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NOTES ON THE GENUS *ENOPLOMETOPUS*, WITH DESCRIPTIONS OF A NEW SUBGENUS AND TWO NEW SPECIES (CRUSTACEA DECAPODA, AXIIDAE)

by

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With 4 text-figures and 3 plates

The first species of the genus *Enoplometopus* to become known to science is *E. occidentalis*, described in 1840 by J. W. Randall under the name *Nephrops occidentalis* and said to be "brought from the west coast of North America by Mr. Nuttall" (Randall, 1840: 139). The type locality indication is obvious erroneous as the species does not seem to occur in the eastern Pacific and is quite common in the Hawaiian Islands; as Thomas Nuttall visited the Hawaiian Islands from January to March 1835 and between September 1835 and March 1836, it is most likely that his *Enoplometopus* material was obtained then. We propose therefore the corrected type locality indication "Hawaiian Islands".

In 1862 A. Milne Edwards described a second species of the genus, *E. pictus*, and proposed the new genus *Enoplometopus* for it. Several later authors synonymized Randall's and A. Milne Edwards' species, but Bouvier (1915: 5-9) showed them to be two distinct species. The type locality of *E. pictus* is Reunion Island, and there are no reliable records of the species from other localities.

After 1862 six more new species of *Enoplometopus* were described: *E. antillensis* Lütken, 1865, from the West Indies; *E. dentatus* Miers, 1880, from St. Helena (a junior synonym of *E. antillensis*, see Gordon, 1968: 80-90); *E. longirostris* De Man, 1888, from Amboina (a postlarval stage, possibly of *E. occidentalis*); *E. holthuisi* Gordon, 1968, from Banda, Moluccas, Indonesia; *E. callistus* Intès & Le Loeuff, 1970, off Takoradi, Ghana, 5°30'N 2°W; *E. biafri* Burukovsky, 1972, off the Niger delta, Nigeria, 4°02'-4°02'9"N 6°30'-6°35'5"E (a junior synonym of *E. callistus*). Of the 5 species recognized at present as valid, two are Atlantic (*E. antillensis* and *E. callistus*) and 3 Indo-West Pacific (*E. occidentalis*, *E. pictus*, and *E. holthuisi*).

The genus can be sharply divided into two groups, which in my opinion should be considered subgenera:

Enoplometopus A. Milne Edwards, 1862(:14). Type species, by monotypy: *Enoplometopus pictus* A. Milne Edwards, 1862. Gender: masculine. Carapace with

2 intermediate spines and at most 1 postcervical spine. Pleura of abdominal somites broadly rounded, without a sharply pointed, posteriorly directed tooth. Telson with a single spine in the middle of each lateral margin.

Hoplometopus new subgenus. Type species: *Enoplometopus antillensis* Lütken, 1865. Gender: masculine. Carapace with 1 intermediate and 2 postcervical spines. Pleura of abdominal somites II to V each with a strong posteriorly curved sharp tooth on the distal margin. Telson with two spines in the middle of either lateral margin.

The new subgenus contains three species: the type (*E. antillensis*), *E. holthuisi* and *E. callistus*. The nominotypical subgenus at present is formed of 4 species, viz., the type (*E. pictus*), *E. occidentalis*, and the two new species described below.

Because of their bright colouration the species of *Enoplometopus* caught the attention of the aquarium trade. When it proved that the animals are not too difficult to keep in captivity, this interest became even greater. Specimens were mainly imported from the Indo-West Pacific region. In a beautifully illustrated article in an aquarium journal Daum (1982: 265-268) discussed the possibilities of keeping *Enoplometopus* in tropical marine aquaria.

Through the kindness of Mr. Helmut Debelius of Ikan, Agentur für populärwissenschaftliche Unterwasserthemata, in Frankfurt, F. R. Germany, I was able to examine numerous colour slides and specimens of *Enoplometopus* imported into Germany. Among these I found two that showed a colour pattern strikingly different from that of the known species, and a closer examination proved these to be undescribed species. The locality of origin of most aquarium specimens is usually only vaguely or not at all indicated, and in some cases quite unreliable. Therefore it was most fortunate that of both new species material could be examined that was collected for scientific purposes and provided with accurate collecting data. The holotype of *E. debelius*, collected in Hawaiian waters, was sent to me by Dr. Mary K. Wicksten of Texas A and M University, College Station, Texas, to whom I express my deep gratitude. Dr. Raymond B. Manning kindly allowed me to examine the holotype of *E. daumi* and other specimens in the collection of the Division of Crustacea, National Museum of Natural History, Washington, D.C. To Mr. Michael Türkay I am indebted for placing at my disposal two specimens of *E. debelius* donated by Mr. Debelius to the Senckenberg Museum, Frankfurt, Germany. Mr. D. Devaney, Bishop Museum, Honolulu, permitted me to study interesting Pacific specimens of *Enoplometopus* from the collections under his care. Dr. Isabella Gordon, London, Dr. J. C. Yaldwyn, Wellington, and Mr. S. W. Tinker, Honolulu, I have to thank for providing me with colour slides of *Enoplometopus occidentalis* from Kenya and Hawaii.

Key to the species of the subgenus *Enoplometopus* s.s.

1. No postcervical spine on the carapace. Upper margin of dactylus of large chelipeds with spines over the full length. Numerous coloured eyespots on the carapace: *E. pictus*

- A postcervical spine present. Dactylus of large chelipeds with 2 or 3 distal spines on dorsal margin, behind which the margin is smooth or provided with low blunt tubercles. No (or at most very few) eyespots on the carapace. 2.
- 2. Five median spines on carapace. Rostrum elongate, narrow, reaching to or beyond end of antennular peduncle. Color dark red all over with some small white spots on abdomen and fewer on carapace: *E. occidentalis*
- Four median spines on carapace. Rostrum rather broad, blunt and short, reaching about to the middle of the last segment of the antennular peduncle. Colour purple and brown. 3.
- 3. Lateral surface of carapace with vertical streaks of a reddish brown colour. Abdomen with ocellated spots: *E. daumi*
- Carapace and abdomen regularly covered with numerous large rounded purple non-ocellated spots (polka-dotted): *E. debelius*

Enoplometopus (Enoplometopus) debelius new species
(figs. 1, 2; pls. 1, 2)

? *Enoplometopus occidentalis* - Kubo, 1952: 97, text-fig. 3, pl. 6.

Material examined: Makapuu Point, Honolulu, eastpoint of Oahu, Hawaiian Islands, 21°19'N 157°39'W; collected at night among coral rubble with handnet; depth 25 m; 1500 m offshore; 2 January 1981, 20h³⁰-21h³⁰; leg. A. Kerstitch. — 1♂ holotype. (Museum Leiden).

Indonesia; 1981; Zoozentrum Höchst vend. — 2♀ paratypes. (Museum Senckenberg).

Indonesia; 1982; H. Debelius don. — 1 moult. (Museum Leiden).

Description. — Size: the holotype♂ has the carapace 22 mm long; the carapace length of the paratype females is 21 mm, that of the moult is 24 mm.

The rostrum fails to reach the end of the scaphocerite and attains about the middle of the last segment of the antennular peduncle. It is rather wide with a blunt tip, the distal of the lateral teeth reaching beyond the middle of the tooth that forms the tip. It is much less slender than in *E. occidentalis*. The armament of the rostrum and carapace is almost the same as in *E. occidentalis*: there are three lateral teeth on the rostrum and the carapace bears one large supra-ocular spine, 2 intermediate, 4 median, 1 postcervical and 3 lateral spines. Instead of the anterior (5th) median spine of *E. occidentalis* there is a slight elevation with 1 or 2 long hairs. The lower orbital angle ends in a sharp antennal tooth. A strong branchiostegal tooth is also present; it is much stronger than in *E. occidentalis*. The surface of the carapace is closely beset with very short hairs, among which some longer hairs are placed. No incisura clavicularis is present.

The abdomen is smooth and has the same pubescence as the carapace: a dense cover of short hairs intermixed with a few long hairs. The pleuron of the first somite is short, triangular, with a blunt tip; it is largely hidden below the very wide pleuron of the second somite. The pleuron of the second somite overlaps both those of the first and third somites; it bears no tooth, the anterior part is somewhat produced and rounded, the posterior part is shorter and with an indistinct blunt angle. The pleura of the third to fifth somites end in a blunt

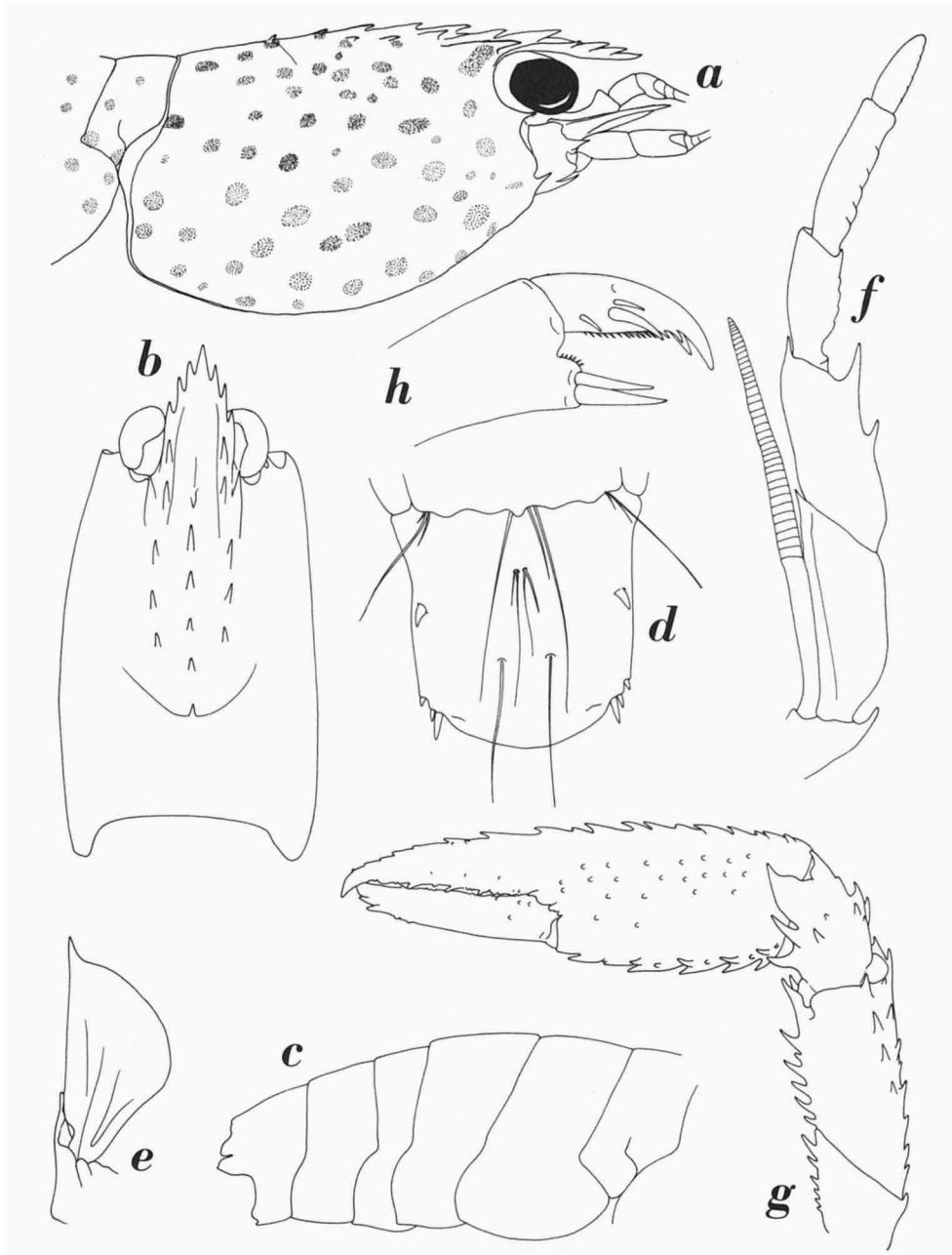


Fig. 1. *Enoplometopus debelius* new species, male holotype. a, anterior part of body in lateral view (showing colour pattern); b, carapace and eyes in dorsal view; c, abdomen in lateral view; d, telson, in dorsal view; e, scaphocerite; f, third maxilliped; g, first cheliped; h, chela of second pereiopod. a-c, g, $\times 3$; d-f, $\times 6$; h, $\times 12$.

posterolateral angle. The pleuron of the sixth somite has a short but distinct tooth placed near the top (in *E. occidentalis* this tooth is hardly visible or absent). The posterior margin of the sixth somite shows a deep incision at a short distance from the lateral margin, so that a posterolateral truncated lobe is formed; the sides of this lobe are parallel, its angles rounded. The rest of the margin is sinuate with a small median lobe.

The telson is trapezoid and about as long as wide. The posterior margin is rounded. The upper surface of the telson carries a single mobile spine near the middle of either lateral margin. There are three short spines at either posterolateral angle, the inner of these spines is longer than the outer two. The

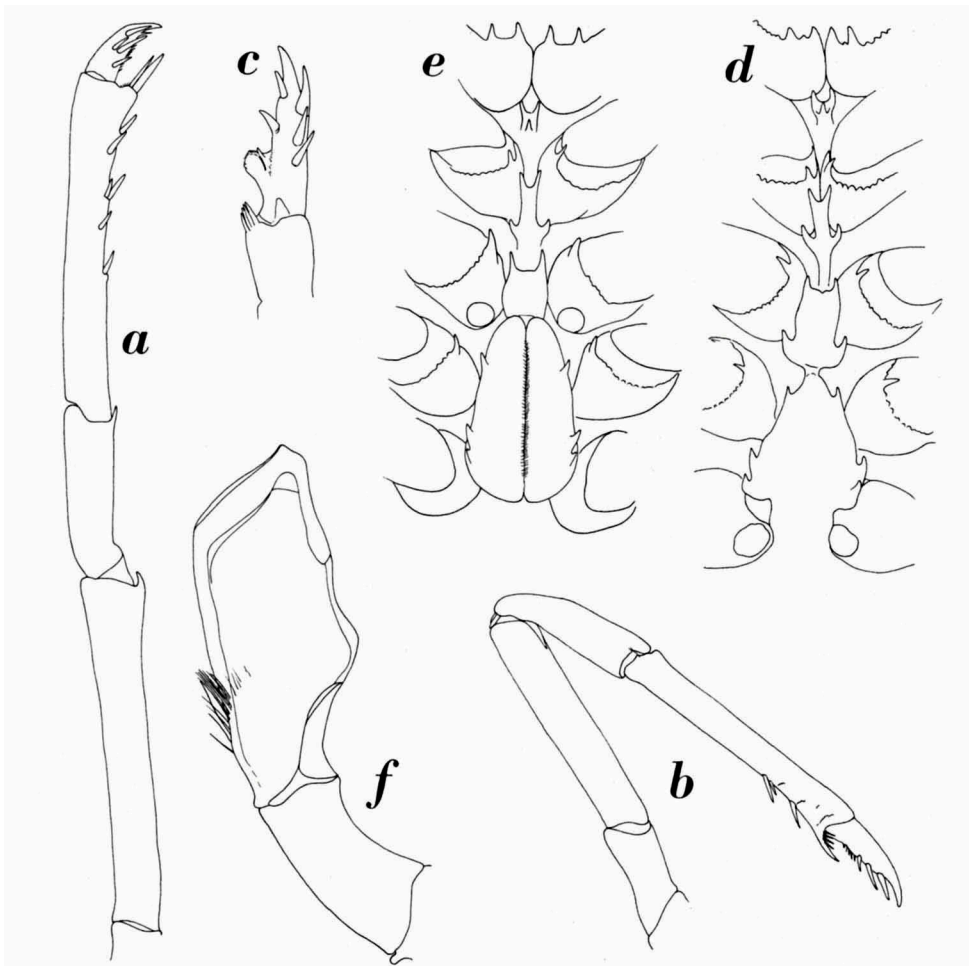


Fig. 2. *Enoplometopus debelius* new species. a, b, d, f, holotype male; c, e, paratype female. a, third pereiopod; b, fifth pereiopod; c, dactylus and part of propodus of fifth pereiopod of female; d, thoracic sternum, male; e, thoracic sternum, female; f, first pleopod, male. a, b, d, e, $\times 6$; c, f, $\times 12$.

upper surface of the telson shows 7 very short transverse setiferous grooves: one median at the end of the basal third, two submedian at 2/3 of the length of the telson, and 4 very short ones just before the posterior margin.

The eyes are well developed, globular, with the black cornea longer but slightly narrower than the stalk.

The three segments of the antennular peduncle become progressively shorter distally. The third shows a sharp spine near the base of the outer (wider) of the two flagella.

The scaphocerite reaches distinctly farther forwards than the antennular peduncle. It is triangular with the inner margin distinctly convex, being wider in the anterior half than that of *E. occidentalis*, which is more narrowly triangular. The antennal peduncle reaches slightly beyond the scaphocerite. A strong outer spine is present on the basis near the implantation of the scaphocerite. The coxa likewise bears a very strong ventral spine.

The dactylus of the third maxilliped is half as long as the propodus. The carpus bears a very small single anteroventral tooth; this tooth, which is much smaller than that in *E. occidentalis* is easily overlooked. The merus has the upper margin ending in a distinct sharp anterodorsal spine; the lower margin ends in a strong anteroventral spine, while a second slightly smaller spine is placed somewhat before the middle of the ventral margin. A distinct ridge extends along the dorsal margin of the ischium which ends in a single spine; the outer lower margin is unarmed, but the inner lower margin ends in a curved strong spine followed by a row of spinules.

The first chelipeds, left and right, are of practically the same size and shape. They reach with the chelae beyond the scaphocerite. In the larger chela the fingers are about 2/3 as long as the palm (measured dorsally). In the small chela the fingers are 7/8 of the length of the palm. The chelae are about three times as long as wide. The dactylus of the large chela has two subdistal dorsal spines followed by a single row of about 6 tubercles, which are placed closest together distally and occupy slightly more than the distal half of the upper margin. In the smaller chela the upper margin of the dactylus has only two small tubercles immediately behind the subdistal spines, the rest of the margin is smooth. The inner and outer surfaces of the dactylus may have 1 to 3 blunt spinules in the extreme basal part and 1 to 4 just above the cutting edge; otherwise the surface is smooth. The cutting edges of both fingers carry 3 or 4 larger teeth in between which there are 3 to 8 smaller ones. The anterior margin of the palm, near the base of the dactylus, has two blunt spines both on the inner and on the outer surface. The upper margin of the palm bears a row of 5 spines, the anterior of which is single, the other four double, so that actually there are 9 spines. Some much smaller additional spinules or tubercles are present there. The lower margin of the palm and the fixed finger bears a row of distinct spines; the distal spines of this row are double. Among the spines several granules are placed, while a longitudinal row of granules is present on the inner surface of the palm just above the spines of the ventral margin. On the upper surface of the palm there

are scattered granules; there is a median row of granules, which are often slightly larger than the others, and the distal granule of which is double. In the living animal these granules are quite conspicuous as they are of a darker colour than the rest of the palm. The lower surface of the palm has similar, but fewer granules. The upper surface of the carpus bears several spines: (a) 3 or 4 on the anterior margin, the inner 2 of which are large and flattened, the outer 1 or 2 are smaller and more cylindrical; 2 or 3 granules usually are placed among these teeth, (b) a large slender spine on the inner margin, and (c) 3 spines and 3 to 5 granules on the upper surface itself. The lower surface of the carpus shows a strong curved spine on the inner margin; the anterior margin bears two strong spines in the inner part and 1 or 2 smaller spines and a granule in the outer, the surface itself is smooth. The upper margin of the merus bears 2 diverging rows of 4 strong spines each, behind which there is a row of 3 single spines. Two strong spines are placed on the inner anterior margin near the articulation between merus and carpus. The lower surface shows 2 diverging rows of about 6 strong spines each; here too the anterior margin bears two strong spines near the articulation point. Apart from a few granules near the lower outer margin, the lateral surfaces of the merus are smooth. The ischium shows a single anterodorsal spine, a ventral row of 6 spines increasing in length distally and a single spine plus a few granules or spinules on the outer surface near the distal end of the ventral row of spines.

The second pereopod reaches with slightly less than half the propodus beyond the scaphocerite. The dactylus is distinctly longer than the fixed finger and measures $1/3$ of the length of the palm. It ends in two horn-coloured spines, the outer of which is the longer and is followed by about 17 small comb-like arranged spinules, which extend over the cutting edge. The outer surface of the dactylus carries 1 strong and 2 small spines in the proximal half; the inner surface carries only the single distal spine. The fixed finger is very short and stubby and ends in 2 strong spines placed side by side; it has no other spines, but a row of minute spinules, about 6 in number, is placed on the cutting edge behind the large spines. The propodus is slender, twice as long as the carpus, and apart from those of the fixed finger, bears no spines at all. The carpus carries a very strong anteroventral spine. The merus is as long as or slightly longer than the propodus and shows a strong anteroventral spine. The ischium is short and unarmed.

The third pereopod reaches with less than $1/3$ of the chela beyond the scaphocerite. The outer surface of the dactylus is provided with 4 spines: 2 very strong and two smaller. The cutting edge, behind the distal spine bears a row of small comb-like arranged spinules. The inner surface of the dactylus has two spines, one near the tip and one more proximally. The fixed finger is very short and blunt and bears two very strong spines which reach about $2/3$ of the length of the dactylus; behind these two strong spines the cutting edge bears a row of about 4 minute spinules. The propodus is about 3 times as long as the dactylus and is about 5 times as long as wide. The posterior margin of the propodus bears 5 to 7 spines (some in pairs) in the distal $2/3$ of its length. The carpus is about half as long as the propodus and carries an anteroventral spine. The merus is

about as long as or slightly longer than the propodus and likewise possesses an anteroventral spine on the outer surface, the anteroventral angle of the inner surface is rounded. The anterior margin of the coxa shows an inner spine and some granules.

The fourth pereopod reaches the middle of the scaphocerite. It resembles the third leg in many respects. However, the distal spine on the inner surface of the dactylus is placed so close to the cutting edge that it almost is in one line with the tip of the dactylus and the row of comb-like arranged spinules. Apart from this large spine the inner surface of the dactylus bears one or two more in the proximal part.

The fifth leg is shorter than the others and does not reach the anterior margin of the carapace. The dactylus of the male is slightly more than 1/3 of the length of the propodus and bears on the cutting edge 3 large spines and a comb of about 6 very small spinules. No spines are present on the outer surface of the dactylus, but the inner surface carries 4 large spines. The anteroventral angle of the propodus is hardly produced and carries 4 or 5 strong spines. The ventral margin shows 3 transverse rows of very densely placed setae in the extreme distal part, and 3 spines, the anterior 2 of which are paired. The carpus is somewhat more than half as long as the propodus and the merus is slightly shorter than the propodus. Neither carpus nor merus shows an anteroventral spine. Nor is there a spine on the coxa. The fifth leg of the female differs from that of the male in that the dactylus shows a spoon-shaped process, which, with a group of about 4 closely placed spinules on the anteroventral margin of the propodus, forms a kind of pincer-like organ reminiscent of the pincers at the fifth legs in the female of numerous *Palinuridea*. The process on the dactylus is short, stubby with a rounded distal margin carrying a distal rim of numerous granules; by a movement of the dactylus it can be opposed to the group of blunt spines of the propodus.

Behind the bases of the first pereopod there is a narrow median sternal process that ends in three spines arranged in a triangle, pointing down and slightly forward. The sternal plate behind the second pereopods is slender and ends anteriorly into two spines, the basal half of the plate is wider and has a strong spine at either side. In the males the sternal plate behind the third pereopods is much wider than that behind the second, but it has the same arrangement of spines. In the females the anterior part of this plate is the same as in the males, but the posterior part is covered by the receptaculum seminis. In the male the sternal plate behind the fourth legs is still wider than the foregoing, and it has the anterior margin produced forward between and beyond the anterior two spines; the wider posterior half of the plate has two spines on either lateral margin. At the base of the fifth male leg there is a small and low vertical truncated plate, which ends in a small anteroventral tooth. In the female the receptaculum seminis occupies the thoracic sternum from the female openings on the third legs to the bases of the fifth. It has a blunt anterior end, while the posterior end is much wider, but also blunt. The anterior half of the receptaculum bears a lateral

spine at each side; the posterior half has two spines on each lateral margin, the posterior spine, being the smaller, is sometimes indistinct.

The first pleopod of the male is similar to that of *E. occidentalis*, but has the apex truncated rather than prolonged in a narrow point (cf. Gordon, 1968: 93, fig. 11A). The endopod of the second pleopod bears two appendages of about equal length, both of which end in slender spines; the inner appendage is narrow and of about the same width throughout, the outer is slightly shorter and widened in the distal half.

The protopodite of the uropod ends dorsally into 2 lobes, each with a sharp spine-like apex. The uropodal endopod is shorter than the telson and bears a distinct posterolateral spine. The exopod is slightly longer; it has a distinct diaeresis, which forms a movable connection between the anterior and posterior parts. The diaeresis has a strong outer fixed spine followed by a stronger movable one; over the rest of the diaeresis there are about 17 immovable spines, the one in the middle being largest.

Colour. — The body is whitish or very pale purple, being darker dorsally than laterally. On this back ground there are numerous regularly distributed large and sharply defined rounded spots of a purplish red or dark purple colour, giving the animal a definitely polka-dotted appearance. This pattern is most characteristic for the species. The spots occur all over the carapace and abdomen and are placed somewhat closer together on the abdomen. The spines on the carapace are dark red or dark purple with a white tip. The short hairs on the body are dark red or dark purple in colour, the long hairs are of two kinds: some are uniformly dark red and slender, they are found on the rostrum, the tail fan and the appendages. The second type has the basal part white and the distal part dark red, usually iridescent; this type is less frequent and found only on the dorsal surface of the animal, viz., on the carapace and abdomen (often arranged in transverse rows on each somite), on the tail fan and on the large chelipeds.

The antennulae and antennae, including the flagella, are uniformly orange brown; only the outer margin of the scaphocerite and that of the antennal peduncle are somewhat darker than the rest.

The third maxilliped is orange brown with pale bands near the articulations.

The large chelipeds have the palm (both the dorsal and the ventral surfaces) of a uniform purple colour, only the granules are of a darker purple. The fingers are orange-pink with about 4 darker purplish bands. The spines of the cheliped are red or purple with a white top. The carpus is of the same purple colour as the chela. The merus is paler and shows some purple spots like those of the carapace but much paler and less distinct. The following pereopods have the dactylus, propodus, carpus and merus uniformly orange-brown, the basal segments are spotted with white.

The lower surface of the body (the thoracic as well as the abdominal sternites) plus the bases of the pereopods show spots like those of the dorsal surface of the body. The second to fifth pleopods have the protopod pale, with a broad longitudinal red stripe over the endo- and exopod. The first pleopod of the

female is uncoloured except for a red spot at the end of the protopodite. The tail fan is spotted like the rest of the abdomen. There is a large dark purple spot on the exopodite behind the diaeresis.

Remarks. — Morphologically the present new species strongly resembles *E. occidentalis*, but differs in the shorter and blunter rostrum, the wider and more semicircular scaphocerite, the much smaller spine on the carpus of the third maxilliped, the spines on the ventral margin of the merus of the third maxilliped which are placed wider apart, and the presence of posterior spines on the propodus of the third pereopod. But the most striking character of the species, which distinguishes it from all other known species of the genus, is its purple-spotted colour pattern.

Kubo (1952: 97, text fig. 3, pl. 6) gave a description and illustrations of an *Enoplometopus* from Taiji, Wakayama Prefecture, Japan, under the name *Enoplometopus occidentalis* (Randall). The colour pattern of the animal as described by Kubo and clearly shown in his pl. 6, however, is quite distinct from that of Randall's species and much more resembles that of *E. debelius*. A difference is that Kubo stated the colour of the spots to be "rather deep chrome orange colour", and not purple. The third maxilliped as shown by Kubo is very much like that of the present new species. Kubo stated that the carpus does not bear any spine, but the small spine present in *E. debelius* is easily overlooked, while that of *E. occidentalis* is distinct. Kubo's figure of the first male pleopod also shows the top blunt, as in the new species.

It is a pleasure to name this beautiful and characteristic new species for Mr. Helmut Debelius, who first drew my attention to the animal and provided material and coloured slides of it, in this way enabling me to give an extensive morphological as well as a colour description of the species. Mr. Debelius was also instrumental in starting me on the present study.

Distribution. — Evidently the species has a wide range: Indonesia to Hawaii and perhaps Japan.

***Enoplometopus (Enoplometopus) daumi* new species**

(figs. 3, 4a; pls. 3, 4)

Enoplometopus pictus - Daum, 1982: 267, 268, 2 figs. (not *E. pictus* A. Milne Edwards, 1862).

Material examined: S.E. coast of Naira, Banda Archipelago, Moluccas, Indonesia, 4°20'30"S 129°54'20"E; depth 10-30 feet (= 0.3-1 m), collected with rotenone; 8 March 1974; leg. V. C. Springer, no. 74-9. — 1♂ holotype (U.S. National Museum, Washington D.C.).

Description. — Size: the carapace length of the holotype is 25.6 mm.

The rostrum almost reaches the end of the blade of the scaphocerite, but distinctly fails to attain the end of the antennular peduncle. It is somewhat wider than in *E. occidentalis*, but has the same armament of three lateral teeth on either side. Like in *E. debelius* there are 1 supra-ocular, 2 intermediate, 3 lateral, 1 postcervical and 4 median spines on the carapace. The postcervical spine is very

small, and instead of the fifth (= anterior) median spine there is a slight median elevation with two long setae. The rest of the carapace is as in *E. occidentalis*.

Also the abdomen is much like that of *E. occidentalis*.

The propodus of the third maxilliped is almost twice as long as the dactylus. The carpus has no spine. The spines of merus and ischium are as in *E. occidentalis*.

In both first chelipeds the fingers are distinctly longer than the palm. The chela is 4 times as long as wide. The dactylus has a spinulation similar to that found in *E. occidentalis*. The lower margin of the palm and the fixed finger has a single row of well developed spines, intermingled with a few tubercles. The upper margin of the palm has a row of 5 pairs of strong spines. The palm shows on either surface a single or double median row of tubercles and some scattered tubercles. The spinulation of the cheliped is similar to that in *E. occidentalis*.

The dactylus of the second pereopod bears a few (about 3) spines on the outer surface and none on the inner. The third pereopod reaches slightly less far forward than the second. The dactylus is similar to that of *E. occidentalis* but the spines on the outer surface are much longer, the longest reaching almost to the apex of the dactylus; the inner surface bears two spines. The posterior margin of the propodus carries two distinct spines in the distal part; the propodus itself is about 6.5 times as long as wide.

The fourth pereopod reaches to the end of the scaphocerite and attains the middle of the propodus of the second pereopod. The dactylus ends in 2 claws behind which there is a row of minute spinules; two slender spines are placed on the inner surface and about 5 on the outer. The fixed finger ends in two strong spines with a third near their base. The propodus has 5 spines distributed over the posterior margin, the distal of these is double. The propodus is 7 times as long as wide.

The dactylus of the fifth leg ends in two teeth, the inner surface shows a single spine and a spoon-shaped process, which with a small process of the propodus (at the place of the fixed finger) which bears a few blunt spines, forms a kind of primitive chela. The outer surface of the dactylus has 5 spines.

The sternite of the first pereopod has the central process ending in two small submedian spines followed by a very small median spinule. The sternite of the second pereopod resembles that of *E. occidentalis*. The receptaculum seminis is similar to that of *E. occidentalis* having on each side an anterolateral ridge with one and a posterolateral ridge with two low blunt teeth.

No male specimen has been examined.

Colour. — The ground colour of the body is very pale brownish or purplish, almost whitish, darker dorsally than ventrally. On this background there is a colour pattern of brown and purple. The purplish colour is most distinct on the first chelipeds, the rostrum and the dorsal part of the carapace. The lower half of the carapace and the abdomen give a more brown impression. The lateral surface of the carapace shows a distinct pattern of vertical brownish or reddish brown bands, which are continuous in the extreme lateral part, but interrupted in the

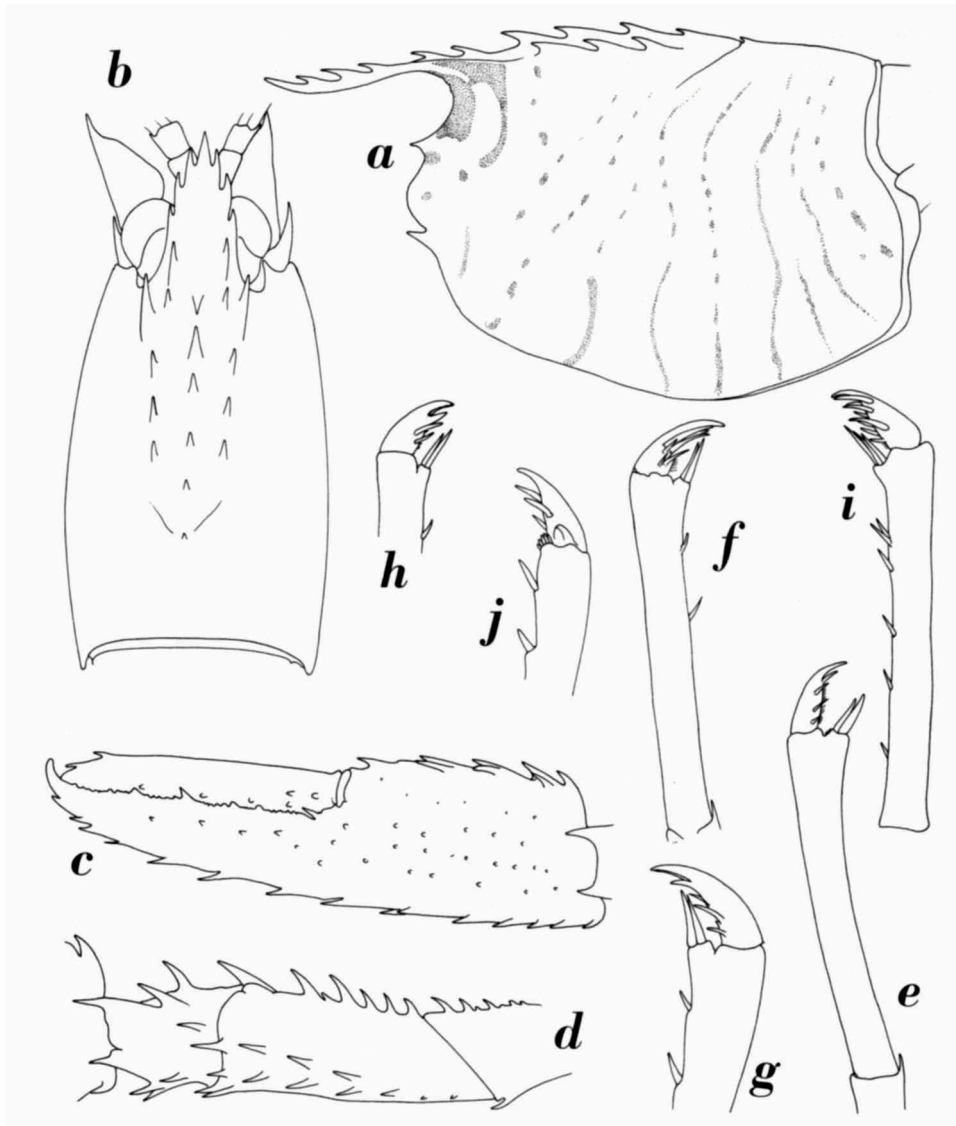


Fig. 3. *Enoplometopus daumi* new species. female holotype. a, carapace in lateral view, showing colour pattern; b, carapace in dorsal view; c, chela of first cheliped; d, carpus, merus, and ischium of first cheliped; e, propodus and dactylus of second leg, outside; f, propodus and dactylus of third leg, outside; g, propodus and dactylus of third leg, inside; h, propodus and dactylus of fourth leg, outside; i, propodus and dactylus of fourth leg, inside; j, propodus and dactylus of fifth leg, outside. a-d, $\times 3$; e-g, $\times 9$; h-j, $\times 10$.

rest of their length. A large dark purple spot is present immediately behind the orbit, and a similar one on the supra-ocular spine; the latter continues down in an interrupted band. The other interrupted bands, about 9 in number, are most distinct laterally (ventrally). The rostrum is dark purple with the distal part of the spines bright white. On the abdomen there are several eyespots consisting of a white central spot surrounded by a brown or reddish brown ring. The first somite shows three large eyespots dorsally: one in the middle and 2 lateral. The pleura of the following somites have an irregular pattern of eyespots and reddish brown dots and lines. Before the posterior margin of the tergites of the second to fifth abdominal somites there are 4 smaller eyespots: 2 submedian and 2 lateral. A small median eyespot is present in the anterior half of the second somite. The sixth somite shows some irregularly arranged eyespots over the entire dorsal surface. The antennulae and antennae are uniformly brownish, only the flagella of the antennulae show a paler colour in the distal part. The third maxilliped is pale with orange-brown bands near the articulations. The large chelipeds are purple, the chela is quite pale purple with the spines and spinules strikingly darker; the tips of the spines are white. The surface of the palm is of a uniform pale purple (except for the darker spinules), the fingers, however, show about 3 reddish brown bands. The carpus and the distal part of the merus are dark purple, the spines being dark reddish purple with white tips. The following pereopods are pale brownish with white spots on ischium and basis. The pleopods have longitudinal white and brown streaks and brown setae. The uropods are marbled with darker and paler brown; behind the diaeresis of the exopod there is a striking large purplish blue spot.

This colour description is based on colour slides placed at my disposal by Mr. H. Debelius. Some of Mr. Debelius's colour photographs have been published, under the name *E. pictus*, by Daum (1982: 267, 268).

Remarks. — The present species, like *E. debelius*, is very close to *E. occidentalis*, but differs in minor, but important details. Especially the colour of the three species, or rather their colour patterns, makes their distinction in the field quite easy. *E. daumi* and *E. debelius* do not seem to attain the length of *E. occidentalis*. Fully adult specimens of the former two species reach a carapace length of 21 to 24 mm, while of *E. occidentalis* I have examined specimens with the carapace length of 40 to 60 mm.

The present new species is named for Mr. Wolfgang Daum, who was the first to publish on it, providing excellent colour photographs and interesting information on the biology. Mr. Daum's (1982) paper made the importance of the colour as a distinguishing character in the genus *Enoplometopus* amply clear, and provided an impetus for the further study of the taxonomy of these animals.

As to the behaviour of the species, Daum (1982: 267, 268) described it as shy, tolerant towards other invertebrates, but aggressive towards rival specimens of its own species, so that it is impossible to keep more than a single pair in an aquarium. The animals hide in rock cavities, often with only the chelae sticking out.

Distribution. — Daum (1982) reported the species from Indonesia and the Philippines. The type locality is Naira Island, Banda Archipelago, Moluccas, Indonesia.

Enoplometopus (Enoplometopus) occidentalis (Randall, 1840)
(fig. 4b)

Nephrops occidentalis Randall, 1840: 139.

Enoplometopus occidentalis - Edmondson, 1933: 222; Edmondson, 1946: 257; Holthuis, 1946: 74, pl. 5 figs. a, c, f, i (here also older references); Barnard, 1947: 382; Barnard, 1950: 532, fig. 100; Matthews, 1954: 115, figs. 1-7; Tinker, 1965: 40, pl. 8; Gordon, 1968: 93, figs. 11, 12; Healy & Yaldwyn, 1970: 56, 58, pl. 26; Intès & Le Loeuff, 1970: 1442, 1445; Burukovsky, 1972: 185, 188 (as *E. occindensis* in key on p. 188); Burukovsky, 1974: 109; Michel, 1974: 255; DeLuca & DeLuca, 1976: 48, fig.; Smale, 1976: 20, fig.; Crosnier, 1977: 237; Johnson, 1979: 326, 327, fig.; Daum, 1982: 265-268, 2 figs.

not *Enoplometopus occidentalis* - Kubo, 1952: 97, text fig. 3, pl. 6; George & George, 1979: 78, pl. 70 fig. 5.

Material examined: S.E. of South Island, Amirante Islands, western Indian Ocean; depth 0-15 feet; 2 March 1964; leg. J. Böhlke, D. Dockins, R. Rosenblatt, W. Starck and J. Tyler, IIOE Sta. F-75. — 1 ♀ (U.S. National Museum, Washington, D.C.).

Amboina, Moluccas, Indonesia; 1863-1869; D. S. Hoedt. — 1 ♂ (Museum Leiden).

Honolulu fish market, Oahu, Hawaiian Islands; 1902; Albatross Expedition. — 1 ♂ (U.S. National Museum, Washington, D.C.).

Maui, Hawaiian Islands; leg. Dr. Winslow, don. J. S. Kingsley. — 3 ♀ (U.S. National Museum, Washington, D.C.).

Puako, Hawaii, Hawaiian Islands; 1982; leg. S. Johnson. — 1 sp. (Bishop Museum, Honolulu).

This seems to be the most common species of the genus in the Indo-West Pacific region. With *E. pictus* it is the largest species of the nominotypical subgenus.

Colour. — *Enoplometopus occidentalis* can at once be distinguished from the other species of the genus by its colour and colour pattern.

The entire animal is of a brilliantly red colour, which extends rather uniformly over the whole body. The spines are red, but most have a brilliantly white or pale tip. There are about 4 bright white spots on the lateral surface of the carapace; these are usually surrounded by a dark red ring. One of these spots is placed in the center of the lateral surface of the carapace, the second some distance below it; the other two are placed near the anterior margin: one behind the antennal spine, the other farther down. Some very small white spots, about 9 in number, are placed on the posterior margin of the carapace. Behind the postcervical spine there is usually a white spot, which may take the shape of a very short transverse white band. Some white or whitish spots may also be present in the median part of the rostrum.

A large white spot is present on the pleuron of the first somite, it is ocellate by the presence of a red ring around the white; a similar but somewhat smaller spot is found on the base of each of the pleura of the following somites. The pleura also have a white ocellate spot on the distal margin, and sometimes additional

smaller and less distinct spots, usually on the margins. The posterior margin of the tergum of the first abdominal somite has a median, and at either side 2 or 3 smaller white spots; all these spots are very similar to those on the posterior margin of the carapace and are much smaller than the spots on the pleura. The terga of the second to fifth abdominal somites show 4 white spots at or somewhat before the posterior margin: two are submedian, two are more lateral; the two submedian of the second somite sometimes are partly fused. Where these spots are placed some distance before the posterior margin, some very small pale spots may be visible on the margin itself. Spots maybe present on the telson.

The flagella of the antennula are red with the distal end somewhat paler; the antennal flagella are uniformly red. The antennular peduncle is red, sometimes with pale spots. The antennal peduncle, including the scaphocerite usually has some white or pale spots on a red background; the final tooth of the scaphocerite is white.

The third maxillipeds are with some white or pale bands. The large chelae are evenly red, with the tips of the spines white; some faint darker and lighter bands may be observed on the fingers. The carpus and merus of the large chelipeds have the same colour as the chela, but the merus may show some irregular pale spots or areas. The following pereopods are red with several narrow white bands.

The uropods are red; the spines have white tips; some irregular pale or white spots may be present.

Many (or all?) of the long hairs of the body have the distal part iridescent.

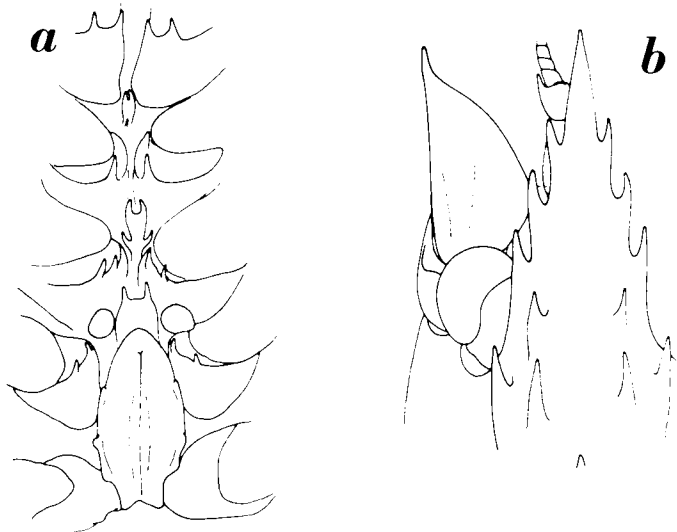


Fig. 4a. *Enoplometopus daumi* new species, female holotype, thoracic sternum. 4b. *Enoplometopus occidentalis* (Randall), male from Amboina, anterior part of body in dorsal view. a, $\times 5$; b, $\times 3$.

The above colour description is based mainly on the published coloured photographs of this species (Healy & Yaldwyn, 1970; Johnson, 1979; Daum, 1982), on published black and white photographs of living or fresh specimens (Rathbun, 1906; Tinker, 1965; Smale, 1976), on colour slides of a living specimen from Mombasa, Kenya (kindly placed at my disposal by Dr. Isabella Gordon) and such colour slides of specimens from the Hawaiian Islands (for which I have to thank Dr. J. C. Yaldwyn and Mr. S. W. Tinker). More or less extensive remarks on the colour of the species have been published by Rathbun (1906), Bouvier (1915), Barnard (1950), Tinker (1965), Gordon (1968), and Daum (1982).

Remarks. — As discussed above (p. 290), the specimen reported from Japan by Kubo (1952) under the name *E. occidentalis*, is not that species but more likely *E. debelius*.

George & George (1979) published a coloured picture of an *Enoplometopus* which they identified as *E. occidentalis*. The colour pattern of the animal, however, shows it to be *E. holthuisi* Gordon (q.v.).

The habitat of the present species was described by Edmondson (1933, 1946) as follows: "on the reefs and at depths of a few fathoms". Tinker (1965), however, characterized the species as rare "in shallow shore-line waters. It appears to live most commonly at depths of one hundred feet or more on the outer side of the reef". Healy & Yaldwyn (1970) also reported it from "the reef edge". Crosnier's (1977) specimens were obtained at a depth of 100 m. Daum (1982) described the animals as shy, hiding in cavities in the rocks in daytime, coming out at night; the species does attack and eat small fishes, but, when well fed, leaves other invertebrates in peace. Matthews (1954) extensively dealt with the spermatophoric mass of this species.

Vernacular names. — Several vernacular names have been published for the species, all of them are artificial: Western Lobster (Tinker, 1965), Reef Lobster (Healy & Yaldwyn, 1970), Hawaiian true Lobster (Johnson, 1979), Hawaiian Lobster (Daum, 1982).

Distribution. — The species has a wide range in the Indo-West Pacific region. It is known with certainty from the following localities: Natal, South Africa (Barnard, 1925, 1934, 1947, 1950; C. von Bonde & Marchand, 1935; ? Smale, 1976), Mombasa, Kenya (Gordon, 1968), Mauritius (Bouvier, 1910, 1914, 1915; Gordon, 1968; Michel, 1974), Amirante Archipelago (present paper), Amboina, Moluccas, Indonesia (Miers, 1880; De Man, 1888, 1924; Ortmann, 1894; Holthuis, 1946; Gordon, 1968; present paper), Sydney Harbour, Australia (Daum, 1982), Heron Island, Great Barrier Reef, Queensland, Australia (Healy & Yaldwyn, 1970), Hawaiian Islands (Kingsley, 1883; Rathbun, 1906; Edmondson, 1933; 1946; Matthews, 1954; Tinker, 1965; DeLuca & DeLuca, 1976; Johnson, 1979; Daum, 1982; present paper). The species has also been reported from Banda, Moluccas, Indonesia (Balss, 1933) and from Reunion and N. of Madagascar (26°05' S 44°50' E) (Crosnier, 1977); however, no morphological details have been provide of these specimens, so that

their identity is not quite certain. Daum (1982) reported that he had received material of this species from dealers in East Africa, Ceylon and the Philippines, indicating that the species in all probability is found in those areas. The type locality indication "from the west coast of North America" obviously is incorrect and should be corrected to Hawaiian Islands. The Hawaiian Islands, namely is the only part of the known range of the species visited by the collector of the type material, Thomas Nuttall. The type material has been discussed by Randall (1840), Gibbes (1850, 1852), Stimpson (1857), Ortmann (1897), Kingsley (1899), and Rathbun (1906).

***Enoplometopus (Hoplometopus) holthuisi* Gordon, 1968**

Enoplometopus antillensis - Holthuis, 1946: 79, pl. 5 figs. b, d, e, g, h, j, k, l, pl. 6 figs. a-c, pl. 7 figs. a, b (not *Enoplometopus antillensis* Lütken, 1865).

Enoplometopus holthuisi Gordon, 1968: 81, 90, figs. 2, 8-10; Intès & Le Loeuff, 1970: 1442, 1447; Burukovsky, 1972: 185, 188; Burukovsky, 1974: 109; Daum, 1982: 265-267, 2 figs.

Enoplometopus occidentalis - George & George, 1979: 78, pl. 70 fig. 5 (not *E. occidentalis* (Randall)).

Material examined: Enewetak Atoll, Marshall Islands; mooring buoy pinnacle, in ledge, 20 m deep; February 1982; S. Johnson. — fragments (Bishop Museum, Honolulu).

Puako, Hawaii, Hawaiian Islands; S. Johnson. — 2 specimens (Bishop Museum, Honolulu).

Colour. — The species is of a predominantly red or orange red colour. The lateral surface of the carapace shows a distinct pale circle in its central part; within the circle one or two small pale spots may be seen. The lateral surface of the carapace outside the circle often is provided with an irregular pattern of pale lines. Some (or all) of the abdominal somites bear a large median white spot on the dorsal surface and an ocellate white red-ringed spot at the base of the pleura. The antennae and antennulae are red with white spots on both the antennal and antennular peduncles. The third maxilliped is banded red and white. The large chelipeds are red with the spines white. The fingers are banded; the palm is red with lighter and darker bands, which may be inconspicuous. The following pereopods are banded red and white; the white bands being the narrower. This description is based on the published coloured figures of the species (by Daum, 1982, and George & George, 1979).

Remarks. — The species which until recently was only known from the type material, has now been reported from a rather large area and even is imported to Europe by the aquarium trade. Its habits are stated by Daum (1982) to be similar to those of *E. occidentalis*, but it is less shy and like the other species of the genus it can be kept in the aquarium without too many difficulties.

The specimen figured by George & George (1979) under the name *E. occidentalis*, judging by its colour pattern belongs to *E. holthuisi*.

Distribution. — The type locality is Banda Island, Moluccas, Indonesia. George & George (1979) reported their animal from "deeper parts of reefs in the Indo-Pacific". Daum (1982) received the species from the Philippines and stated that "inzwischen wurde sie auch schon um Hawaii fotografiert".

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Enoplometopus debelius new species, lateral view.



Enoplometopus debelius new species, frontal view.



Enoplometopus daumi new species, oblique lateral view.



Enoplometopus daumi new species, oblique frontal view.