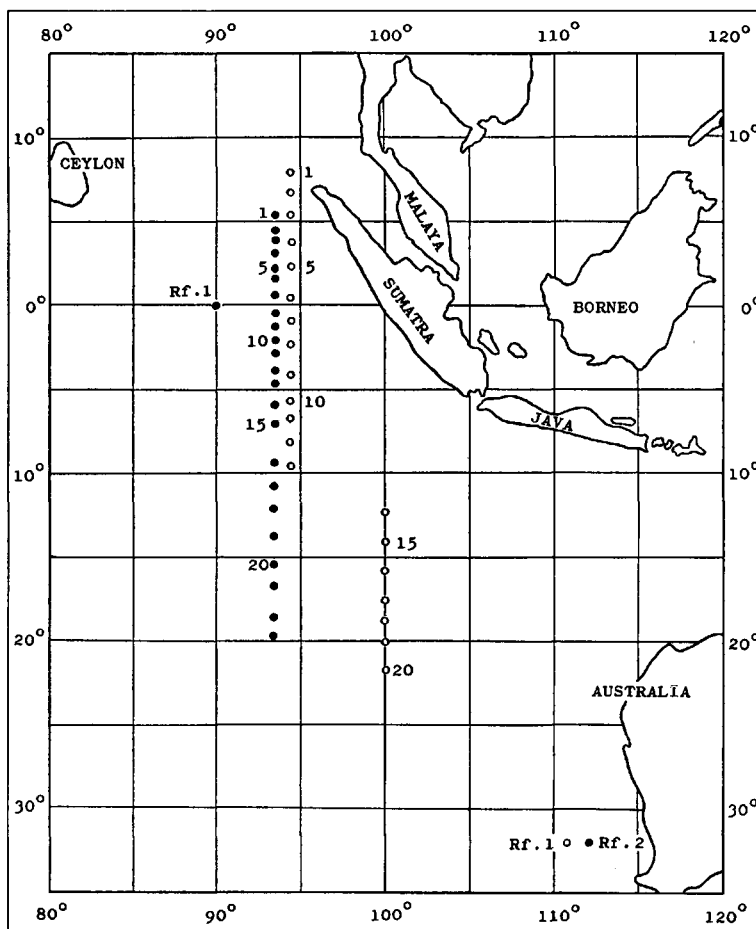


Fig. 1. Map showing stations of "Koyo Maru" during the International Indian Ocean Expedition, 1962-1963 (●) and 1963-1964 (○). Numerals show station number; Rf means reference station.

It is highly remarkable that the following four rare species occur in the East Indian Ocean, viz., *Acanthephyra indica*, *Notostomus longirostris*, *Meningodora sibogae* and *Oplophorus novaezeelandiae*, for the second species has been collected from some localities of the Atlantic, but in the Indo-Pacific the present specimen is the third record of the species, and the other three species are also reported only a few times in literature. We therefore made a short description of the four species, in addition to the figures of them except for the first. *Systellaspis debilis*, *Oplophorus spinicauda*, *O. spinosus*, *O. typus* and *Heterocarpus ensifer* are known to be distributed both the Atlantic and Indo-West-Pacific. The adults of these species are easily distinguished and well known, but it is not so easy to determine the young specimens of them. Fortunately the IIOE collections included a number of immature specimens, then we laid emphasis on the difference between the young and adult specimens. Moreover we tried to compare the two allied species of the genus *Acanthephyra*; *A. smithi* and *A. sanguinea*, and gave some clear distinctions between them.

The first cruise from October 1962 to February 1963 had 23 observational stations from 5° N to 20° S along the 94° E line, with two reference stations, 0°, 90° E and 32°13' S, 112°01' E. In the course of the second cruise from October 1963 to February 1964, 20 stations along the 94° E and 100° E line from 8° N to 21° S, with one reference station, 31°49' S, 111°24' E were observed (Fig. 1). Furthermore several tuna long line fishing were operated during both cruises. The bathypelagic caridean shrimps were only found in the samples collected by both the Indian Ocean standard net which were hauled in every observational stations and the Isaacs-Kidd midwater trawl which were operated in all except for stations 5, 9, 12, 17, 21 in the first cruise and stations 4, 5, 7, 11, 13, 16 in the second cruise.

We take great pleasure in thanking Prof. Isao Matsui and Prof. Arao Tsuruta of the Shimonoseki University of Fisheries for the opportunity to study this collection and for donating a part of the collection to the Zoological Laboratory, Kyushu University (ZLKU). We are also indebted to Dr. B. F. Kensley, South African Museum, Cape Town, Dr. A. Crosnier, Office de la Recherche Scientifique et Technique Outre-Mer, Pointe-Noire, Dr. J. Forest, Muséum National d'Histoire Naturelle, Paris, and Dr. J. C. Yaldwyn, Australian Museum, Sydney, for providing copies of their interesting papers.

#### Family Oplophoridae

#### *Acanthephyra smithi* Kemp, 1939

(Fig. 2)

*Acanthephyra smithi* Kemp, 1939, p. 577.

*Material examined.*

First cruise: St. 4, 02°43'N, 94°02'E, Nov. 26, 1962, time 21:25-22:35, Standard net—1♂, 1♀. St. 6, 01°02'N, 93°56'E, Nov. 28, 1962, time 21:26-23:09, Midwater trawl—2♀♀. St. 11, 03°06'S, 94°00'E, Dec. 4, 1962, time 18:25-19:30, Standard net—2♂♂. St. 14, 06°28'S, 93°52'E, Dec. 7, 1962, time 04:30-06:35, Midwater trawl—2♂♂, 1♀, 1 sp. (1♂, ZLKU No. 11635). St. 15, 08°01'S, 94°00'E, Dec. 23, 1962, time 18:50-20:00, Standard net—1♂.

Second cruise: St. 1, 08°07'N, 94°00'E, Nov. 23, 1963, time 20:00-20:48, Standard net—1♂, 1♀ (ZLKU No. 11654). St. 6, 00°26'N, 93°52'E, Nov. 28, 1963, time 20:00-21:47, Midwater trawl—13 spp. St. 8, 02°35'S, 94°02'E, Nov. 30, 1963, time 21:28-22:15, Standard net—1♀. St. 9, 04°04'S 94°04'E, Dec. 1, 1963, time 19:52-20:46, Standard net—1 sp. St. 10, 05°25'S, 93°54'E, Dec. 16, 1963, time 21:04-22:00, Standard net—1♀. St. 12, 09°06'S, 93°54'E, Dec. 18, 1963, time 19:50-20:36, Standard net—1♀.

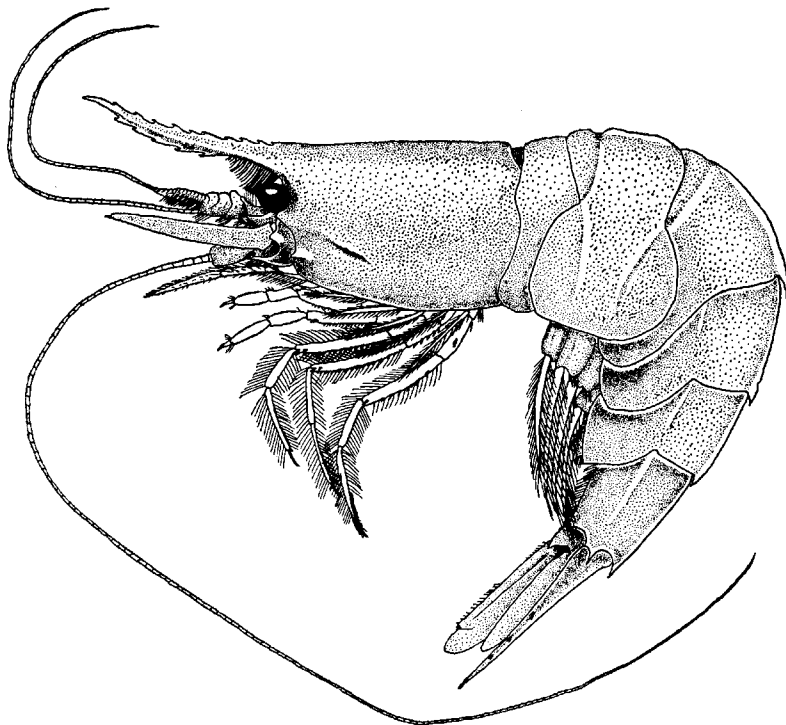


Fig. 2. *Acanthephyra smithi* Kemp. Immature specimen from St. 6 of second cruise,  $\times 5.2$ .

*Remarks.* Kemp (1939) gave a revision of the *Acantheephyra purpurea* group. In this very important paper he established a new species *A. smithi* for the specimens having the following characters.

- 1) The large and stout body is covered uniformly with fine pits, which are marks of the attachment of small lanceolate scales.
- 2) The rostrum is usually shorter than the carapace.
- 3) The branchiostegal spine is small, supported by a very small carina.
- 4) A distinct dorsal carina is present on the second to sixth abdominal somites. The carinae of the third to sixth somites ends in large teeth.
- 5) The telson bears three pairs of dorsolateral spines.

The IIOE material is collected from 11 stations along the 94°E line from 8°N to 9°S. All the specimens agree well with Kemp's (1939) description of *A. smithi*.

*Size.* Carapace length of largest male 24.5 mm; of largest female 23.0 mm. No ovigerous females examined.

*Distribution.* Indo-West-Pacific form. "Indo-Pacific from the East Africa coast to mid-Pacific in 131°W. At the western end of its range it extends to 14°S and at the eastern end from 20°N to 24°S" (Kemp, 1939). The vertical distribution of the species has not been recorded.

### *Acantheephyra sanguinea* Wood-Mason and Alcock, 1892

*Acantheephyra sanguinea* Wood-Mason and Alcock, 1892, p. 358, fig. 1.  
*Acantheephyra sanguinea*: Kemp, 1939, p. 576.

#### *Material examined.*

First cruise: St. 2, 04°06'N, 94°13'E, Nov. 24, 1962, Midwater trawl, time 20:47-21:57—1 ♂; time 22:26-23:55—4 ♂♂, 2 ♀♀. St. 4, 02°43'N, 94°02'E, Nov. 26, 1962, time 21:25-22:35, Standard net—1 ♀. St. 6, 01°02'N, 93°56'E, Nov. 28, 1962, time 21:26-23:09, Midwater trawl—1 ♂. St. 7, 00°01'N, 94°01'E, Nov. 29, 1962, time 21:10-22:45, Midwater trawl—1 ♀. St. 11, 03°06'S, 94°00'E, Dec. 4, 1962, time 18:25-19:30, Standard net—5 ♂♂, 1 ♀ (1 ♀, ZLKU No. 11656). St. 18, 12°26'S, 94°13'E, Dec. 27, 1962, time 03:10-04:15, Standard net—2 ♀♀.

Second cruise: St. 1, 08°07'N, 94°00'E, Nov. 23, 1963, time 20:00-20:48, Standard net—3 ♂♂, 3 ovig. ♀♀, 2 spp. (1 ♂, 1 ovig. ♀, ZLKU No. 11657). St. 2, 06°35'N, 93°55'E, Nov. 24, 1963, time 06:10-06:57,

Standard net—1 ♂. St. 4, 03°30'N, 94°01'E, Nov. 26, 1963, time 20:00–20:48, Standard net—2 ♀♀. St. 5, 01°59'N, 94°01'E, Nov. 27, 1963, time 19:58–20:45, Standard net—1 ♀. St. 6, 00°26'N, 93°52'E, Nov. 28, 1963, time 20:00–21:47, Midwater trawl—4 spp. St. 6, 00°26'N, 93°58'E, Nov. 28, 1963, time 21:50–22:35, Standard net—1 sp. St. 7, 01°06'S, 93°58'E, Nov. 29, 1963, time 21:00–21:45, Standard net—1 ♀, 1 sp. St. 14, 12°25'S, 99°40'E, Jan. 3, 1964, time 21:25–22:12, Standard net—1 ♀.

*Remarks.* This species differs from the former *A. smithi* Kemp in having the following characters. 1) The body is stout, slender and covered with the fine pits arranged to form a narrow vertical bands. 2) The rostrum is longer than the carapace, bearing seven to nine upper and five or six lower teeth. 3) The branchiostegal spine is very small without any supported carina. 4) The telson is dorsally sulcate, with four pairs of the dorsolateral spines. 5) From the distributional view point, *A. sanguinea* is mostly collected from the northern hemisphere while many specimens of *A. smithi* are obtained from the southern hemisphere in the IIOE material.

*Size.* Length up to 126 mm (Kemp, 1939). In our material ovigerous females with carapace length of 16.7 mm; eggs numerous and small, measuring 0.5 × 0.8 mm. Largest male with carapace length of 20.3 mm.

*Distribution.* The species is the Indo-West-Pacific form, recorded from the Gulf of Aden and East African coast to 138°E, and from 18°N to 12°S (after Kemp, 1939). It occurs at depths from surface to 3200 m.

### *Acanthephyra indica* Balss, 1925

*Acanthephyra* sp., de Man, 1920, p. 68, pl. 6 fig. 16.

*Acanthephyra indica* Balss, 1925, p. 264, figs. 34, 35.

#### *Material examined.*

First cruise: St. 2, 04°06'N, 94°13'E, Nov. 24, 1962, time 22:26–23:55, Midwater trawl—1 ♀. St. 6, 01°02'N, 93°56'E, Nov. 28, 1962, time 21:26–23:09, Midwater trawl—7 ovig. ♀♀, 6 ♀♀ (2 ovig. ♀♀, ZLKU No. 11659). St. 7, 00°10'N, 94°01'E, Nov. 29, 1962, time 21:10–22:45, Midwater trawl—1 ♂.

*Description.* Integument thin and membranous. Rostrum short and straight; upper margin bearing five to seven teeth; lower margin unarmcd. Carapace with a postrostral carina at anterior three-fourths; a carina supporting branchiostegal spine reaching to hind margin of

carapace; an obtuse lateral carina running from the hind margin of orbit to posterior end of carapace, though being interrupted at anterior third. Eye subcylindrical with an erect process on inner upper surface of eyestalk. Dorsal carinae of second to sixth abdominal somites rather low; carinae of third to sixth somites ending in a small tooth. Telson with two pairs of dorsolateral spines; posterior margin ending in a slender spine flanked by three unequal spines.

*Remarks.* The species seems to be rare, as far as we know, only four specimens have been reported from the northern Indian Ocean and the Banda Sea at depths from 0 to 2500 m. The IIOE specimens agree very well with Balss's (1925) description and figures and show about same size.

*Size.* Both males and ovigerous females with carapace length of 9.0 mm; eggs numerous and small,  $0.65 \times 0.75$  mm.

### *Notostomus longirostris* Bate, 1888

(Fig. 3)

*Notostomus longirostris* Bate, 1888, p. 833, pl. 135 fig. 4.

*Notostomus longirostris*: Sivertsen and Holthuis, 1956, p. 13, fig. 8.

#### *Material examined.*

First cruise: St. 6,  $01^{\circ}02'N$ ,  $93^{\circ}56'E$ , Nov. 28, 1962, time 21:26-23:09, Midwater trawl - 2 ♀♀ (1 ♀, ZLKU No. 11661),

*Description.* Carapace elevated and anteriorly produced as a long, slender rostrum; about 75 minute teeth present along upper margin of

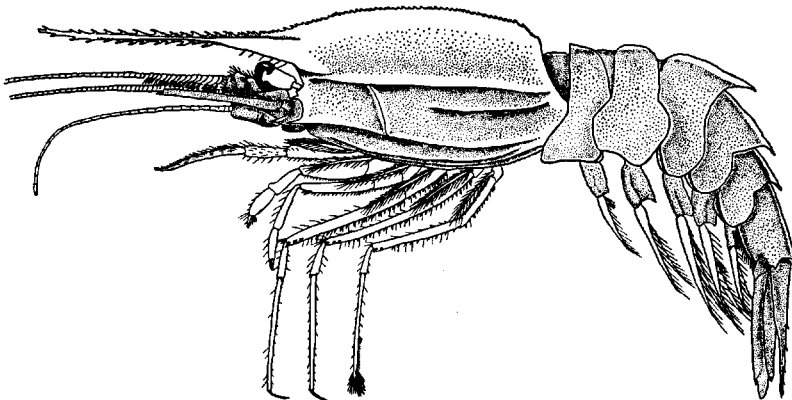


Fig. 3. *Notostomus longirostris* Bate. Immature female from St. 6 of first cruise,  $\times 2.0$ .

rostrum and arched postrostral carina; lower margin of rostrum with 13 teeth. Five lateral carinae on posterior half of carapace; rostral carina short; lateral carina at base of rostrum. All abdominal somites dorsally carinate, carinae of last four somites ending in a stout spine. Telson longer than sixth somite with four pairs of dorsolateral spines.

*Remarks.* The distinction between *N. longirostris* Bate and both *N. patentissimus* Bate and *N. westergreni* Faxon, which belong to a group having five longitudinal carinae on the posterior half of the carapace, is not clear. In spite of small size (13.9 and 15 mm in carapace length), the present material has the long rostrum and the arched carapace, which correspond to the type description and figures of *N. longirostris* Bate.

*Distribution.* This species has a wide distribution. In the Atlantic it has been found from the Bermuda, the Bahamas, S.E. of Spain, N.E. of the Cape Verde Islands, off the Gold Coast and West Africa, while in the Indo-West-Pacific, it seems to be very rare and has been reported two times, each based on only one specimen; off Banda Islands, N. of New Amsterdam. It has been recorded from surface to 3500 m.

### *Meningodora sibogae* de Man, 1916

(Fig. 4)

*Acanthephyra* (*Meningodora*) *sibogae*: de Man, 1920, p. 69, pl. 7 figs. 17-17j.

#### *Material examined.*

First cruise: St. 6, 01°02'N, 93°56'E, Nov. 28, 1962, time 21:26-23:09, Midwater trawl - 1 ♂ (ZLKU No. 11662).

*Description.* A single specimen rather poor condition. Integument soft and membranous. Rostrum very short, not extending to end of eye; upper margin bearing six or seven teeth; lower margin unarmed. Carapace dorsally carinate its entire length and laterally decorated with a carina from orbit to posterior margin of carapace. Small antennal spine present and branchiostegal spine also small, supported by a short carina extending to anterior third of carapace. First two abdominal somites dorsally smooth, not carinate; third somite scarcely carinate dorsally; last three somites with a low carina; carinae of fifth and sixth somites ending in a small spine; sixth somite 1.7 times as long as fifth. Telson dorsally sulcate; distal half broken off. Eyes subcylindrical with a small erect process at inner upper surface of stalk; stalk rather larger than cornea.



*Remarks.* The present specimen is smaller than types and is rather different from the description and figures of them.

1) In the present material there is a small antennal spine, situated just below the obtuse suborbital angle, while the type specimens have no "post-antennular spine."

2) de Man's smaller specimen has a small spine on the lower margin of the rostrum but in his larger specimen the rostrum is broken off. The HIOE material bears no tooth on the lower margin of the rostrum.

3) In the HIOE specimen the dorsal carina of the fourth abdominal somite does not end in a small tooth as in the description of the types given by de Man (1920), though its dorsal end of the present material somewhat resembles that of his figure (1920, pl. 7 fig. 17).

These differences may be due to a specimen size or an individual variation.

Although de Man made the detailed description of the grooves and carinae on the carapace, the present specimen is rather damaged, especially the carapace is much wrinkled, it, therefore, is difficult to trace the grooves and carinae, except for the lateral carina,

*Size.* Carapace 10.4 mm, rostrum 1.8 mm in length.

*Distribution.* As far as we know, this specimen is the second record of this species; the type was collected from the Gulf of Boni, Celebes Island at the depth of 1944 m.

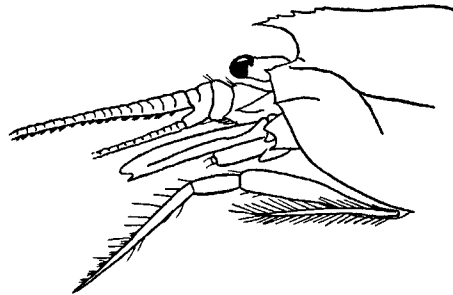


Fig. 4. *Meningodora sibogae* de Man. Anterior part of body of immature male from St. 6 of first cruise,  $\times 4.1$ .

### *Systellaspis debilis* (A. Milne Edwards, 1881)

*Acanthephyra debilis* A. Milne Edwards, 1881, p. 13.

*Systellaspis debilis*: Balss, 1925, p. 242.

*Systellaspis debilis*: Holthuis, 1951, p. 32.

*Systellaspis debilis*: Sivertsen and Holthuis, 1956, p. 17, fig. 14.

*Systellaspis debilis*: Richardson and Yaldwyn, 1958, p. 31, fig. 17.

*Systellaspis debilis*: Kensley, 1968, p. 309.

*Material examined.*

First cruise: St. 2, 04°06'N, 94°13'E, Nov. 24, 1962, time 22:26-23:55, Midwater trawl—4 ♂♂, 1 ♀. St. 5, 01°37'N, 94°01'E, Nov. 27, 1962, time 22:39-23:42, Standard net—1 ♂, St. 11, 03°06'S, 94°00'E, Dec. 4, 1962, time 18:25-19:30, Standard net—4 ♂♂. St. 12, 03°46'S, 94°28'E, Dec. 5, 1962, time 18:25-19:25, Standard net—3 ♂♂, 6 ♀♀ (1 ♀, ZLKU No. 11665). St. 14, 06°28'S, 93°52'E, Dec. 7, 1962, time 04:30-06:35, Midwater trawl—3 ♂♂, 2 ♀♀. St. 18, 12°26'S, 94°13'E, Dec. 27, 1962, time 03:10-04:15, Standard net—1 ♂. St. 22, 18°21'S, 93°50'E, Dec. 31, 1962, time 18:30-20:25, Midwater trawl—2 ovig. ♀♀.

Second cruise: St. 5, 01°59'N, 94°01'E, Nov. 27, 1963, time 19:58-20:45, Standard net—1 sp. St. 6, 00°26'N, 93°52'E, Nov. 28, 1963, time 20:00-21:47, Midwater trawl—3 ♂♂, 2 ovig. ♀♀, 3 ♀♀ (1 ♂, 1 ovig. ♀, ZLKU No. 11663). St. 9, 04°04'S, 94°04'E, Dec. 1, 1963, time 19:52-20:46, Standard net—1 ♀. St. 9', 03°59'S, 94°02'E, Dec. 15, 1963, time 20:01-20:46, Standard net—1 ovig. ♀, 1 ♀. St. 20, 21°30'S, 100°00'E, Jan. 25, 1964, time 21:35-22:39, Standard net—1 sp.

*Remarks.* The present species is characterized by having the carinated third and fourth abdominal somites and the crenated hind margins of the fourth and fifth abdominal pleura. Some specimens obtained during the first cruise (St. 12, 3 ♂♂, 6 ♀♀; St. 18, 1 ♂; St. 22, 2 ovig. ♀♀) bears one or two pairs of small spines on the hind margin of sixth somites as well.

Young specimens differ in some respects from adults; the rostrum is longer in young, being about two times as long as the carapace, and in adult it is only 1.3 to 1.7 times; a median spine of the third to fifth abdominal somites is larger in young than in adult; the number of serration of the fourth and fifth somites is fewer in young than in adult.

*Size.* Ovigerous female with carapace length of 13.5-15.1 mm; eggs few (ten or eleven) and large, being 2.0-2.6 × 3.6-4.6 mm. Largest male with carapace length of 13.1 mm.

*Distribution.* This species has been reported from all the world except for the North Pacific. It was found in depths from surface to 3000 m.

*Oplophorus spinicauda* A. Milne Edwards, 1883

*Oplophorus spinicauda* A. Milne Edwards, 1883, pl. 30.

*Oplophorus spinicauda*: Chace, 1940, p. 184, fig. 54.

*Material examined.*

First cruise: St. 2, 04°06'N, 94°13'E, Nov. 24, 1962, time 20:47-21:57, Midwater trawl—1 ♂, 1 ovig. ♀, 2 spp.; time 22:26-23:55—1 ♀. St. 3, 03°03'N, 94°45'E, Nov. 25, 1962, time 20:22-21:53, Midwater trawl—3 ♂♂, 3 ♀♀, 7 spp. St. 4, 02°23'N, 94°20'E, Nov. 26, 1962, time 22:37-23:49, Midwater trawl—5 ♂♂, 2 ovig. ♀♀, 1 ♀, 8 spp. St. 6, 01°02'N, 93°56'E, Nov. 28, 1962, time 21:26-23:09, Midwater trawl—2 ♂♂. St. 7, 00°10'N, 94°01'E, Nov. 29, 1962, time 21:10-22:45, Midwater trawl—1 ♂, 2 ♀♀, 3 spp. St. 12, 03°46'S, 94°28'E, Dec. 5, 1962, time 18:25-19:25, Standard net—2 spp. St. 14, 06°28'S, 93°52'E, Dec. 7, 1962, time 04:30-06:35, Midwater trawl—4 ♂♂, 3 ♀♀, 2 spp. St. 22, 18°21'S, 93°50'E, Dec. 31, 1962, time 18:30-20:25, Midwater trawl—1 sp.

Second cruise: St. 5, 01°59'N, 94°01'E, Nov. 27, 1963, time 19:58-20:45, Standard net—1 sp. St. 6, 00°26'N, 93°52'E, Nov. 28, 1963, time 20:00-21:47, Midwater trawl—4 ♂♂, 2 ovig. ♀♀, 6 ♀♀, 13 spp. (1 ovig. ♀, 1 ♀, ZLKU No. 11666). St. 8, 02°35'S, 94°02'E, Nov. 30, 1963, time 21:28-22:15, Standard net—1 ♀. St. 9, 04°04'S, 94°04'E, Dec. 1, 1963, time 19:52-20:46, Standard net—1 ♀.

*Remarks.* This species is readily distinguished from the other species of this genus by having 1) a large terminal spine on the second abdominal somite, 2) the posterolateral angle of the carapace smooth and 3) outer margin of the antennal scale serrated.

It is not easy to determine the sex of the rather small and non ovigerous specimens, for the male of this species bears no appendix interna on the endopod of the second pleopod. As mentioned by Chace (1940, 1947), however, the sex of the fairly sized specimens, more than about 6 mm in carapace length, are determined by the features of the lower margin of the first abdominal pleuron, which is "more concave or sinuous" in males than in females.

*Size.* Ovigerous females with carapace length of 7.2 to 7.8 mm; eggs few (eight or nine) and large, 1.6-1.9 × 2.4-2.6 mm. Largest male with carapace length of 8.2 mm.

*Distribution.* This species has a wide distribution, North Atlantic to West Indian region and Bermuda area, the Indian Ocean, north Madagascar and south of India and the Hawaiian Islands. It was found in depths from surface to 1900 m.

*Oplophorus spinosus* (Brullé, 1839)

*Palaemon spinosus* Brullé, 1839, p. 18.

*Hoplophorus grimaldii* Coutière, 1905, p. 1114.

*Oplophorus spinosus*: Sivertsen and Holthuis, 1956, p. 19, fig. 15, pl. 3 figs. 1, 2.

*Material examined.*

First cruise: St. 2, 04°06'N, 94°13'E, Nov. 24, 1962, time 22:26-23:55, Midwater trawl—1 sp. St. 12, 03°46'S, 94°28'E, Dec. 5, 1962, time 18:25-19:25, Standard net—3 ♂♂, 6 ♀♀. St. 22, 18°21'S, 93°50'E, Dec. 31, 1962, time 18:30-20:25, Midwater trawl—4 ♂♂, 1 ovig. ♀ (1 ♂, 1 ovig. ♀, ZLKU No. 11668).

Second cruise: St. 12, 09°06'S, 93°54'E, Dec. 18, 1963, time 19:50-20:36, Standard net—1 sp. St. 19, 19°59'S, 99°42'E, Jan. 8, 1964, time 20:54-21:36, Standard net—1 ♂. St. 20, 21°35'S, 100°00'E, Jan. 25, 1964, time 20:21-21:33, Midwater trawl—1 ♀. St. 20, 21°30'S, 100°00'E, Jan. 25, 1964, time 21:35-22:39, Standard net—1 ♂, 1 sp. Rf. St. 1, 31°49'S, 111°24'E, Jan. 19, 1964, time 19:53-20:43, Standard net—1 sp.

*Remarks.* This species belongs to a group which has the third, fourth and fifth abdominal somites terminating in a large spine, but differs from the other members of this group in having 1) no spine at the posterolateral angle of the carapace and 2) the inner margin of the antennal scale with a distinct barb, the outer margin with a series of spines.

One specimen collected from west of Fremantle, Australia (Rf. St. 1, 31°49'S, 111°24'E) is a young, being 4.4 mm in carapace length, and rather different from the other specimens examined. The pterygostomian angle is feebly pointed; the rostrum is long, about 2.5 times as long as the carapace; the outer margin of the antennal scale bears fewer (4 or 5) and larger spines; the terminal spine of the third abdominal somite is enormously large, while those of the fourth and fifth somites are comparatively small; and the telson terminates in a sharp point flanked by several lateral spinules. Although the young specimens agrees well with Sivertsen and Holthuis's (1965) figure 15, c, its characteristics mentioned above coincide curiously with those of the small specimens of *O. gracilirostris* obtained from southern Japan, in which the posterolateral angle of the carapace is smooth, not provided with a diagnostic spine. By the external morphology, these young specimens of the two species could not be distinguished. We determined the IIOE specimen as *O. spinosus*, in as much as there are no material of *O. gracilirostris* in the Indian Ocean collection, while the Japanese specimen is collected together with 14 adult specimens of *O. gracilirostris* and no specimen of *O. spinosus* in the same haul.

*Size.* A single ovigerous female with carapace length of 11.0 mm; eggs few and large 1.9 × 2.9 mm. Largest male 16.1 mm in carapace length.

*Distribution.* This species has been recorded from the North and South Atlantic (off east coast of U.S.A., Bahamas, Bermuda, W. of Madeira, off Canary Islands; N. of Tristan de Cunha) and the Indo-West-Pacific (W. of Australia, S. of Japan, near Easter Island). It has been found in depths ranging between surface and 2200 m. (Sivertsen and Holthuis, 1956). In eastern Indian Ocean the specimens seem to be more abundant in the southern hemisphere than in the northern hemisphere.

*Oplophorus typus* (H. Milne Edwards, 1837)

*Hoplophorus typus*: Bate, 1888, p. 762, pl. 127 fig. 1.

*Hoplophorus typus*: Balss, 1925, p. 248, figs. 21-23 (in part).

*Oplophorus typus*: Chace, 1936, p. 30.

*Oplophorus typus*: Calman, 1939, p. 188 (in part).

*Oplophorus typus*: Chace, 1947, figs. 8-11.

*Material examined.*

First cruise: St. 2, 04°06'N, 94°13'E, Nov. 24, 1963, time 20:47-21:57, Midwater trawl—5 ♂♂, 1 ovig. ♀, (1 ♂, 1 ovig. ♀, ZLKU No. 11670). St. 7, 00°10'N, 94°01'E, Nov. 29, 1962, time 21:10-22:45, Midwater trawl—1 ♂. St. 14, 06°28'S, 93°52'E, Dec. 7, 1962, time 04:35-06:35, Midwater trawl—1 ♂, 1 ♀.

Second cruise: St. 6, 00°26'N, 93°52'E, Nov. 28, 1963, time 20:00-21:47, Midwater trawl—5 ♂♂, 1 ovig. ♀, 1 ♀. St. 8, 02°35'S, 94°02'E, Nov. 30, 1963, time 21:28-22:15, Standard net—1 sp.

*Remarks.* The species is closely related to *O. gracilirostris* A. Milne Edwards. Balss (1925) and Calman (1939) considered these two species to be identical, while Chace (1936, 1947) believed that "adults of the two forms can be readily distinguished from one another." We critically compared the IIOE specimens of *O. typus* (cl. 5.5, 6.5 and 12.9 mm) with three spimens of *O. gracilirostris* (cl. 4.5, 6.5 and 12.0 mm) obtained from southern Japan, and came to the conclusion that these two species, even in the smaller specimens were distinguished from each other by the following characters.

1) The rostrum is comparatively shorter in *O. typus* than in *O. gracilirostris* in every size, though it is proportionally longer in young than in adult in both species.

2) There is a barb near the distal end of the inner margin of the antennal scale in *O. gracilirostris*, which is entirely absent in *O. typus*.

3) The median lateral carina converges posteriorly toward the middorsal line in *O. typus*, while it is subparallel to the middorsal line in *O. gracilirostris*.

In *O. gracilirostris* the still smaller specimen (cl. 3.5 mm) also represents the first two characters, but its posterolateral angle of the carapace is smooth, then in turn, it bears a close resemblance to the smaller specimens of *O. spinosus*, as mentioned in the account for *O. spinosus*.

*Size.* Ovigerous female with carapace length of 12.9 mm; eggs few (only five) and large (2.1 × 2.9 mm); largest male with carapace length of 15.8 mm.

*Distribution.* The records of *O. typus* in literature are restricted in the Indo-West-Pacific, viz., Fiji Islands, New Guinea, Philippine Islands, Bali Sea, Timor, E. of Saleyer, Andaman Islands, Maldives, Gulf of Aden, Arabian Sea and East Africa. It has been reported from surface to 2400 m.

### *Oplophorus novaezeelandiae* de Man, 1931

(Fig. 5)

*Oplophorus novae-zeelandiae* de Man, 1931, p. 369, figs. 1-20.

*Oplophorus novaezeelandiae*: Crosnier and Forest, 1968, p. 1126, fig. 2.

#### *Material examined.*

First cruise: Rf. St. 2, 32°13'S, 112°01'E, Jan, 7, 1963, time 23:45-00:45, Standard net—4 spp. (2 spp., ZLKU No. 11672).

Second cruise: Rf. St. 1, 31°49'S, 111°24'E, Jan. 19, 1964, time 19:53-20:43, Standard net—1 sp.

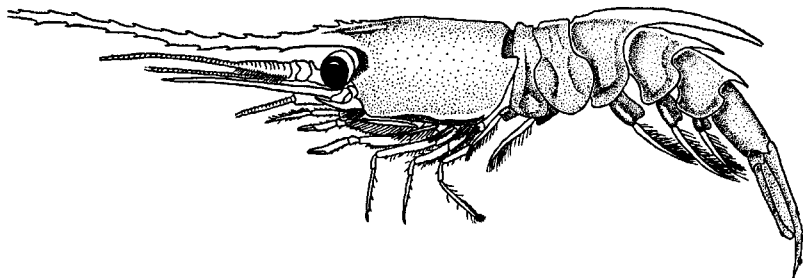


Fig. 5. *Oplophorus novaezeelandiae* de Man. Juvenile from Rf. St. 2 of first cruise, ×4.7.

*Description.* Our material 3.5 to 5.1 mm in carapace length. Rostrum slender, long, more than three times as long as carapace; upper margin with 15 or 16 teeth, lower margin with 10 or 11 teeth. Postrostral carina extending backward to end of carapace. A short carina present on base of rostrum, just below first tooth of upper series.

Carapace with an antennal spine; pterygostomian angle rectangular, followed by a distinct carina; no spine on posterolateral angle. First abdominal somite not carinate dorsally; second abdominal somite dorsally carinate; third, fourth and fifth abdominal somites ending in a long spine. Telson twice as long as sixth somite, with three pairs of dorsolateral spines and terminating in a sharp point, with several lateral spinules. Antennal scale with smooth outer margin; inner margin of terminal spine finely serrated, but without a distinct barb.

*Remarks.* These specimens are rather different from the description of this species (de Man, 1931; Crosnier and Forest, 1968).

1) The rostrum is much long, more than three times as long as carapace in the IIOE material, while 1.55 to 1.75 in New Zealand specimens and 1.1 to 1.2 in West African specimens.

2) In Indian specimens the telson, which is much longer than the uropod, bears three pairs of dorsolateral spines and ends in an acute point, flanked by several lateral spinules. The telson is as long as in the types or slightly longer in the West African specimens than the uropod and ends in an acute point with three pairs of dorsolateral spines only in both the types and the West African specimens.

These differences may due to the size of specimens, for the IIOE specimens are very small, 3.5 to 5.1 mm in carapace length and their characters are common to the very young oplopholids. The other characters agree well with Crosnier and Forest's (1968) description.

*Distribution.* The species has been reported from New Zealand and West Africa at depths between surface and 2000 m. The present material is partly fills the gap between the above two localities.

## Family Pandalidae

### *Parapandalus zurstrasseni* Balss, 1914

*Parapandalus zur strasseni* Balss, 1914, p. 597.

*Parapandalus Zur Strasseni*: de Man, 1920, p. 141, pl. 12 fig. 32-32d.

*Parapandalus Zurstrasseni*: Balss, 1925, p. 281, figs. 53-59, pl. 27.

#### *Material examined.*

First cruise: St. 2, 04°06'N, 94°13'E, Nov. 24, 1962, time 20:47-21:57, Midwater trawl—1 ovig. ♀, 1 ♀ (1 ovig. ♀, ZLKU No. 11674). St. 4, 02°43'N, 94°02'E, Nov. 26, 1962, time 21:25-22:35, Standard net—1 ♂. St. 4, 02°23'N, 94°20'E, Nov. 26, 1962, time 22:37-23:49, Midwater trawl—1 ♀. St. 5, 01°37'N, 94°01'E, Nov. 27, 1962, time 22:39-23:42, Standard net—1 ovig. ♀, 1 ♀. St. 14, 06°28'S, 93°52'E, Dec. 7, 1962, time 04:30-06:35, Midwater trawl—1 ovig. ♀. St. 15,

08°01'S, 94°00'E, Dec. 23, 1962, time 18:50-20:00, Standard net--  
1 ♂, 1 ovig. ♀, 1 ♀ (1 ♀, ZLKU No. 11675).

Second cruise: St. 5, 01°59'N, 94°01'E, Nov. 27, 1963, time 19:58-20:45,  
Standard net-1 ovig. ♀. St. 6, 00°26'N, 93°58'E, Nov. 28, 1963,  
time 21:50-22:35, Standard net-3 ♂♂, 1 ♀. St. 6, 00°26'N, 93°52'E,  
Nov. 28, 1963, time 20:00-21:47, Midwater trawl-2 ♂♂, 1 ovig. ♀,  
1 ♀. St. 9', 03°59'S, 94°02'E, Dec. 15, 1963, time 20:01-20:46,  
Standard net-1 ♂. Rf. St. 1, 31°49'S, 111°24'E, Jan. 19, 1964, time  
19:53-20:43, Standard net-2 spp.

*Remarks.* This species is distinguished from the other species of  
the genus by the following characters.

1) The rostrum is long, about three times as long as the carapace;  
the upper margin of the rostrum bears two large teeth above the eye  
and about ten very small ones on the distal half.

2) The sixth abdominal somite is long, about three times as long  
as the fifth somite.

*Size.* Ovigerous female, 7.9-8.0 mm in carapace length; eggs small,  
0.48-0.56 × 0.66-0.72 mm. Male with carapace length of 7.6 mm.

*Distribution.* The species has been collected from several points of  
the Indian Ocean and Malay Archipelago, near the Seychelles, Arabian  
Sea, Bay of Bengal, S.W. of Sumatra, between Celebes and Buru,  
Mauipa Strait, S. of Ambon, W. of Banda. Although the southern  
limit of the distribution has been reported as 10°08'S, near the S.W. of  
Sumatra, in our material examined two specimens are obtained from  
far south, 31°49'S, 111°24'E. The vertical distribution of the species  
has been reported between surface and 3600 m.

### *Heterocarpus ensifer* A. Milne Edwards, 1881

(Fig. 6)

*Heterocarpus ensifer* A. Milne Edwards, 1881, p. 8.

*Pandalus carinatus* Smith, 1882, p. 63, pl. 10 fig. 2, pl. 11 figs. 1-3.

*Heterocarpus ensifer*: A. Milne Edwards, 1883, pl. 27.

*Heterocarpus ensifer*: Bate, 1888, p. 638, pl. 112 fig. 4.

*Heterocarpus ensifer*: Rathbun, 1906, p. 917, pl. 21 fig. 7.

*Heterocarpus ensifer* var. *parvispina* de Man, 1920, p. 167, pl. 14 figs. 41-41b.

*Heterocarpus ensifer*: Figueira, 1957, p. 40, fig. 4, pl. 3 fig. 2.

#### *Material examined.*

First cruise: St. 2, 04°06'N, 94°13'E, Nov. 24, 1962, time 22:26-23:55,  
Midwater trawl-1 sp. (ZLKU No. 11676).



*Remarks.* *Heterocarpus ensifer* A. Milne Edwards is distinguished from the other species of the genus by the following characters. The first and second abdominal somites are not sharply carinate. The third and fourth somites are distinctly carinate and end in the overhanging spine. The characters of the species, however, seem to vary in fairly degree according to different authors. The overhanging spine on the third abdominal somite is variable in length, hence de Man (1920) erected its variety *parvispina* for the specimen having the comparatively longer such spine. Further the shapes of the carapace and of the first two abdominal somites and the position of the posterior tooth on the carapace are slightly variable.

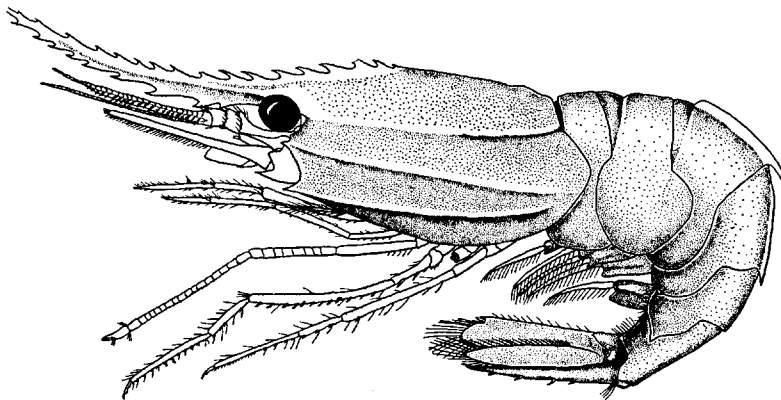


Fig. 6. *Heterocarpus ensifer* A. Milne Edwards. Immature specimen from St. 2 of first cruise,  $\times 3.9$ .

The present specimen is thought to be too small to fully represent its specific character and does not entirely agree with any descriptions and figures of the species in literature.

1) The first and second abdominal somites are not carinated, like those of Smith's (1882) *Pandalus carinatus*, and of de Man's (1920) variety. The specimens referred to this species by the other authors (Bate, 1888; Rathbun, 1906; Figureira, 1957) have more or less carinated first two somites.

2) The carapace is low, not elevated into a crest as in Bate's specimens. With regard to this point, the IIOE specimen resembles the figures of the West Indies (A. Milne Edwards, 1883) and of Rathbun's specimens, and de Man's variety.

3) Any tubercles on the first and second abdominal somites are absent, while according to Bate, de Man and Figureira, there are one or two small tubercles are present on each side of the first two somites.

4) The posterior tooth on the postrostral crest is placed a little

anterior to the middle of the carapace. In the specimens referred to the species by many authors except for Bate, this tooth is placed a little anterior to or just on the middle of the carapace, while in Bate's specimens the tooth is placed on the "phyloric region" of the carapace.

5) The overhanging spine of the third abdominal somite is about 2.5 times as long as that of the fourth somite. It is intermediate between the typical species and its variety.

*Distribution.* The typical species were reported both the Atlantic and Indo-Pacific Oceans; Barbados, St. Kitts, Montserrat and Grenada, off the coast of Carolina and Madeira; off Andaman Islands between Philippine Islands and Borneo, Sagami Bay and southern Japan, New Britain, and Hawaiian Islands. It has been recorded from depths varying between 55 and 850 m. The variety has been described only from the original localities, N. of Sulu Islands, Kai Island and Bali Sea at the depths of 275, 310 and 521 m.

### References

- Anonymous, 1965. Data of oceanographic observations and exploratory fishings, No. 1, International Indian Ocean Expedition 1962-63 and 1963-64. Shimonoseki Univ. Fish., pp. 1-453.
- Balss, H., 1914. Diagnosen neuer Macruren der Valdiviaexpedition. Zool. Anz., vol. 44, pp. 592-599.
- , 1925. Macrura der Deutschen Tiefsee-Expedition. 2. Natantia, Teil A. Wiss. Ergebn. Valdivia Exped., vol. 20, pp. 217-315, textfigs. 1-75, pls. 20-28.
- Bate, C. S., 1888. Report on the Crustacea *Macrura* collected by H.M.S. Challenger during the years 1873-1876. Rep. Voy. Challenger, Zool., vol. 24, pp. i-xc, 1-942, textfigs. 1-76, pls. 1-150.
- Brullé, M., 1837-1839. Crustacés. In: Baker-Webb, P. and Berthelot, S., Histoire naturelle des canaries, vol. 2, pt. 2 Entomologie, pp. 13-18, 1 pl. (text published in 1839, plate published in 1837).
- Calman, W. T., 1939. Crustacea: Caridea. Sci. Rep. John Murray Exped., vol. 6, pp. 183-224, textfigs. 1-8.
- Chace, F. A., Jr., 1936. Revision of the bathypelagic prawns of the family Acanthephyridae, with notes on a new family, Gomphonotidae. Jour. Wash. Acad. Sci., 26, pp. 24-31.
- , 1940. Plankton of the Bermuda Oceanographic Expeditions. IX. The bathypelagic caridean Crustacea. Zoologica, N.Y., vol. 25, pp. 117-209, textfigs. 1-64.
- , 1947. The deep-sea prawns of the family Oplophoridae in the Bingham Oceanographic collection. Bull. Bingham Oceanogr. Coll., vol. 11, art. 1, pp. 1-51, textfigs. 1-15.
- Coutière, H., 1905. Sur quelques Crustacés provenant des campagnes de la Princesse-Alice (filet à grande ouverture). C. R. Acad. Sci. Paris, vol. 140, pp. 1113-1115.

- Crosnier, A. and Forest, J., 1968. Note préliminaire sur les carides recueillis par l' "Ombango" au large du plateau continental, du Gabon a l'Angola (Crustacea Decapoda Natantia). Bull. Mus. Hist. Nat., ser. 2 vol. 39, pp. 1123-1147, textfigs. 1-7.
- Figueira, A. J. G., 1957. Madeiran decapod crustaceans in the collection of the Museu Municipal do Funchal. I. On some interesting deep-sea prawns of the families Pasiphaeidae, Oplophoridae and Pandalidae. Bol. Mus. Mun. Funchal, No. 10, art. 26, pp. 22-51, textfigs. 1-5, pls. 1-4.
- Holthuis, L. B., 1951. The caridean Crustacea of tropical West Africa. Atlantide Rep., vol. 2, pp. 7-187, textfigs. 1-34.
- Kemp, S., 1939. On *AcanthePHYra purpurea* and its allies (Crustacea Decapoda: Hoplophoridae). Ann. Mag. nat. Hist., ser. 11 vol. 4, pp. 568-579.
- Kensley, B. F., 1968. Deep sea decapod Crustacea from west of Cape Point, South Africa. Ann. S. Afr. Mus., vol. 50, pt. 12, pp. 283-323, textfigs. 1-19.
- de Man, J. G., 1920. The Decapoda of the Siboga Expedition, Part IV. Fam. Pasiphaeidae, Styrodactylidae, Hoplophoridae, Nematocarcinidae, Thalassocaridae, Pandalidae, Psalidopodidae, Gnathophylidae, Processidae, Glyphocrangonidae and Crangonidae. Siboga Exped. Monogr., 39 a<sup>3</sup>, pp. 1-318, pls. 1-25.
- , 1931. On a new species of the genus *Hoplophorus* [*Oplophorus*] H. M.-Edw., *Hoplophorus novae-zeelandiae*, sp. n. J. Linn. Soc. Lond., vol. 37, pp. 369-378, textfigs. 1-20.
- Milne Edwards, A., 1881. Description de quelques Crustacés Macroures provenant des grandes profondeurs de la mer des Antilles. Ann. Sci. nat., Zool., ser 6 vol. 11, pt. 4, pp. 1-16.
- , 1883, Recueil de figures de Crustacés nouveaux ou peu connus, Paris. pp. 1-3, pls. 1-44.
- Rathbun, M. J., 1906. The Brachyura and Macrura of the Hawaiian Islands. Bull. U. S. Fish Comm., vol. 23, pt. 3, pp. 827-930, textfigs. 1-79, pls. 3-24.
- Richardson, L. R. and Yaldwyn, J. C., 1958. A guide to the natant decapod Crustacea (shrimps and prawns) of New Zealand. Tuatara, vol. 7, pp. 17-41, textfigs. 1-50.
- Sivertsen, E. and Holthuis, L. B., 1956. Crustacea Decapoda (The Penaeidae and Stenopodidea excepted). Rep. Michael Sars North Atlant. Exped. 1910, vol. 5, no. 12, pp. 1-54, textfigs. 1-32, pls. 1-4.
- Smith, S. I., 1882. Report on the Crustacea. Part I. Decapoda. Reports on the results of dredging, under the supervision of Alexander Agassiz, on the east coast of the United States, during the summer of 1880, by the U. S. coast survey steamer "Blake," commander J. R. Bartlett, U.S.N., Commanding. Bull. Mus. Comp. Zoöl. Harvard, vol. 10, pp. 1-108, pls. 1-15.
- Wood-Mason, J. and Alcock, A., 1892. Natural history notes from H.M. Indian marine survey steamer "Investigator," commander R. F. Hoskyn, R.N., Commanding.—Series II., No. 1. On the results of deep-sea dredging during the season 1890-91. Ann. Mag. nat. Hist., ser. 6 vol. 9, no. 52, pp. 358-370, textfigs. 1-6.

