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Investigational Report No.57

The Penaeoidea of southeast Africa.

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A.J. de Freitas

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THE PENAEOIDEA OF SOUTHEAST AFRICA: II. The Families *Aristeidae* and *Solenoceridae*

by
ANTÓNIO J. DE FREITAS

ABSTRACT

This is the second monograph of a series of five on the Penaeoidea of southeast Africa and deals with two families; the Aristeidae and Solenoceridae.

The Aristeidae are represented by four genera, with a total of six species, namely *Aristeus virilis*, *A. antennatus*, *Pseudaristeus sibogae*, *Aristaeomorpha foliacea*, *Plesiopenaeus edwardsianus* and *P. nitidus*.

The Solenoceridae are represented by five genera with a total of seven species, namely *Hymenopenaeus halli*, *Haliporus taprobanensis*, *Haliporoides triarthrus vnirio*, *Cryptopenaeus catherinae*, *Solenocera algoensis*, *S. africana* and *S. choprai*. Of these *H. triarthrus vnirio* is of considerable economic importance, being exploited from southern Mozambique and Natal. Limited knowledge of the biology of this species exists and is presented here.

INTRODUCTION

The decapod superfamily Penaeoidea is divided into five families all of which are represented in southeast African waters. For the purpose of this investigation the study area extended from the Rovuma River in the north to the Kei River in the south; a stretch of the east coast of Africa which forms the southern half of the Western Indian Ocean Zoogeographic Province (de Freitas 1980).

This monograph constitutes the second in a five part series on the penaeoids of southeast Africa and deals with two families, the Aristeidae and the Solenoceridae. The family Benthescymidae, closely related to the Aristeidae, has not been included in the study for it has received adequate attention in Kensley (1971) and Crosnier (1978).

Many well established penaeoids have not been conveniently described in the literature and, therefore, the objective of this study was to collect, identify and fully describe the penaeoids of southeast Africa. Of the thirteen species included in this volume, only one is of commercial importance and was, therefore, the object of a somewhat deeper investigation. This species was the solenocetid *Haliporoides triarthrus vnirio* commonly known as the knife, or Natal, pink prawn.

Most of the material was collected from trawls made by commercial prawn trawlers within the study area. Other material examined was kindly loaned by the South African Museum in Cape Town. All measurements given under Material Examined refer to carapace length (C.L.). This paper is part of a thesis presented to the University of the Witwatersrand for the degree of Doctor of Philosophy.

FAMILY ARISTEIDAE Wood-Mason 1891

This family was created by Wood-Mason in 1891 as a subfamily to accommodate several genera of deepsea species collected by the Royal Marine Survey Ship "Investigator". It is represented in southeast Africa by four genera, namely *Aristeus*, *Pseudaristeus*, *Aristaeomorpha* and *Plesiopenaeus*. A further three genera, *Hepomadus*, *Parahepomadus* and *Hemipenaeus*, have been recorded from Madagascar (Crosnier 1978) but so far have not been found within the study area.

The members of this family have no prosartema, or if present it is very reduced. Exopodites are found on maxillipeds II and III but are either absent or rudimentary on all pereopods. The lateral antennular flagella are very short and flattened laterally.

Genus *Aristeus* Duvernoy, 1840

Aristeus Duvernoy, 1840: 218; Bate, 1881: 187-188; Bate, 1888: 309-311; De Man, 1911: 27; Balss, 1925: 224; Ramadan, 1939: 36; Balss, 1959: 1517; Holthuis, 1962: 112; Crosnier, 1978: 60.

Aristaeus Wood-Mason, 1891b: 278; Alcock, 1901: 27-29; Burkenroad, 1936: 90, 94-95.

This genus was established by Duvernoy in 1840 to accommodate a deep water specimen previously named *Penaeus antennatus* by Risso. *Aristeus* is most closely related to *Hemipenaeus* but differs from the latter by having no podobranch on pereopod III.

The genus comprises of medium to large animals; rostrum with three dorsal teeth; no hepatic spine; last three abdominal segments carinated; no podobranch on pereopod III; epipodites on pereopods IV and V; cervical sulcus distinct only basally.

According to Ramadan (1938) and Pérez Farfante (pers. comm.) there are nine species to this genus excluding *A. japonicus* which is a synonym for *Aristaeomorpha foliacea*. Of these nine species *A. antillensis* is from the Caribbean, *A. occidentalis* is from the west coast of Central America, while the other seven species (*A. antennatus*, *A. virilis*, *A. semidentatus*, *A. alcocki*, *A. varidens*, *A. crosnieri* and *A. mabahissae*) are found in the Indo-Pacific. Only *A. virilis* and *A. antennatus* have been found in Mozambique and South African waters and the presence of these species off the southeast African coast constitutes new records and extends their geographical distribution southward.

Aristeus virilis (Bate, 1881) (Fig. II-1)

Hemipenaeus virilis Bate, 1881: 187; Bate, 1888: 303-304.

Aristeus tomentosus Bate, 1881: 189.

Hemipenaeus tomentosus Bate, 1888: 307-308.

Aristaeus virilis Wood-Mason, 1891b: 279-280; Alcock, 1901: 30-31; Kubo, 1949: 194-200.

Aristeus virilis De Man, 1911: 27-29; Ramadan, 1938: 39-40; Kensley, 1977: 21-22; Crosnier, 1978: 61-65; de Freitas, 1980: 60-66, Holthuis, 1980: 11; Crosnier, 1984: 21.

Aristeus semidentatus Balss, 1925: 224 (part, from Stat. 192 only)

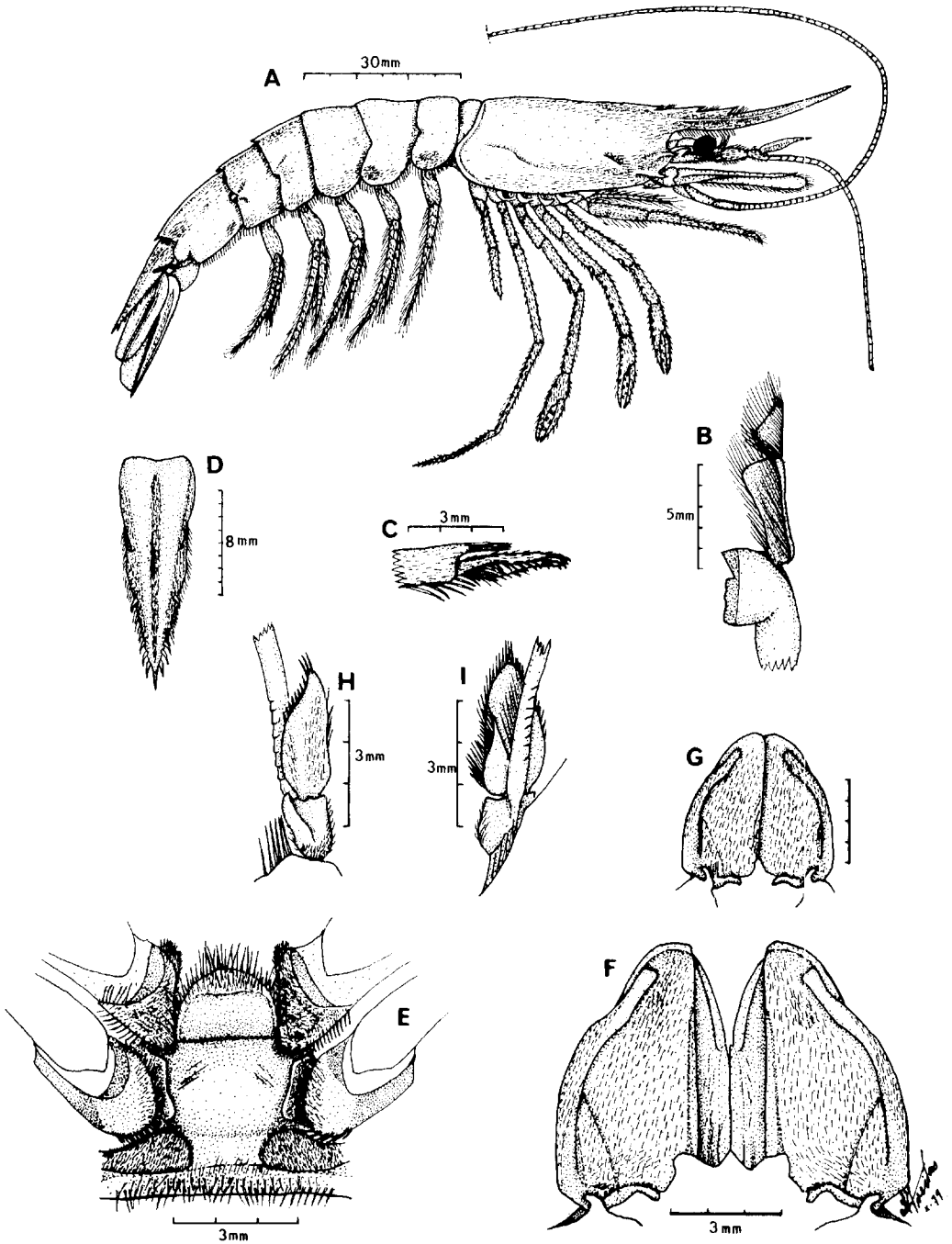


Fig. II-1: *Aristeus virilis* (Bate). A. Whole animal; B. Mandibular palp (left); C. Maxilliped III; D. Telson; E. Thelycum; F. Petasma (open); G. Petasma (closed); H. Appendix masculina (anterior view); I. Appendix masculina (posterior view showing Appendix interna).

Material examined

Mozambique: Bazaruto (300-350 m), 10 ♂♂, 29.5-37.3 mm; 20 ♀♀, 29.8-38.8 mm. Barra Falsa (200 m), 1 ♀, 46.2 mm; 1 ♂, 39.5 mm.

Description

Rostrum: Distinctly upward curved anteriorly in female, reaching beyond antennal scale; in male straight to slightly upward curved anteriorly, reaching to between distal end of antennular peduncle and distal end of antennal scale; rostral formula 3/0; one tooth behind orbital margin; adrostral carina short but well developed; postrostral carina not well defined, almost reaching posterior dorsal midpoint of carapace; no median sulcus.

Carapace: Irregularly pubescent; gastrofrontal sulcus and carina absent; no orbital spine; cervical sulcus indistinct except for basal part, just dorsal to well marked cervical carina; no gastro-orbital carina; orbito-antennal sulcus mere depression; antennal spine small; antennal carina ill defined; no hepatic spine; hepatic sulcus wide, starting just anterior to ventral end of cervical carina, all but continuous with anteroventral end of branchiocardiac sulcus which is distinct, oblique and bent at its midpoint; pterygostomian angle rounded.

Antennule: Lateral flagellum about twice length of third antennular article, inserted at about midpoint of article, laterally compressed; mesial flagellum of larger males twisted at base; no prosartema; stylocerite long and broad, terminating in sharp spine which almost reaches distal end of basal article; distolateral spine short but sharp; parapenaeid spine absent.

Scaphocerite: Distolateral spine almost reaching distal end of short antennular flagellum; apex at times thickened in males; basicerite free of spines.

Mandibular palp: Reaching to base of carpocerite; proximal article 2.8 times as long as wide; ventral surface slightly concave and setose; distal article subtriangular, attached to lateral edge of apex of proximal article 0.6 times length of proximal article; surface and margins of distal article covered with long setae.

Maxilliped III: Endopodite reaching beyond distal end of basal article by dactylus; exhibits sexual dimorphism, male propodite with prominent protruberance overlapping dactylus proximally and bears tuft of long setae; exopodite almost reaching distal end of merus of endopodite; epipodites and podobranchiae present.

Pereiopods: Exopodites absent from all pereiopods; epipodites present on first three pairs; podobranchiae found on first two; well developed movable spine at anterior end of merus of first three pereiopods. Luminous organs on carpopodites and propodites of first three legs and on distal three articles of last two; chela of each leg longer than corresponding merus. Pereiopod IV reaches beyond antennular peduncle by dactylus. Extended laterally lengths of pereiopods in ascending order are: first, second, third and fourth (fifth pereiopod missing in examined specimens).

Abdomen: Irregularly pubescent; segments four to six dorsally carinated, carina of each segment terminating in spine; sixth segment with two short indistinct cicatrices, more clearly seen on dry surface.

Telson: Telson longer than sixth abdominal segment, shorter than mesial ramus of uropods; dorsally somewhat flattened with shallow median sulcus; terminal spine sharp; four pairs of movable marginal spinules, distal three pairs being closer together than first is from second.

Thelycum: Simple open structure. Anterior portion consists of transverse plate arising from sternite between fourth pair of pereiopods; projects slightly anteroventrally, apex rounded; posterior surface smooth and slightly concave; anterior surface convex and covered in long setae. Posterior portion consists of two lateral plates each placed very close against the coxa of fifth pereiopods; lateral surface concave and median surface smooth and convex; ventral edge furnished with short setae; posteriorly lateral plates meet setose posterior sternal process; in centre sternite membranous and smooth; slightly convex with small tubercle.

Petasma: Simple and slightly folded structure. Dorsomedian lobules about half length of petasma, united along midline; occupy proximal half of petasma; glabrous on both dorsal and ventral surfaces. Ventromedian lobules narrow; slightly shorter than lateral lobes and pointed distally; ventral surface of each half glabrous but dorsal surface sparsely setose. Dorsolateral lobules subrectangular with medially directed pointed apex distally; lobules thin but more strongly sclerotized than median lobes; fairly densely setose on both surfaces. Ventrolateral lobules slightly thicker than dorsolateral lobules; subtriangular and best seen from dorsal view; proximal base thick and medially bends to form short blunt dorsolateral lobule as seen from ventral view; ventral costae narrow; slightly shorter than petasma as a whole; distally free with truncate apex directed medially, slightly overlapping dorsolateral lobule.

Appendix masculina: About twice as long as wide, apex narrow; distal and distolateral margins with short setae; no setae along distomedian margin; dorsal surface lightly setose. Appendix interna completely obscured by appendix masculina from dorsal view; subtriangular; about 0.75 times length of appendix masculina; fringed with long setae; apex fairly sharp. Basal segment of endopodite of pleopod II subquadrate; dorsal surface convex and lightly setose.

Spermatophore: Ventrally consists of two sclerotized concave, ear-shaped plates; wider anteriorly than posteriorly; margins wavy, both plates fitted closely together; not firmly anchored, being easily detached; dorsally spermatophore has irregular mass of somewhat hardened gelatinous matter.

Colour in life: The specimens examined are preserved and have lost their colour but, according to Alcock (1901), this species is said to be blood-red in colour.

Taxonomic status and comments

There is no doubt that the specimens from southeast African waters belong to this species. The recognition by Ramadan (1938) of the importance of the movable spine on the merus of the first three pereopods facilitates the distinction of this species from others of the same genus.

From the male specimens examined it seems that the thickening of the scaphocerite apex is not a constant feature and is probably related to reproduction. The twist found at the base of the mesial antennular flagella also does not appear in all individuals, being more conspicuous in the larger specimens.

The rostrum of the females and young males extends some way in front of the last tooth and is upwardly curved. In the larger males the rostrum is very short and straight, ending a little in front of the last tooth. This agrees with the description given by Wood-Mason (1891b).

In all other characteristics the specimens agree very closely with the descriptions given by other authors.

Distribution (Fig. II-12)

Aristeus virilis is essentially an Indo-west Pacific species found widely among the East Indies. On the western region of the Indian Ocean this species has only been recorded from Zanzibar, off central Mozambique and Natal. More specifically, however, *A. virilis* has been recorded from the New Hebrides, Philippines (Bate); Indonesia — Ceram Sea, Kei Island, Halmanhra Sea, off Saleyer, Flores Sea, Straits of Makasar, Bali Sea, off Kepulauan Batu (De Man, Balss, Crosnier); Japan — Owashi (Kubo); Andaman Sea (Alcock); Zanzibar (Ramadan); Mozambique — Bazaruto, Barra Falsa (de Freitas); South Africa — Natal (Kensley).

The finding of *A. virilis* off Barra Falsa in Mozambique and off Natal in South Africa extends the geographic distribution of this species south along the east African coast from its previous African location off Zanzibar.

No information has been found regarding the distribution of larval and juvenile forms nor of the nursery areas. The adults of this species have been trawled from 188 to 900 metres and most occur between 450 m and 700 m (Crosnier, 1984). In southern Mozambique and off Natal *A. virilis* was caught at depths of 200-350 metres, on a muddy sand substratum.

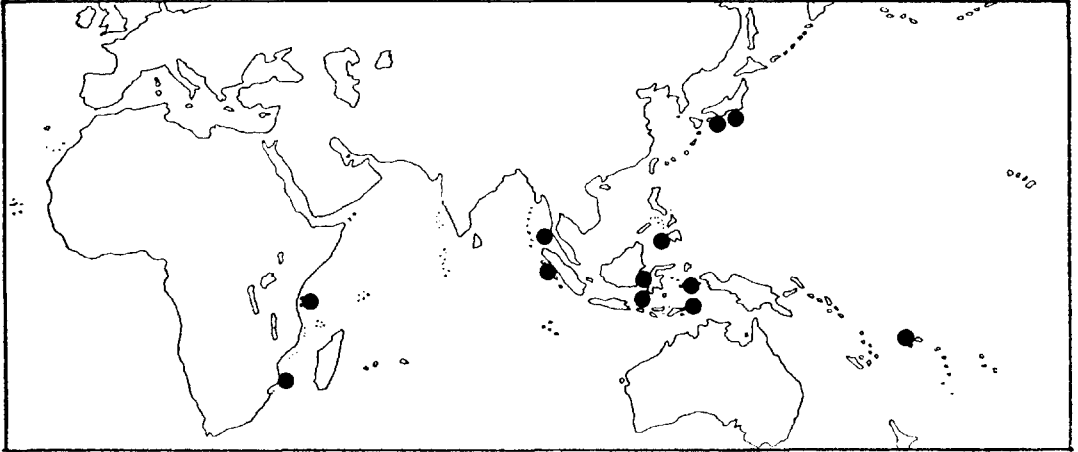


Fig II-2: Distribution of *Aristeus virilis*

***Aristeus antennatus* (Risso 1816)**
(Fig. II-3)

Penaeus antennatus Risso, 1816: 96.

Aristeus antennatus Bouvier, 1908: 71-75; Ramadan, 1938: 45-47; Orsi & Relini, 1971: 40-62; Crosnier, 1978: 71-74; de Frietas, 1980: 66-72; Holthuis, 1980: 10.

Material examined

Mozambique: Bazaruto (540 ml), 12♀♀, 44.3-58.6 mm; 1♂, 33.9 mm.

South Africa: Natal (560-900 ml), 53♀♀, 14.0-66.7 mm; 10♂♂, 20.5-38.0 mm.

Description

Rostrum: Distinctly upward curved distally in female; reaching well beyond antennal scale; in male straight and reaching to about end of first antennular segment; rostral formula 3/0; one tooth behind orbital margin; adrostral sulcus and carina short but well developed; postrostral carina fairly distinct terminating slightly before small tubercle found on midline just anterior to posterior margin of carapace; no median sulcus.

Carapace: Galbrous and generally highly polished in appearance; gastrofrontal, postocular and horizontal sulci absent; no orbital spine; cervical sulcus indistinct except for basal part, just dorsal to well marked cervical carina; hepatic spine absent; no gastro-orbital carina; orbito-antennal sulcus mere depression; antennal carina not well defined; antennal spine prominent but small; hepatic sulcus deep and horizontal; branchiocardiac sulcus distinct, sigmoid and continuous with hepatic sulcus; branchiostegal spine prominent with distinct buttress on same level as hepatic sulcus; pterygostomial angle straight bearing no spine.

Antennule: Lateral flagellum as long as second antennular article; inserted at about

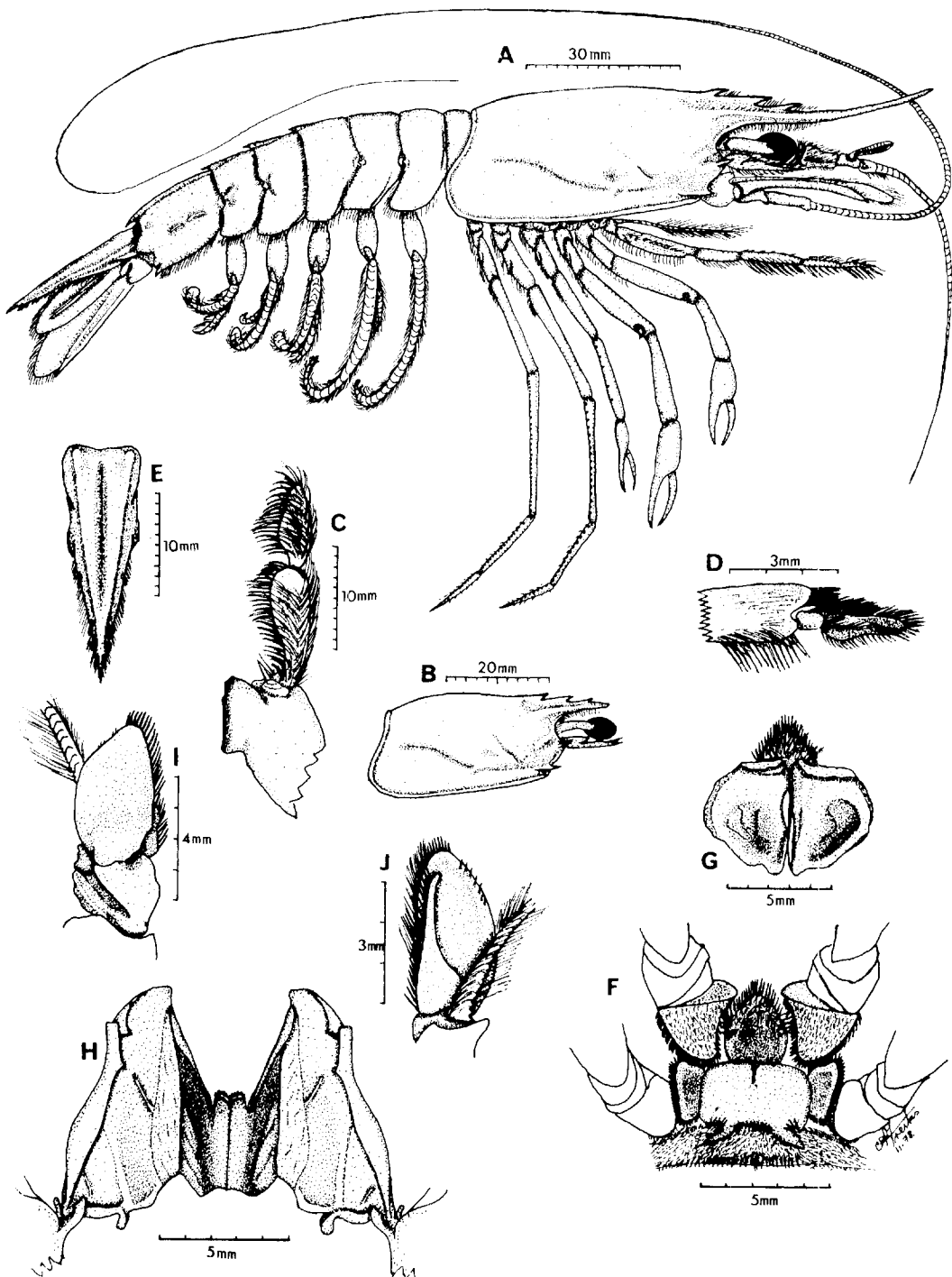


Fig. II-3 *Aristeus antennatus* Risso: A. Whole animal; B. Male carapace; C. Mandibular palp; D. Maxilliped III; E. Telson; F. Thelycum; G. Thelycum with spermatophore; H. Petasma; I. Appendix masculina (anterior view); H. Appendix masculina (posterior view showing Appendix interna).

midpoint of third article; laterally compressed; mesial flagellum of males strongly double bent at base; foliaceous prosartema absent, reduced to hairy tubercle; stylocerite long and broad; terminates in sharp spine extending beyond distal end of basal segment; distolateral spine short but sharp; no parapenaoid spine.

Scaphocerite: Distolateral spine reaching to or beyond distal end of short flagellum; basicerite free of spines.

Mandibular palp: Reaching to base of carpocerite; proximal article 2.6 times as long as wide; ventral surface slightly concave and setose; distal article subtriangular; about 0.7 times length of proximal article; attached to lateral edge of proximal article; surface and margins covered with long setae.

Maxilliped III: Endopodite of both sexes reaching distal end of third antennular article; exhibit sexual dimorphism; male propodite with small protruberance bearing tuft of short setae, slightly overlapping dactylus proximally; dactylus of male shorter and stouter than that of female; exopodite reaching two thirds along merus of endopodite; epipodites and podobranchiae present.

Pereiopods: Exopodites absent from all pereiopods; epipodites present on first three pairs; podobranchiae present on first two pairs; well developed movable spine at anterior end of merus of first two pereiopods. Photophores found on carpopodite and propodite of first three pairs and on distal three articles of pereiopods IV and V; carpus of fifth pereiopod with more than 50 photophores. Chela of each leg equal to or just longer than corresponding merus; chela of second and third legs equal in length; chela of first leg much longer than carpus. Pereiopod IV reaching to beyond antennular peduncle by dactylus and about 0.7 of propodite; pereiopod V reaching to beyond antennular peduncle by dactylus and half propodite; extended laterally lengths of pereiopods in ascending order are: first, second, third and fourth and fifth.

Abdomen: Glabrous and generally highly polished; segments three to six dorsally carinated; carina of each segment terminating in spine; sixth segment with two short cicatrices more distinct on dry surface.

Telson: Telson longer than sixth abdominal segment; shorter than mesial ramus of uropods; dorsally somewhat flattened, more so on distal half; median sulcus shallow occupying little more than proximal half; terminal spine sharp; four pairs of movable marginal spinules; distal three pairs being closer together than first is from second.

Thelycum: Simple and open structure. Anterior portion consists of transverse subtriangular plate arising from sternite between fourth pereiopods; this plate projects slightly anteroventrally; apex narrow but rounded; posterior surface flat and covered with setae; anterior surface convex and sparsely setose; associated with this plate is subtriangular setose pad on each coxa of fourth pereiopods. Posterior portion consists of two small lateral plates placed close to coxae of fifth pereiopods; both surfaces of lateral plates flat; lateral surface setose while mesial surface glabrous; coxae of fifth pereiopods each have smaller setose pad; posterior sternal process setose; sternite membranous and smooth in centre.

Petasma: Simple and slightly folded structure. Dorsomedian lobule about two fifths length of petasma; united along midline; occupies proximal part of petasma; subrectangular. Ventromedian lobule normally folded under dorsolateral lobule; slightly shorter than dorsolateral lobule; apex pointed with broad inwardly facing border. Dorsolateral lobules subrectangular; distal pointed apex medially directed; thin but more strongly sclerotized than median lobules; occupies most of ventral aspect of petasma. Ventrolateral lobules thicker than dorsolateral lobules; subtriangular; proximal base thick and medially forms short club-like process; ventral costae about as long as ventromedian lobule; distally free with truncate apex; about two thirds along its length there is a small inwardly directed process; whole petasma glabrous.

Appendix masculina: Deltoid in shape; apex rounded. About 1.5 times as long as wide; dorsal surface slightly concave and glabrous; mesial margin with row of short setae. Appendix

interna completely obscured by appendix masculina from dorsal view; subtriangular; roughly 0.75 times as long as appendix masculina; apex long and sharp; mesial margin fringed with long setae. Basal segment of endopodite of pleopod II subquadrate; less than half length of appendix masculina; dorsal surface convex; deep furrow runs length of outer margin.

Spermatophore: Ventrally consists of two sclerotized convoluted plates; both plates fitting closely together; not very firmly anchored being easily detached; dorsally there is hardened jelly-like mass; seems to be held in position by coxal pads of pereopods IV and V.

Colour in life: Generally light to bright pink; rostrum may be uniform pink or light pink at base darkening distally; pink colour more intense on lower margins of carapace and on overlapping parts of abdominal segments; mature females have a mauve hue to carapace due to colour of ripe ovaries seen by transparency; antennules and flagella pink to red; antennal flagella red to pink; scaphocerite and uropods bright pink to red distally; pereopods light to bright pink; photophores on ventral edge of dactyls, propodites, carpopodites and meropodites are deep red in colour; pleopods uniformly pink; marginal setae of uropods, pleura, pleopods and scaphocerite cream in colour; buccal area intensely red.

Taxonomic status and comments

Aristeus antennatus is easily distinguished from *A. virilis* by having a movable spine on the merus of the first two pereopods only whereas the latter species possesses the spine on the first three. However, the other three Indian Ocean species, viz- *A. alcocki*, *A. mabahissae* and *A. semidentatus* also have the movable spine on the merus of the first two pereopods only. These three also have a glabrous integument as has *A. antennatus*.

According to Ramadan (1938) the pleurobranches of pereopods I-IV (segments X-XIII) of *A. alcocki* are "... very minute papillae ... possessing no pinnules at all". In the southeast African specimens these pleurobranches, although small, are certainly plumose and not "mere papillae", therefore, they cannot be identified as *A. alcocki*.

Concerning *A. mabahissae* Ramadan (1938) states that the "... propodus of the external maxilliped is not (sexually) modified ...". However, the third maxillipeds of the southeast African species clearly show sexual dimorphism.

The distinction between *A. antennatus* and *A. semidentatus* was a little more difficult to establish. de Freitas (1980) felt that these two might be synonymous but it is clear from Crosnier (1978) that they can be distinguished by the fact that in *A. antennatus* the chela is much longer than the carpus, while in *A. semidentatus* the chela is equal to or just longer than the carpus. Also the former species has more than 50 photophores along the carpus of the fifth pereopod while in *A. semidentatus* there are less than 30. These are fairly easy characteristics to examine and the photophores are clearly distinguishable even in specimens after many years in formalin.

Two bottles of specimens from the South African Museum, labelled as *Plesiopenaeus nitidus* and collected off the Natal coast (30°32'S, 30°53'E and 30°14'S, 31°14'E) proved to be *A. antennatus*.

It is of interest to note that of the 65 female examined, 48 were found to be impregnated and one male (33.9 mm) had the spermatophores exuding. These specimens were caught in August 1971 (Bazaruto), November 1976 and March 1977 (off Natal).

Distribution (Fig. II-4)

Aristeus antennatus is common in the Mediterranean Sea where it is of economic importance (Ghidalia & Bourgois 1961). At present this species has been recorded from the East Atlantic, Mediterranean Sea, Zanzibar, Maldiv Islands (Ramadan); Mozambique — Bazaruto, South Africa — Natal coast (Kensley, de Freitas).

The finding of this species off the Mozambique and Natal coasts constitute new records and

extends the geographical distribution from Zanzibar south to Natal.

Aristeus antennatus was probably originally restricted to the Mediterranean Sea and East Atlantic but its appearance along the east African coast and in the Maldive Islands can be explained by the possible migration of this species from the Mediterranean through the Suez Canal. It appears to be spreading south and west.

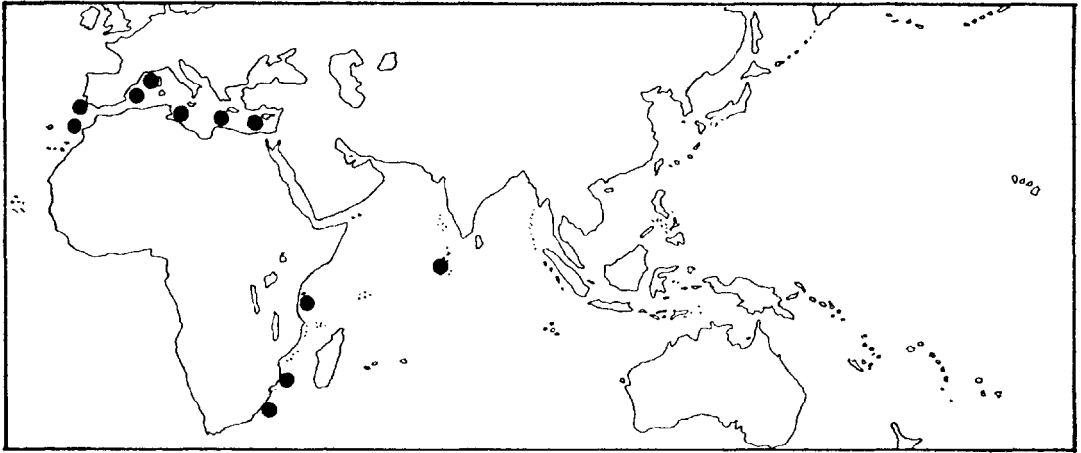


Fig. II-4 Distribution of *Aristeus antennatus*.

The distribution of the nursery areas of this species is not known. The adults have, however, been caught at depths ranging from 200-1400 metres (Ramadan 1938).

Ghidalia and Bourgois (1961) working in the western Mediterranean claimed that *A. antennatus* preferred muddy substrates and temperatures around 12.8°C. It also seems that this species is most abundant, within their depth range, in water around 550-570 metres. The specimens caught off Bazaruto Island and off the Tugela Bank were all large impregnated females. They were caught in 540 and 560 metres of water respectively.

In May 1977, when operating south of Durban, the South African Museum caught many specimens of this species in the midwater trawl operating between the surface and 700 metres depth, and further specimens from 625-900 metres depth. The specimens from the midwater trawl ranged from 7.5-28.3 mm in carapace length while those trawled from deeper water measured between 20.7-38.0 mm in carapace length. This may indicate that the juveniles and young adults are pelagic, becoming demersal when more mature.

Genus *Pseudaristeus* Crosnier 1978

Pseudaristeus Crosnier, 1978: 81.

Hemipenaeus Bate, 1881: 186 (part); Bate, 1888: 299 (part); de Man, 1911: 23 (part); Ramadan, 1938: 47 (part).

This genus was recently established by Crosnier (1978) with Wood-Mason's species *Pseudaristeus crassipes* as the type species. They have the same branchial arrangement as *Aristeus* but are easily distinguished by the well defined structure of the cervical sulcus.

The genus consists of medium sized individuals; rostrum with two to three dorsal teeth; no hepatic spine; well developed podobranchs on first two pereopods only; no epipodite on

pereiopod IV; abdominal segments four to six carinated; carapace and abdomen irregularly pubescent.

There are so far four known species to this genus, namely *P. speciosus*, *P. gracilis*, *P. crassipes* and *P. sibogae*. According to Crosnier (1978) it is quite possible that the last three species may prove to be synonymous. Only *P. sibogae* has been found in southeast African waters.

***Pseudaristeus sibogae* (De Man, 1911)**
(Fig. II-5)

Hemipenaeus sibogae de Man, 1911: 6,25-27; de Man, 1913, pl.2, fig.5; Ramadan, 1938: 48-49.
Pseudaristeus sibogae Crosnier, 1978: 83-85.

Material examined

South Africa: Natal (280°37.8'S, 32°38.4'E) (1000-1200 m) 7 ♀♀ 23.3 mm — 40.6 mm; 7 ♂♂ 25.6 mm — 38.1 mm (SAM. N°A18825).

Description

Rostrum: Distinctly upcurved in female; reaching well beyond antennal scale; in male straight, reaching end of antennular peduncle; rostral formula 2-3/0; one tooth behind orbital margin; adrostral sulcus and carina short reaching hindmost rostral tooth; postrostral carina well developed; terminating slightly before small tubercle found on dorsal midline just anterior to posterior margin of carapace; notched by cervical sulcus at about one third of its length; no median groove.

Carapace: Irregularly pubescent; gastrofrontal, postocular and horizontal sulci absent; no orbital spine; cervical carina short but distinct; cervical sulcus well defined extending from carina to dorsal midline notching postrostral carina; postcervical sulcus distinct, curving dorsal almost reaching midline; hepatic spine absent; gastro-orbital carina well defined, oblique, almost reaching cervical sulcus; antennal carina short, terminating in prominent antennal spine; orbito-antennal sulcus deep; postorbital spine absent; hepatic carina very well defined, long, terminating in prominent branchiostegal spine; posthepatic sulcus distinct, meeting hepatic sulcus; branchiocardiac carina distinct; branchiocardiac sulcus deep extending from almost posterolateral margin to meet with hepatic sulcus; suprahepatic sulcus broad and curved; pterygostomian angle acute, bears no spine; sub-marginal carina distinct, extending from pterygostomian angle to above posterior end of branchiocardiac carina.

Antennule: Mesial flagellum long; lateral flagellum short, as long as or just longer than second antennular article; laterally flattened with distinct dorsal rib; inserted halfway along third article; foliaceous prosartema absent, reduced to hairy tubercle; stylocerite long, not reaching end of basal article; terminates in short sharp spine; distolateral spine well developed; parapenaëid spine absent.

Scaphocerite: Distolateral spine reaching about halfway along lateral antennular flagellum; basicerite free of spines.

Mandibular palp: Reaching base of antennal flagellum; proximal article 2.3 times as long as wide; ventral surface slightly concave and setose; distal article subelliptical in shape; about 0.7 times length of proximal article; attached to outer edge of proximal article; surface and margins covered with long setae.

Maxilliped III: Exhibits sexual dimorphism; endopodite reaching end of antennular peduncle in female; reaching end of second antennular article in male; dactylus of male sigmoid

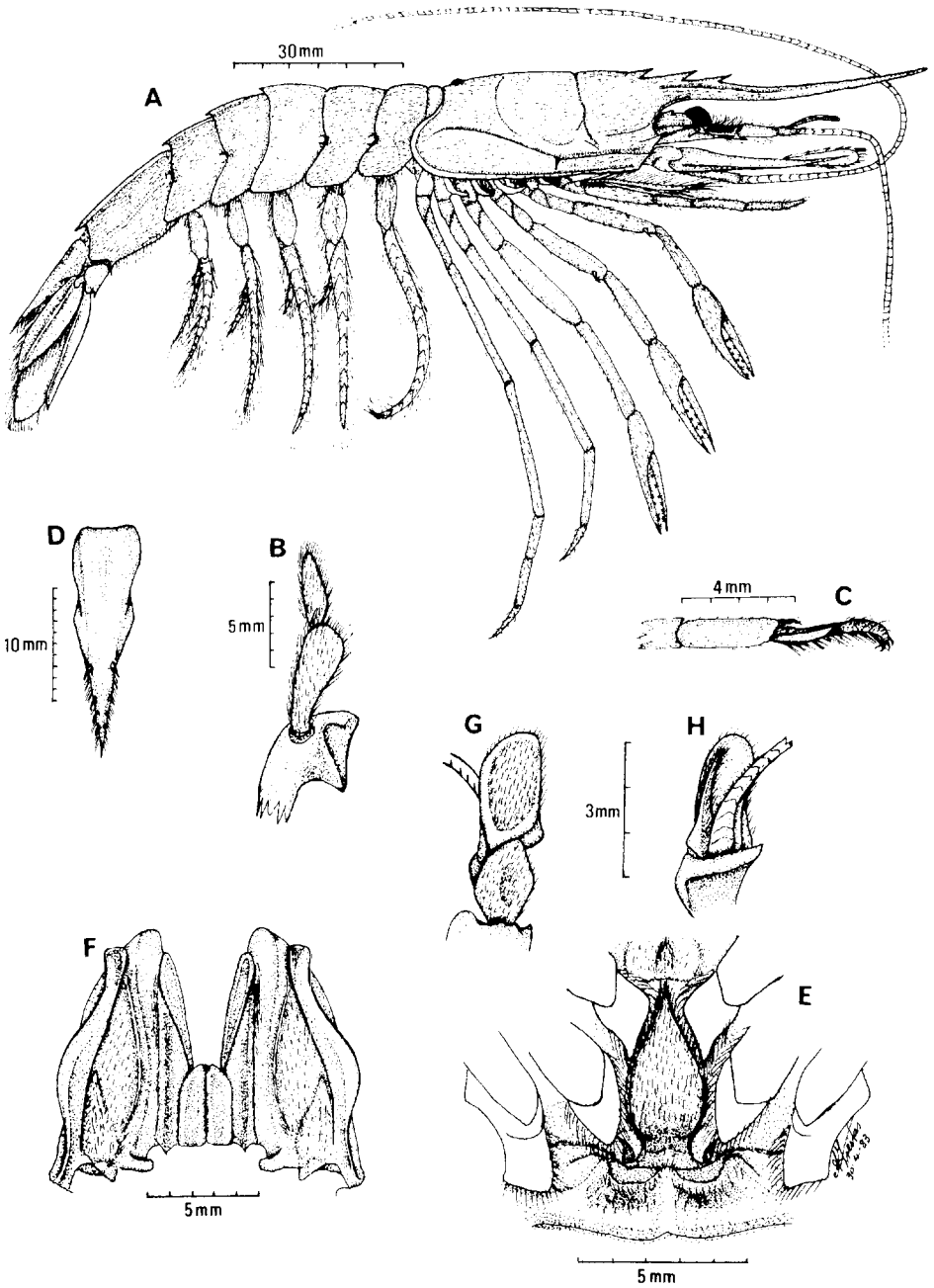


Fig. II-5 *Pseudaristeus sibogae* De Man: A. Whole animal; B. Mandibular palp; C. Maxilliped III; D. Telson; E. Thelycum; F. Petasma; G. Appendix masculina (anterior view); H. Appendix masculina (posterior view showing Appendix interna).

laterally; slightly twisted; ventral surface setose; exopodite of both sexes reaching to within first quarter of merus; epipodite and podobranchiae present.

Pereiopods: Exopodites absent from all five pairs; epipodites present on first three pairs; podobranchiae present on first two pairs. Well developed movable spine at anterior end of merus of first two pairs; no photophores distinguishable on any leg; chela of each leg longer than corresponding carpus. Pereiopod IV reaches to beyond antennular peduncle by dactylus and threequarters of propodite; pereiopod V extends beyond antennular peduncle by dactylus and propodite; extended lateral lengths of pereiopods in ascending order are: first, second, third, fourth and fifth.

Abdomen: Irregularly pubescent; dorsally carinated on segments 5 and 6 and on posterior two thirds of segment 4; carina of each segment terminating in sharp spine; sixth segment with distinct single lateral cicatrix.

Telson: Longer than sixth abdominal segment; shorter than mesial ramus of uropods; dorsally somewhat flattened; anterior half with shallow median depression; surface pubescent; terminates in sharp spine; four pairs of movable marginal spinules, distal three pairs being closer together than first is from second.

Thelycum: Simple open structure. Anterior portion single subtriangular plate; apex pointed and sharp; lateral margins curved; small curved ridge posterolaterally; surface flat and setose. Posterior portion consists of single subrectangular plate; anteriorly wide, deep rectangular groove separates this from anterior portion; just posterior to groove plate possesses somewhat broad ridge; surface irregular; pubescent.

Petasma: Simple and slightly folded structure. Dorsomedian lobule about 0.4 length of petasma; united along midline; occupies proximal part of petasma; subrectangular in shape. Ventromedian lobule normally folded under dorsolateral lobule; elongated subtriangular in shape; slightly shorter than dorsolateral lobule; apex rounded; inner distal half with broad subelliptical border. Dorsolateral lobule narrow, elongated, extending length of petasma; ventral surface concave. Ventrolateral lobule thicker and more sclerotized than other lobules; subtriangular in shape; proximal base broad; small, medially directed club-like process found midway along base; prominent ridge along mesial margin of lobule; ventral costa about as long as lobule; distally free with truncate apex; ventral surface setose; dorsally, thick, subtriangular plate between ventral costa and central ridge.

Appendix masculina: Deltoid in shape; apex rounded; about 1.6 times as long as wide; dorsal surface concave and finely setose; inner margin with short setae; outer margin forming high ridge ventrally. Appendix interna broad base with narrow curved apex; inner margin with short setae. Basal article of endopodite of pleopod II 0.7 times length of appendix masculina; dorsal surface convex; prominent ridge along outer margin; surface lightly setose.

Colour in life: It is not possible to describe the colouration in detail as only formalinized specimens were examined. However, Crosnier (1978) states simply that this species is orange in colour.

Taxonomic status and comments

While examining a bottle of specimens from the South African Museum labelled as *Plesiopenaeus nitidus* and having number SAM A15173, fourteen individuals were very obviously different from the rest due to the deep and long cervical sulcus. On closer examination they proved to be *Pseudaristeus sibogae* and conformed clearly to the existing descriptions.

The possibility that *P. sibogae* could be a synonym for *P. gracilis* and *P. crassipes* needs to be investigated further because even de Man (1911) writes that "*Hemip. gracilis* Sp. Bate from the Philippines may be identical with this species (i.e. *P. sibogae*) or with *Hemip. crassipes*" which shows his uncertainty. Ramadan (1938) states "... that *H. sibogae* is distinguished from the

remaining two species (i.e. *P. gracilis* and *P. crassipes*) by the legs being covered with microscopical spinules." In the specimens found off Natal the pubescence was clearly visible although the "microscopical spinules" could be easily rubbed off. Only by actually examining the three species concerned together will this problem be resolved satisfactorily.

Distribution (Fig. II-6)

Pseudaristeus sibogae is an Indo-west Pacific species so far recorded from Indonesia — Savu Sea (de Man); Madagascar — SW coast (Crosnier); South Africa — Natal (Kensley).

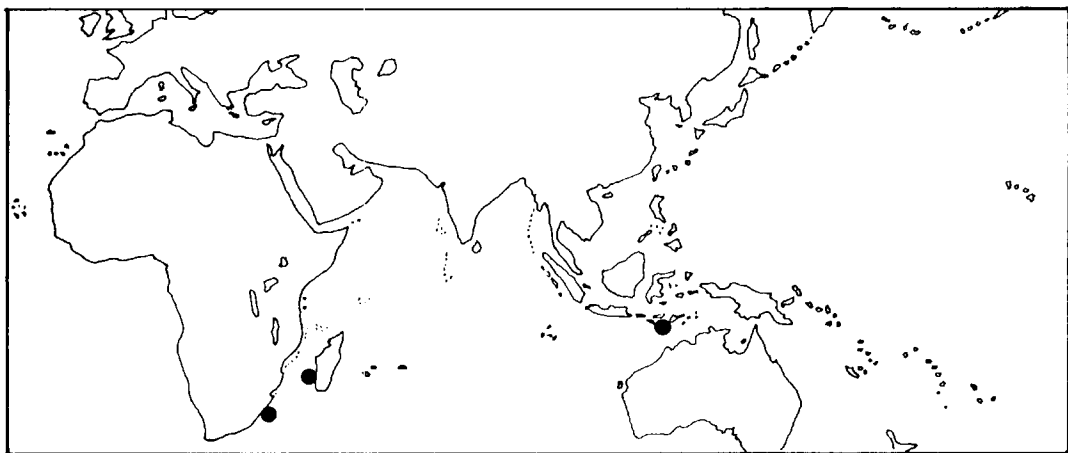


Fig. II-6 Distribution of *Pseudaristeus sibogae*

The finding of this species off Natal constitutes a new record and extends the geographical distribution across the Mozambique Channel to the South African coast.

Nothing is known about the biology of this species and no information exists with regard to the distribution of the juvenile forms nor nursery areas. Adults have been recorded from 810-1200 metres in Indonesia and Madagascar, and off Natal they were found at depths of 1000-1200 metres.

Genus *Aristaeomorpha* Wood-Mason, 1891

Aristaeomorpha Wood-Mason, 1891b: 286; Alcock, 1901: 13 & 38; Stebbing, 1914a: 24; Calman, 1925: 8; Kubo, 1949: 200; Barnard, 1950: 625; Crosnier, 1978: 52.
Aristeomorpha Ramdan, 1938: 53; Balss, 1959: 1517; Holthuis, 1962: 12.

The genus *Aristaeomorpha* was established by Wood-Mason in 1891 to accommodate Spence Bate's (1888) species *Aristeus rostridentatus* which possesses a distinct hepatic spine. It is distinguished from the other members of the family by having a well developed podobranch on the third pereopod and a well developed epipodite on pereopod IV.

The genus consists of medium sized individuals; rostrum with more than three dorsal teeth; hepatic spine present; well developed epipodite on pereopod IV; no movable spine on merus of first and second pereopods; dorsally carinated on abdominal segments four to six.

There are two known species, *A. wood-masoni* and *A. foliacea* of which only the second has been found in southeast African waters. *A. rostridentatus* originally designated as type species has now been found to be a synonym of *A. foliacea* (Calman 1925).

***Aristaeomorpha foliacea* (Risso 1827)**
(Fig. 11-7)

Penaeus foliaceus Risso, 1827: 69, pl.2, fig. 6.

Aristaeomorpha giglioliana Wood-Mason, 1891a, pl.2, fig.22.

Aristaeomorpha rostridentatus Stebbing, 1914a: 24-25.

Aristaeomorpha rostridentatus Parisi, 1919:59; Balss, 1925: 221.

Aristaeomorpha foliacea Calman, 1925: 7-8; Schmitt, 1926: 313; Kubo, 1949: 200; Barnard, 1950: 625; Richardson & Yaldwyn, 1958: 17-41; Monod, 1974: 117; Crosnier, 1978: 54-59; Crosnier, 198:21.

Aristeus japonicus Yokoya, 1933: 3.

Aristaeomorpha foliacea Ramadan, 1938: 53; Balss, 1959: 1517; Ghidfalia & Bourgois, 1961: 1; Monod, 1966: 131; Racek, 1969a: 1-8; Kensley, 1972: 10 (in key); de Freitas, 1980: 73-80; Holthuis, 1980: 8; Grey, Dall & Baker, 1983: 36.

Material examined

Mozambique: Monte Belo (25°50'S, 34°00'E) (220-560 metres) 5 ♀♀, 44.50-51.34 mm; 4 ♂♂, 36.45-39.70 mm; Cabo das Correntes (24°5'S, 34°40'E), 6 ♀♀, 48.85-52.35 mm.

South Africa: Off Tugela River mouth (28°20'S, 32°00'E), 6 ♀♀, 41.75-46.6 mm.

Description

Rostrum: In female distinctly double curved, generally reaching well beyond third antennular article; forms prominent crest as far as end of first antennular article; anterior of crest, rostrum styliform; styliform section often broken (see 'comments'); in male, short, often not reaching beyond antennular peduncle; no styliform section (see 'comment'); rostral formula 5-10/0 (see 'comment'); two teeth behind orbital margin; six teeth situated on rostral crest; four most anterior teeth very small; adrostral carina and sulcus well developed reaching between first and second teeth; postrostral carina reaches to about dorsal midpoint; median sulcus absent; small but distinct tubercle just anterior to posterodorsal margin.

Carapace: Irregularly pubescent; gastrofrontal sulcus and carina, longitudinal and postocular sulci absent; no orbital spine; cervical sulcus shallow, almost reaching dorsum of carapace; cervical carina short and horizontal, terminating in prominent hepatic spine; gastro-orbital carina not too well defined, short and occupies anterior third of distance between hepatic spine and orbital margin; antennal carina short and ill defined, terminating in short but prominent antennal spine; orbito-antennal sulcus shallow, wide anteriorly narrowing somewhat posteriorly and meets hepatic sulcus just below hepatic spine; hepatic sulcus wide, horizontal under hepatic spine bending anteroventrally to just before prominent branchiostegal spine; pterygostomial angle acute with no spine; branchiocardiac carina well developed and horizontal to slightly oblique anteriorly; extending from almost posterior margin of carapace to just before posthepatic carina; posthepatic carina and sulcus well defined and continuous with hepatic sulcus; submarginal carina well developed.

Antennules: Lateral flagellum inserted near proximal end of dorsolateral surface of third antennular article; very short, being about as long as second article; laterally flattened; mesial flagellum cylindrical and at least as long as body of animal; prosartema absent; stylocerite 0.75 times length of basal article; terminating in long sharp spine; distolateral spine of basal article fairly long and prominent; parapenaoid spine absent.

Scaphocerite: Distolateral spine just reaching point of insertion of lateral antennular flagellum; apex of lamella reaches distal end of third article of antennular peduncle; basicerite with one short somewhat blunt spine.

Mandibular palp: Reaching to about halfway along basal article of carapace; proximal article 2.6 times as long as wide; ventral surface concave; surface and margin with long stout

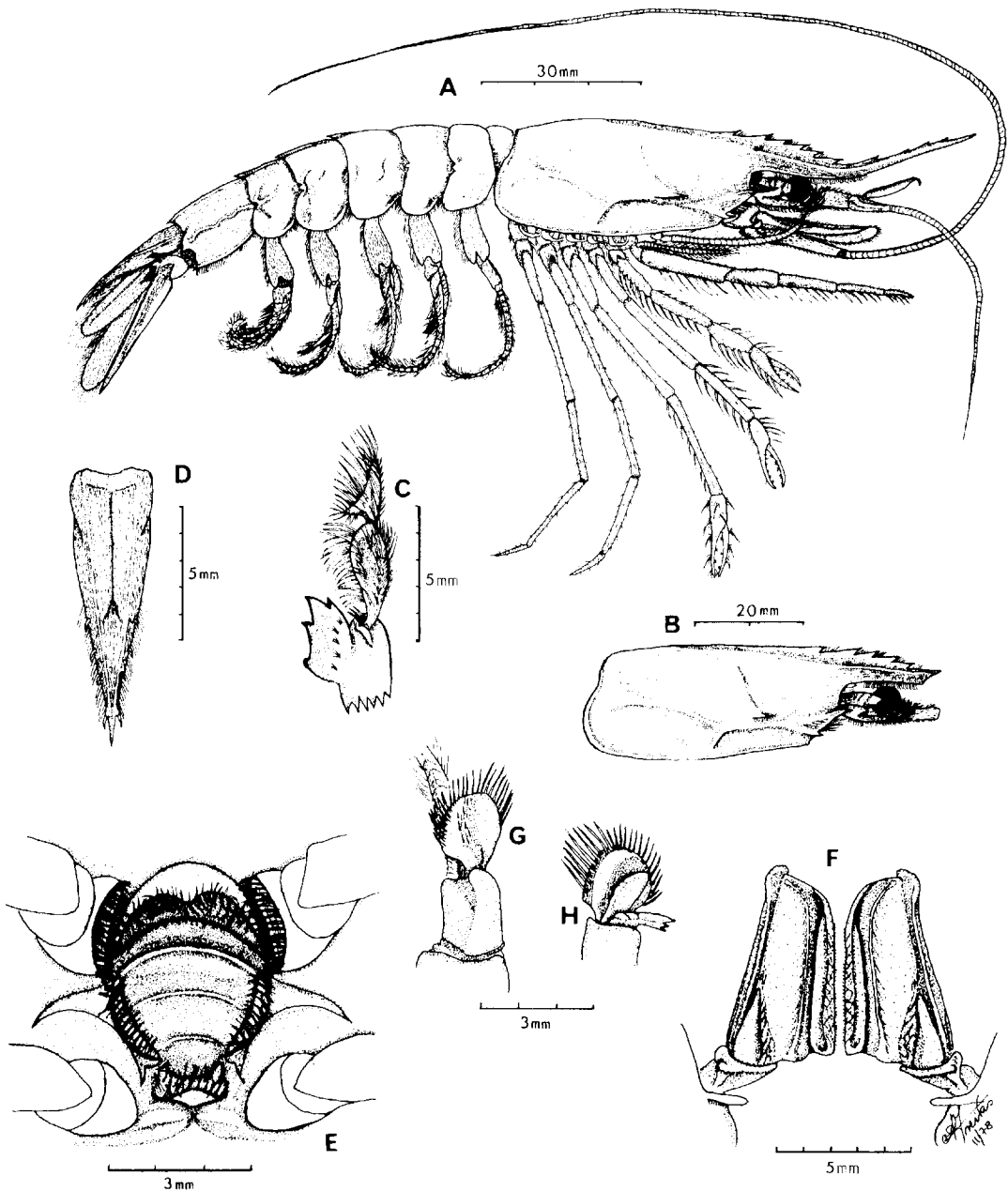


Fig. II-7 *Aristaeomorpha foliacea* Wood-Mason: A. Whole animal; B. Male cara pace; C. Mandibular palp; D. Telson; E. Thelycum; F. Petasma; G. Appendix masculina (anterior view); H. Appendix masculina (posterior view showing Appendix interna).

bristles, interspersed with short setae; distal article subtriangular, 0.7 times length of proximal article; surface and margins with long stout bristles, interspersed with short setae.

Maxilliped III: Endopite reaching just beyond tip of antennular peduncle by half length of dactylus; no sexual dimorphism; short but stout spine at distoventral margin of ischium; whole endopodite densely covered with setae; long and stout bristles situated along lateral margins; expodite very thin and not well developed; does not reach distal end of ischium; epipodites and podobranchiae present.

Pereiopods: Expodites absent from all pereiopods; epipodites present on first four pairs; podobranchiae found on first three; no spines on any pereiopodal articles; last two pairs of legs extremely slender and covered with very short setae; second and third pairs stouter and have long and stout bristles on carpopodite; first pair very stout and all segments have long stout bristles. Pereiopods IV and V reach to end of second antennular article; extended laterally lengths of pereiopods in ascending order are: first, second, fourth, fifth and third.

Abdomen: Irregularly pubescent; more densely so on sixth segment; dorsally carinated from posterior half of third segment to sixth; carinae end in short spine on each segment; wavy lateral cicatrix along length of sixth article.

Telson: As long as sixth and half of fifth abdominal segments taken together; slightly shorter than mesial ramus of uropod; median sulcus narrow; dorsolateral carina well developed, running length of telson on each side; telson terminates in long sharp spine; four pairs of movable lateral spines; surface irregularly pubescent.

Thelycum: Extremely simple and open structure. Anterior portion consists of broad transverse plate projecting slightly anteroventrally from sternite between fourth pair of pereiopods; this plate has blunt but pointed apex and its posterior surface is covered with setae. Posterior portion formed by three processes projecting ventrally from sternite between fifth pair of pereiopods; there is a median process between fifth coxae which has thick base and raised semicircular section; anterior face concave and covered with setae; posterior face glabrous with slight central ridge; flat semicircular process fringed with setae on each side between coxae of fourth and fifth pereiopods; three processes of posterior portion together with anterior portion form sides of deep trapezoid well-like cavity.

Petasma: Simple and not involuted structure; not united along midline; lobules not easily definable. Dorsomedian lobule subtriangular; apex reaching about two thirds height of petasma; free margin lined with series of hook-like papillae which would suggest union with its counterpart. Ventromediam lobule very narrow and subrectangular; forms one half of central furrow. Dorsolateral lobule forms other half of central furrow; distally curved outwards. Ventrolateral lobule wide and subrectangular ventral costae narrow, distally slightly longer than rest of petasma.

Appendix masculina: Deltoid in shape; longer than wide; dorsal surface slightly concave with row of short setae running down centre; apex rounded, furnished with fairly long, stout setae. Appendix interna completely obscured by appendix masculina; subrectangular; mesial margin with short, stout setae; slightly more than half length of appendix masculina. Basal segment of endopodite of pleopod II longer than broad; about 1.5 times as long as appendix masculina.

Spermatophore: A gelatinous mass completely and compactly filling the central deep trapezoid well-like cavity of thelycum.

Colour in life: Body and head red; head somewhat deeper red; rostrum red with several deeper red spots along ventral surface; telson and uropods same as body; lateral ramus of uropods with row of darker red spots down middle and another along inner anterior margin; ventrally abdominal sterna have odd deep red stripes; pereiopods red with deeper red spots along ventral edges; rows of deep red spots also found on endopodite of maxilliped III and on scaphocerite; marginal setae of pleura, pleopods, scaphocerite and uropods pink to transparent; setae of pereiopods and of first antennular article deep red.

Taxonomic status and comments

There is no doubt that the Mozambique and Natal specimens belong to this species. There have been various statements (Barnard 1950; Kubo 1949; Kemp & Sewell 1912) with regard to the shorter rostrum of the male. However, of the four males examined two have rostra similar to the females while the other two have the styliform section of the rostrum missing. As the males are generally smaller in size than the females, the distal portion of the rostrum is proportionately more slender and more easily broken. The breaking of the styliform section of the rostrum would obviously affect the number of teeth in the rostral formula, only those on crest persisting.

Another point worthy of mention is that all the male specimens examined and all literature consulted indicate that the two petasomal halves are not united. However, due to the presence of hook-like papillae along the inner margins it is possible that they may at times be united to facilitate the passing of the spermatophore to the female.

Distribution (Fig. II-8)

Aristaeomorpha foliacea has a very wide geographical distribution being found off the Fiji Islands (Bate, Calman, Barnard); New Zealand (Richardson & Yaldwyn); Australia — Gabo Island, New South Wales, Victoria (Schmitt, Kubo, Barnard, Racek, Grey *et al*); Japan — Yokohama, Owase, Kumononada, Sidouka Pref. (Parisi, Kubo, Yokoya, Barnard); New Caledonia (Monod); Indonesia — Ceram Sea (Balss, Crosnier); Sri Lanka — Maldive Islands (Ramadan); Mediterranean Sea (Risso, Bouvier, Balss, Calman, Barnard); West Atlantic — off Massachusetts, USA, Bahamas, Gulf of Mexico, Colombia (Crosnier); East Atlantic — Bay of Biscay; Morocco, Rio de Oro (Balss, Calman, Bouvier, Barnard, Crosnier); Tanzania — Zanzibar (Ramadan); Mozambique — Cabo das Correntes, Monte Belo (de Freitas); Madagascar — S.W. coast (Crosnier); South Africa — off Durban, Tugela River, East London, Port Elizabeth (Stebbing, Calman, Barnard, de Freitas).

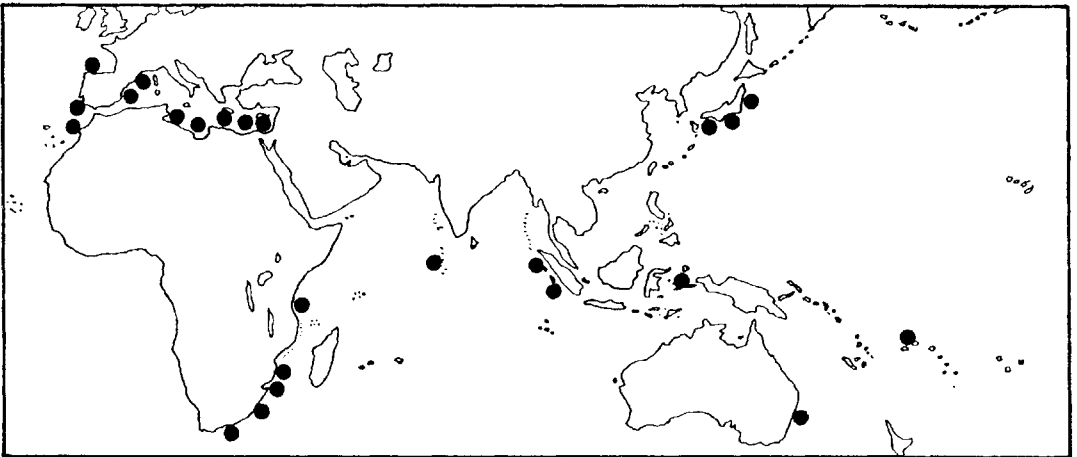


Fig. II-8 Distribution of *Aristaeomorpha foliacea*.

Because *A. foliacea* has not been recorded off the west coast of Africa south of Rio de Oro, one can assume that the existence of this species in the Indo-west Pacific region is a result of the migration through the Suez Canal.

Aristaeomorpha foliacea is an oceanic species caught off the continental shelf. Nothing is known about the life-cycle of this species and it is, therefore, not possible to determine the spatial distribution of nursery areas and juveniles.

Off Mozambique, *A. foliacea* has been caught in 200 metres of water. In Madagascar this species is caught between 170 and 810 m (Crosnier, 1978). The depth range is now recorded as being between 71 metres and 1300 metres (Ramadan 1938; Crosnier 1978).

Ghidalia and Bourgois (1961) carrying out a survey of the important Penaeidae of the western Mediterranean claimed that *A. foliacea* favours exclusively muddy substrata usually at great depths. While attempting to determine the influence of temperature, they stated that the distribution of *A. foliacea* depended on a temperature in the region of 13.5°C.

Crosnier (1978) states that there is a vertical distribution based on the day/night cycle. During the day *A. foliacea* are found at 650-750 m, while at night they move up to shallower depths.

Genus *Plesiopenaeus* Bate, 1881

Panaeus Johnson, 1867 (part).

Plesiopenaeus Bate, 1881 (part): 188; Faxon, 1895: 196; Bouvier, 1908: 63-64; Milne Edwards & Bouvier, 1909: 200; de Man, 1911: 6; Balss, 1925: 223; Burkenroad, 1936: 94-95; Ramadan, 1938: 49-51; Barnard, 1950: 621-622; Balss, 1959: 1517; Holthuis, 1962: 109; Crosnier, 1978: 85-86.

Aristaeus Bate, 1881 (part): 187; Bate, 1888 (part): 309.

Aristaeopsis Wood-Mason, 1891b: 282-283; Alcock, 1901: 40; De Man, 1911: 6.

The generic name *Plesiopenaeus* was provisionally suggested by Bate (1881) to accommodate those members of the genus *Aristeus* that possess an epipodite on the fourth pereopod. At that time no type species was named but the only species mentioned by Bate in that paper to have an epipodite on pereopod IV were *Aristeus armatus* and *A. rostridentatus* a synonym for *Aristaeomorpha foliacea*. Faxon (1895) selected *A. armatus* as the type and Holthuis (1962) proposed that *Plesiopenaeus* be placed on the Official List of Generic Names with *A. armatus* as the type, a proposal accepted by Opinion 864 of the International Commission on Zoological Nomenclature (1969).

This genus consists of rather large animals; prosartema absent or reduced to rigid scale; podobranchs on pereopods I-III; epipodites on first four pereopods; exopods on all pereopods; outer antennular flagella short and flat; rostrum dorsally toothed only; rostrum tridentate; hepatic spine absent.

There appear to be four species to this genus, three having been recorded from the Indian Ocean and from the north Atlantic. These are *P. armatus*, *P. coruscans* and *P. edwardsianus*. A fourth species *P. nitidus* Barnard, has so far only been recorded off Cape Point and Natal and, together with *P. edwardsianus*, are the only species found in southeast African waters. Kensley (1977) identified several specimens from Natal waters as *P. nitidus*, although, two bottles of *P. nitidus* from the area were examined and proved to be *Aristeus antennatus*, having no epipodites on pereopod IV. 11 males with the number SAM A15139 clearly belong to *P. nitidus*.

***Plesiopenaeus edwardsianus* (Johnson, 1867)**

(Fig. II-9)

Penaeus edwardsianus Johnson, 1867: 897.

Aristeus edwardsianus Miers, 1878: 308.

Aristeus coralinus Bate, 1888: XXXII

Aristaeopsis edwardsianus Wood-Mason, 1891b: 283-285; Alcock & Anderson, 1894: 147.

Aristeus splendens Richard, 1900: 89.

Aristeus (Plesiopenaeus) edwardsianus Alcock, 1901: 36.

Plesiopenaeus edwardsianus. Bouvier, 1908: 64-69; Milne Edwards & Bouvier, 1909: 200-201; Balss, 1925: 223; Ramadan, 1938: 51; Barnard, 1950: 624-625; Holthuis & Rosa, 1965: 6; Monod, 1966: 132; Hall, 1966: 99; Crosnier & Bondy, 1967: 68-69; Crosnier & Tanter, 1968: 3; Couture & Trudel, 1968: 859-860; Kensley, 1972: 10 (in key); Mota, 1972: 46-47; Champion, 1973: 187; Crosnier & Forest, 1973: 292; Kensley, 1977: 16; Crosnier, 1978: 88-92; Holthuis, 1980: 11; Grey, Dall & Baker, 1983: 38.

Material examined

Mozambique: Off Machangulo Peninsula (260°20'S, 33°20'E) (470-630 m), 2 ♀♀ 75.5-102.0 mm; Monte Belo, 1 ♂, 59,5 mm; 1♀, 94,6 mm.

Description

Rostrum: Straight or somewhat sinuous, horizontal to very slightly upcurved; reaching to beyond antennal peduncle and scaphocerite in female; in male rostrum shorter not extending beyond antennular peduncle; rostral formula 3/0; middle rostral tooth in line with or just in front of orbital margin; adrostral carina short ending just behind middle rostral tooth; postrostral carina distinct reaching to just less than half length of carapace; median sulcus absent.

Carapace: Uniformly glabrous; gastrofrontal and postocular sulci absent; no orbital spine; cervical sulcus distinct almost reaching dorsum; cervical carina distinct, just less than half length of sulcus; short suprahepatic carina present, level with end of cervical carina; hepatic spine absent; gastro-orbital carina well defined, situated about half way up carapace, horizontal anteriorly, bending posterodorsally to meet cervical sulcus above cervical carina; antennal carina short, ending in small antennal spine; orbito-antennal sulcus deep; postorbital spine absent; hepatic carina very well defined, long, terminating anteriorly in small but well defined branchiostegal spine; posthepatic carina well defined; branchiocardiac carina very distinct, reaching from posthepatic carina almost to posterolateral margin of carapace; submarginal carina prominent, extending from almost anterior margin of carapace to posterior end of branchiocardiac carina; pterygostomial angle rounded bearing no spine.

Antennule: Mesial flagella very long; lateral flagella short, about as long as second antennular article, flat and inserted half way along third antennular article; prosartema absent; stylocerite pointed distally but does not form sharp spine; almost as long as basal antennular article; no distolateral spine; parapenaëid spine absent.

Scaphocerite: Exhibits sexual dimorphism; in female, apex of lamella pointed and reaching beyond end of antennular peduncle; in male apex of lamella prolonged into long fleshy process; distolateral spine reaching or almost reaching distal end of third antennular article; basicerite unispionose.

Mandibular palp: Reaching to base of carpopodite; proximal article 3.4 times as long as wide; ventral surface slightly concave; ventral surface and margins covered with long, stout bristles; distal article subtriangular; apex narrow and rounded; inner surface with broad tooth-like process; 0.6 times length of proximal article; surface and margins covered with long, stout bristles.

Maxilliped III: Endopodites exhibit no sexual dimorphism; reaching beyond distal end of antennal peduncle in female and just reaching end of third antennular article in male; exopodite reaching distal quarter of merus of endopodite; epipodites present.

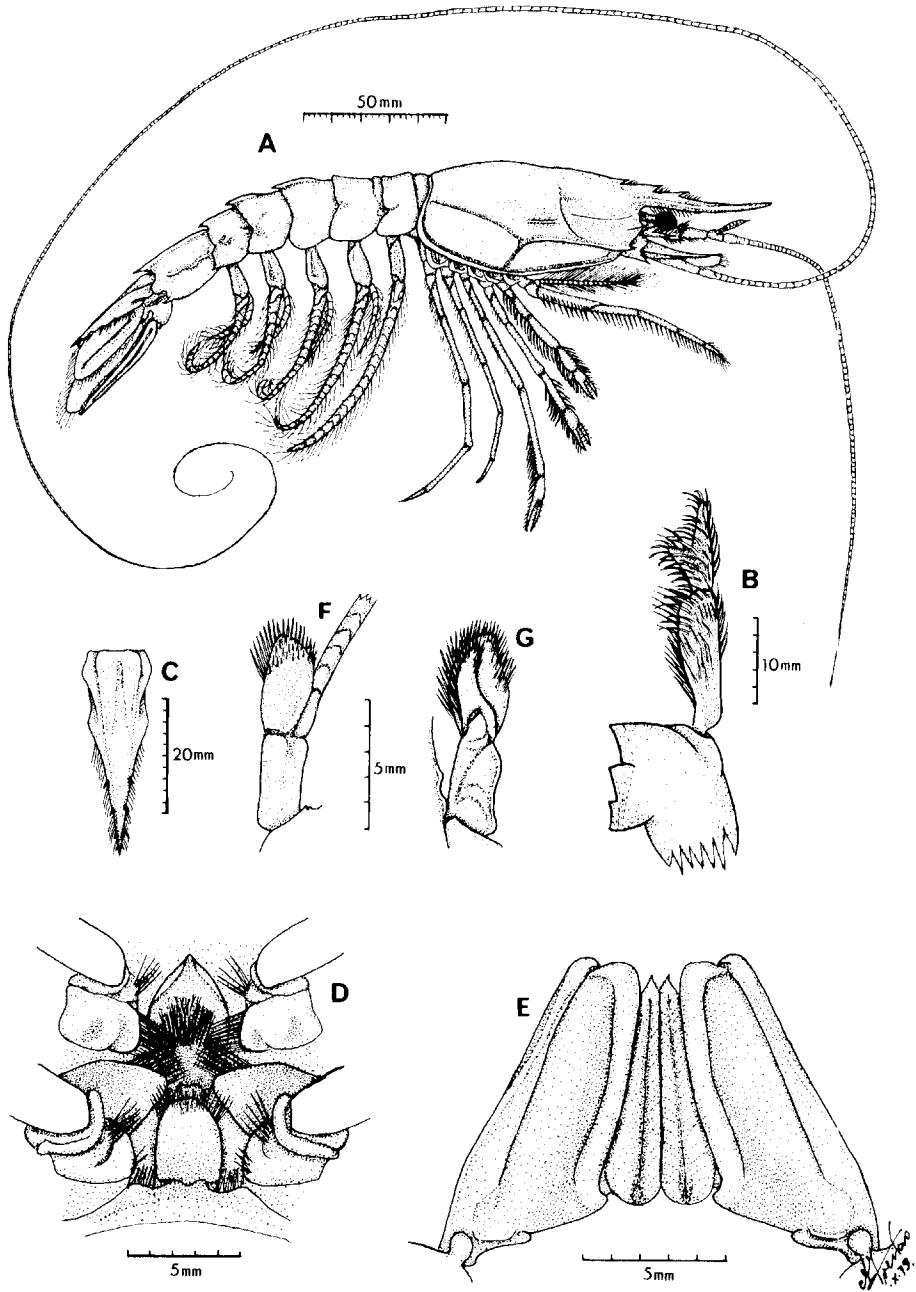


Fig. 11-9 *Plesiopenaeus edwardsianus* Bate: A. Whole animal; B. Mandibular palp; C. Telson; D. Thelycum; E. Petasma; F. Appendix masculina (anterior view); G. Appendix masculina (posterior view showing Appendix interna).

Pereiopods: Exopodites absent from all pereiopods; epipodites present on first four pairs; no ischial nor basal spines present; palm of cheliped I and II swollen; palm of cheliped III narrow. Pereiopod IV reaching just short of end of second antennular article; pereiopod V reaching end of second antennular article; extended laterally lengths of pereiopods in ascending order are: first, second and fourth, fifth and third.

Abdomen: Uniformly glabrous; dorsal carina present from third to sixth segments, terminating in short spine in each segment; long wavy lateral cicatrix on sixth segment which seems more pronounced in smaller males.

Telson: Longer than sixth segment; considerably shorter than mesial ramus of uropod; median sulcus very wide; telson terminates in sharp spine; four pairs of very small movable marginal spines present; most proximal pair not very distinct, situated just over half way along telson.

Thelycym: Simple and open structure. Anterior portion arises from sternum between fourth pereiopods, consists of single triangular process with acute apex, anterior face convex, posterior face flat and copiously supplied with long red setae. Posterior portion consists of three plates; two fleshy lateral plates arise from between fourth and fifth pereiopods, each semi-elliptical, slightly slanting medially, rounded apex well provided with long red setae; posterior medial plate elliptical, very thick and fleshy, anterior face flat with shallow longitudinal sulcus, posterior face rounded, sides and apex with long red setae. All four plates, together with coxal processes of fourth pereiopods, form deep central well which efficiently retains spermatophore.

Petasma: Simple and slightly involuted pod-like structure. Dorsomedian lobules loosely united along midline; distally narrows to point; proximally slightly rounded; distally just shorter than lateral lobules. Ventromedian lobules subequal in length to dorsomedian lobules; folded inwards so that mediolateral ridges meet along midline; together with dorsomedian lobules form incomplete tube. Dorsolateral lobules simple and subrectangular; distal margin rounded at inner corner; inner margin adjacent to mediolateral ridge thick. Ventrolateral lobule subrectangular; best seen from dorsal view; thick convex triangular piece found proximally; ventral costa narrow but forms distal portion of lobule; distally apex curves medially slightly overlapping distal margin of dorsolateral lobule.

Appendix masculina: Deltoid in shape; mesial margin thick and covered with long setae; apex broadly rounded, furnished with short, stout setae; anterior surface convex, distal third lightly setose. Appendix interna completely obscured by appendix masculina; as long as appendix masculina; narrow, subtriangular in shape; mesial margin with long setae, curved and slightly twisted to fit shape of thick mesial margin of appendix masculina. Basal segment of endopodite of pleopod II subrectangular, longer than broad, subequal in length to appendix masculina; lateral margin with row of setae.

Spermatophore: Consists of milky to grey gelatinous mass completely filling well-like central cavity of thelycym; secured in position by long setae from thelycal plates and coxal processes of fourth pereiopods.

Colour in life: The whole body, pereiopods, pleopods, uropods, telson and antennal filament as well as all setae are uniformly bright red to deep scarlet. Agrees very well with the colour illustration of Bouvier (1908).

Taxonomic status and comments

Plesiopenaeus edwardsianus is a large penaeid reaching a total length of 31.5 cm in the female, the male being considerably smaller reaching about 19.0 cm in total length. As described above and by Wood-Mason (1891b) and Alcock (1901) the male specimens have much shorter rostra than the females. This difference is probably more pronounced with age.

P. edwardsianus is very abundant around the Azores Islands (Bouvier 1908) but off the

southeast African coast it is an uncommon species, the odd one only appearing in the trawls together with other deep water forms such as *Haliporoides triarthrus*, *Aristaeomorpha foliacea* and *Penaeopsis balssi*.

The specimens examined from Mozambique waters agree in every detail with existing descriptions and illustrations. One specimen had a rostrum with four dorsal teeth. This condition is not normal and somewhat uncommon as are the rostra with two teeth (Barnard 1950).

Wood-Mason (1891b) and Alcock (1901) show, in their illustration of *P. edwardsianus*, the presence of a second cervical groove which reaches the dorsum. This groove is not present in the southeast African specimens examined and neither is it mentioned nor illustrated by any other author.

Distribution (Fig. II-10)

P. edwardsianus has a distribution which stretches from the Caribbean Sea and Canada, the east Atlantic Ocean down the west African coast, around South Africa and up the east African coast to Indian and Sumatra. More specifically this species has been recorded from the Antilles in the Caribbean Sea (Milne-Edwards & Bouvier, Holthuis & Rosa); Canada — Anticosti Island, Cape Gaspe (Couture & Trudel); Portugal — south of Portugal, Azores, Madeira (Bouvier, Balss, Holthuis & Rosa); Morocco — off Casablanca (Bouvier, Balss, Holthuis & Rosa); Gulf of Guinea, Gabon, Congo-Brazzaville (Monod, Crosnier & Bondy, Crosnier & Tanter, Crosnier & Forest, Holthuis & Rosa); South Africa — off Cape Point, Natal (Barnard, Holthuis & Rosa, Kensley); Mozambique — off Machangulo, Monte Belo (Champion, de Freitas); Madagascar — west coast (Crosnier); Tanzania — Zanzibar (Ramadan, Hall); Somalia (Balss, Holthuis & Rosa); Arabian Sea near Malabar Coast, Gulf of Manaar, Bay of Bengal, Andaman Islands (Wood-Mason, Alcock & Anderson, Alcock, Balss, Holthuis & Rosa); Indonesia — Sumatra (Balss, Holthuis & Rosa); Australia — New South Wales (Grey *et al.*).

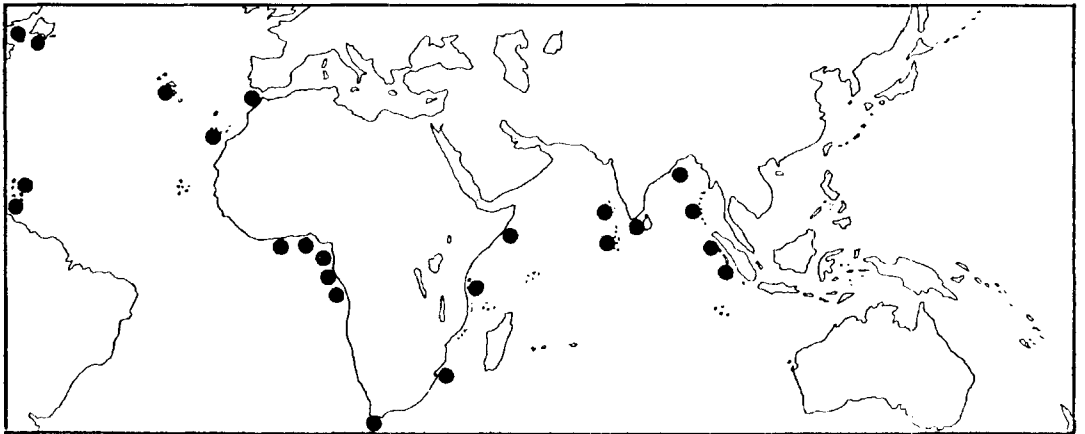


Fig. II-10 Distribution of *Plesiopenaeus edwardsianus*.

An interesting fact about the geographic distribution of *P. edwardsianus* is that although it is very abundant around the Azores Islands and is found south of Portugal and off Casablanca, it has not been found in the Mediterranean Sea (Bouvier 1908; Balss 1925). Whether this species was originally an Atlantic or an Indian Ocean species does not detract from the fact that its distribution from one side of the African continent to the other has taken place by a migration around the southern tip of Africa rather than through the Suez Canal, as achieved by other members of this family, namely *A. antennatus* and *A. foliacea*.

The biology of this species is almost completely unknown and no information exists on the distribution of the larval and juvenile stages, nor have the nursery areas been identified.

The adults at least are deep water forms having been found in depths ranging from 274-1850 metres, being most common, however, from 400-900 m (Crosnier & Forest 1969). Mota (1972) claims that, from the analysis of the results of some preliminary trawls for this species off the coast of Angola, with an increase in depth there seemed to be an increase in abundance, an increase in the number of males in relation to the females and an increase in the size of the animals in general.

Off Madagascar *P. edwardsianus* is found from 500-1200 m being most common between 700 and 800 m. Off Mozambique it was caught on the continental shelf in the Limpopo Bight at depths between 470-630 m and Kensley (1977) found his specimens (5 ♂♂) and 6 (♀♀) in six stations located between Kosi Bay and St Lucia at depths ranging from 710-1200 metres.

***Plesiopenaeus nitidus* Barnard 1946**

Fig. II-11)

Plesiopenaeus nitidus Barnard, 1946: 383-384; Barnard, 1950: 622-624; Grindley & Penrith, 1965: 280 & 291; Kensley, 1968: 285 & 298; Kensley, 1972: 10-11; Kensley, 1977: 16.

Material examined

South Africa: Natal (700-1200 m) 11-♂♂, 20.35 — 23.50 mm (SAM A15139); 36 ♀♀, 25.0 — 34.7 mm (SAM A15173); off Cape Point (855-1134 m) 2♂♂, 24.4 & 15.0 mm; 2 ♀♀, 28.0 & 31.0 mm TYPES (SAM A1260 and SAM A1193).

Description

Rostrum: Distinctly upcurved; long, reaching well beyond scaphocerite in female; in male straight, reaching to end of first antennular segment; rostral formula 3/0; one tooth behind orbital margin; adrostral sulcus and carina short but well developed, extending from last rostral tooth to just in front of first rostral tooth; postrostral carina absent; no median groove.

Carapace: Glabrous; gastrofrontal, postocular and horizontal sulci absent; no orbital spine; cervical sulcus restricted to depression above short but clear cervical carina; hepatic spine absent; no gastro-orbital carina; orbito-antennal sulcus very short and a mere depression; antennal carina not well defined; antennal spine strong; hepatic sulcus deep and horizontal; no posthepatic sulcus; branchiocardiac sulcus distinct; sigmoid and continuous with hepatic sulcus; branchiostegal spine prominent; pterygostomial angle acute bearing no spine; small but distinct dorsomedian tubercle found just anterior to posterodorsal margin; submarginal carina well defined.

Antennule: Lateral flagellum short, as long as second and third antennular articles taken together; inserted at about midpoint of third article; laterally compressed; mesial flagellum of male strongly double bent and flattened at base; foliaceous prosartema absent, reduced to small hairy tubercle; stylocerite long and broad; terminate in sharp spine, extending beyond distal end of basal article; distolateral spine short and blunt; no parapenaed spine.

Scaphocerite: In female distolateral spine reaching end of lateral flagellum; in male distolateral spine reaching to about two-thirds along the lateral flagellum; basicerite with small ventral spine.

Mandibular palp: Reaching base of carpocerite; proximal article 2.6 times as long as wide; ventral surface slightly concave and setose; distal article subtriangular; about 0.7 times length of proximal article; attached to outer edge of proximal article; surface and margins setose.

Maxilliped III: Endopodite reaching distal end of third antennular article; exhibit sexual dimorphism; dactylopodite of male short with slender ventral projection ending in tuft of long

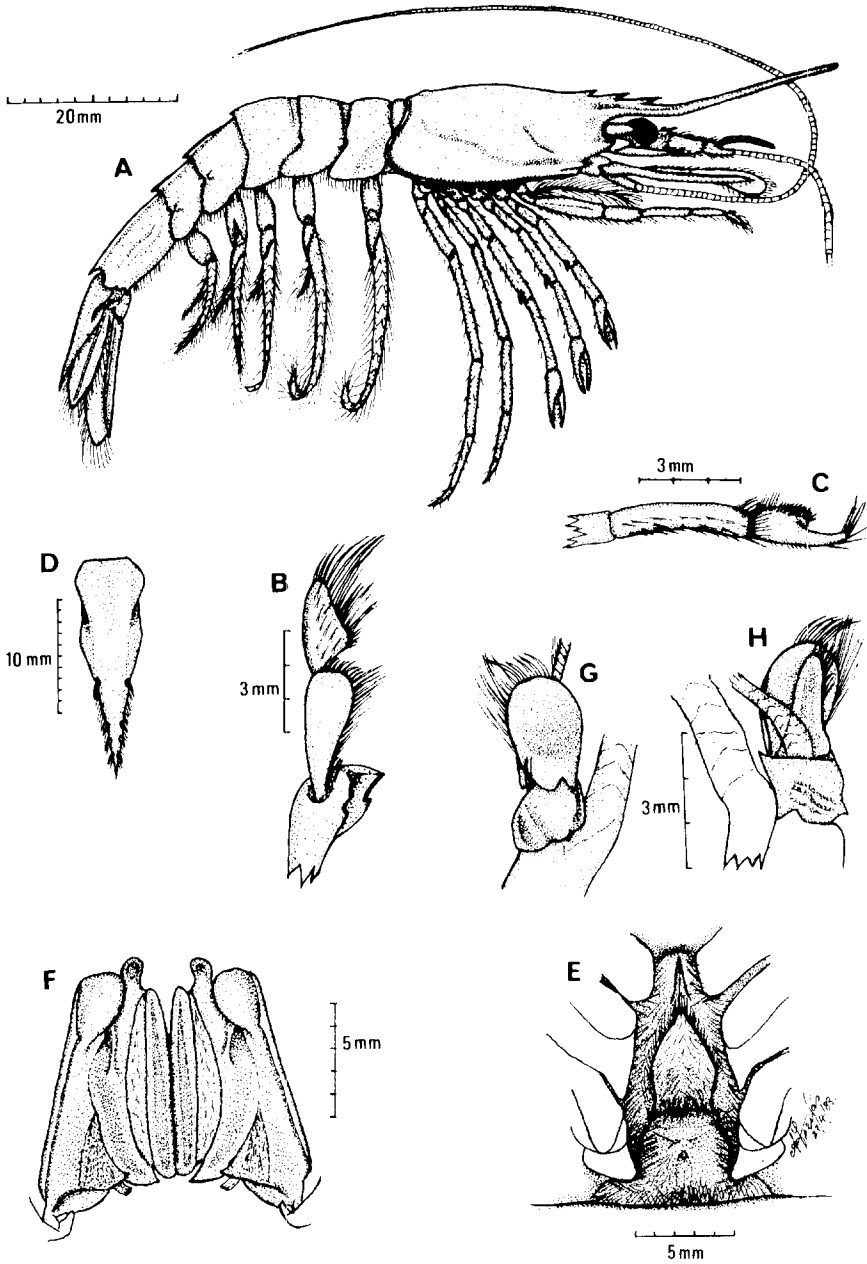


Fig. II-11 *Plesiopenaeus nitidus* Barnard: A. Whole animal; B. Mandibular palp; C. Maxilliped III; D. Telson; E. Thelycum; F. Petasma; G. Appendix masculina (anterior view); H. Appendix masculina (posterior view showing Appendix interna).

setae; outer surface glabrous; inner surface concave and setose; dorsal and ventral margins with brush-like setae; distal protruberance of propodite not very pronounced; exopodite reaching to end or just beyond merus in female; reaching two-thirds along merus in male; epipodite and podobranchia present.

Pereiopods: Exopodites absent from all five pairs of pereiopods; epipodites present on first four pereiopods; podobranchiae present on first three pairs, rudimentary on third; well developed movable spine at anterior end of merus of first three pairs; no coxal spines on any pereiopods; pereiopod IV of female extending beyond antennular peduncle by dactylus; in male reaching just beyond second antennular article; pereiopod V to just beyond antennular peduncle by dactylus in male and by dactylus and one third propodite in female; extended laterally lengths of pereiopods in ascending order are: first, second, third, fourth and fifth.

Abdomen: Glabrous; segments four to six strongly carinate; carina terminating in distinct sharp spine; sixth segment with longitudinal cicatrices, more distinct on dry surface.

Telson: As long as sixth segment; shorter than mesial ramus of uropods; dorsally somewhat flattened; median sulcus very shallow; terminal spine sharp; four pairs of moveable marginal spinnules; distal three closer together than first is from second.

Thelycum: Simple and open structure. Anterior portion consists of a single subtriangular process arising from sternum between fourth pereiopods; apex acute; ventral surface flat and setose; posterolateral margins forming ridge. Posterior portion consists of single central plate; centre of plate raised into fairly wide ridge; small setose tubercle at posterior point of ridge; lateral margins of plate slightly raised; all but anterior margins setose.

Petasma: Simple and slightly folded structure. Dorsomedian lobule about 0.6 length of the petasma; united along midline; subtriangular. Ventromedian lobule folded under dorsolateral lobule; subelliptical and narrow. Dorsolateral lobule curved and twisted; better seen from dorsal aspect; fairly well chitinized; distally rather thick, twisted medially into horn-like structure which projects beyond distal limit of petasma; proximally equal in length to dorsomedian lobule; ventrally possesses oblique rib about 1/3 distance from distal margin. Ventrolateral lobule well chitinized; lateral margin straight with longitudinal ridge ventrally; inner margin strongly concave; distally free from dorsolateral lobule; apex broad and round; proximal base broad; medially forming short club-like process.

Appendix masculina: Deltoid in shape; apex rounded; about 1.4 times as long as wide; dorsal surface concave; glabrous; apex and mesial margin setose; lateral margin forming high ridge. Appendix interna completely obscured by appendix masculina; subtriangular; about 0.8 times as long as appendix masculina; apex pointed; mesial margin with long setae. Basal segment of endopodite of pleopod II subquadrate; about 0.6 times as long as appendix masculina; anterior surface convex; deep furrow runs length of lateral margin.

Spermatophore: Consists of hardened disc with central ridge covering softer sac which completely and tightly fits into concave posterior portion of thelycum. Marginal setae of thelycum assures security of structure.

Colour in life: As only preserved material was examined it is not possible to describe the colouration of this species.

Taxonomic status and comments

Probably the most striking feature which separates *P. nitidus* from the other three species of this genus is the fact that the sutures on the carapace are very feeble in contrast to the very clear and deep sutures present on the carapace of *P. armatus*, *P. coruscans* and *P. edwardsianus*. Besides this it is the only species of *Plesiopenaeus* where the mesial antennular flagella of the male are modified, being strongly double-bent and flattened at the base.

Although the type material examined was not in a very good condition, it was sufficient to clarify any of the doubts expressed earlier (de Freitas 1980). These had arisen essentially because two bottles received from the S.A. Museum as examples of *P. nitidus* turned out to be

Aristeus antennatus. There is no doubt, however, that *P. nitidus* is a distinct species.

The material examined agreed favourably with the description given by Barnard (1946, 1950).

Distribution (Fig. II-2)

Plesiopenaeus nitidus is a species endemic to the waters of south and southeast Africa. This species has been found only from South Africa — Cape Point and Natal (Barnard, Kensley).

Nothing is known about the distribution of the juvenile stages of this species but the adults have been found at depths ranging from 475-1200 metres (Barnard 1946; Kensley 1968 & 1977).

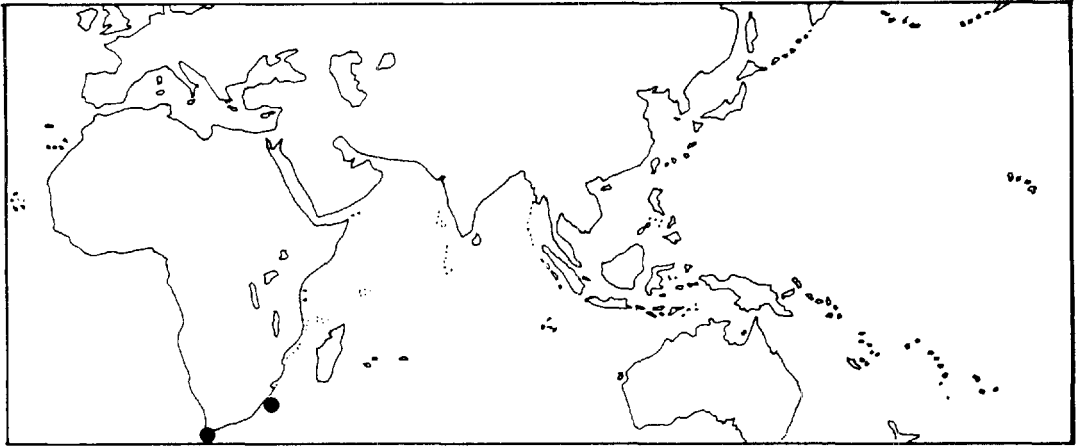


Fig. II-12 Distribution of *Plesiopenaeus nitidus*.

FAMILY SOLENOCERIDAE Wood-Mason, 1891

This is a large family with eight genera, namely *Hadropenaeus*, *Mesopenaeus*, *Pleoticus*, *Hymenopenaeus*, *Haliporoides*, *Haliporus*, *Cryptopenaeus* and *Solenocera*. Of these only the last five are represented in southeast African waters.

The members of this family are usually large to medium size animals, many of which are found deeper than 100 metres. They have a postorbital spine and usually possess a well developed prosartema. There are exopodites on all maxillipeds and pereiopods, those of the third maxilliped being short, never reaching beyond the ischium of the endopodite. There are two well developed arthrobranchiae on the penultimate thoracic segment. Appendix masculina contains an appendix interna.

Genus *Hymenopenaeus* Smith 1882

Haliporus Bate, 1881: 185 (part); Bate, 1888: 284 (part); Alcock, 1902: 22; Bouvier, 1906: 1 (part); de Man, 1911: 13 (part).

Hymenopenaeus Smith, 1882: 91; Burkenroad, 1936: 102 (part); Kubo, 1949: 212 (part); Holthuis, 1962: 108; Pérez Farfante, 1977: 266; Crosnier, 1978: 100.

The genus *Hymenopenaeus* was established by Smith in 1882, to accommodate the type specimen name *H. debilis*. Burkenroad (1936) included several genera in this genus but went on to state that he recognised the fact that the genus *Hymenopenaeus sensu lato* probably contained four superspecies. Pérez Farfante (1977) revised the solenocerids and concluded that Burkenroad's genus included at least five genera, one of them *Hymenopenaeus sensu stricto*.

The genus is composed of small to medium animals with slender bodies and elongated carapace; rostrum usually armed with dorsal teeth only, although occasionally ventral teeth may be present; epigastric and first rostral teeth separated from remaining teeth by relatively wide interval; no orbital spine; postorbital, antennal, hepatic and branchiostegal spines present; pterygostomian angle may or may not be spinose; cervical sulcus well developed and long almost reaching middorsal line; hepatic and branchiocardiac sulci present; submarginal carina present; prosartema moderately long; telson with fixed pair of subapical spines; antennular flagella longer than carapace, filiform; fourth and fifth pereopods extremely long; exopodites on all maxillipeds and pereopods.

Pérez Farfante (1977) agrees with Burkenroad (1936) that the genus *Hymenopenaeus* may be divided into two sections depending on whether or not the pterygostomian angle is spinose. Of the thirteen known species of this genus, four possess a pterygostomian spine, while nine do not.

Three species, *Hymenopenaeus aphoticus*, *H. debilis* and *H. chacei* are exclusively Atlantic species, seven are Indo-west Pacific, viz.: *H. sewelli*, *H. aequalis*, *H. fattahi*, *H. halli*, *H. obliquirostris*, *H. neptunus* and *H. propinquus*, two are eastern Pacific (*H. doris* and *H. nereus*) and one (*H. laevis*) has been found in both the Atlantic and Indo-west Pacific. In southeast Africa one species, *H. halli*, has so far been found.

***Hymenopenaeus halli* Bruce, 1966**

(Fig. II-13)

Haliporus obliquirostris de Man, 1911: 36.

Hymenopenaeus halli Bruce, 1966: 216; Burukovsky, 1974: 46; Crosnier, 1978: 120; Kensley, 1981a: 53; Kensley, 1981b: 19; Crosnier, 1984: 24.

Material examined

South Africa: Off Natal, south of Durban (625-900 m), 5♀♀, 7.1-11.7 mm.

Description

Rostrum: Straight and upwardly directed, reaching to proximal third of second antennular article; rostral formula 7-8/0; epigastric and one other tooth behind orbital margin; epigastric and first rostral tooth separated from remaining teeth by wide space; adrostral carina short, running from orbital margin to tip of rostrum; postrostral carina well developed terminating somewhat before posterior margin; small and somewhat indistinct tubercle just behind epigastric tooth; distinct tubercle on dorsal midline near posterior margin of carapace; no median sulcus.

Carapace: Uniformly glabrous; postocular and gastrofrontal sulci, as such, are absent but area has some short grooves; no longitudinal sulci; orbital spine absent; postorbital spine present and situated at level of antennal spine; gastro-orbital carina and orbito-antennal sulcus absent; antennal spine small but prominent; no antennal carina; hepatic spine well developed; branchiostegal spine prominent; branchiocardiac sulcus and carina well developed, curved; hepatic sulcus long and undulating, extending from branchiocardiac sulcus to depression above branchiostegal spine; no hepatic carina as such; cervical sulcus well developed, long, originating from dorsal midline, extending from postrostral carina to just anterior of hepatic

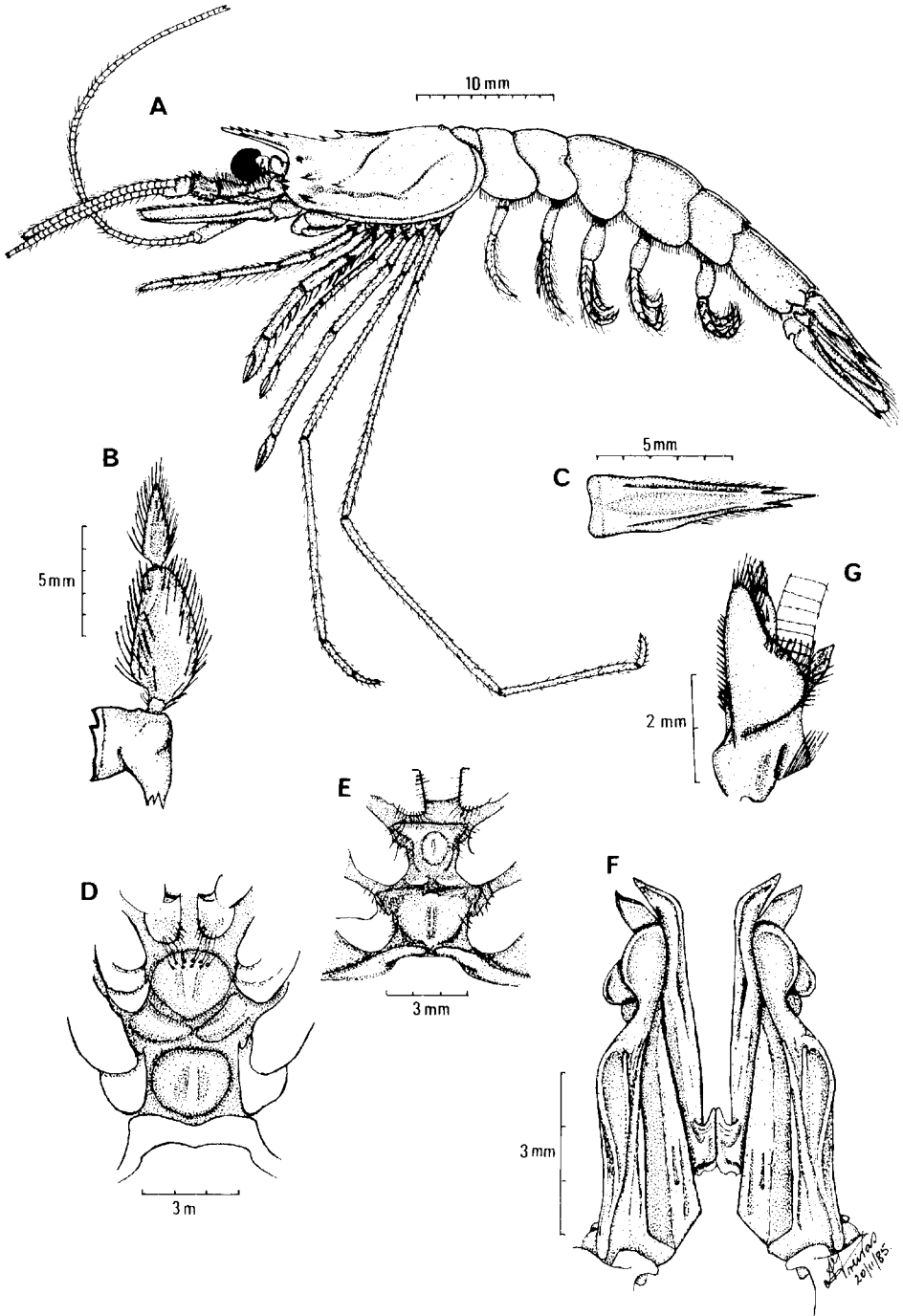


Fig. II-13 *Hymenopeneus hali* Bruce: A. Whole animal; B. Mandibular palp; C. Telson; D. Thelycum; E. Thelycum (after Crosnier 1978); F. Petasma (after Bruce, 1966 and Crosnier 1978); G. Appendix masculina (anterior view) (after Bruce, 1966).

spine; cervical and carina present along central half of sulcus; pterygostomian angle broadly rounded, submarginal carina prominent extending from posterior margin of carapace to pterygostomian angle; no transverse, posthepatic nor longitudinal sulci.

Antennules: Lateral flagella setose, about 1.3 times carapace length; mesial flagella lacks setae, at least 3 times carapace length (Bruce, 1966); subcylindrical; prosartema with narrow apex, reaching distal end of optic calathus, copiously covered with long hairs; stylocerite about half length of basal article, terminating in short sharp spine; distolateral spine long and sharp, extending into first third of second antennular article; no parapenaeid spine.

Scaphocerite: Distal spine well beyond distal end of third antennular article; apex of lamella not extended beyond distal spine; basicerite with single anteroventral spine; carpocerite long, reaching end of distolateral spine of basal antennular article.

Mandibular palp: Reaching distal end of basal antennular article; proximal article twice as long as wide; margins and part of surface covered with long setae; distal article 0.6 times length of proximal, 0.5 times as wide as proximal, tapering to subacute apex; margins with long setae.

Maxilliped III: Endopodites probably not exhibiting sexual dimorphism (no male specimen available for comparison); extending beyond scaphocerite by dactylopodite and one third of propodite; exopodite minute, difficult to see; epipodite present.

Pereiopods: Exopodites present on all pereiopods, rudimentary and difficult to see; epipodites present on pereiopods I-IV; first pair stoutest and with rows of stout bristles; fixed spine and distally on ischiopodite of first pereiopods only; basipodites of fourth and fifth pereiopods have short, broad and blunt spines; pereiopods IV and V extremely long, both reaching beyond scaphocerite by greatly elongated carpopodite, propodite and dactylopodite; portion beyond scaphocerite roughly 1.1 and 1.2 times longer than rest of pereiopods respectively; extended laterally lengths of pereiopods in ascending order are: first, second, third, fourth and fifth.

Abdomen: Uniformly glabrous; dorsal carina on posterior two-thirds of segment four and on segments five and six; carina on sixth terminates in distinct spine; no lateral cicatrices.

Telson: Equal in length to sixth abdominal segment; fails to reach end of mesial uropodal ramus by a fifth of its length; wide but shallow median sulcus; apical spine sharp; prominent pair of fixed subapical spines; distinct lateral ridge stopping short of subapical spines; no movable marginal spines.

Thelycum: Extremely simple. Anterior and posterior portions similar, consisting of raised subtriangular cushion-like process between fourth and fifth pereiopods respectively. Adults may have central ridge on both portions (Fig. II-13E).

Petasma: No male specimen was available for first hand description. The following is based on the original description by Bruce (1966) and both his illustration and that of Crosnier (1978). The petasma is a simple, involuted structure. Dorsomedian lobule united along more than one quarter of its length; free section of lobule thick; distomedian projection extending well beyond ventrolateral lobule; distal extremity produced into pair of pointed pinna-like processes; just below, hoof-like lateral process extends between distal portions of dorsolateral and ventrolateral lobules; proximally, thick inner edge of dorsomedian lobule overlaps itself slightly. Ventromedian lobule appears to be membranous, forming fold between dorsomedian and dorsolateral lobules. Dorsalateral lobule subtriangular; apex broad and rounded, protruding slightly over dorsomedian lateral process dorsally; longitudinal ridge runs laterally to base of lobule. Ventrolateral lobule almost entirely occupied by ventral costa; apex free; forming broadly rounded hoof-like process extending over dorsomedian lateral process ventrally.

Appendix masculina: Broadly subtriangular dorsally; ventrally deeply concave; lateral margin with short, stiff setae joining tuft of longer setae distally; medial half of inner margin with row of long setae. Appendix interna subrectangular in shape; distal end level with that of appendix masculina; row of short, stout setae distally and mesially. Basal article of endopodite

of pleopod II as wide as long; surface irregularly ridged; distolateral portion subrectangular, produced into broad blunt spur (Bruce, 1966).

Colour in life: According to Bruce (1966) and Crosnier (1978) this species is a yellowish white in colour possibly with scattered reddish mottlings.

Taxonomic status and comments

Bruce's type material was a single male specimen but Crosnier, having collected several specimens of both sexes, was able to complete the description of the species by adding details of the female genitalia.

Crosnier (1978) commented that his specimens agreed well with the description given by Bruce (1966) but there were some differences. The specimens from Natal also agreed fairly well with the original description but, again, some important discrepancies were encountered.

Crosnier (1978) reports the presence of only one spine on the merus of the first pair of pereiopods compared with the two described and illustrated by Bruce (1966). The specimens from Natal clearly have no spines on the merus but a distinct spine on the ischiopodite which agrees with the description of *H. obliquirostris* given by de Man (1911). On the other hand, both de Man (1911) and Bruce (1966) mention a spine on the basiopodite of the first pereiopods, whereas the examined specimens have no sign of a basal spine. According to Bate (1888) the female specimens of *H. obliquirostris* had no spines on the basiopodites of the first two pereiopods but Crosnier (1978), having examined the type specimens, states that there is a "very visible" spine on the basiopodites of pereiopods I and II.

The mandibular palp of the specimens from Natal do not agree with the illustration by Crosnier (1978) regarding the Madagascar collection. In the latter, the apex of the proximal portion is narrow for at least the first quarter of its length then widening to its maximum width. In the Natal specimens, although the apex is narrow, it immediately widens gradually and has no "neck-like" section.

The thelycum of the specimen collected by Kensley (1981) does not agree with that illustrated by Bate (1888) but neither does it agree with the drawing by Crosnier (1978). In the Natal specimens, neither the anterior nor the posterior portions possess central teeth or carina. This, however, may be due to the fact that the examined specimens were pre-adults and the genitalia were not yet fully developed.

I have, therefore, decided to give Kensley (1980) the benefit of the doubt and have classified these as *Hymenopenaeus halli* until such time as the importance of the pereiopodal spine and mandibular palp is defined.

Distribution (Fig. II-14)

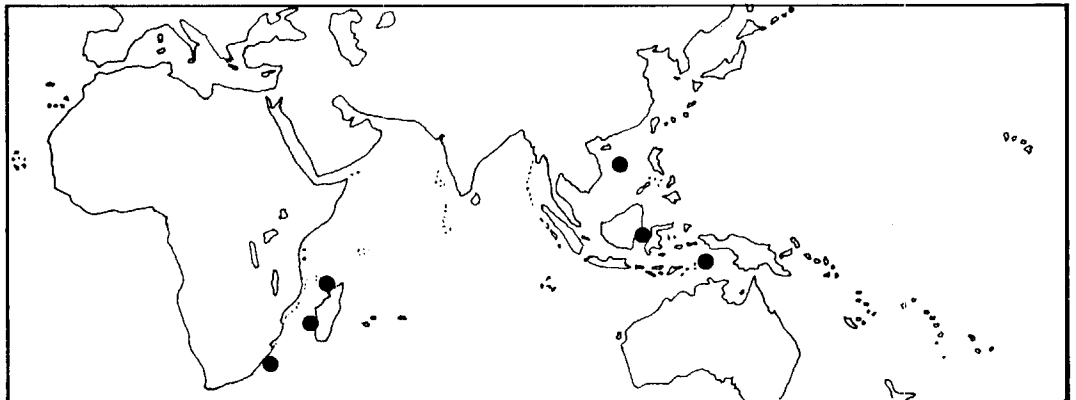


Fig. II-14 Distribution of *Hymenopenaeus halli*.

Hymenopenaeus halli is an Indo-Pacific species having been recorded from the South China Sea (Bruce); Indonesia — Great Kei Island, Makassar Strait (de Man, Crosnier); Madagascar — northwest and north coast (Crosnier); South Africa — off Durban (Kensley).

The finding, by Kensley, of this species off Durban was a new record and extends the geographical distribution across the Mozambique Channel to the South African coast.

Genus *Haliporus* Bate 1881

Haliporus Bate, 1881: 185; Bate, 1888: 284; Bouvier, 1905: 1 (part); Bouvier, 1908: 78 (part); De Man, 1911: 31; Burkenroad, 1936: 100; Perez Farfante, 1977a; 262; Crosnier, 1978: 97.
NOT *Haliporus* Wood-Mason, 1891b: 277; Milne Edwards & Bouvier, 1909: 206.

The genus *Haliporus* was established by Bate in 1881 to accommodate first four, then five (Bate 1888) species, one from the mid-Atlantic and the others from the mid-Pacific and Polynesia. Bouvier (1906) revised the genus and included in it a total of 19 species. Burkenroad (1936), in a careful and detailed analysis of the Solenocerinae, disagreed with Bouvier and rearranged the group recognizing two genera, *Haliporus* and *Hymenopenaeus* only.

Burkenroad (1936) placed only two species in the genus, namely *Haliporus curvirostris* and *H. thetis*. Pérez Farfante (1977a), while revising the genus *Hymenopenaeus sensu lato*, allocates two further species, *H. villosus* and *H. taprobanensis* to the genus *Haliporus*.

This genus consists of medium sized animals, usually found in deep water off the continental shelf. Generally they have a short prosartema; antennular flagella cylindrical; maxilliped I with single arthrobranchia; podobranchs usually present behind maxilliped II and telson with movable lateral spinules anterior to a fixed pair.

At present only four species are known, *H. curvirostris* from the mid-Pacific, and *H. thetis*, *H. villosus* and *H. taprobanensis* from the Indo-west Pacific. *H. villosus* was recorded from the Laccadive Sea (Alcock & Anderson 1896) and Pérez Farfante (1977a) examined two specimens from eastern Madagascar although Crosnier does not mention them. Kensley's specimens of this species were caught off southwest Africa. *H. taprobanensis* is the only species so far recorded from southeast African waters.

Haliporus taprobanensis Alcock & Anderson, 1899

(Fig. II-15)

Haliporus taprobanensis Alcock & Anderson, 1899: 280-282; Alcock, 1901: 25-26; Bouvier, 1908: 80; de Man, 1911: 31; Crosnier, 1978: 97-99; Crosnier, 1984: 23.

Haliporus kannemeyeri de Freitas, 1980: 105.

Hymenopenaeus taprobanensis Burkenroad, 1936: 104; Anderson & Lindner, 1945: 290.

Hymenopenaeus kannemeyeri Kensley, 1977: 27-29.

Material examined

South Africa: (28°21.9'S, 32°34.6'E) off St Lucia (775-825 m), 1 ♂ 32.44 mm; 1 ♀ 29.55 mm.

Description

Rostrum: Slightly upwardly directed, reaching end of second antennular article; ventral margin straight; rostral formula 7-8/0; epigastric and two other teeth situated behind orbital margin; epigastric and rostral teeth separated by regularly decreasing intervals; adrostral carina

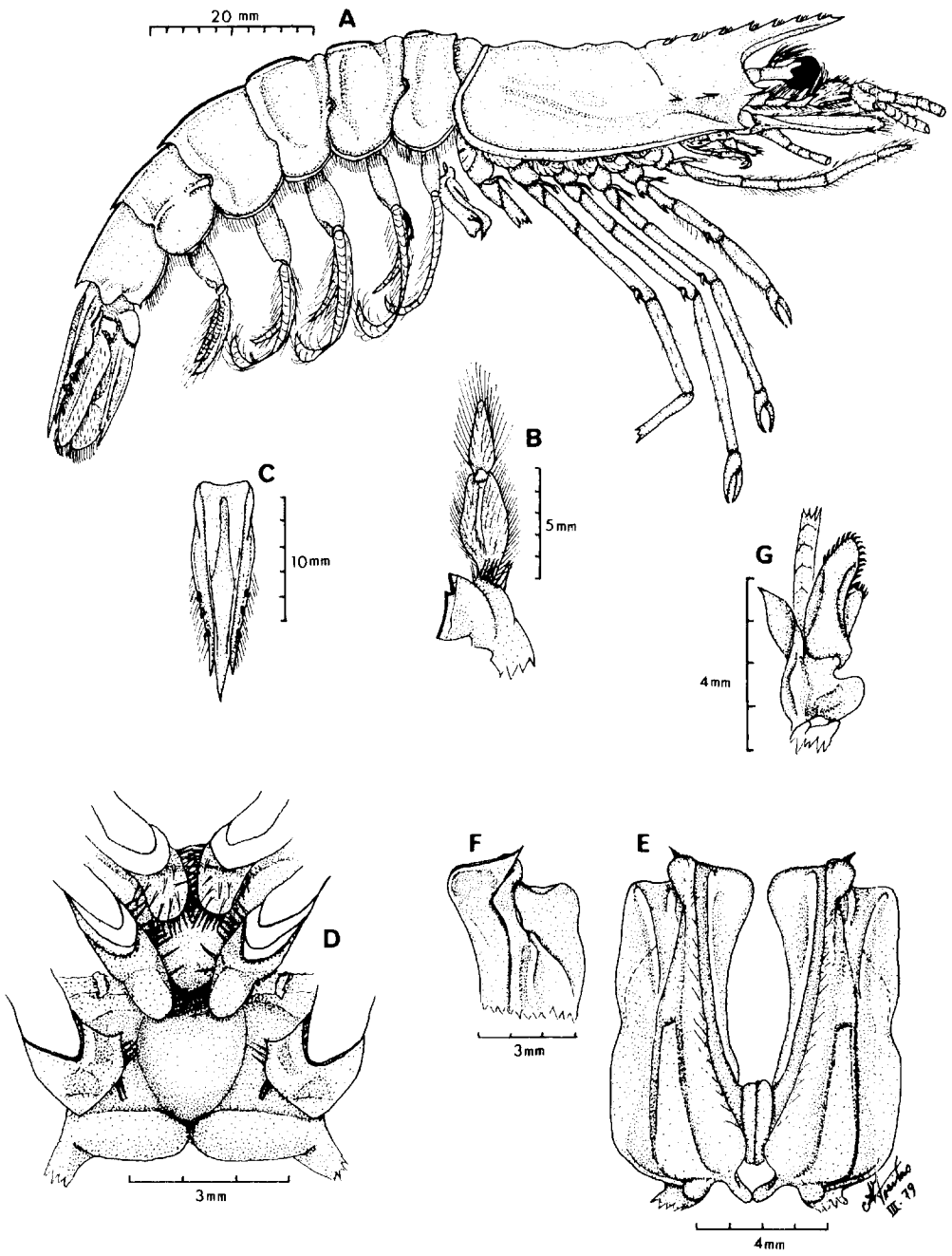


Fig. II-15 *Haliporus taprobanensis* A & A: A. Whole Animals; B. Mandibular palp; C. Telson; D. Thelycum; E. Petasma (yental view); F. Petasma (dorsal view); G. Appendix masculina.

not very clear, just reaches orbital margin; post-rostral carina not well developed, somewhat indistinct, interrupted by notch behind epigastric tooth and by wide depression about half way along carina; distinct tubercle just anterior to posterodorsal margin of carapace; median sulcus absent.

Carapace: Uniformly glabrous; gastrofrontal, postocular sulci and longitudinal suture absent; no orbital spine; cervical sulcus well developed, almost reaching dorsal midline; cervical carina restricted to short ridge about half way along sulcus; hepatic spine prominent with short rounded ridge extending a little way behind it; gastro-orbital carina indistinct; postorbital spine prominent and situated level with well developed antennal spine; antennal carina short; orbito-antennal sulcus wide running below postorbital spine and then vertically down to meet hepatic sulcus; hepatic carina sharp, directed anteroventrally; hepatic sulcus wide extending anteroventrally with carina and posteriorly from below hepatic spine; branchiocardiac carina and sulcus well developed and long; branchiostegal spine absent; pterygostomian angle spinose, spine sharp; submarginal carina long; transverse suture absent.

Antennule: Flagella subcylindrical in cross-section; (broken in specimens therefore impossible to measure); prosartema short, upright, paddle-like scale with long setae; stylocerite sharply pointed distally, short, not reaching end of eye; distolateral spine broad, long and sharp; parapenaeid spine present, situated near anteromedian angle of basal article.

Scaphocerite: Distolateral spine reaching well beyond distal end of antennular peduncle; apex of lamella extends slightly beyond distolateral spine; basicerite unispinose.

Mandibular palp: Reaching about distal end of basicerite; proximal article 1.8 times as long as wide; surfaces and margins covered with long setae; distal article 0.7 times length of proximal, about 0.4 times as wide as proximal, tapering to rounded apex.

Maxilliped III: Endopodites probably not exhibiting sexual dimorphism (maxilliped III of female missing); extending beyond scaphocerite by half of dactylopodite; exopodite very short, just reaching into ischiopodite of endopodite; epipodites present; podobranch not found.

Pereiopods: Exopodites present on all pereiopods, short but well developed, longest on first pereiopod and shortest on fifth; epipodites present on pereiopods I-IV; basipodite and ischiopodite of first pereiopod only with prominent spines; females with very small but distinct coxal spine and male with very broad canine-like coxal spine on fifth pereiopod; prominent movable spine on distal end of meropodite of pereiopods I-V; pereiopod III extends beyond antennular peduncle by chela; (impossible to give lengths of pereiopods as neither specimen has complete set).

Abdomen: Uniformly glabrous; dorsal carina present from posterior half of first segment to end of sixth segment; carinae of fourth to sixth segment terminate in short spine; second and third segments with wide tergal sulcus just anterior to dorsal carina, down to about half way along pleuron; wide pleural sulci on posterior half of first to fourth segments; vertical sulci of pleura absent; two lateral cicatrices present on fifth segment.

Telson: About 1.5 times length of sixth segment; about as long as mesial ramus of uropod; lateral carinae well developed, run length of telson terminating in fixed subapical spine; median sulcus shallow proximally and widens distally becoming slightly concave between lateral carinae; three small but distinct pairs of movable spinules evenly spaced anterior to fixed pair of spines.

Thelycum: Simple open structure; anterior portion formed by convex face of sternite between pereiopods IV. Posterior portion on sternite between pereiopods V similar to anterior portion but convex sternite face wider; posterior thoracic ridge with vertical posterior face and median notch.

Petasma: Simple and partially involuted. Dorsomedian lobule with short fleshy proximal section, 0.3 times length of petasma; united along entire length of proximal section; distal section sclerotized, elongate, widening distally; prominent ridge runs length of ventral surface of section; from ventral view surface convex distally; distomedian projection curved slightly

dorsally; subtriangular tooth-like in shape. Ventromedian lobule membranous and subtriangular with two longitudinal folds; distally terminates in small fleshy bulb attached to distal portion of dorsomedian lobule. Dorsolateral lobule subtriangular, formed of two sclerotized triangular plates; median plate runs length of petasma, distally forms tooth-like ridge which curves under distomedian projection (best seen from dorsal view); lateral plate shorter and much thicker than median plate; dorsal surface convex, proximally with short horizontal projection medially directed. Ventrolateral lobule entirely occupied by ventral costa; apex free and broad and curved dorsally; dorsal surface with curved ridge, ventral surface with two short ridges distally.

Appendix masculina: Dorsally with broad longitudinal ridge with concave lateral faces; ventrally deeply concave; distal and mesial margins with row of short, stout setae; appendix interna shorter than appendix masculina, half fitting into ventral concave face of latter; subrectangular; apex with short stout setae. Basal article of endopodite of pleopod II as wide as long with irregular, ridged surface, distolateral surface concave, subtriangular and produced into broad blunt spur.

Colour in life: As only preserved specimens have been examined it was not possible to describe the colour patterns of this species in detail. However, Crosnier (1978) states that *H. taprobanensis* is uniformly light orange to orange-red in colour.

Taxonomic status and comments

The two specimens in question are undoubtedly members of the family Solenoceridae. They are in good condition although some of the pereopods are missing and the antennae and antennules are broken. Kensley (1977) in his examination of the specimens, clearly failed to see the three pairs of small movable spinules anterior to the fixed pair of subapical spines on the telson.

The presence of these movable spinules is a characteristic of the genus *Haliporus*. Two other features which are apparently peculiar to this genus are the very small prosartema and the presence of a podobranch, at least on maxillipeds II and III. The prosartema of the specimens in question have been described above as being a short, upright and paddle-like scale with long setae, which agrees with the requirements. However, careful examination of both individuals show that maxilliped II has a clear and well developed podobranch but none has been found on maxilliped III; a situation also found by Alcock (1901) and Bouvier (1908).

What must be determined at this stage is the taxonomic importance of the presence or absence of the podobranch on the segments after maxilliped II, and whether this has intergeneric or interspecific significance. Pérez Farfante (1977a) suggest that the differences between *H. villosus* and *H. taprobanensis* and the type species *H. curvirostris* would seem to be of supraspecific significance and she continues, "... I believe that a study of adequate material might demonstrate that they should be relegated to separate monotypic genera." The features found in the specimens in question strengthen the case.

For the present I have decided to allocate Kensley's species *Hymenopenaeus kannemeyeri* to the genus *Haliporus* solely on the presence of the movable telsonic spines, the short, scale-like prosartema and the podobranch on maxilliped II.

Further, although de Freitas (1980) accepted Kensley's new species and simply allocated it to *Haliporus*, closer examination with the aid of Crosnier (1978), in which the illustrations are excellent, leads me to believe that this species is in fact *H. taprobanensis*. It agrees in every detail with the existing descriptions and illustrations with the exception of the absence of a podobranch on maxilliped III.

Distribution (Fig. II-16)

Haliporus taprobanensis is an Indian Ocean species having been found in India — Gulf of Mannar and Cape Comorin (Alcock & Anderson; Alcock, Bouvier, (Crosnier); Indonesia —

Makassar Strait, Ceram Sea (Crosnier); Madagascar — west coast (Crosnier); South Africa — Natal (Kensley).

Adults of this species have been recorded from 700 m to 1200 m. In southeast Africa it was found in 775-825 m of water.

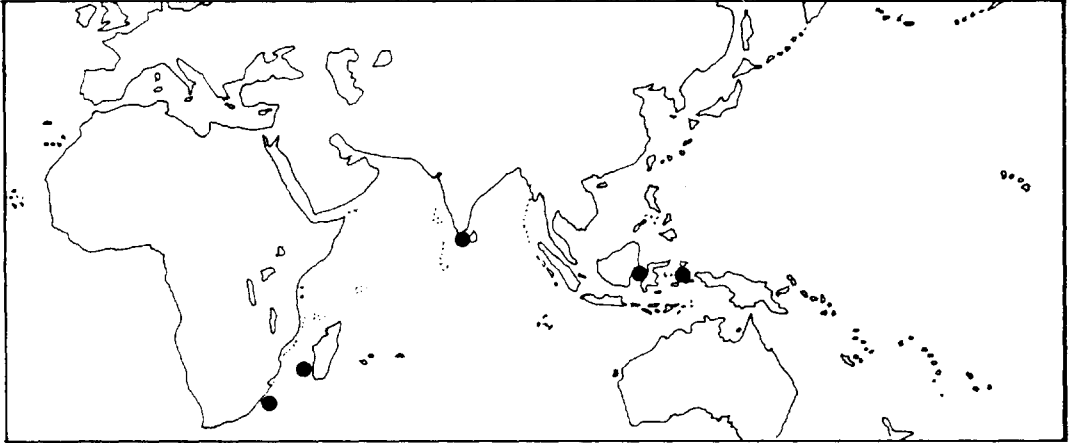


Fig. II-16 Distribution of *H. taprobanensis*.

Genus *Haliporoides* Stebbing 1914

Haliporus Bouvier, 1906: 1 (part); Bouvier, 1908: 78 (part); De Man, 1911: 31 (part); Calman, 1925: 9.

Haliporoides Stebbing, 1914a: 20; Pérez Farfante, 1977a: 289.

Hymenopenaeus Burkenroad, 1936: 102 (part); Crosnier, 1978: 100.

Parahaliporus Kubo, 1949: 207.

Hymenopenaeus (*Haliporoides*) Barnard, 1950: 619.

The genus *Haliporoides* was established by Stebbing (1914) to accommodate the southeast African species *H. triarthrus*. Burkenroad (1936) in his revision of the generic complex which comprised the genera, *Haliporus*, *Hymenopenaeus*, *Pleoticus* and *Haliporoides*, recognised only two genera, viz.: *Hymenopenaeus* and *Haliporus*, and included *Haliporoides* within the former genus. Burkenroad himself, however, was clearly unhappy about the taxonomic status of the genus *Hymenopenaeus* and admitted that this genus could be divided into four super-species, "... according to the presence or absence of branchiostegal or pterygostomial spines and to the nature of the postrostral armature." However, it was left to Pérez Farfante (1977) to finally clarify the situation and recognize, within *Hymenopenaeus sensu lato*, five genera. A sixth genus was subsequently recognised by de Freitas (1979).

The name *Haliporoides* was thus reinstated and now comprises medium to large prawns; cervical sulcus extends to or almost to mid-dorsum of carapace; orbital and branchiostegal spines absent; suprahepatic and pterygostomial spines present; branchiocardiac carina present; abdominal dorsal carina present on segments 3-6; prosartema moderately long and broad; parapenaeid spine absent; antennular flagella long, subcylindrical and equal in length; exopodites on all maxillipeds and pereopods; epipodites present on maxillipeds II and III and pereopods I to IV; telson with pair of fixed subapical spines; no movable lateral spines; appendix masculina and appendix interna present.

So far only three species of this genus are known. One, *H. diomedae*, is from the eastern Pacific, and two, *H. triarthrus* and *H. sibogae*, are from the Indo-west Pacific.

***Haliporoides triarthrus vnirio* Stebbing, 1914**

(Fig. II-17)

Haliporoides triarthrus Stebbing, 1914a: 21; Pérez Farfante, 1977: 290; Kensley, 1977: 16; de Freitas, 1980: 106-126; Holthuis, 1980: 3.

Haliporus triarthrus Calman, 1925: 9.

Hymenopenaeus triarthrus Barnard, 1950: 619-621; Hall, 1966: 98; Kensley, 1972: 18; Ivanov & Hassan, 1976: 245.

Hymenopenaeus triarthrus vnirio Crosnier, 1978: 110-112.

Material examined

Mozambique: Ilhha do Fogo, 6 ♀♀, 31.50-36.10 mm Bazaruto (200-560 m), 11 ♀♀, 30.75-44.50 mm, 2 ♂♂, 28.05-36.20 mm; Barra Falsa (200 m), 2 ♂♂, 31.05-25 mm; Monte Belo (450 ml), 11 ♀♀, 34.80-48.35 mm, 2 ♂♂, 33.65-34.60 mm.

Description

Rostrum: Very broad and crested upper edge curved downwards as from anterior half; reaching distal end of antennular peduncle; rostral formula 10-12/2-3; epigastric and one other tooth behind postorbital margin; adrostral sulcus distinct, reaching second rostral tooth; postrostral carina distinct, terminating one quarter of length of carapace before posterior margin; median sulcus absent.

Carapace: Uniformly pubescent; postocular sulcus present; gastro-frontal sulcus, longitudinal suture, gastrofrontal carina and orbital spine absent; cervical sulcus well developed, extending dorsally to base of postrostral carina slightly behind epigastric tooth; cervical carina terminating anteroventrally in small hepatic spine; about one-third distance along cervical carina is minute and somewhat inconspicuous suprahepatic spine; antennal carina well developed terminating in prominent antennal spine; carina occupies little less than anterior half of distance between antennal and hepatic spines; orbito-antennal sulcus well developed; small but distinct postorbital spine present half way between antennal spine and cervical sulcus; no orbital spine; hepatic carina and sulcus restricted to depression below hepatic spine; no posthepatic carina; branchiocardiac carina and sulcus distinct and terminate anteroventrally slightly behind hepatic depression; pterygotomian spine prominent; branchiostegal spine absent.

Antennule: Flagella longer than length of animal; mesial flagella cylindrical along entire length; lateral flagella with short laterally compressed portion near base; prosartema reaching distal margin of eye, has rounded blunt apex and covered with minute hairs stylocerite about half length of basal article, terminating in blunt spine; distolateral spine short and blunt; parapenaeid spine absent.

Scaphocerite: Distolateral spine reaching distal end of third antennular article; single anteroventral spine on basicerite.

Mandibular palp: Reaching to half way along carpocerite; proximal article 2.7 times as long as wide; distal article narrow, tapering to rounded apex; 0.5 times length of proximal article; both articles covered in long setae.

Maxilliped III: Endopodites long, reaching well beyond distal end of antennular peduncle; no sexual dimorphism; ischiopodite long, flat with median sulcus; exopodites extremely small and no more than minute paddle-like hairy processes; epipodites present; no spines present.

Pereiopods: Exopodites and epipodites present on pereiopods I and IV; no ischial or basal spines; in female coxapodites II-V with median dilations, largest being on coxapodite of third pereiopods; in male prominent blunt spine-like process present on fifth coxapodites. Pereiopod V reaching beyond antennular peduncle by dactylus, propodite and half carpopodite; pereiopod IV reaching beyond antennular peduncle by dactylus and one-third propodite;

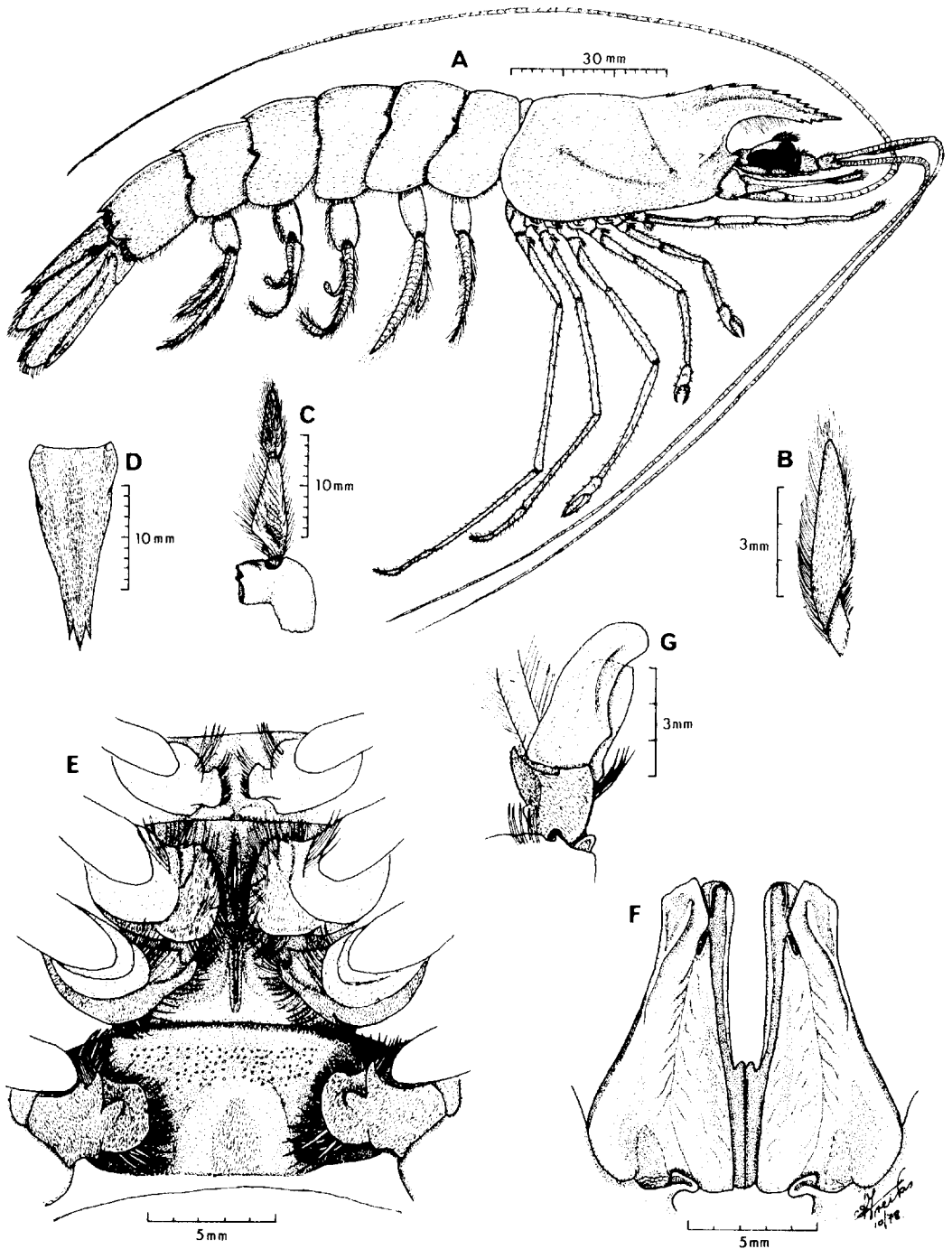


Fig. II-17 *Haliporoides triarthrus vnirio* Stebbing: A. Whole animal; B. Prosartema; C. Mandibular palp; D. Telson; E. Thelycum; F. Petasma; G. Appendix masculina.

extended laterally lengths of pereopods in ascending order are: first, second, third, fourth and fifth.

Abdomen: Uniformly pubescent; faint dorsal carina on last quarter of third segment; dorsal carinae of segments four to six well developed each terminating in small spine; no lateral cicatrices.

Telson: Slightly longer than sixth abdominal segment; four-fifths length of mesial uropodal ramus; wide but shallow median sulcus; apical spine long and sharp; prominent fixed subapical spines; no movable lateral spines.

Thelycum: Extremely simple. Anterior portion consisting of median ridge between fourth pereopods; tuft of hair present on higher anterior end of median ridge; second median ridge found between third pereopods. Posterior portion between fifth pereopods consisting of convex sternite with faint broad median ridge often not apparent.

Petasma: Fairly simple structure, double folded on itself. Dorsomedian lobules united along proximal two fifths of their length; distal half prolonged forming subrectangular process. Ventromedian lobule subrectangular; twice as long as united portion of dorsomedian lobule; subtriangular in shape. Ventrolateral lobule broad at base; distally as long as distomedian projection; ventral costae narrow; prominent median ridge occupies distal third of costae.

Appendix masculina: Elongate, about 2.4 times as long as wide; apex broadly rounded; dorsal surface glabrous; convex mesially and concave laterally; ventral surface concave. Appendix interna about 0.75 times length of appendix masculina; apex truncate and slightly curled; dorsal surface concave and lightly setose. Basal article of endopodite of pleopod II 0.4 times length of appendix masculina; dorsal surface convex and setose; lateral face concave; distolateral angle produced into blunt spur.

Spermatophore: Consists of thick cream to yellow convoluted "shield"; broad anteriorly and narrow posteriorly; the "shield" protects membranous milk-white sack containing the sperm. Coxal plates of pereopods III-V assist in holding spermatophore in place.

Colour in life: Body uniformly pink; pleura slightly deeper pink; telson and uropods brighter pink to orange; antennules and antennal flagella mauve at base becoming light pink to white in centre and red distally; pereopods pink to mauve; marginal setae of pleura, pleopods and scaphocerite white; setae of uropods orange.

Taxonomic status and comments

Stebbing's type material, a female, was found off East London and there is no doubt that the Mozambique specimens belong to this species. Crosnier (1978) discusses in some detail the slight but real differences that exist between the specimens described by Stebbing (1914a) and specimens collected from Mozambique; differences that were also the subject of comment by Ivanov and Hassan (1976). In particular, the rostrum of the Mozambique specimens are not as broad and arched as the Cape specimens and have fewer rostral teeth. Crosnier (1978) has, therefore, decided to establish a subspecies to accommodate the southeast African specimens.

H. triarthrus vnirio is very closely related to *H. sibogae* but both Ivanov and Hassan (1976) and Crosnier (1978) have shown the distinction between them.

H. triarthrus vnirio, commonly known as the pink prawn, is of considerable commercial importance off southern Mozambique and Natal.

Distribution (Fig. II-18)

H. triarthrus vnirio has so far been found only off the southeast coast of Africa. Existing data shows that this species has been recorded from Mozambique — Ilha do Fogo, Bazaruto, Zavora, Monte Belo, Inhaca (de Freitas, Ivanov & Hassan); South Africa — Natal coast, East London, off Table Bay (Stebbing, Calman, Barnard and Berry, Heydorn & Alletson).

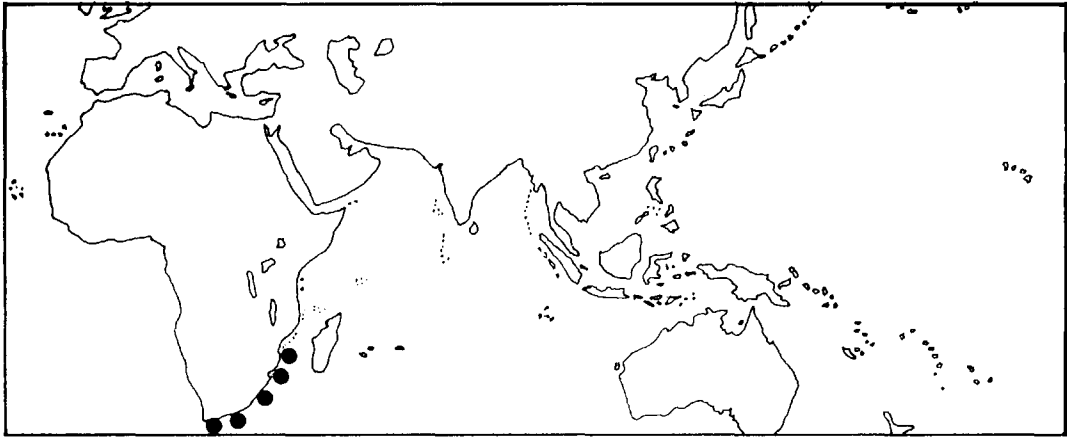


Fig. II-18 Distribution of *H. triarthrus vnirio*.

Nothing is known about the larval and juvenile phases of this species. No information exists on the location of the nursery areas although it is probable that this species completes its entire life-cycle in oceanic conditions.

Adults are found on the continental slope and have a depth range from 180 m to 650 m. The largest individuals seem to occupy the deeper waters.

Biology

Very little is known of the biology and population dynamics of *H. triarthrus vnirio*, a species with considerable economic importance to southern Africa. Apart from a short study carried out by Berry, Heydorn and Alletson between 1969/1971 and again 1973/1974, no scientifically orientated research programme has been directed to this species. During the period between November 1975 and October 1976 irregular monthly samples were obtained from two trawlers of a Durban based company that normally operated on the ground in the Limpopo Bight.

These samples, seven in number, were frozen at sea, in plastic bags, and although reportedly taken before any selection was made, it is possible that the smallest individuals were not included in the sample. During the study period a total of 1415 females and 1200 males were measured (carapace length) and in the females the ovaries were examined to determine maturation. Other observations were made, e.g. incidence of parasitism, moulting and impregnation but no weights were taken. Data on the seasonal fluctuations in abundance were obtained from the detailed daily catch records of seven vessels operating in the area during 1976.

Reproduction

Maturity. No work has been done on the anatomy of the male and female reproductive systems, although it probably follows the general penaeoid pattern. The determination of the state of maturity is based on the development of the gonads and, although it is difficult to detect stages of maturation in the testes, in the ovary maturation is accompanied by distinctive colour changes. These make it possible to divide the ovarian development into the following five stages:

Stage I: Undeveloped — Translucent, smooth and threadlike.

Stage II: Developing — Opaque; pink to pinkish grey in colour; slightly distended and finely granular.

- Stage III: Ripening — Fully distended; grey to blue-grey in colour; coarsely granular.
 Stage IV: Ripe — Fully distended; blue to deep blue in colour; individual ova visible to naked eye.
 Stage V: Spent — Flaccid; grey to cream in colour; the odd loose egg may be present.

Although the existing information about *H. triarthrus* is limited, data collected in 1976 from the Limpopo Bight shows that all females with a carapace length (C.L.) smaller than 23-24 mm have undeveloped ovaries and that the largest female with undeveloped ovaries measured C.L. = 45-46 mm. The smallest females with ripening (III) or ripe (IV) ovaries measured C.L. = 31-32 mm, while the majority (50% or more) of the females first showed ripening or ripe ovaries at C.L. = 45-46 mm (Fig. II-19).

Mating: The thelycum of this species is of the open type and the spermatophores are very easily dislodged. Of the 1415 females sampled only nine (0.6%) were found with spermatophores still in place, but in the same samples loose spermatophores were common. Impregnated females were found only during the late winter months of July, August and September and all were on females with ovaries in stages III and IV. The smallest female found impregnated measured 37.3 mm in carapace length. Of the impregnated females six (67%) were soft-shelled.

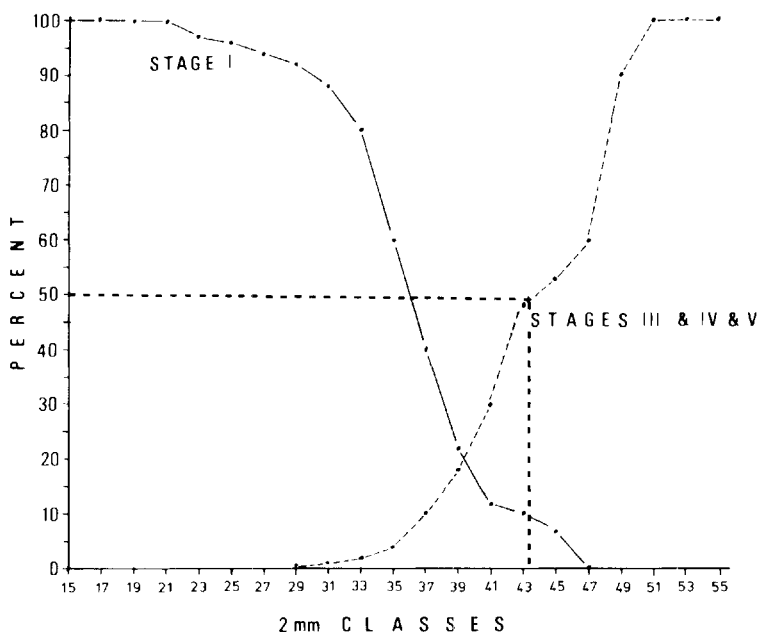


Fig. II-19 Percentage of *Haliporoides triarthrus* females in Stage I and Stages III + IV + V of gonadal maturation.

During August and September 1976, of the 369 males sampled, 28 (7.6%) had spermatophores protruding from the external opening of the vas deferens. Besides these 28, two of 61 males sampled in June were found to be in the same state. This fact seems to confirm that mating activity, if not restricted to the winter months, is at least more frequent at this time.

Spawning: The incidence of ripe and spent females in a population has generally been accepted as indicative of spawning activity. Of the 1415 females sampled only one, in August, was considered to have spent ovaries, and a further 56 were ripe.

Although samples were not obtained every month, the data collected (Fig. II-20) was sufficient to indicate that some degree of spawning occurs throughout the year although it is

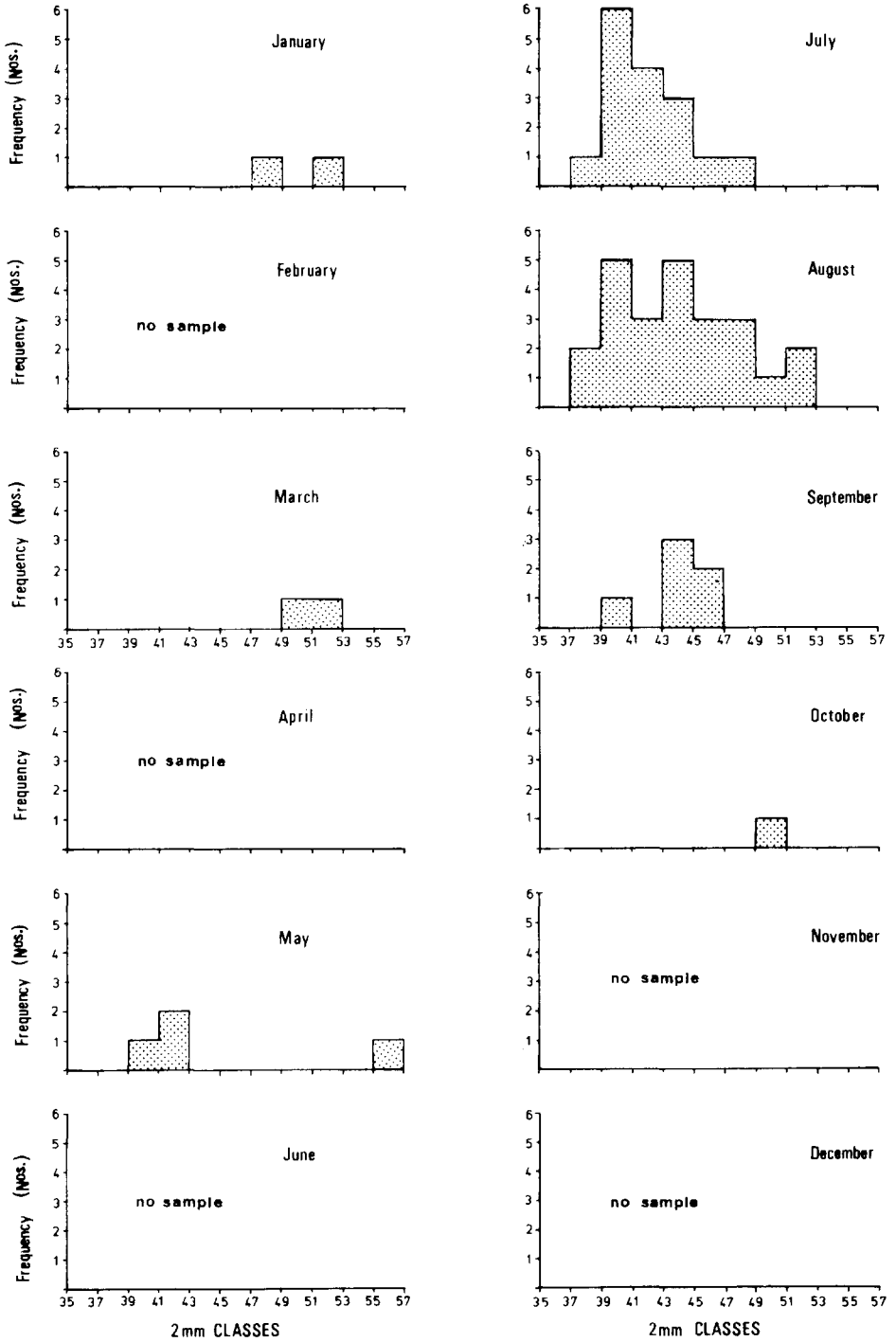


Fig. II-20 Size frequency distribution of ripe and spent females of *H. triarthrus*.

more prevalent during the winter months. Further, although few in number, the ripe females found in October, January and March were all large (C.L. = 47-55 mm) (Fig. II-20). This may indicate that whereas a female first spawns during late winter (with C.L. = 37-45 mm), spawning probably occurs several times during the following months while the female grows from 45 mm to 55 mm. This fact possibly explains the presence, in the population, of fairly large females with undeveloped ovaries (Fig. II-19). It is possible that these have, in fact, ovaries in the process of regeneration after spawning.

Associated species and parasites

The main penaeoids associated with *H. triarthrus vnirio* are *Penaeopsis balssi* and *Aristaeomorpha foliacea*. Far less common are *Plesiopenaeus edwardsianus*, *Aristeus antennatus* and *A. virilis*. Other crustacean species caught on the Limpopo Bight fishing grounds are the crayfish *Palinurus delagoae*, the langoustine *Metanephrops andamanicus* and the crab *Geryon quinquidens*. However, the first two species seem to have their own preferred depth range and thus would only be found with *H. triarthrus vnirio* along the outer edge of their range where they overlap (Fig. II-24).

A total of 35 fish species were identified and considered as cohabitants with *H. triarthrus vnirio*. Of these the most abundant were *Argentina sphyraena*, *Chlorophthalmus agassizi*, *Malacocephalus laevis*, *Chamsodon capensis*, *Chascanopsetta lugubris*, *Cubiceps squamiceps*, *Synagrops japonicus*, *Neoscombrops annectens*, *Ruvettus pretiosus*, *Epinnula orientalis*, *Helicolenus dactylopterus*, *Lophius piscatoris* and *Chaunax pictus*. No stomach contents of any fish species were analysed so it is not possible to list any as predators of *H. triarthrus vnirio*.

The most conspicuous parasite found on *H. triarthrus vnirio* is a bopyrid isopod, possibly *Epipenaeon* sp. Of the total of 2615 prawns examined, 3.1% were found to be infected. Forty two females were found parasitized and of these 76.2% had undeveloped ovaries, 14.3% developing ovaries and 9.5% ripening ovaries. No parasitized female was found with ripe ovaries.

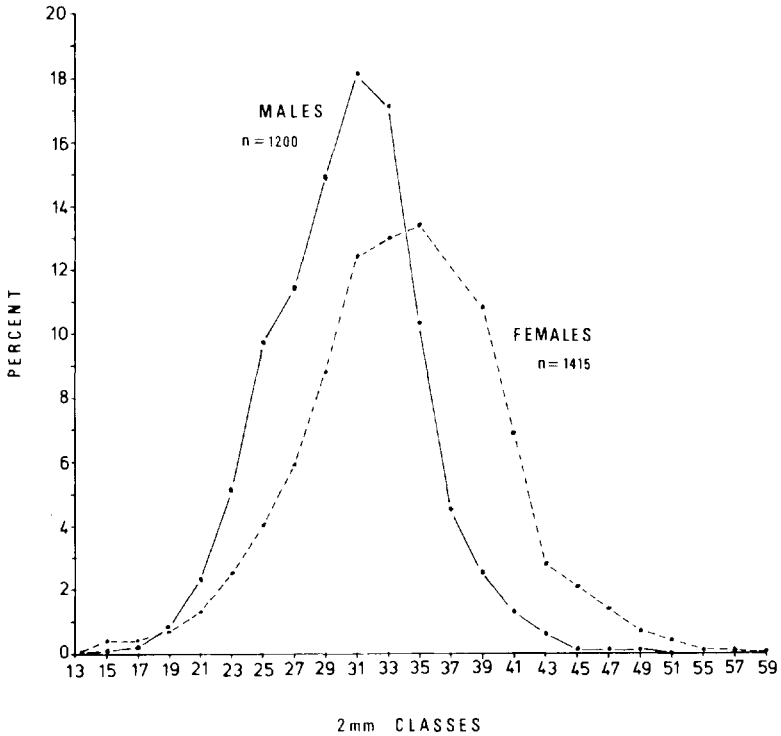
Population structure

Sex ratio. From the data collected in 1975, the males formed roughly 50% of the population from January to May. The percentage dropped to 37-39% in July and August, increasing again to 48% and 47% in September and October respectively. It is interesting to note that the increase in the number of females in the population coincides with the period of increased spawning activity.

Size composition. From the size composition of the *H. triarthrus vnirio* population found on the fishing grounds in the Limpopo Bight in southern Mozambique it is evident that females generally attain a larger size than the males (Fig. II-21). The overall size range was C.L. = 15.6-49.8 mm for males and C.L. = 14.6-55.8 mm for females with the annual means being C.L. = 30.4 mm and C.L. = 34.1 mm respectively.

The monthly size frequency distributions (Fig. II-22) are somewhat difficult to interpret because of the small sample sizes and also because of the extended breeding season. On the whole the monthly distributions for males and females seemed to be rather uniform but this was probably because of the selectivity of the fishing gear.

With the exception of July and August, 80% or more of the males were found in the lower half of the size range (C.L. = 33 mm or less). In July and August 67% and 51% of the male population measured C.L. = 32 mm and smaller. During July and August, 76% and 70% of females respectively were larger than C.L. = 33 mm while in October only 28% were situated in the upper half of the scale. During the remaining months 52-62% of the females measured 33 mm and less in carapace length.



Morphometrics: Data for morphometric analyses were not collected during 1976. Berry *et al.* (1975) calculated that the carapace length/total length relationships can be expressed by the equations:

$$Y = 20.28 + 3.67 X \text{ for males and}$$

$$Y = 22.06 + 3.53 X \text{ for females}$$

where X is the carapace length and Y the total length in mm.

The carapace length/total weight relationships are expressed by the equation:

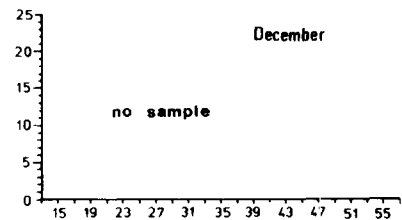
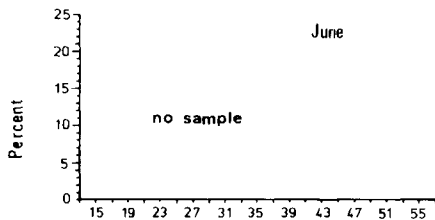
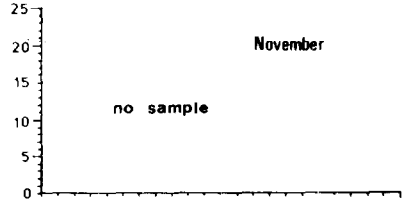
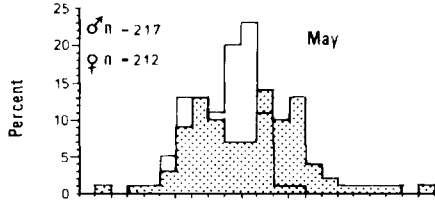
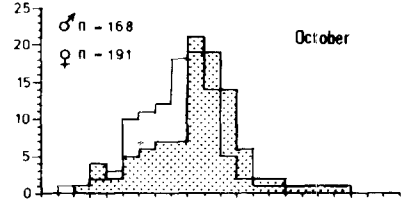
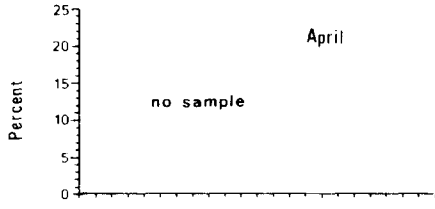
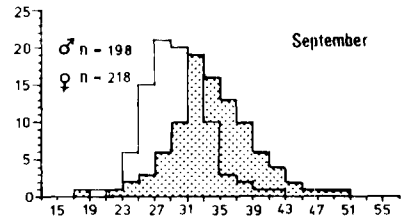
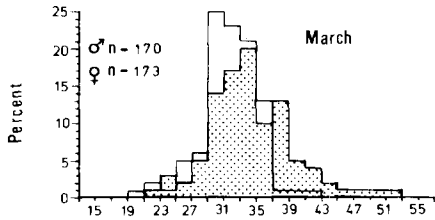
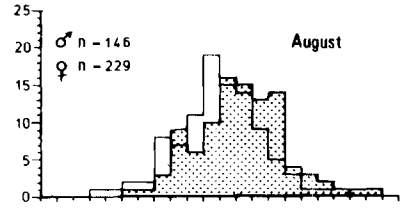
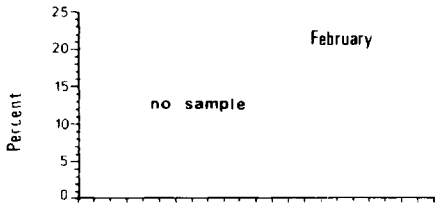
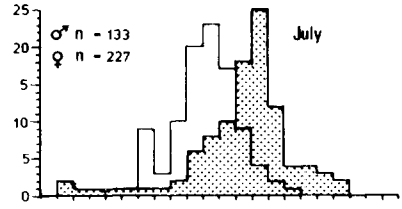
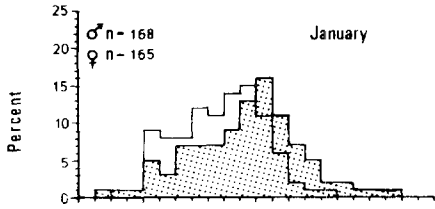
$$W = 1.231 \times 10^{-3} \times C^{2.79} \text{ for males and}$$

$$W = 1.307 \times 10^{-3} \times C^{2.75} \text{ for females}$$

where W is the total weight in grams and C the carapace length in mm.

Abundance

It was difficult, with the data available to be conclusive about the seasonal abundance of *H. triarthrus vnirio* in southeast African waters. The information available was based on the catch figures supplied by commercial trawlers from November 1975 to October 1976, and are,



2mm CLASSES

2mm CLASSES

Fig. II-22 Monthly size frequency distribution of *H. triarthrus* males (shaded) and females (unshaded) in percentage per 2mm classes.

therefore, subject to some bias. The monthly catch per unit effort in kg per day (Fig. II-23) shows that higher catches were recorded during autumn and winter than during the other seasons. The low values given for August, September and October are probably somewhat lower than reality because, as the prawn catches drop, the fleet change their target species, moving to the adjacent langoustine grounds.

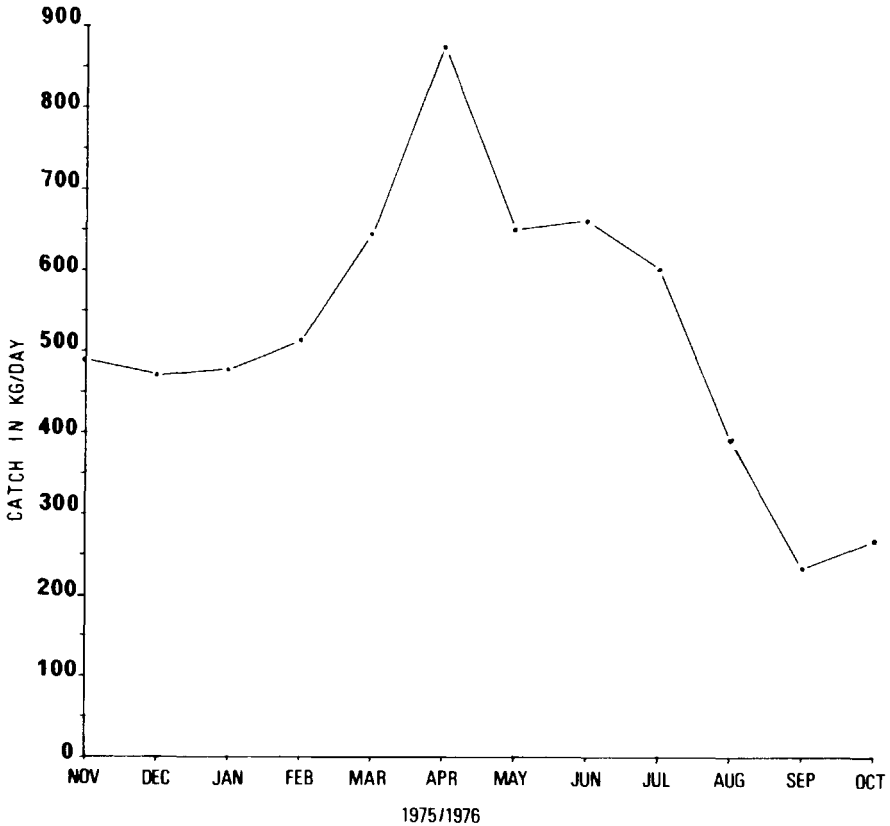


Fig. II-23 Catch per unit effort of *H. triarthrus* based on the catch returns of trawlers fishing in southern Mozambique from November 1975 to October 1976.

Exploitation

Fishing grounds: Along the southeast African coast the best and most extensive *H. triarthrus* grounds are situated in the Limpopo Bight in southern Mozambique. They stretch from about 30 km east of Inhaca Island eastwards for some 180 km in a belt which varies in width from 10-20 km (Fig. II-24). Although this species has a depth distribution from 300 to 650 metres, the best fishing areas are limited between the 360 to 540 metre isobaths.

Commercial concentrations are also known off Bazaruto Island to the north and off Natal to the south. The former grounds are rather narrow and situated on the continental slope which is rather steep in that area. The Natal grounds stretch from Cape Vidal southwards to Durban, being about 15 km wide in the north and widening to some 40 km off Durban.

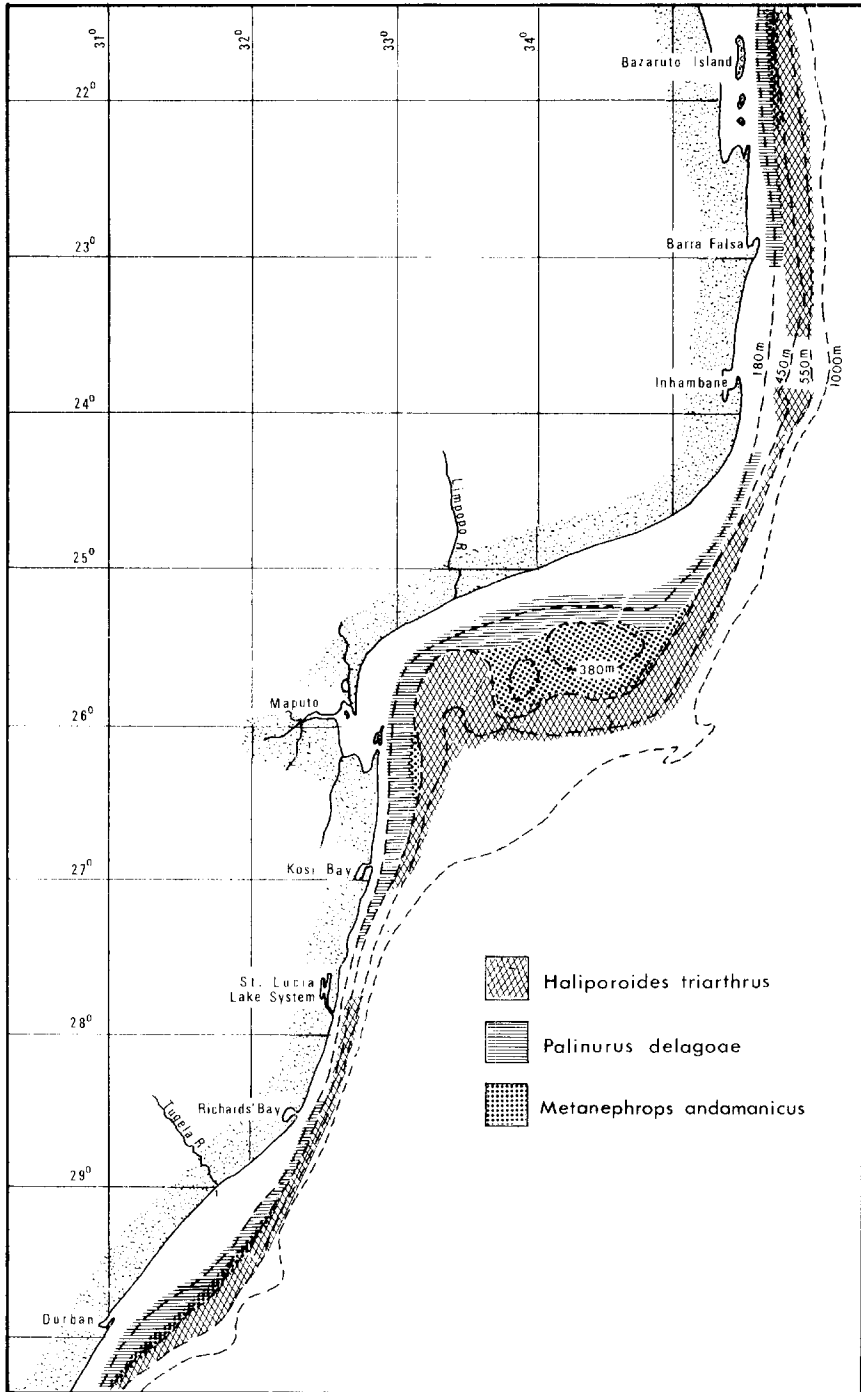


Fig. II-24 Coast of southern Mozambique and Natal showing fishing grounds of *H. triarthrus* and associated species.

Fishing activity: The trawling of *H. triarthrus vnirio* as a fishing activity can not be separated from the exploitation of two other important Crustacea, the Natal rock lobster, *Palinurus delagoae* and the langoustine, *Metanephrops andamanicus*, the latter being more abundant and more sought after than the former. In southern Mozambique *M. andamanicus* is found on a plateau between 325 and 490 metres and roughly 33 x 16 km in area. *P. delagoae* is found to the landward of this plateau at depths ranging from 160-360 metres.

The exact target species will depend on the availability of the species and on the market demands. *H. triarthrus vnirio* is not the best of species for on-board handling as it is a comparatively soft bodied animal easily damaged and very susceptible to melanosis (black spot). However, the relatively large quantities usually caught, class it as an economically important species. Should the catches of *H. triarthrus vnirio* in southern Mozambique decrease, or if the market demands for langoustine increase, only a slight change of fishing grounds is needed for the fleet to be catching *M. andamanicus*.

Fishing on the Natal grounds is far less intense for various reasons. In spite of the fact that the grounds are in no way as large and probably not as rich as the Mozambique grounds, many fishermen believe that stocks of both *H. triarthrus vnirio* and *M. andamanicus* exist in commercial quantities. The limiting factor to the convenient exploitation of these species in this area seems to be the high incidence of bad weather days experienced south of Cape St Lucia as compared with the weather in the Limpopo Bight. The strong and irregular ocean currents experienced in the area also create many difficulties in the actual trawling operation. Both these factors then contribute to the infrequent exploitation of the Natal grounds.

Discussion

Haliporoides triarthrus vnirio, commonly known as the pink prawn, has a geographic distribution limited to the southeast African waters. It inhabits the continental slope between depths of 300 and 650 m and the larger individuals occupy the deeper parts of their habitat.

Very little is known about the reproductive cycle of this species and no information is available on the larval forms or on their nursery areas. Berry, Heydorn and Alletson (1975), with data collected from 1969/1971 and 1973/1974 indicated that the *H. triarthrus vnirio* population off Mozambique seemed to show that "active or ripe ovaries were first recorded" in the 29-30 mm size class and 50% had them in the 41-42 mm carapace length size class, whereas in the Natal samples first evidence of ovarian activity was in the 37-38 mm size class and 50% of females showed signs of it in the 49-50 mm size class. These results are in the same region as those found during this study and it can be taken that maturing gonads first appear in females of 29-32 mm in carapace length and 50% or more show ripening or ripe ovaries at C.L. = 45-50 mm.

It is not possible to determine, by macroscopic examination, the attainment of sexual maturity by the males of this species. Berry *et al.* (1975) used the incidence of joined petasmal halves as an indication of male sexual maturity. They showed that the "majority of males have joined petasmata in the 31-32 mm carapace length size classes . . .". Unfortunately because the join of the petasmal halves in this species is not very efficient and is very easily disturbed by the mechanical action of the trawl, no data on this characteristic was collected during 1976.

Berry *et al.* (1975) were not able to make any reliable deductions as to the reproductive cycle of *H. triarthrus vnirio* due to the small numbers of females showing evidence of reproductive activity, which appeared in their samples. They suggested, however, that a possible explanation was that breeding females move ". . . off the open muddy bottom which constitutes the fishing ground, onto adjacent areas where the substratum is rough . . ." and trawling is impossible. They also suggested that these areas may be deeper than the normal fishing grounds. Further, they indicated, in their report, that breeding may occur earlier in Mozambique than in Natal waters. That is, during August and September in Mozambique and October to December in Natal. The data collected in 1976 was exclusively from southern Mozambique and seems, at

least, to confirm the fact that July to September is the period of important breeding activity. No further light can be shed on the breeding season off Natal.

In general it appears that although some incidence of breeding occurs throughout the year, the greatest breeding activity takes place during late winter. Females start breeding when they reach a size of 37-45 mm in carapace length and probably reproduce several times during their life. The fairly low incidence of ripe females in the samples, especially those collected by Barry *et al.* (1975), may be indicative of a migration of the breeding population to habitats as yet not located.

Although the data collected during the study indicates that about 3.1% of the *H. triarthrus vnirio* examined was infected with a still unidentified bopyrid parasite, probably *Epipenaeon* sp., Berry *et al.* (1975) records approximately 6% infection. Tuma (1967) found that the banana prawn, *Penaeus merguensis*, when infected by a similar bopyrid parasite, showed retardation in the development of the gonads. However, Berry *et al.* (1975) found that several infected females had ripe ovaries, although marked retardation of sexual development in infected males was apparent. When the parasite was lost, gonadal development appears to have restarted.

Berry *et al.* (1975) having carried out some exploratory trawls off the Natal coast, showed that there was a tendency for the larger prawns of both sexes to be found in deeper water. During the present investigation the samples were taken from depths ranging from 350 to 480 metres. Although it was not possible to directly relate the size of the prawns with depth, it was an established fact among fishermen that the largest prawns are to be found beyond 400 metres in depth.

The samples used in this study were obtained from prawn trawlers and taken from their normal fishing operations. It is possible, therefore, that due to some degree of selectivity from the gear, samples may not be truly representative of the total population. Notwithstanding, it seems that there is a 1:1 ratio of males and females for most of the year, the males dropping to about 40% of the population during July and August. Females generally attain larger sizes than males, the mean annual carapace lengths being 30.4 mm for males and 34.1 mm for females.

The larger individuals are more abundant during July and August with mean carapace lengths of 32.2 mm and 33.7 mm respectively for males and 36.9 mm and 36.5 mm respectively for females. There is a drastic drop in the large size classes during October, which probably means that there is some migration away from the fishing area during September and October. This migration may be for breeding purposes as suggested by Berry *et al.* (1975).

The southeast African stocks are being exploited commercially. The best season seems again to be during the autumn and winter months and the larger individuals are more frequently found below 360 metres. In southern Mozambique the weather and current systems are normally good and are not limiting factors for the exploitation of *H. triarthrus vnirio*. Off Natal, on the other hand, stocks are not as abundant as in Mozambique probably because of the much narrower continental slope. Also, the high incidence of bad weather makes fishing a more difficult operation than in Mozambique.

Not enough data have been collected from Natal waters to be able to ascertain the size of the stock, but indications are that it is sufficient to support a modest fleet of medium sized vessels, particularly when one considers that, in fact, this is a mixed fishery exploiting three highly valued species, the pink prawn, *H. triarthrus vnirio*, the langoustine, *Metanephrops andamanicus* and the Natal rock lobster, *Palinurus delagoae*.

Genus *Cryptopenaeus* de Freitas, 1979

Cryptopenaeus de Freitas, 1979: 123.

This genus was established by de Freitas (1979) to accommodate a species, *C. catherinae* which, although fitting into the genus *Hymenopenaeus sensu lato*, does not satisfy the generic

conditions of any of the five genera which Pérez Farfante (1977) established within *Hymenopenaeus*.

The genus thus comprises medium sized animals with moderately robust body; short rostrum with convex ventral margin; epigastric tooth and first rostral tooth separated by interval equal to or only slightly greater than that between first and second rostral teeth; no orbital, suprahepatic nor branchiosegal spine; pterygostomial angle with prominent spine; branchio-cardiac carina distinct but not sharp; no movable margin spines on telson.

Only one species of this genus, namely *C. catherinae* has, so far, been found off the east coast of Africa. A second species, *C. clevai* has recently been found by Crosnier (1984) in the Cream Sea of Indonesia.

***Cryptopenaeus catherinae* de Freitas, 1979**

(Fig. II-25)

Cryptopenaeus catherinae de Freitas, 1979: 125-131; Emmerson, 1981: 135; Pérez Farfante, 1985: 316.

Material examined

Mozambique: Off Monte Belo and Cape Santa Maria (310-500 m), 5 ♂♂, 44.50-47.70 mm; 1 ♀, 63.2 mm.

South Africa: Off Tugela River mouth (240 m), 1 ♀, 37.4 mm.

Description

Rostrum. Slightly downwardly directed, reaching to or just beyond end of first antennular article; ventral margin convex; rostral teeth 7-8/0; epigastric and three other teeth situated behind orbital margin; adrostral carina short, just reaching orbital margin; post-rostral carina well developed, long, almost reaching posterior margin of carapace and with conspicuous notch behind epigastric tooth; median sulcus absent.

Carapace. Uniformly glabrous and lightly punctate; gastrofrontal and postocular sulci and longitudinal suture absent; no suprahepatic or orbital spines; cervical sulcus and carina well developed and long but not reaching dorsal midline; cervical carina terminating antero-ventrally in prominent hepatic spine; gastro-orbital carina absent; postorbital spine prominent; antennal spine present but relatively small; antennal carina absent; orbito-antennal sulcus restricted to wide depression extending from below postorbital spine to below hepatic spine; hepatic carina sharp, anteroventrally directed and situated just anterior and below hepatic spine; hepatic sulcus wide and deep, extending posteriorly below hepatic spine; branchiocardiac carina distinct but not sharp; branchiostegal spine absent; pterygostomial spine prominent and sharp; submarginal carina long and sharp; no vertical suture or carina.

Antennule. Flagella subequal in length; about 2.5 times length of antennular peduncle; subcylindrical; mesial flagella twice as thick as lateral flagella; prosartema flexible with pointed apex, reaching just beyond distal end of first antennular article, copiously provided with long setae; stylocerite sharply pointed distally, straight and reaching just beyond end of eye or to end of first antennular article; distolateral spine prominent and long; parapenaeid spine absent.

Scaphocerite. Distolateral spine reaching just beyond distal end of antennular peduncle; apex of lamella extending beyond distolateral spine; basicerite with single broad blunt tooth distally.

Mandibular palp. Reaching to basal one-third of carpocerite; proximal article 1.8 times as long as wide; distal article subequal to proximal, tapering to rounded apex.

Maxilliped III. Endopodite not exhibiting sexual dimorphism; reaching distal end of

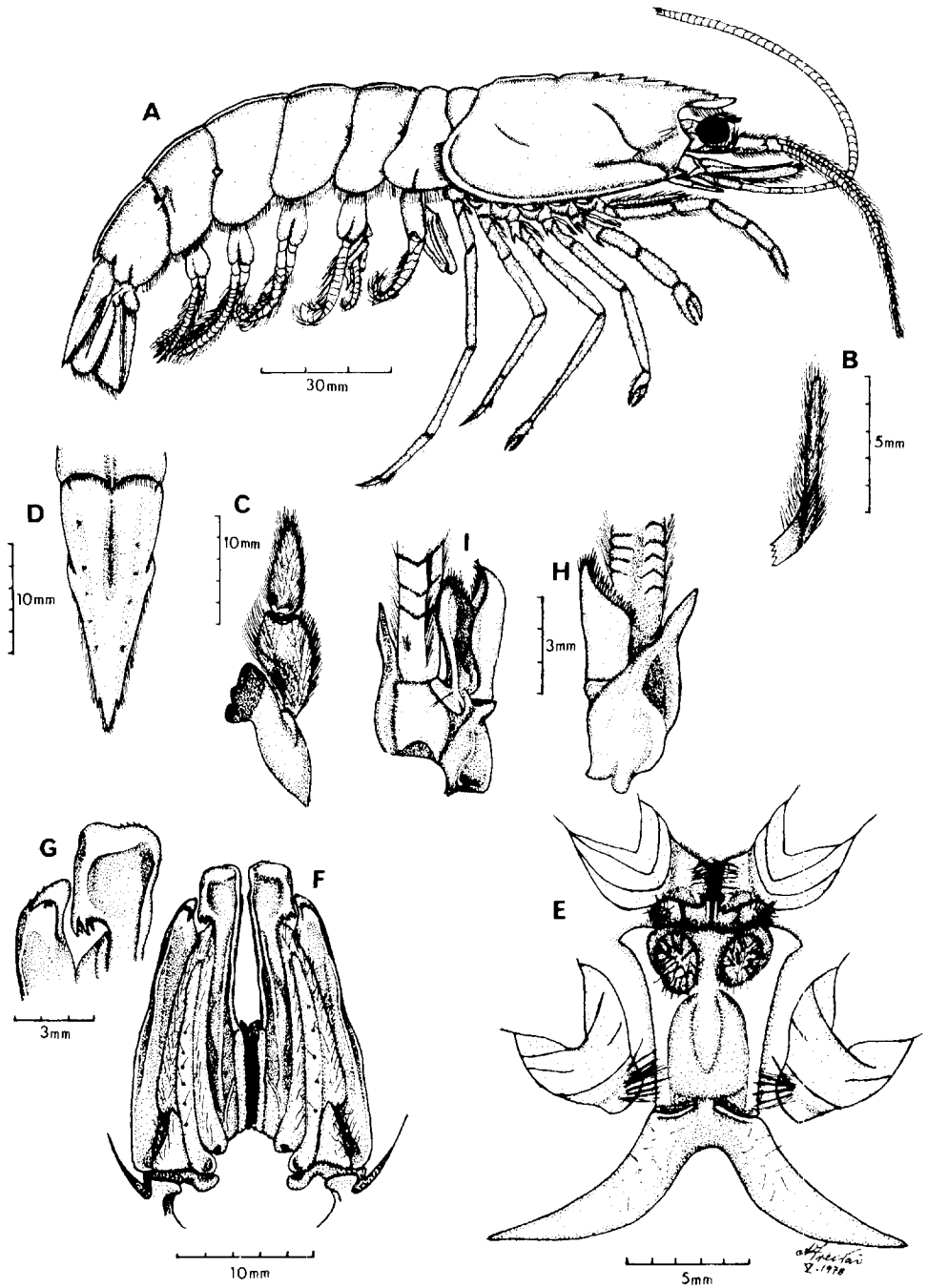


Fig. II-25 *Cryptopenaeus catherinae* de Freitas: A. Whole animal; B. Prosartema; C. Mandibular palp; D. Telson; E. Thelycum; F. Petasma; G. Distal sub-quadrated process of petasma; H. Appendix masculina (anterior view); I. Appendix masculina (posterior view showing Appendix interna).

scaphocerite; exopodite short, reaching less than half way along merus of endopodites; epipodite present.

Pereiopods. Exopodites present on all pereiopods, well developed, longest on first pereiopod and shortest on fifth; epipodites present on pereiopods I-IV; basipodites of first, second and third with prominent spines; ischial spine present on first pereiopod only; distinct coxal spine on fifth pereiopod; pereiopod IV reaching to apex of mandibular palp; pereiopod V reaching to distal end of antennular peduncle; extended laterally lengths of pereiopods in ascending order are: first, second, fourth, third and fifth.

Abdomen. Uniformly glabrous; dorsal carina present from posterior half of second segment to end of sixth where it terminates in short spine; short vertical sulcus on pleura of first segment; lateral cicatrices absent.

Telson. Slightly longer than sixth segment; about as long as mesial ramus of uropod; median sulcus deep, occupying only anterior half of telson; apical spine somewhat blunt; pair of inconspicuous, very short, fixed subapical spines present; movable marginal spines lacking.

Thelycum. Simple open structure. Anterior portion formed by vertical posterior face of sternite between fourth pereiopods; posterior face with short median sulcus and low lateral ridges; covered with short setae and obscured by coxal protruberances of fourth pereiopods. Posterior portion (between fifth pereiopods) consisting of elongate plate; broad central ridge occupying slightly more than anterior two-thirds of plate; well-defined lateral ridges extending from posterior sternal process to anterior margin of somite; two suboval, setose, boss-like structures present between anterior third of lateral ridges and median ridge; anterior margin of posterior thoracic ridge interrupted by deep median sulcus.

Petasma. Simple and very slightly involuted. Dorsomedian lobule about two-fifths of total length of petasma; entirely united along midline. Ventromedian lobule elongate and subtriangular; inner membranous section folded slightly on itself; heavily sclerotized central ridge running length of lobule terminating distally in thick subquadrate process; distal margin smooth; proximolateral angle of quadrate process; beak-like with four or five blunt teeth; ventral face of process concave; dorsal face convex. Dorsolateral lobule elongate and subtriangular; apex situated under proximolateral angle of distal ventromedian process; lower inner angle forms small proximal process; ventral surface sparsely covered with long setae. Ventrolateral lobule occupied entirely by ventral costa; ventral costa extending along lateral margin of petasma reaching half way into distal ventromedian process; apex free and bi-lobed; dorsal lobe longer than ventral lobe; ventral lobe with one to four minute teeth.

Appendix masculina. Dorsally convex, ventrally concave, roughly trapezoid in shape; distal margin with row of short, stout setae. Appendix interna subequal in length to appendix masculina, half fitting into concave face of latter; elongate with concave median surface; apex with short stout setae. Basal article of endopodite of pleopod II as wide as long, its distolateral portion concave, subtriangular and produced into long, blunt spur.

Colour in life. Body generally red, carapace with broad white stripe running from below hepatic sulcus to almost posterior margin of carapace on each side; this stripe wider in posterior half of carapace; on abdominal segments brighter red patch running anteroventrally on posterior third of each pleuron; some specimens have distinct white longitudinal stripe on dorsal carina of abdominal segments 4-6; telson and uropods pinkish white becoming red along posterior half; lateral margins of scaphocerite red; rostral crest and pereiopods pinkish white; basal segments of pleopods grey to white; pleopodal endopodites greyish white becoming bright red distally; marginal setae of pleura, pleopods and uropods orange while those of scaphocerite and antennules white.

Taxonomic status and comments

The description of this species by de Freitas (1979) was based on one female and five males collected from southern Mozambique. Subsequently, Emmerson (1981) found a second female (C.L. 49.7 mm) and Pérez Farfante (1985) reports the finding of a male (C.L. 39.6 mm) and a female (49.7 mm) off Kenya. A fourth female (C.L. 37.4 mm) has subsequently been collected from Natal, bringing the total known specimens to six males and four females.

Distribution (Fig. II-26)

Cryptopenaeus catherinae is endemic to east Africa having been found in Mozambique —Monte Belo and Cape Santa Maria (de Freitas); South Africa — off Tugela River and Durban (Emmerson, de Freitas) and Kenya — Ungama Bay (Pérez Farfante).

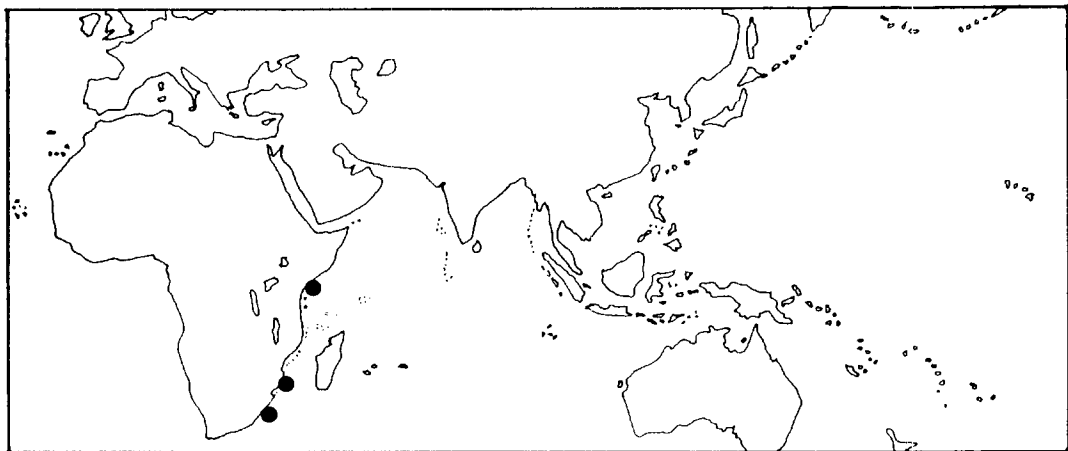


Fig. II-26 Distribution of *Cryptopenaeus catherinae*.

All specimens found have been adult and have been trawled from 310-500 m in Mozambique while the Durban specimen came from a depth of 406 m and those from Kenya were trawled from a depth of 400-430 m. The finding of this species off Durban and again off Kenya greatly widens the distribution along the east coast of Africa.

Genus *Solenocera* Lucas, 1849

Solenocera Bate, 1881: 183; Alcock, 1901: 19; de Man, 1911: 45; Stebbing, 1914b: 66; Burkenroad, 1934b: 68; Burkenroad, 1936: 120; Kubo, 1949: 223; Barnard, 1950: 611; Balss, 1959: 1518; Crosnier, 1978: 129.

Parasolenocera Wood-Mason, 1891b: 276; Alcock, 1901: 21.

To genus consisting of essentially deep water species and very closely related to *Hymenopenaeus*. Burkenroad (1936) reviews the genus clearly showing the important generic characteristics. Wood-Mason (1891b) created a new genus, *Parasolenocera*, which he separated from *Solenocera* due to the existence, in the former, of a fine segmented filament prolonged beyond the abrupt constriction of the antennular flagellum. However, Burkenroad (1936), clarifies this point stating that "... the filamentous termination of the antennular flagella represents a

character of no generic significance..."*Parasolenocera* is therefore synonymous with *Solenocera*.

This genus is composed of medium sized animals; rostrum with dorsal teeth only; cervical sulcus well defined and reaching or almost reaching dorsal midline; antennal, orbital and hepatic spines present; antennular flagella concave on inner side forming, when juxtaposed to the partner, a respiratory canal; eye stalk with small tubercle; exopodites on all maxillipeds and pereopods; epipodites on maxillipeds II and III and on the first four pereopods; telson with fixed subapical spines; no movable marginal spinules; anterodorsal scutum on first and second abdominal segments.

There are 24 species of this genus of which 15 are known from the Indo-west Pacific region. Five species have been recorded from southern African waters. Of these, *Solenocera siphonocera* is an Atlantic Ocean species while *S. comata* has not been found in the Indian Ocean north of Great Fish Point. *S. algoensis* and *S. africana* are fairly common on the southeast coast of Africa while the finding in this region of *C. choprai* is a new record for the region.

***Solenocera algoensis* Barnard, 1946**
(Fig. II-27)

Solenocera rathbuni Ramadan, 1938: 57.

Solenocera algoense Barnard, 1946: 383; Barnard, 1950: 617; Kensley, 1972: 18 (in key); Kensley, 1974: 70; de Freitas, 1980: 131.

Solenocera ramadani Ivanov & Hassan, 1976: 242.

Solenocera algoensis Starobogatov, 1972: 385; Crosnier, 1978: 130; Emmerson, 1981: 135.

Material examined

Mozambique: Off Monte Belo, 17 ♀♀, 28.9-36.8 mm, 1 ♂ 21.85 mm.

South Africa: Off Natal (29°40'S, 31°34'E), 6 ♀♀, 20.5-29.8 mm, 2 ♂♂, 19.8-20.2 mm. .

Description

Rostrum. Straight and fairly broad, distally upcurved; reaching to or extending beyond distal end of eye; rostral formula 6-7/0; four teeth behind orbital margin; adrostral carina clear but short, extending from orbital margin obliquely to just anterior of most distal rostral tooth; postrostral carina well developed just behind epigastric, becoming less distinct posteriorly, terminating before small dorsomedian tubercle found just anterior to posterodorsal margin of carapace; no median sulcus; rostrum pubescent on its lateral surface.

Carapace. Pubescent on dorsum, frontal, orbital and gastric regions; postocular and gastrofrontal sulci and longitudinal suture absent; orbital spine well developed; postorbital spine prominent; gastro-orbital carina absent; orbito-antennular sulcus distinct extending from below postorbital spine to pit in front of prominent hepatic spine; antennular carina absent; small but prominent antennular spine present; cervical sulcus and carina well developed and sigmoid in shape, extending from hepatic spine to almost dorsal midline; hepatic sulcus distinct; hepatic carina present anteriorly where sulcus bends anteroventrally forming subrectangular lobe; in front of lobe is distinct pit; branchiocardiac carina absent; no branchiostegal spine; pterygostomial angle spinose.

Antennules. Flagella about two and one third as long as antennular peduncle; concave inwardly; four flagella together form respiratory tube; prosartema long and narrow terminating in fine spine-like point; copiously covered in long setae; extends to about half way along second article of antennular peduncle; stylocerite about two-thirds length of basal antennular article;

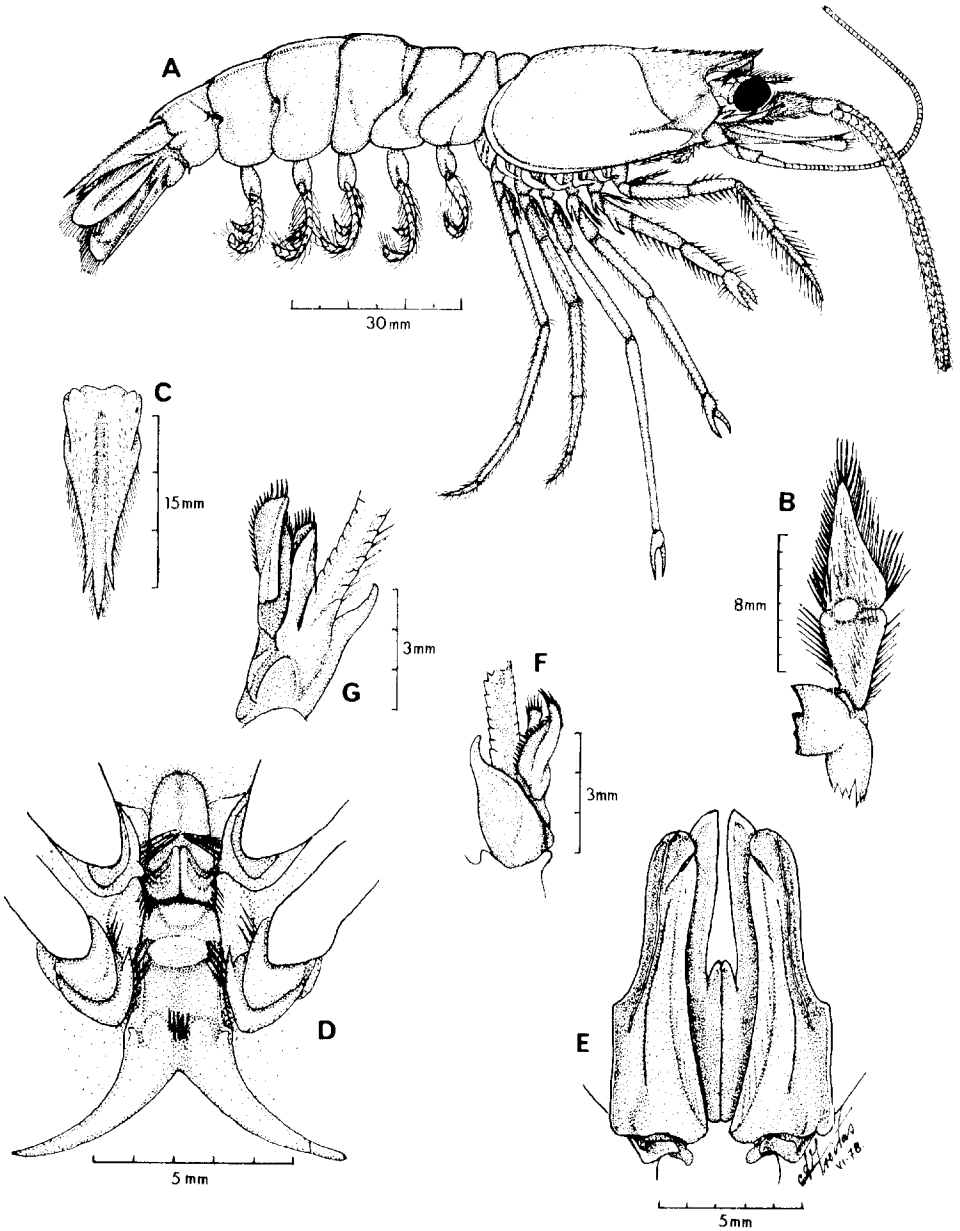


Fig. II-27 *Solenocera algoensis* Barnard: A. Whole Animal; B. Mandibular palp; C. Telson; D. Thelycum; E. Petasma; F. Appendix masculina (anterior view); G. Appendix masculina (posterior view showing Appendix interna).

terminating in long sharp spine; distolateral spine long and sharp; no parapenaeid spine; eye-stalk with very hairy tubercle.

Scaphocerite. Distolateral spine reaching slightly beyond distal end of antennular peduncle; basicerite with prominent ventrolateral spine.

Mandibular palp: Reaching to one third along carpocerite; proximal article as long as wide; distal margin of article broad; ventral surface slightly concave and lightly setose; outer and inner margins with long setae; distal article 1.5 times proximal article; apex tapering to rounded point; article subtriangular; surface setose; distinct swollen tubercle present between distal and proximal articles.

Maxilliped III: Endopodite reaching beyond antennular peduncle by dactylus and one quarter of propodite; no sexual dimorphism; exopodite small reaching about half along ischiopodite; epipodites present.

Pereiopods: Exopodites present on all pereiopods; epipodites found on first four; first pair has strong basal and ischial spines; second pair has strong basal spine only; coxopodite of fifth pair in male and female with prominent spine, which is longer in male; pereiopod V reaching beyond antennular peduncle by dactylus; pereiopod IV just reaching tip of antennular peduncle; extended laterally length of pereiopods in ascending order are: first, fourth, second, fifth and third.

Abdomen: Uniformly glabrous; both first and second segments with anterodorsal scuta, less distinct in third segment; dorsally carinated from third to sixth segments; carina of third segment starts behind anterodorsal scutum; carina of all segments cleft posteriorly; carina of sixth segment terminates in sharp spine; pleuron of first segment has vertical sulcus; posteroventral angle of sixth segment bears small spine; no lateral cicatrices on any segment.

Telson: About 1.5 times longer than sixth segment; subequal to mesial ramus of uropods; pair of prominent fixed subapical spines present; telson terminating in long sharp spine; median sulcus well defined; terminal spine with dorsomedian carina; whole telson, except within the sulcus and posterior to subapical spines, setose.

Thelycum: An open and very simple structure. Anterior portion consisting of subrectangular, narrow plate on sternite between fourth pair of pereiopods; plate very slightly concave; posterior margin of plate forms ventrally directed broad, saddle-like elevation which is grooved along midline; on each side of this elevation is small concave process; on posterolateral margin of whole elevation is small tuft of setae. Posterior portion also a subrectangular plate between fifth pereiopods; slightly broader than anterior portion; surface concave; fairly wide sulcus posteriorly; broad tubercle on each side of sulcus; outside tubercle is blunt tooth-like process forming anterolateral margin of posterior sternal process; posterior thoracic ridge projects posterolaterally into two divergent horn-like structures.

Petasma: Simple and slightly involuted tri-lobed structure. Dorsomedian lobule membranous and united along just less than half its length; distomedian projection broad and extends beyond limits of lateral lobes. Ventromedian lobules membranous and shorter than dorsomedian lobules; forms mediolateral ridge which meet proximally; distally forms small papilla-like lobe, better seen from dorsal view; from this papilla there is curved ridge running distolaterally to border of ventrolateral lobule; there are few fairly long setae seen in dried condition from ventral view. Ventrolateral lobule broad proximally narrow in middle and widening to form club-like head distally; prominent longitudinal ridge runs almost length of ventral costae; from dorsal view there is short transverse ridge on club-like distal head; proximally ventrolateral lobule has medially directed process projecting under proximal limit of dorsolateral lobule.

Appendix masculina: Elongate 2.8 times longer than wide; apex beak-like; dorsal surface glabrous with thick central ridge, bordered with short setae along mesial margin; lateral margin proximally curved with short setae; mesially, below central row of setae is ventrally directed

wall which bears short setae distally. Appendix interna just shorter than appendix masculina; subrectangular; apex rounded with short stout setae. Basal article of endopodite of pleopod II with acutely oblique distal margin; lateral face concave; distolateral angle projected into prominent curved spur.

Taxonomic status and comments

The specimens considered by Bate (1881) as *Solenocera lucasii* were later (1888) placed by him in the genus *Philonicus* due to the fact that the antennular flagella were not concave. The genus *Philonicus* was included in the genus *Hymenopenaeus sensu lato* which was subsequently divided into six genera (Pérez Farfante, 1977; de Freitas 1979).

Rathbun (1905) identified the two male specimens she found off Hawaii as *S. lucasii*, retaining the original generic name. However, Ramadan (1938) disagreed with her and apparently accepted the fact that Bate's specimens, not having the concave antennular flagella, could not be identified as belonging to the genus *Solenocera*. He, therefore, renamed the Hawaiian specimen as *S. rathbuni* considering his single female specimen from Zanzibar as this species.

Ivanov and Hassan (1976) believed that the name *S. rathbuni* should be applied to the Hawaiian species which according to them was "... specifically distinct..." from theirs, and they have, therefore, gone to the point of choosing a lectotype. They then suggested that Ramadan's specimen was probably identical to their specimens taken off southern Mozambique and Zululand.

Ivanov and Hassan considered that their specimens were different from Barnard's species *S. algoensis* because "... our specimens have seven instead of six rostral teeth and 4th pereopod does not reach the end of the antennular peduncle as in *S. algoensis*".

After careful analysis of the existing and available data, although having examined neither Ramadan's nor Ivanov's specimens, and hesitantly accepting the distinction given to the Hawaiian specimens, I conclude that *S. ramadani* is a synonym for *S. algoensis* and that the two objections given by Ivanov and Hassan are variations within the species. My motives for this arise from the examination of 18 specimens and finding that nine have six rostral teeth and five have seven rostral teeth. Five were found to have pereopods IV reaching the distal end of the antennular peduncle while seven had their fourth pereopods not reaching the end of the peduncle. These differences were independent of size and sex. This agrees with Crosnier (1978) who accepts that *S. ramadani* is a synonym for *S. algoensis*.

Distribution (Fig. II-28)

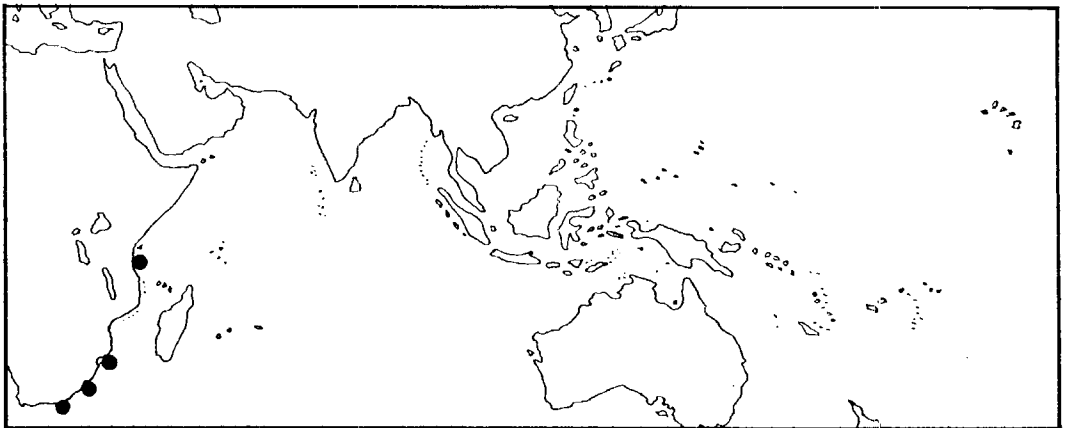


Fig. II-28 Distribution of *S. algoensis*.

S. algoensis is an East African species, so far found only in Tanzania, Zanzibar (Ramadan); Mozambique — off Monte Belo lighthouse (Ivanov & Hassan, de Freitas); South Africa — off Zululand, Durban, Port Elizabeth (Barnard, Ivanov & Hassan, de Freitas, Emmerson).

However, should the specimens from Hawaii described by Rathbun (1906) prove to be identical to *S. algoensis* then the distribution of this species will be greatly extended.

The adults are considered as oceanic species having a depth distribution ranging from 90 metres (Barnard 1950) to 560 metres (de Freitas, this study).

***Solenocera africana* Stebbing, 1917**

(Fig. II-29)

Solenocera africanus Stebbing, 1917: 32; Calman, 1925: 10; Burkenroad 1934: 70.

Solenocera africanum Barnard, 1950: 613; Hall, 1966: 98.

Solenocera africana Kensley, 1972: 18 (in key); Holthuis, 1980: 4.

Material examined

South Africa — Cape Peninsula (160 m), 12 ♀♀, 13.3-25.4 mm; 4 ♂♂, 15.8-16.3 mm.

Description

Rostrum: Straight to slightly curved distally, ventral margin convex; reaching to just before distal end of eye; rostral formula 6/0; epigastric and two other teeth behind orbital margin; adrostral carina distinct but short, extending from orbital margin to just anterior of distal rostral tooth; postrostral carina well developed extending to just before posterior margin of carapace; no median sulcus; rostrum pubescent on lateral surfaces; no tubercle on dorsum near posterior margin of carapace.

Carapace: Uniformly glabrous; postocular and gastrofrontal sulci and longitudinal suture absent; orbital spine well developed, postorbital spine prominent; gastro-orbital carina absent; orbito-antennal sulcus distinct in larger specimens, runs from below postorbital spine to pit in front of prominent hepatic spine; antennal carina absent; antennal spine small but prominent; cervical sulcus and carina very well developed extending from hepatic spine to almost dorsal midline; cervical carina interrupted by notch at one-third of its length from hepatic spine; hepatic sulcus well developed extending posteriorly to about level of where cervical carina approaches dorsum; hepatic carina present anteriorly where it bends anteroventrally forming subrectangular lobe; distinct pit in front of lobe; branchiocardiac carina absent although sulcus present but very indistinct; no branchiostegal spine; pterygostomial angle spinose.

Antennules: Flagella three times as long as antennular peduncle; concave inwardly, four flagella together form respiratory tube; prosartema long and narrow, copiously covered with hairs, extending to first quarter of second article of antennular peduncle; stylocerite about half length of basal antennular article, terminating in short spine; prominent spine at distolateral angle of basal article; no parapenaeid spine; eye-stalk with very hairy tubercle.

Scaphocerite: Distolateral spine reaching slightly beyond distal end of antennular peduncle; basicerite with prominent ventrolateral spine.

Mandibular palp: Reaching to base of carpocerite; proximal article just about as long as wide; ventral surface slightly concave; distinct tubercle situated just inward of centre along distal edge; distal article 1.4 times length of proximal article, subtriangular, base 0.7 times length of article; apex tapered but blunt; ventral surface of both articles covered with long setae.

Maxilliped III: Endopodite reaching beyond antennular peduncle by dactylus; no sexual dimorphism; exopodite very small, reaching two-thirds along ischiopodite; epipodites present.

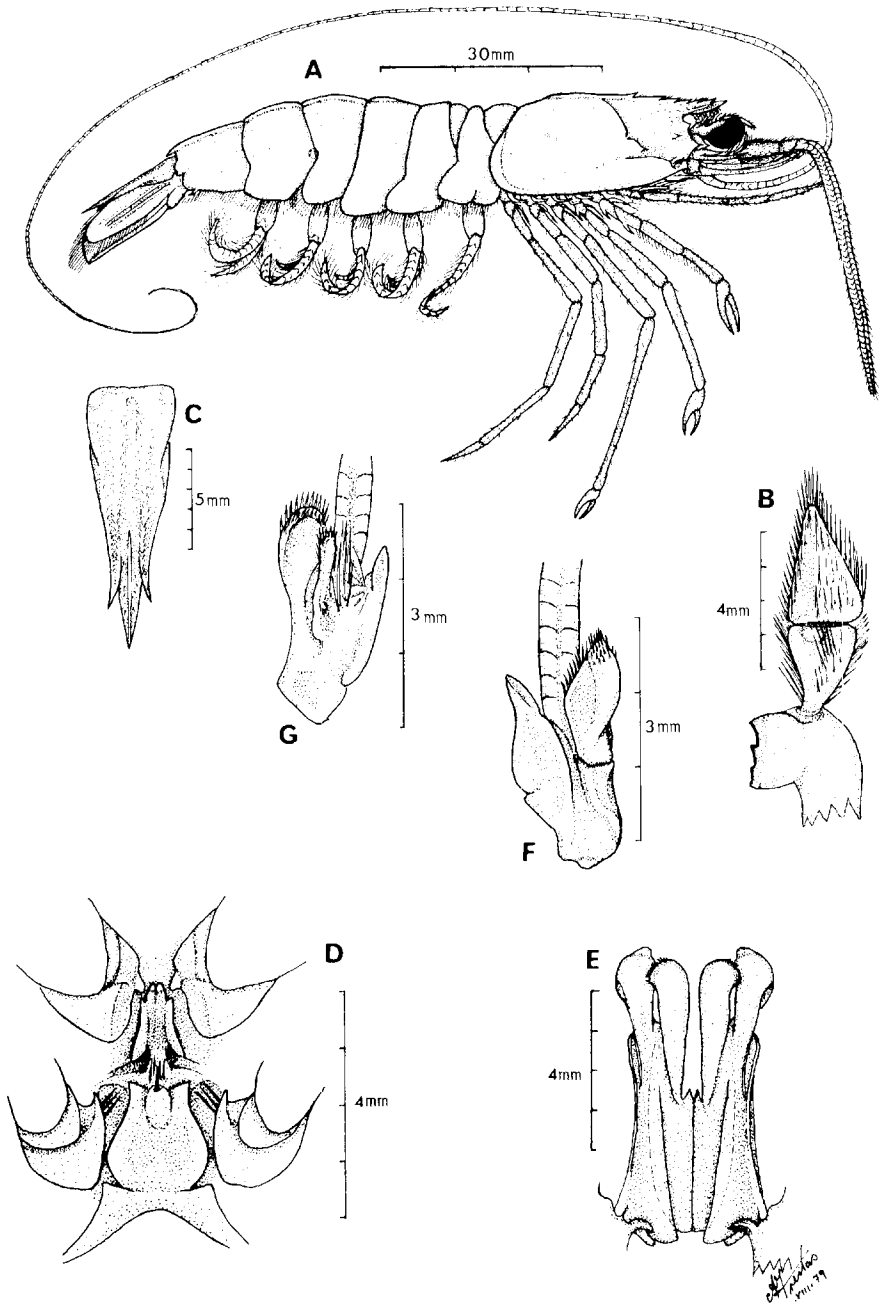


Fig. II-29 *Solenocera africana* Stebbing: A. Whole animal; B. Mandibular palp; C. Telson; D. Thelycum; E. Petasma; F. Appendix masculina (anterior view); G. Appendix masculina (posterior view showing Appendix interna).

Pereiopod: Exopodites present on all pereiopods; epipodites found on first four; ischial spine present on first pair while basal spine present on first two pairs; coxopodite of fifth pair with prominent spine, longer in male; pereiopod V reaching beyond antennular peduncle by dactylus; pereiopod IV reaching to tip of second antennular article; extended laterally, length of pereiopods in ascending order are: first, second, fourth, third and fifth.

Abdomen: Uniformly glabrous; first and second segments with distinct anterodorsal scuta, less distinct on third segment; strong dorsal carination from posterior-two thirds of third to sixth segments; first and second segments with weak dorsal carination; carina of sixth segment terminates in sharp spine; vertical sulcus on pleuron of first segment; posterolateral angle of sixth segment bears small spine; no lateral cicatrices on any segment.

Telson: About 1.4 times length of sixth segment; subequal to mesial ramus of uropods; well defined and wide median sulcus; pair of prominent fixed subapical spines; telson terminating in long sharp spine; terminal spine with dorsomedian carina; whole telson, except within median sulcus and just behind subapical spines, covered with short setae.

Thelycum: An open and very simple structure. Anterior portion consisting of subrectangular, narrow plate on sternite between fourth pereiopods; plates somewhat concave with central sulcus which divides anterior margin forming two small lobes; anterior margin hidden by small coxal processes of fourth pereiopods. Posterior portion also subrectangular plate between fifth pereiopods; plate concave with central tubercle; tuft of fairly long setae anterior of tubercle; posterior thoracic ridge broadly concave medially.

Petasma: Simple and involuted bi-lobed structure. Dorsomedian lobules membranous and united along little more than half its length; free section of lobule thick; distomedian projection broad and does not extend beyond ventrolateral lobule; distal margin rounded and edge curled dorsally; dorsal face of tip concave, distomedian angle tooth-like and rest of curled edge armed with short setae. Ventromedian lobules membranous and two-thirds length of dorsomedian lobules; form mediolateral ridge which meet proximally. Dorsolateral lobule subequal to ventromedian lobule; elongate subtriangular in shape; from dorsal view dorsolateral lobule has deep groove proximally; medially directed process projects under proximal limit of dorsolateral lobule. Ventrolateral lobule fairly narrow; distally, tip forms subtriangular head; small tooth-like point situated at distomedian angle; ventral face of head concave; ventral costa occupies two-thirds of lobule.

Appendix masculina: About 2.1 times longer than wide; anteromedian face convex, anterolateral face flat to concave; distal and outer margins armed with short, stout setae; posteromedian face thick with distinct tooth-like ridge in centre, posterolaterally thin forming deep furrow under tooth-like ridge; distal portion of thick section with short, stout setae. Appendix interna thin, slightly shorter than appendix masculina; club-shaped; half fitting into posterolateral furrow of appendix masculina; exposed half and distal margin with short, stout setae. Basal article of endopodite of pleopod II distinctly longer than wide; deep longitudinal furrow centrally, lateral face concave, subtriangular and produced into long, blunt ridged spur.

Colour in life. As no fresh specimens were available it was not possible to describe the colouration of this species. No colour descriptions are to be found in the literature.

Taxonomic status and comments

Some doubt exists in the literature regarding the validity of this species as being distinct from *S. siphonoceras* (Philippi). Barnard (1950) stated that having re-examined the type female he agreed with Burkenroad (1934) who claimed that *S. africana* is but a variety of *S. siphonoceras* as they are really only distinguishable by the former having longer antennular flagellae. However, Barnard (1950) found other differences such as *S. africana* having a distinct dorsal carina on the third abdominal segment in addition to the carinae of segments four and six. This carina is very prominent and I doubt whether it could have been overlooked by the describers of *S. siphonoceras*.

I have in addition described the presence of a carina on the first and second segments. These are very weak in some specimens and could easily have been overlooked. They are, to me however, unmistakable and I could not leave them out of the description.

The one disturbing fact, which is also mentioned by Barnard, is that Stebbing (1917) has illustrated the carapace of *S. africana* as having a small suprahepatic spine, but in the specimens examined and in agreement with Barnard (1950) no such spine exists although the cervical carina is interrupted at that point by a distinct notch.

Until such time as *S. siphonoceras* and *S. africana* can be examined in more detail, I follow Barnard in maintaining them separate.

Distribution (Fig. II-30)

Solenocera africana is a species found off Sebastian Bluff, Cape St Blaize, Struys Point and Algoa Bay, all in the region of the Agulhas Bank and off Cape Point to the south and off Durban in the north (Stebbing, Barnard). It has not been found in Mozambique waters.

The adults may be considered as shelf species, that is, found on the continental shelf, and the recorded specimens were found to have a depth range from 40 metres to 150 metres (Barnard 1950).

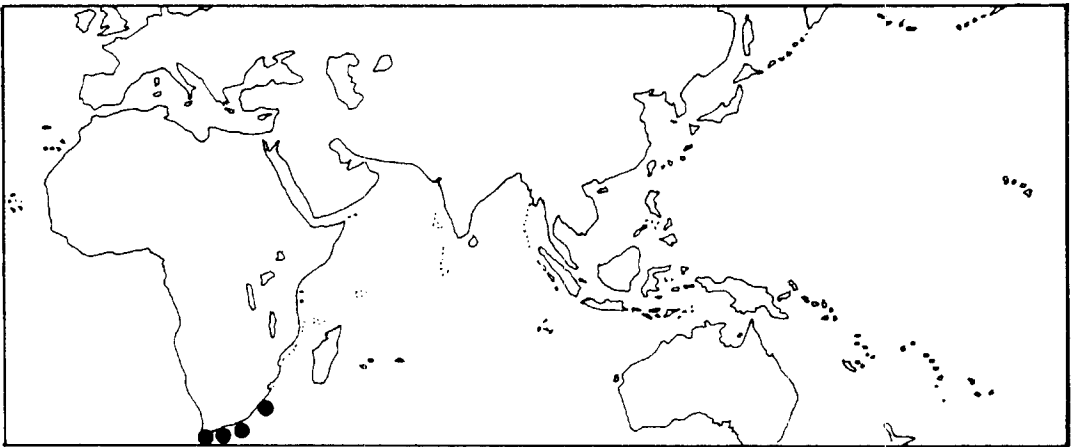


Fig. II-30 Distribution of *S. africana*.

***Solenocera choprai* Nataraj 1945**

(Fig. II-31)

Solenocera choprai Nataraj, 1945: 91; George, 1969: 18; Starobogatov, 1972: 362, 382; Tirmizi, 1972: 186; Tirmizi & Bashir, 1973: 2; Crosnier, 1978: 141; Holthuis, 1980: 5; Grey, Dall & Baker, 1983: 42; Crosnier, 1984: 32.

Solenocera koelbeli Burkenroad, 1959: 71, 285.

Solenocera alticarinata Hall, 1961: 79; Hall, 1962: 12; Starobogatov, 1972: pl.2, fig.5a-b; de Freitas, 1980: 142.

Material examined

Mozambique: Pebane (30 m), 1♀, 32.0 mm.

South Africa: (32°49'S, 28°17'E), Cape Henderson (75 m), 1♂, 22.6 mm.

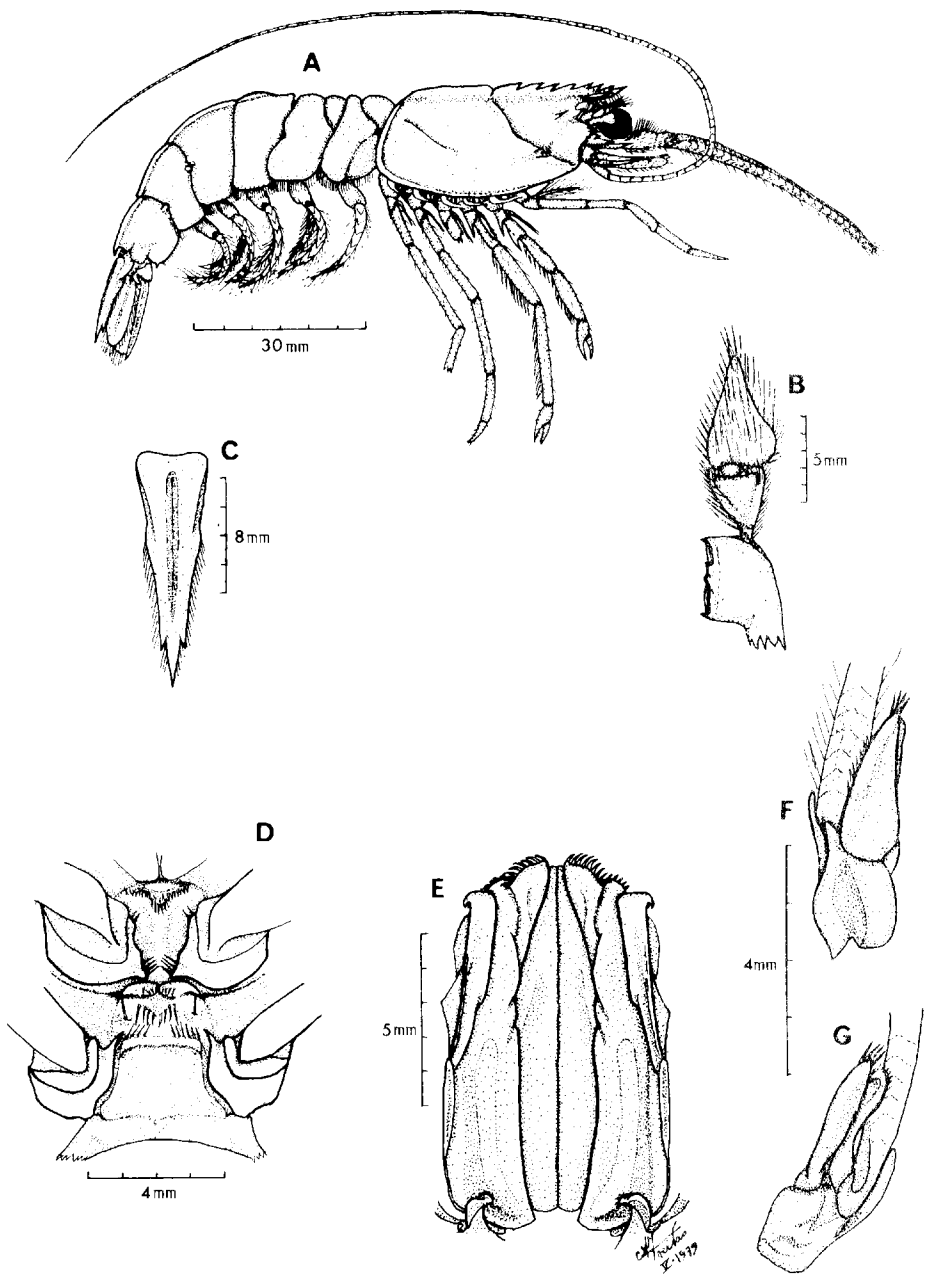


Fig. II-31 *Solenocera choprai* Kubo: A. Whole animal; B. Mandibular palp; C. Telson; D. Thelycum; E. Petasma; F. Appendix masculina (anterior view); G. Appendix masculina (posterior view showing Appendix interna).

Description

Rostrum: Straight and broad; almost reaching distal end of eye; rostral formula 8/0; four teeth behind orbital margin; adrostral carina clear but short, extending from orbital margin anteriorly to just below last rostral tooth; postrostral carina well developed, high and laminose, reaching posterior margin of carapace; notched just behind first rostral tooth; no median sulcus except at end of postrostral carina; rostrum pubescent on lateral surface.

Carapace: Uniformly glabrous, except on frontal region; postocular sulcus restricted to distinct pit; gastrofrontal sulcus and longitudinal suture absent; orbital spine well developed; postorbital spine prominent; no gastro-orbital carina nor orbito-antennal sulcus; antennal carina limited to broad hump; small but prominent antennal spine; cervical sulcus well defined, wide, almost reaching dorsum of carapace; cervical carina well defined, almost reaching postrostral carina; anteroventrally cervical carina terminating in prominent hepatic spine; shallow notch interrupts cervical carina at one-third of its length from hepatic spine; deep pit beneath hepatic spine; hepatic sulcus shallow but distinct being horizontal along its posterior half where it ends roughly in line with posterior end of cervical carina; anterior half of hepatic sulcus bends anteroventrally and is very wide; oblique section is accompanied by hepatic carina which terminates anteriorly in small semicircular loop; in front of loop is circular pit which bears small tuft of hair on dorsal margin; branchiocardiac carina well defined and oblique; pterygostomian angle rounded and bears no spine; no branchiostegal spine.

Antennules: Flagella about 2.33 times as long as antennular peduncle; concave inwardly and four flagella together form respiratory tube; prosartema has pointed apex and straight mesial margin; lateral margin curves outwards broadening at base; apex reaches distal end of eye; whole surface of prosartema covered with hairs; stylocerite terminating in blunt spine and reaching half way along basal article of antennular peduncle; prominent spine at distolateral angle of basal article; no parapenaeid spine; eye-stalk with unispinose tubercle.

Scaphocerite: Distolateral spine reaching slightly beyond distal end of antennular peduncle; basicerite bears prominent spine ventrolaterally.

Mandibular palp: Just reaching base of carapacerite; proximal article just about as long as wide; ventral surface concave; distinct tubercle situated just inward of centre along distal edge; distal article 1.6 times length of proximal article; subtriangular, with base 0.6 times length of article; apex tapered but blunt.

Maxilliped III: Endopodite reaching beyond antennular peduncle by dactylus and one quarter of propodite; no sexual dimorphism; exopodite very small, reaching about one third along ischiopodite; epipodites present.

Pereiopods: Exopodites present on all pereiopods; epipodites found on first four; first pair has strong basal and ischial spine while only basal spine found on second pair; coxal spine on pereiopod V of female small but sharp, spine of male is more leaf-like; pereiopod IV just falls short of reaching end of first antennular article; pereiopod II reaching beyond peduncle by chela.

Abdomen: Uniformly glabrous; both first and second segments have anterodorsal scuta, that of second segment being narrower than first; dorsally carinated from posterior two-thirds of third to sixth segments; carina of sixth segment terminating in short spine; pleuron of first segment has vertical sulcus; posteroventral angle of sixth pleuron has small spine; no lateral cicatrices on any segment.

Telson: About as long as sixth and half fifth abdominal segments; as long as mesial ramus of uropods; pair of short fixed subapical spines present; telson terminating in sharp spine; well defined and wide median sulcus which does not exist posterior to fixed lateral spines; no movable lateral spines.

Thelycum: An open and very simple structure. Anterior portion consisting of two vertical subrectangular plates arising from sternite between and just posterior to coxae of fourth pair of

pereiopods; these two plates meet along midline; centre of posterior surface covered with very small setae, while long, thin setae arise from lateral margins; anterior to these vertical plates is central plate with median flat but wide tubercle covered with long hairs. Posterior portion consisting of subquadrate sternal plate between fifth pereiopods; anterior third little elevated from posterior two-thirds; this anterior "platform" has pair of central tubercles with one lateral tubercle on each side; all tubercles setose; posterior two-thirds of portion flat and smooth; coxal spines of fifth pereiopods probably important in holding spermatophore in place.

Petasma: Simple, involuted pod-like structure. Dorsomedian lobule membranous, united along inner margin; distomedian projection not extended beyond limit of other lobes. Ventromedian lobule generally narrow and membranous; distal margin broad and convex, armed with row of stout bristles; distal inner margin slightly curled dorsally; mediolateral ridge well developed and overlap or at least touch along midline. Dorsolateral lobule as long as ventromedian lobule, membranous with exception of proximal outer half of lobule which is thick; distal margin gently convex, armed with row of bristles. Ventrolateral lobule almost entirely occupied by ventral costa; distal third free from dorsolateral lobule; distal margin curled dorsally, edge serrated.

Appendix masculina: Elongate and subtriangular; ventrally concave, dorsally convex; distal margin with row of short, stout setae; circle of short setae surrounds flat patch on lateral margin. Appendix interna subequal in length to appendix masculina; half fitting into concave face of latter; elongate and spoon-shaped with small oval concave mesial face and convex lateral face; distal mesial margin with row of small teeth. Basal article of endopodite of pleopod II dorsally subquadrate, with wide furrow medially; lateral margin curved forming blunt tooth distally; lateral face flat to concave with distoventral angle produced to form spur.

Colour in life: No live specimens were available to permit a description of the colour patterns. However, Hall (1962) merely mentions the fact that the antennular flagella are banded in red and white, the middle white band being the widest of the five bands.

Taxonomic Status and Comments

In August 1972 a single female specimen, trawled from 30 metres off Pebane in central Mozambique, was collected. It was originally identified as *Solenocera alticarinata* (de Freitas 1980) due to the very high postrostral carina and the deep notch in the carina just above the posterior end of the cervical sulcus. In 1979, a specimen from the collection of the South African Museum numbered A13190 was examined and, although labelled as *Sicyonia longicauda*, was also identified as a male *S. alticarinata* (de Freitas 1980). In spite of the fact that the rostrum is broken, the high keeled postrostral carina is evident and the deep notch behind the first rostral tooth is unmistakable.

According to Starobogatov (1972) *S. choprai* have paired tubercles on the posterior portion of the thelycum. This is the case with the southeast African specimen although the central pair are so close to each other that very careful examination is essential. However, the "highly developed furrow, extending parallel to the anterior portion of the lower edge of the carapace, so that the edge of this furrow looks like a carina", is not that evident in the specimens examined.

Crosnier (1978) had the opportunity to examine a female *S. choprai* from the Arabian Sea and a male and female from Hall's collection from Singapore. All three appear to belong to the same species, *S. choprai*.

It seems obvious, however, that Crosnier (1978) is correct when he states that "... *S. choprai* belongs to a group of species whose systematics is not very clear and which includes ... *S. koelbeli* de Man, *S. alticarinata* Kubo, *S. vietnamensis* Starobogatov and *S. halli* Starobogatov." Until such time as the systematics of these five Indo-west Pacific species are sorted out, the southeast African species will be identified as *Solenocera choprai*.

Distribution (Fig. II-32)

Presently *S. choprai* has been recorded from the Arabian Sea and Andaman Sea (Nataraj), Gulf of Suez (Burkenroad); Persian Gulf, Pakistan, India (Holthuis, Grey *et al.*); Australia, off northwest coast (Grey *et al.*); South China Sea (Hall); Straits of Malacca (Crosnier); Madagascar, off east coast (Crosnier); Mozambique off Pebane (de Freitas); South Africa, off Cape Henderson (S.A. Museum).

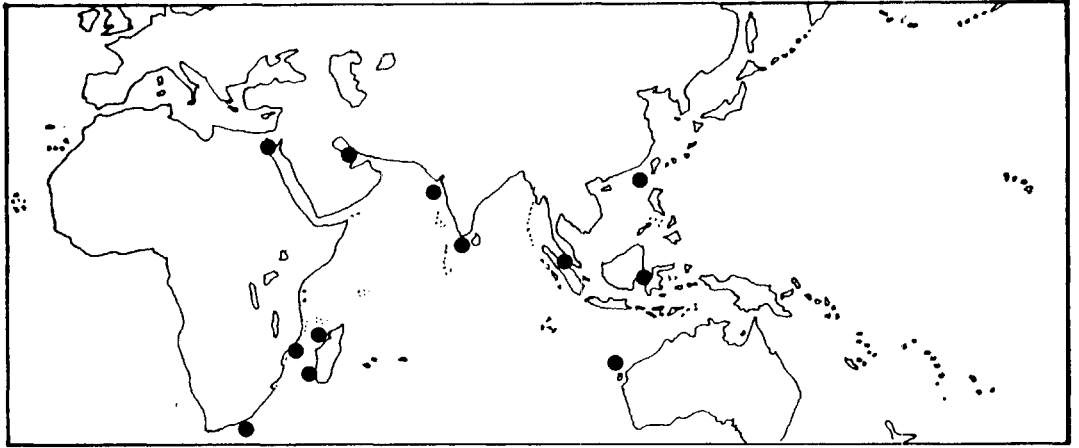


Fig. II-32 Distribution of *S. choprai*.

Hall (1962) mentions that in the South China Seas this species was caught at depths between 40 and 69 fathoms (124 metres) but the one specimen of *S. choprai* found off Mozambique was trawled from only 30 metres depth together with the usual commercially important shrimps. The South African specimen was trawled from 75 metres together with other penaeids such as *Penaeus indicus*. The specimens from Madagascar were trawled up from 65-175 m of water.

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