

REVISION OF THE GAMBA PRAWN GENUS *PSEUDARISTEUS*, WITH DESCRIPTION OF TWO NEW SPECIES (CRUSTACEA: DECAPODA: PENAEOIDEA)

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ABSTRACT

The genus *Pseudaristeus* (family Aristeidae) is widespread in the Indo-West Pacific where five species—*P. crassipes*, *P. gracilis*, *P. kathleenae* n. sp., *P. protensus* n. sp., and *P. sibogae*—have been found at depths between 719 and 1,785 m; another species, *P. speciosus*, occurs in the southwestern Atlantic, where it was taken at 4,847 m. Females of *Pseudaristeus* possess a styliform, long rostrum, 0.70-1.40 as long as the carapace; most males have shorter ones 0.20-0.57, but some have been found in which the rostrum is as long as that of the females. This suggests that in this genus, as in *Aristeus*, at certain stages of the life cycle, males develop a long rostrum. Following a revised definition of the genus, a key to the species, a synonymy, the location of the types, type-locality, and a list of specimens examined are given for each species. Detailed morphological accounts, including intraspecific variation, accompany statements of maximum sizes, and geographic and bathymetric ranges. The description of *P. gracilis* is the first to take into consideration adult material. In discussing relationships, *P. crassipes*, *P. kathleenae*, and *P. protensus*, sympatric off the coast of India, are shown to constitute a rather homogenous group somewhat distantly related to the other very distinctive members of the genus.

The deep-sea "gamba prawns" of the genus *Pseudaristeus* are widely distributed at depths of 719-1,785 m in the Indo-West Pacific—from the Gulf of Aden and off Natal, South Africa to the Philippines—where five (*P. crassipes*, *P. gracilis*, *P. kathleenae* n. sp., *P. protensus* n. sp., *P. sibogae*) of the six species recognized herein are found. The sixth (*P. speciosus*) occurs in the southwestern Atlantic, off northeastern Argentina. It is unlikely that members of the genus occur in the northwestern Atlantic, including the Gulf of Mexico and the Caribbean, where, although intensive collecting have been conducted, no *Pseudaristeus* have been taken.

The large gamba prawns (reaching as much as 47.5 mm carapace length, about 150 mm total length) that occur at shallower depths might, in the not too distant future, make a minor, but highly esteemed, contribution to the commercial catches of penaeoids in certain areas of the Indo-West Pacific, as do members of other deep-sea genera (*Aristaeomorpha*, *Aristeus*, and *Plesiopenaeus*) of the family Aristeidae.

The genus *Pseudaristeus* has been poorly understood largely because the original descriptions of the first three recognized species, *P. speciosus*, *P. gracilis*, and *P. crassipes*, are inadequate for sep-

arating them, and the illustrations of the latter two, although well rendered, are of little help. Incomplete descriptions and inadequate illustrations were primarily responsible for subsequent assignment of specimens of two new species described here to *P. crassipes*, which, like them, occurs in the waters off India.

Availability of the rich collections of *Pseudaristeus* made by the U.S. Bureau of Fisheries steamer *Albatross* during the Philippine Expedition, 1907-10, and the loan of critical material from several museums have enabled me to make detailed studies of all six species of the genus. Included in the accounts of each are numerous diagnostic characters which have not been previously recognized in the four described species. One of these characters is the sinuous ventral antennular flagellum found in male *P. gracilis*, which not only allows a ready identification of these animals but constitutes another significant element for the interpretation or a better understanding of the relations of the members of *Pseudaristeus* to those of the closely allied *Aristeus*.

PRESENTATION OF DATA

In the account of the species, most of the terminology used follows that proposed and illustrated by Pérez Farfante (1969, 1977). The anterolateral carina, a unique feature of one member of *Pseudaristeus*, which has not been cited by me previously,

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extends between the gastro-orbital and branchiostegal-hepatic carinae. The names of various parts of the eye, adopted from Young (1956, 1959), were recently employed and illustrated by Pérez Farfante (1985). The measurement of rostrum length (RL) is the linear distance from apex to orbital margin, that of carapace length (CL) is the distance between orbital margin and the midposterior margin of the carapace, and, finally, that of total length (TL) is the distance from the apex of the rostrum to posterior end of the telson. All measurements are made to the nearest 0.5 mm. The petasmata have been described and all but one depicted unfolded; the illustrations were made from stained specimens. Because more than one species have been found in lots reported by various authors under a single name and new species are described herewith from waters from which records have been previously cited, the map is based on only the specimens examined by me. Scales accompanying the illustrations are in millimeters.

Abbreviations of the repositories of the specimens examined during this study are as follows:

BMNH - British Museum (Natural History), London.
 MP - Muséum National d'Histoire Naturelle, Paris.
 USNM - National Museum of Natural History, Smithsonian Institution, Washington, D.C.
 ZMA - Zoologisch Museum, Amsterdam.
 ZMB - Zoologisches Museum der Humboldt - Universität, Berlin.
 ZSI - Zoological Survey of India, Calcutta.

GENUS *PSEUDARISTEUS* CROSNIER, 1978

Hemipenaeus Bate 1881:186 [part].

Aristaeus Wood-Mason and Alcock 1891:278 [part].

Aristeus Anderson 1896:91.

Pseudaristeus Crosnier 1978:81 [type species, by original designation, *Aristaeus crassipes* Wood-Mason 1891:281. Gender masculine].

Diagnosis.—Body slender, covered with densely set minute setae. Rostrum long in females and short or long in males; armed with 2 dorsal teeth; epigastric tooth distinctly posterior to first rostral, situated about 0.1 CL from orbital margin. Antennal and branchiostegal spines present; orbital, pterygostomial, and hepatic spines lacking. Cervical sulcus crossing postrostral carina (rarely only reaching it); postcervical sulcus extending to postrostral carina; gastro-orbital, antennal, branchiostegal-hepatic, and branchiocardiac carinae strong; hepatic sulcus long,

usually fusing with branchiocardiac sulcus and descending obliquely almost to margin of branchiostegite. Abdomen with dorsomedian carina extending from fourth through sixth somites; elongate sixth somite bearing pair of long cicatrices. Telson produced posteriorly in sharp, median spine and with posterior 0.4 of length armed with 4 pairs of small, movable, lateral spines. Eye with well-developed cornea and dorsoventrally depressed peduncle bearing mesial tubercle; basal article not produced in scale. Antennular peduncle length about 0.55 CL; prosartema rudimentary, consisting of short stump bearing brush of long setae; dorsal flagellum short, about 0.4 length of antennular peduncle, and flattened; ventral flagellum long, no less than 2.75 CL, and filiform. Mandibular palp (Fig. 1A) reaching to about base of ischiocerite (third article of antennal peduncle), distal article suboval and much smaller than basal. Palp of first maxilla unsegmented (Fig. 1B). Second maxilla and first and second maxillipeds as illustrated (Fig. 1C-E). Exopods on all maxillipeds but lacking on pereopods. Petasma with dorsomedian lobule short, only about 0.4 length of petasma; ventromedian lobule with rib narrow proximally, broadening to level of distal end of dorsomedian lobule where reaching mesial margin, and continuing almost to end of lobule; ventral costa distally free, not attached to dorsolateral lobule; endopod of second pleopod bearing appendices masculina and interna. Thelycum of "open type", with large, lanceolate median plate on sternite XIII. Well-developed podobranchia on second and third maxillipeds and first and second pereopods, those on pereopods subequal in size. One arthrobranchia on somite VII and two on VIII through XIII, all well developed except very small anterior one on somite VIII. Pleurobranchia on somites IX through XIV, that on XIV well developed, remaining ones much smaller. Nonbifurcate, large epipod on somites VII through XII, that on XII subequal in size to that on XI. (Modified from Crosnier 1978.)

It seems worth emphasizing that although the rostrum is long in females, 0.70-1.40 CL, and relatively short in most of the males examined, 0.20-0.57 CL, I have found one male in each of two species with long rostra, 0.70 and 1.40 CL.

Five species known from the Indo-West Pacific are *P. crassipes*, *P. gracilis*, *P. kathleenae* n. sp., *P. protensus* n. sp., and *P. sibogae*; and the one from the southwestern Atlantic is *P. speciosus*. The species from the Indo-West Pacific have been taken at depths between 750 and 1,785 m and that from the southwestern Atlantic at 4,847 m. These depths and all others cited are those noted for the stations

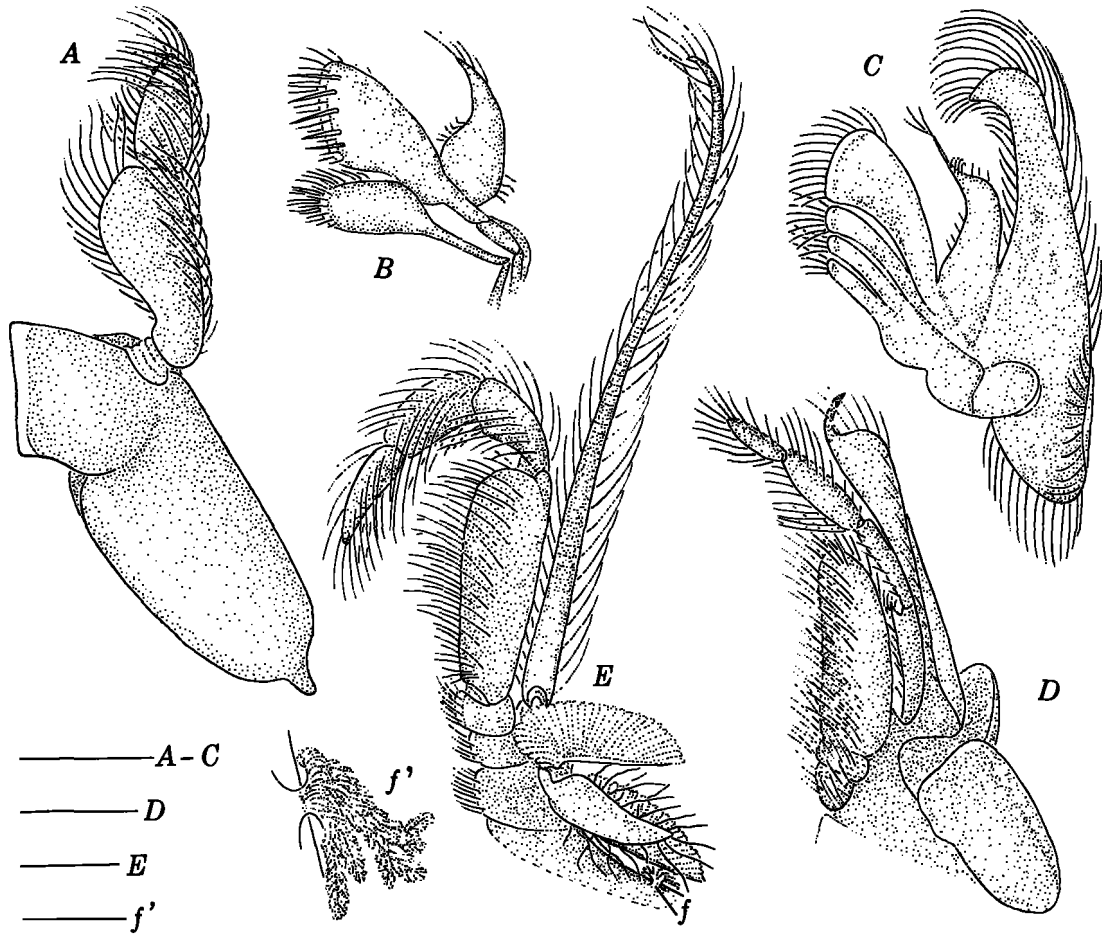


FIGURE 1.—*Pseudaristeus kathleenae* n. sp., ♀ 35 mm CL, Lagonoy Gulf, east of southern Luzon, Philippines. A, Mandible. B, First maxilla. C, Second maxilla. D, First maxilliped. E, Second maxilliped. f, Rudimentary arthrobranchia. f', Enlargement of f. (All from left side). Scales: A-E = 3 mm; f' = 1 mm.

at which the specimens were obtained, but because open nets were used in collecting, it is not possible to ascertain the actual level at which the shrimp entered the net.

Pseudaristeus is quite close to *Aristeus*, having the same branchial formula, but differing from it in exhibiting a well-marked cervical sulcus which reaches the dorsomedian carina of the carapace and in possessing a postcervical sulcus. Among the members of *Pseudaristeus* only males of *P. gracilis* exhibit a sinuous ventral antennular flagellum, a feature characteristic of the males of all species of the genus *Aristeus*. This similarity, together with a branchial formula common to the two genera, indicates a close affinity between members of the genera *Pseudaristeus* and *Aristeus* and is a convincing basis for the postulate that they have had

a more recent common ancestor than either share with *Hemipenaeus*. The species now assigned to *Pseudaristeus* were placed in the genus *Hemipenaeus* by almost all authors in this century until Crosnier (1978) proposed that they be removed to his new genus.

Key to species of *Pseudaristeus*

1. Ventral extremity of cervical carina blunt, not forming sharp-edged arc. Anterolateral carina present. Posterior part of hepatic sulcus not fusing with branchiocardiac sulcus but extending longitudinally subparallel to latter. *P. speciosus*
- Ventral extremity of cervical carina forming

sharp-edged arc. Anterolateral carina absent. Posterior part of hepatic sulcus fusing with branchiocardiac sulcus and continuing posteroventrally oblique to latter. 2

2. Optic calathus long, mesial margin at least 1.5 width of distal extremity. Pereopods covered with minute setae. *P. sibogae*

Optic calathus short or relatively so, mesial margin 1.3 or less width of distal extremity. Pereopods not covered with setae. 3

3. Thelycum with median plate of sternite XIII very long (length more than 4 times basal width), almost reaching spine on sternite XII, and narrow, maximum width 0.40 length. [Males unknown]. *P. protensus*

Thelycum with median plate of sternite XIII relatively short (length less than 3.5 times basal width) and broad or relatively broad, maximum width more than 0.40 length. . . . 4

4. Third article of antennular peduncle expanded laterally, forming strong, subtriangular projection in males and variably developed rounded prominence in females. Petasma with ventral costa neither strongly inclined distomesially nor contracted preapically. Thelycum with median plate of sternite XIII moderately broad (maximum width 0.65-0.75 length) and lacking posterolateral prominences. *P. kathleenae*

Third article of antennular peduncle not expanded laterally, forming neither strong prominence in males nor rounded prominence in females. Petasma with ventral costa strongly inclined distomesially or contracted preapically. Thelycum with median plate of sternite XIII either relatively narrow (maximum width 0.45-0.55 length) or, if broad (0.80-0.93), bearing posterolateral prominences. 5

5. Males with ventral antennular flagellum sinuous proximally and bearing narrow band of densely set small setae distal to dorsal flagellum; petasma with ventral costa markedly contracted preapically. Females with median plate of sternite XIII expanded in pair of conspicuous posterolateral prominences. *P. gracilis*

Males with ventral antennular flagellum straight proximally and lacking band of small setae; petasma with ventral costa not markedly contracted preapically. Females with median plate of sternite XIII lacking posterolateral prominences. *P. crassipes*

Pseudaristeus kathleenae, new species

Figures 1-3, 4C, 5-9

Aristaeus crassipes. Alcock 1901a:50 [part].

Hemipenaeus crassipes. De Man 1911:24. Kemp and Seymour Sewell 1912:17 [part], pl. 1, fig. 8. De Man 1913, pl. 2, fig. 4a-c and in legend to fig. 5 [under Remarks for *H. sibogae*]. Balss 1925:229 [part].

Materials.

Holotype: ♂, USNM 216710, 23.5 mm CL, 6.5 mm RL, about 88 mm TL; type-locality: Teluk Bone, Sulawesi (Celebes), Indonesia; 3°19'40"S, 120°36'30"E; 900 m; gray mud; 19 December 1909; *Albatross* stn 5657.

Paratypes: India—1 ♀, USNM 216711, collected with holotype. 1♂, ZSI 7806/10, W of Cape Comorin, Tamil Nādu, India; 7°46'N, 76°37'E; 1,225 m; 26 April 1911; *Investigator* stn 388. 2♂, ZSI, S of Cape Comorin, Tamil Nādu, India; 7°36'N, 78°05'E; 556-595 m; 10 April 1900; *Investigator* stn 268.

Indonesia—1 ♀, ZMB, off W Sumatra; 0°39'S, 98°52'E; 750 m; 31 January 1899; *Valdivia* stn 191. 1♂, ZMA, eastern Flores Sea; 7°24'00"S, 118°15'12"E; 794 m; fine gray mud, with some radiolariae and diatoms; 6 April 1899; *Siboga* stn 45. 1♀, USNM, Teluk Bone, Sulawesi (Celebes); 3°17'40"S, 120°36'45"E; 885 m; gray mud; 19 December 1909; *Albatross* stn 5656. 3♀, USNM, Teluk Bone, Sulawesi (Celebes); 3°32'40"S, 120°31'30"E; 933 m; gray mud; 19 December 1909; *Albatross* stn 5658. 1♀, USNM, W of Halmahera; 0°35'00"N, 127°14'40"E, 127°14'40"E; 795 m; fine gray sand, mud; 27 November 1909; *Albatross* stn 5619.

Philippines—2♀, USNM, Cagayan Is, Sulu Sea; 9°38'30"N, 121°11'00"E; 929 m; gray mud, coral sand; 31 March 1909; *Albatross* stn 5423. 1♂ 1♀, USNM, Lagonoy Gulf, E of southern Luzon; 13°32'30"N, 123°58'06"E; 1,033 m; gray mud; 10 June 1909; *Albatross* stn 5460. 1♀, USNM, Lagonoy Gulf, E of southern Luzon; 13°40'57"N, 123°57'45"E; (549 m); sand; 16 June 1909; *Albatross*

stn 5463. 1 ♀, USNM, Lagonoy Gulf, E of southern Luzon; 13°39'42"N, 123°40'39"E; 914 m; gray mud; 17 June 1909; *Albatross* stn 5465. 1 ♀, USNM, Verde Island Passage, N of Mindoro; 13°36'11"N, 120°45'26"E; 622 m; fine sand; 20 January 1908; *Albatross* stn 5114. 4 ♀, USNM, Lagonoy Gulf, E of southern Luzon; 13°35'27"N, 123°37'18"E; 878 m; gray mud; 18 June 1909; *Albatross* stn 5467. 2 ♂ 5 ♀, USNM, Lagonoy Gulf, E of southern Luzon; 13°36'48"N, 123°38'24"E; 914 m; green mud; 18 June 1909; *Albatross* stn 5469.

Diagnosis.—Optic calathus relatively short, mesial margin 1.0-1.3 times distal width. Anterolateral carina lacking. Ventral extremity of cervical carina forming sharp-edged arc. Posterior extremity of hepatic sulcus turned ventrally. Third article of antennular peduncle expanded laterally, forming large subtriangular projection in males, but weak to rounded prominence in females; males with ventral antennular flagellum never sinuous, and ultimate article of third maxilliped strongly curved, spatulate and bearing patch of strong, rigid setae. Pereopods not covered with minute setae. Petasma with ventral costa only slightly inclined distomesially, and ventral surface of dorsolateral lobule lacking setae. Thelycum with plate of sternite XIV rather long and produced at either side in short anterolateral hood; median plate of sternite XIII moderately long (not nearly reaching spine on sternite XII), rather broad (maximum width 0.65-0.75 length) but not expanded posterolaterally in conspicuous prominences.

Description.—Body slender (Fig. 2), densely studded with minute setae. Rostrum in males usually short, its length 0.25-0.45 CL (but in one male, 24 mm CL, 1.4 CL), and roughly lanceolate; in females long (Fig. 3), 1-1.15 CL (but in one female 23 mm CL, 0.70 CL), relatively deep and convex basally, styliform and slightly unturned anteriorly. Rostral plus epigastric teeth 3; rostral teeth situated variably in males, basally in females. Adrostral carina strong, in males almost reaching apex, in females (and in male with long rostrum) extending just anterior to second tooth. Antennal spine sharp; branchiostegal spine as long as or longer than antennal and acutely pointed. Cervical sulcus crossing postrostral carina (rarely only reaching it) at about 0.45 CL from orbital margin, with ventral part turning anteriorly; accompanying carina blunt except for sharp strongly arched ventral extremity; weak postcervical sulcus reaching, but not crossing, postrostral carina at about 0.70 CL from orbital margin. Postrostral

carina, extending 0.75-0.80 CL from orbital margin, well marked and sharp to cervical sulcus, low and blunt posteriorly, and followed by small tubercle situated near posterior margin of carapace. Anterolateral carina lacking; gastro-orbital carina well defined; antennal carina rather short; branchiostegal-hepatic carina long, raised and sharp. Orbito-antennal sulcus shallow; hepatic sulcus fusing with branchiocardiac sulcus, then turning obliquely almost ventrad, forming small branch nearly reaching margin of branchiostegite; branchiocardiac sulcus, accompanied by carina, long, extending posteriorly to near margin of carapace; blunt, dorsally concave ridge (disposed dorsal to posterior part of hepatic sulcus and anterior part of branchiocardiac sulcus) delimited dorsally by weak groove, latter approaching cervical sulcus anteriorly and ending about level of postcervical sulcus posteriorly.

Eye (Fig. 4C) with optic calathus relatively short, length of mesial margin 1.0-1.3 times distal width; mesial tubercle strong and situated between distal 0.25 and 0.30 length of margin.

Gnathal appendages, except third maxilliped, illustrated in Figure 1.

Antennular peduncle with stylocerite produced in sharp spine falling conspicuously short of mesial base of distolateral spine; latter small and sharp; third article in adult males uniquely produced in large subtriangular or ax-head shaped projection (Fig. 2) directed ventrolaterally, in females (Fig. 5B) expanded laterally in broadly rounded prominence. Dorsal flagellum reaching between distal 0.20 and 0.15 of scaphocerite; ventral flagellum straight and long, although incomplete in all specimens examined, in one male with 19 mm CL its length at least 2.75 times CL.

Scaphocerite extremely long, surpassing antennular peduncle by as much as 0.4 its own length; strong lateral rib ending in sharp spine falling considerably short of distal end of lamella. Antennal flagellum at least 1.25 times TL of shrimp.

Third maxilliped sexually dimorphic. In males (Fig. 5A) with penultimate article often slightly to strongly inflated proximally, compressed and produced in strong, subelliptical or acuminate process (overhanging proximal part of ultimate article) distally; article also bearing brush of long thickly set setae on both mesial and lateral surfaces, and dense row of setae along distal margin of process. Ultimate article subspatulate, strongly arched, not expanded basally, bearing distally dense patch of strong, rigid setae on lateral surface, proximalmost setae short and more distal ones considerably longer; terminal margin with tuft of very long flex-

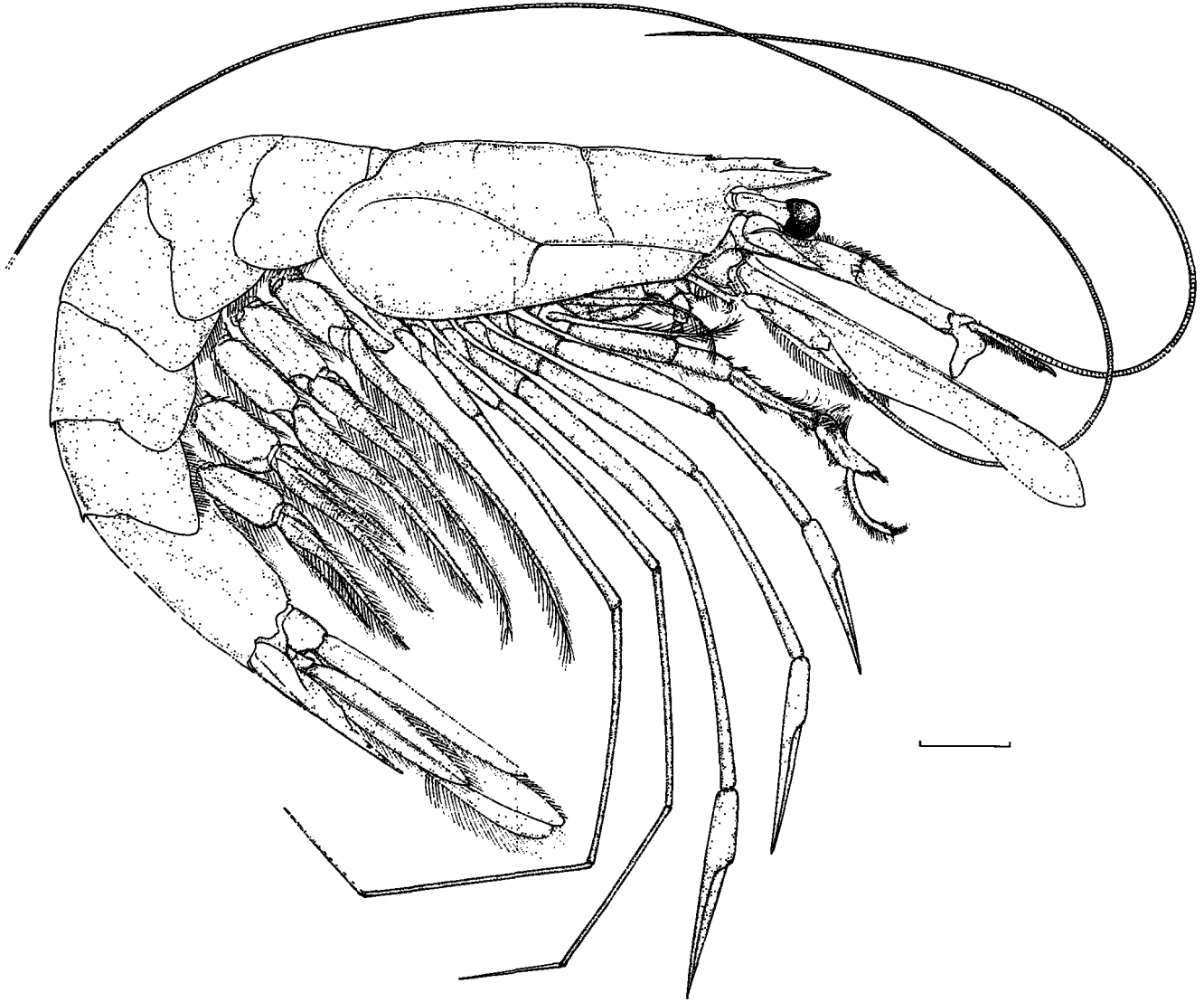


FIGURE 2.—*Pseudaristeus kathleenae*, holotype ♂ 23.5 mm CL, Teluk Bone, Sulawesi (Celebes), Indonesia. Lateral view. Scale = 6 mm.

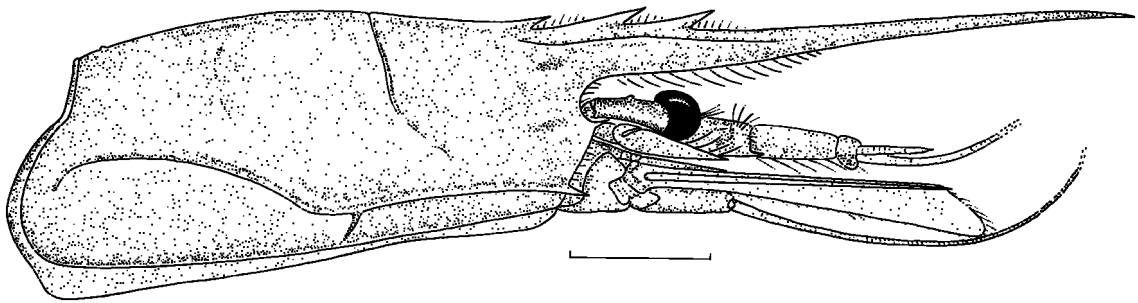


FIGURE 3.—*Pseudaristeus kathleenae*, ♀ 37 mm CL, Verde Island Passage, north of Mindoro, Philippines. Anterior region, lateral view. Scale = 10 mm.

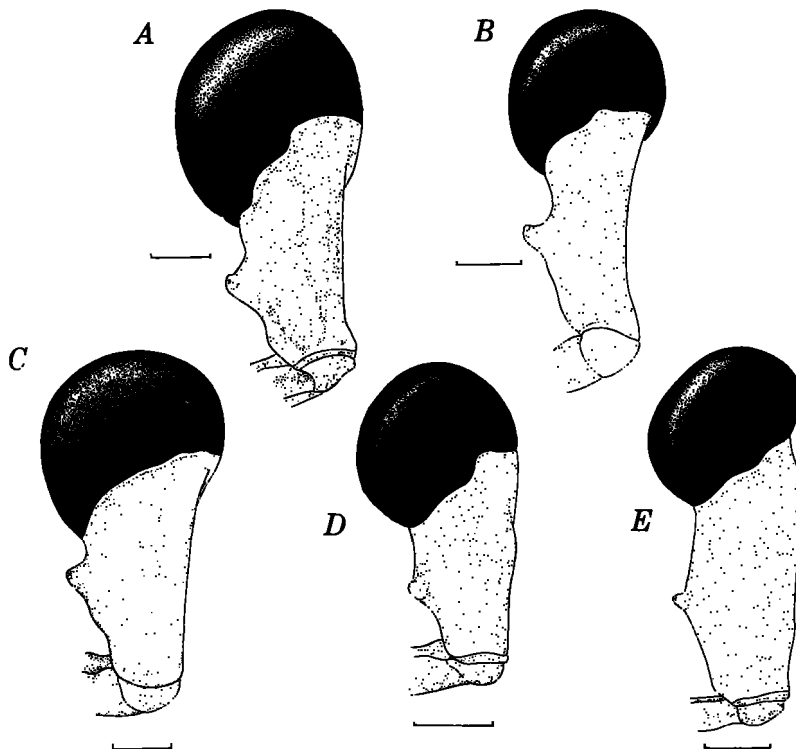


FIGURE 4.—Eyes. A, *Pseudaristeus crassipes*, ♂ 28.5 mm CL, south of Cape Comorin, Tamil Nādu, India. B, *P. gracilis*, ♂ 20 mm CL, eastern Mindanao Sea, Philippines. C, *P. kathleenae*, holotype ♂ 23.5 mm CL, Teluk Bone, Sulawesi, Indonesia. D, *P. protensus*, holotype ♀ 40 mm CL, west of Everal Gujārat, India. E, *P. sibogae*, ♀ 47.5 mm CL, south of Pulau Muna, Sulawesi, Indonesia. Scales: A, B, C = 1 mm; D, E = 2 mm.

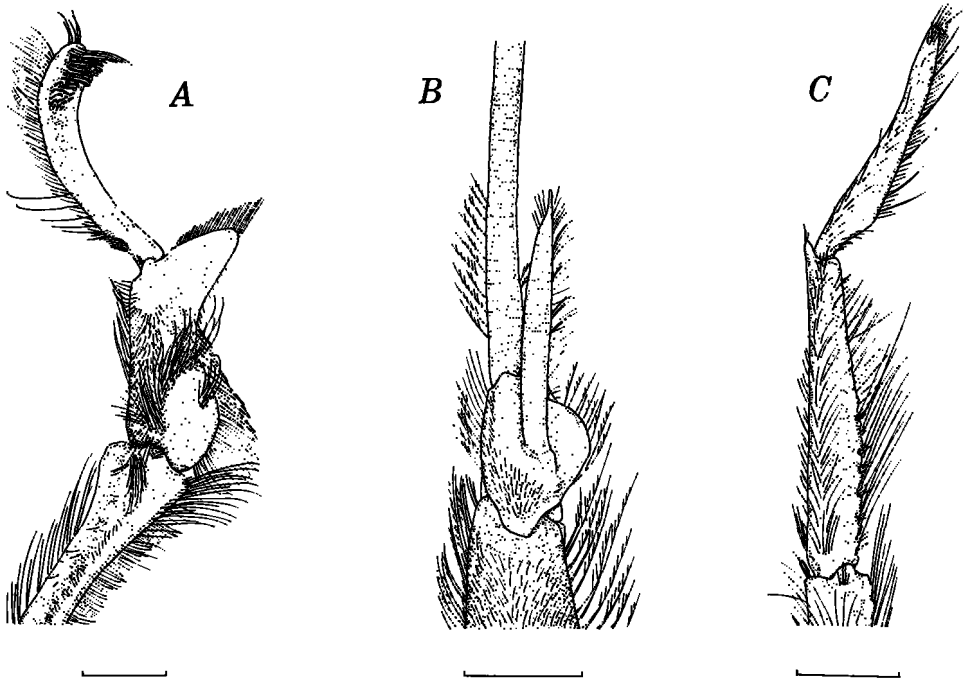


FIGURE 5.—*Pseudaristeus kathleenae*: A, ♂ 26 mm CL, Lagonoy Gulf, east of southern Luzon, Philippines, distal articles of left third maxilliped, lateral view. B, ♀ 39 mm CL, Teluk Bone, Sulawesi, Indonesia, distal articles of right antennular peduncle and flagella, dorsal view. C, same ♀, distal articles of left third maxilliped, dorsal view. Scales = 2 mm.

ible setae, and entire ventral margin supporting numerous ones. In females (Fig. 5C), ultimate article slender, flattened, broadening slightly from narrow base, then tapering gently to blunt apex.

Pereopods not covered with setae; first and second with broad, compressed merus bearing small, slender, distomesial spine.

Abdomen with sharp dorsomedian carina extending from posterior 0.75 of fourth somite posteriorly through sixth somite and produced in spine on caudal margin of last 3 somites; sixth also bearing pair of minute posteroventral spines and 2 elongate cicatrices. Telson with median sulcus weak, usually distinct along anterior 0.75 length of telson, and flanked by paired longitudinal dorsolateral ridges; bearing 4 pairs of movable spines: 3 at about 0.60, 0.75, 0.85 length from basal margin of telson, fourth flanking short terminal part. Mesial ramus of uropod surpassing apex of telson by as much as 0.40 its own length; lateral ramus overreaching mesial ramus by as much as 0.33 its own length.

Petasma (Figs. 6, 7A, B) with dorsomedian lobule cinnulate along entire mesial margin. Ventro-median lobule extending distally as far as dorso-lateral lobule and bearing elongate, lapel-like flap

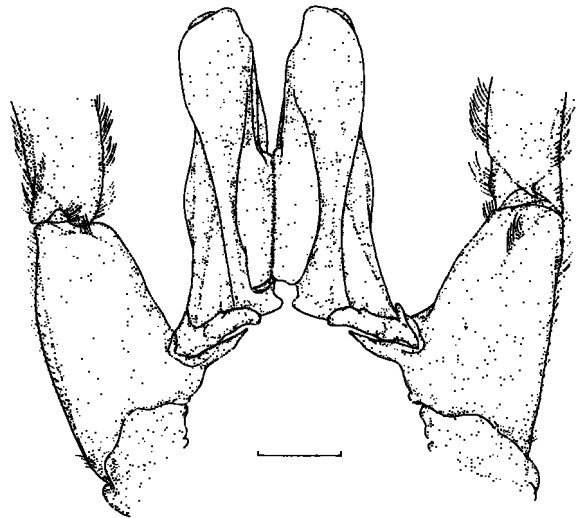


FIGURE 6.—*Pseudaristeus kathleenae*, ♂ 24.5 mm CL, Lagonoy Gulf, east of southern Luzon, Philippines. Petasma and proximal part of first pleopods, dorsal view. Scale = 2 mm.

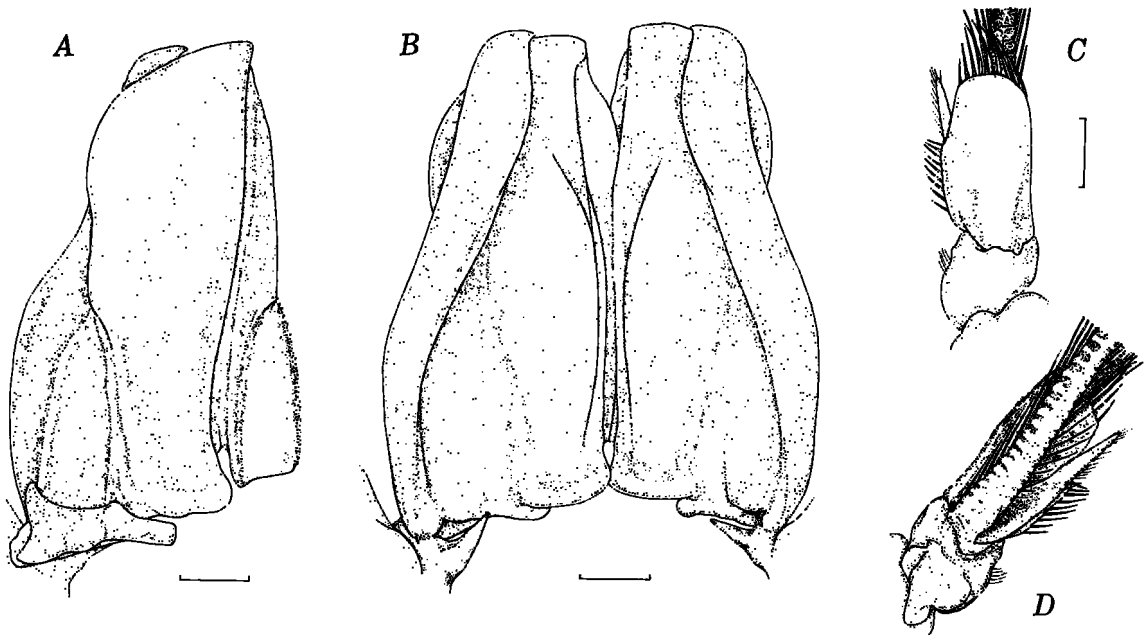


FIGURE 7.—*Pseudaristeus kathleenae*, holotype ♂, 23.5 mm CL, Teluk Bone, Sulawesi, Indonesia. A, Petasma, dorsolateral view of left half. B, Ventral view. C, Right appendices masculina and interna, and basal sclerite of endopod, dorsal view. D, Ventral view. Scales = 1 mm.

distoventrally along mesial margin. Dorsolateral lobule sclerotized, expanding distolaterally before tapering to subangulate mesial apex, its distolateral margin strongly curved; ventral surface, exhibiting arched slender rib, lacking setae. Ventral costa gently sinuous, only slightly inclined distomesially, its terminal part forming truncate blade lying free but against ventral surface of dorsolateral lobule.

Appendix masculina (Fig. 7C, D) roughly obovate, with proximal part curving ventrally embracing appendix interna; its distal margin bearing long setae and mesial margin bearing short, more numerous ones. Appendix interna roughly triangular and subequal in length to appendix masculina.

In males, sternite XIV with setose anteromedian tubercle; plate of sternite XIII elongate (length 2-3 times basal width), broadly rounded anteriorly and produced in minute apical spine bearing tuft of long setae.

Thelycum (Fig. 8) with setose, moderately long plate of sternite XIV either traversed by shallow groove posteriorly or broadly depressed, and with anteromedian margin varying from distinctly concave to slightly convex, plate produced at either side in short anterolateral hood; fossa immediately anterior to plate very conspicuous and bearing pair of small oblique ridges. Median plate of sternite XIII,

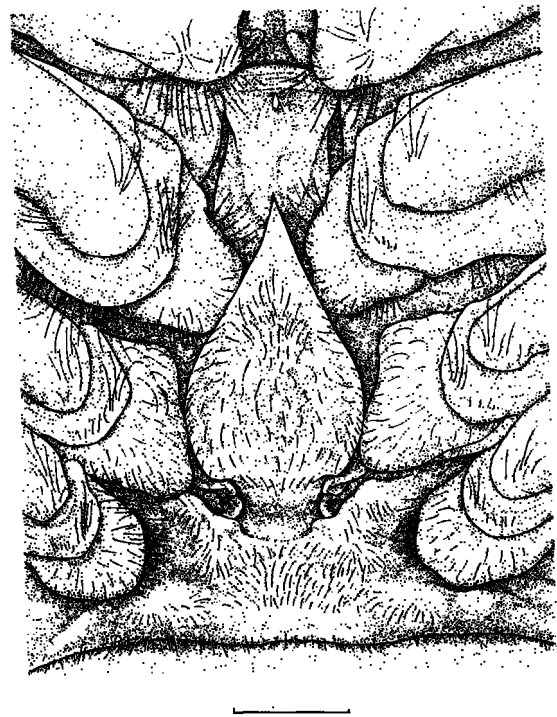


FIGURE 8.—*Pseudaristeus kathleenae*, ♀ 47 mm CL, Lagonoy Gulf, east of southern Luzon, Philippines. Thelycum. Scale = 2 mm.

also covered with setae, moderately long (length 3-3.5 times basal width), falling considerably short of spine on sternite XII, broadly lanceolate (maximum width 0.65-0.75 length), and flat or slightly excavate; posterolateral margins of plate, sometimes turned ventrally, abutting slender ridges extending posteromesially before curving laterally on margin of sternite XIII. Sternite XII minutely setose, bearing median keel ending anteriorly in anteroventrally directed sharp spine.

Maximum lengths.—Males, 24 mm CL; females, 46.5 mm CL.

Geographic and bathymetric ranges.—From west of Cape Comorin, India, through Indonesia, and northward to east of Luzon, Philippines (Fig. 9). It has been obtained at depths between 549 and 1,225 m.

Discussion.—This species differs from *P. crassipes*, with which it has been confused previously, in the following unique characteristics. In males, the third article of the antennular peduncle is strikingly produced in a subtriangular or roughly ax-head shaped lateral projection, and in females it is expanded laterally in a broadly rounded prominence. This is a feature by which the females of *P. kathleenae* can be infallibly distinguished from those of *P. crassipes* which, otherwise, are quite similar. In *P. crassipes*, the third article of the antennular peduncle of both sexes is uniform in width proximally and gradually tapers distomesially. In males of *P. kathleenae*, the penultimate article of the third maxilliped is compressed distally and produced in a strong subelliptical or acuminate process which overhangs the ultimate article; the latter is subspatulate, conspicuously curved throughout, almost uniform in width, and bears long rigid setae on the lateral surface. In the males of *P. crassipes* the penultimate article of the third maxilliped is subtriangular in cross section throughout and does not project distally in a conspicuous process but instead is rounded distally; the ultimate article is twisted, expanded basally, and weakly to conspicuously so distally, and bears lateral rows of spinules on its ventral surface.

Pseudaristeus kathleenae differs further from *P. crassipes* in features of the petasma. In the former, the dorsolateral lobule is expanded distolaterally before tapering to a subangulate mesial apex; also the ventral costa is sinuous and does not turn strongly distomesially from its basal part. In contrast, the dorsolateral lobule is not expanded distolaterally in *P. crassipes*, tapers to broadly elliptical apex, and the ventral costa is almost straight basally before

turning rather abruptly distomesially. Finally, in females of *P. kathleenae* the median plate of sternite XIII is broader than that in *P. crassipes*, its maximum width ranging from 0.67 to 0.75 rather than from 0.45 to 0.55 as it does in the latter.

In females of *Pseudaristeus* the rostrum is long, almost as long or considerably longer than the carapace, whereas, in males it is usually short, less than 0.33 the length of the carapace. Among the 8 males of *P. kathleenae* examined in this study, one possesses a rostrum that is 1.4 times the length of the carapace (longer than that of any female examined), and among the three available males of *P. crassipes*, the rostrum of one, although proportionally not so long, is 0.7 as long as the carapace. Perhaps these males with long rostra are not as rare as one might anticipate. This suggestion is based on a study by Burukovsky and Romensky (1972) in which they noted considerable variation in the length of the rostrum in another aristeid, *Aristeus varidens*, occurring in the eastern Atlantic from Ghana to Angola. It was well known that in all genera of Aristeidae the rostrum of females is much longer than that of males; however, they found that although the majority of males of this gamba prawn have a relatively short rostrum, in almost 30% of them it is long. Also, they noted that in both sexes the rostrum decreases proportionately with increasing size (a fact well established for penaeoid species) and that this age-dependent variation is different for the sexes: in small females the rostrum may exceed 1.5 times the length of the carapace, whereas in large ones it is about as long as the carapace; in small males the length of the rostrum may be almost 1.5 times that of the carapace, but as they grow it decreases to 0.1-0.5 times. Nevertheless, in individuals of the same size they found that the range of variation is smaller in females than in males. Their study demonstrates that sexual dimorphism in the length of the rostrum, thought to be typical of aristeids, disappears at least in small males of *A. varidens*. This too might obtain in members of *Pseudaristeus*, but because of the lack or paucity of males of all 6 species I am unable to conduct a meaningful investigation of variations in RL/CL. Because no correlation was observed between variations in the length of the rostrum and changes in the petasma or in the structure of the gonads in males with short and long rostrum which would indicate sexual change, Burukovsky and Romensky suggested that the reduction of the rostrum, more marked in males than in females, might be associated with the transition from a benthic to a bathypelagic existence undergone by members of the family Aristeidae.

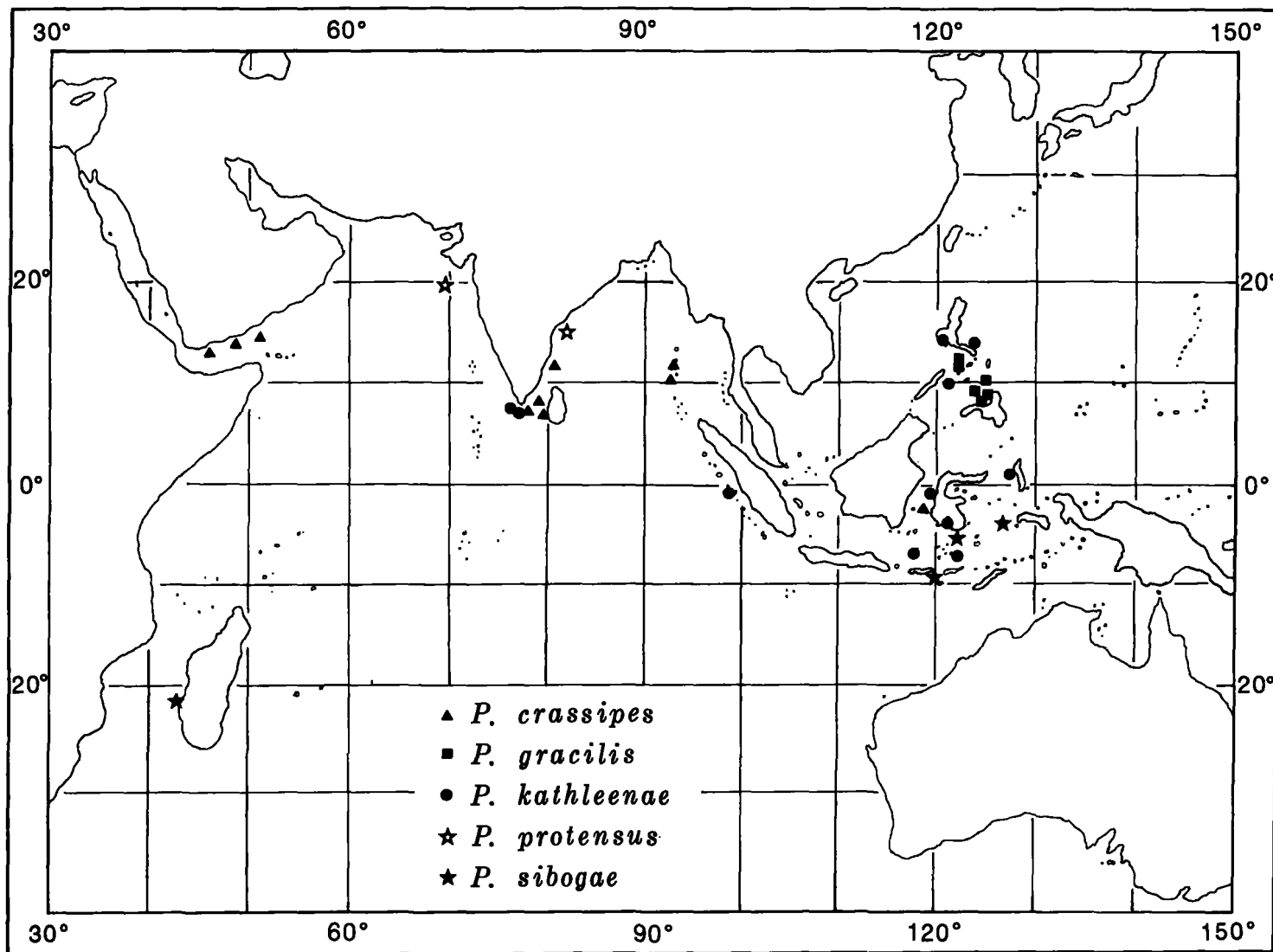


FIGURE 9.—Ranges of *Pseudaristeus crassipes*, *P. gracilis*, *P. kathleenae*, *P. protensus*, and *P. sibogae*.

Only a few of the available specimens of this species still have entire pereopods, and even fewer have retained all 5 pereopods; in almost all, the fourth and fifth are missing, or only two or three podomeres are represented. The data obtained by me, however, seem to confirm those presented by De Man (1911) and Crosnier (1978), which indicate that the pereopods of *P. kathleenae* are more slender than those of *P. sibogae*. Their data were based on a female 31 mm CL collected by the Siboga Expedition and identified by them as "*crassipes*". This specimen was examined during the present study and is assigned herein to *P. kathleenae*.

Etymology.—I take pleasure in naming this shrimp for my daughter Kathleen P. Canet.

***Pseudaristeus crassipes*
(Wood-Mason 1891)**

Figures 4A, 9-13

Aristaeus crassipes Wood-Mason 1891:281, fig. 7 [syntypes: 1 ♀, ZSI 6713/9, Andaman Sea; 11°25'05"N, 92°47'06"E; 405 fm (741 m); green mud; 9 December 1890; *Investigator* stn 116. 1 ♀, ZSI 3171/9 (could not be located in ZSI, 24 November 1984, Maya Deb of ZSI, pers. commun.²); off SW Sri Lanka; 6°29'00"N, 79°34'00"E; 597 fm (1,092 m)]. Alcock and Anderson 1894:147. Faxon 1895:198. Anderson 1896:91. Alcock 1901a:50 [part]; 1902:268, figs. 63, 64a, b.

[?] *Aristaeus crassipes*. Alcock 1898:74. Alcock and Anderson 1899:3. Doflein 1906:259.

Aristaeus (Hemipeneus) crassipes. Alcock 1901b:33.

Aristeus (Hemipeneus) crassipes. Alcock and McArdle 1901, pl. 49, figs. 1, 2.

Aristeus crassipes. Lloyd 1907:2.

Hemipeneus crassipes. Kemp and Sewell 1912:17 [part], pl. 1, fig. 9.

Hemipeneus crassipes. Balss 1925:224 [part]. Ramadan 1938:49. Anderson and Lindner 1945:301. Ramadan 1952:15, fig. 18. Sewell 1955:203. Burukovsky 1974:48. Silas and Muthu 1979:78. Not *Hemipeneus crassipes* Monod 1974:118, figs. 7-11 [= *Aristeus virilis* (Bate 1881) and *Aristeus mabahissae* Ramadan 1938; fide Crosnier 1978:85].

Pseudaristeus crassipes. Crosnier 1978:83, fig. 30d; 1986:862.

Pseudaristeus sp. Crosnier 1984:22.

Material.

Gulf of Aden—3 ♀, BMNH + 1 ♀, USNM, off Djibouti; 13°06'12"N-13°03'00"N, 46°24'30"E-46°21'42"E; 1,061 m; 7 May 1934; green mud; John Murray Exped. stn 193. 1 ♀, ZMB, off Yemen (Aden); 13°02'N, 46°41'W; 1,469 m; 4 April 1899; *Valdivia* stn 271. 1 ♀, BMNH, off Yemen (Aden); 13°41'N-13°40'N, 48°17'E-48°19'E; 1,295 m; 15 October 1933; John Murray Exped. stn 33. 1 ♀, BMNH, off Yemen (Aden); 14°36'06"N-14°38'42"N, 51°00'18"E-50°57'42"E; 1,269 m; 4 May 1934, John Murray Exped. stn 184.

India—1 ♀, ZMB, Arabian Sea, *Investigator* [stn not given]. 2 ♂, ZSI, S of Cape Comorin, Tamil Nādu; 7°36'N, 78°15'E, 1,017-1,088 m; green mud, sand; 10 April 1900; *Investigator* stn 268. 1 ♀, MP, Gulf of Mannar; 8°11'N, 79°03'E; 1,035 m; 28 July 1981; *Safari II* stn 4, CP 06. 1 ♂, ZSI, off Chidambaram, Tamil Nādu; 11°29'45"N, 80°02'30"E; 816 m; 19 March 1901; *Investigator* stn 280. 1 ♂ 1 ♀, BMNH, S of Andaman Is, 10°06'N, 92°29'E; 1,289 m; *Investigator* stn 315.

Sri Lanka—2 ♀, ZSI, NW of Colombo; 6°54'30"N, 79°34'30"E; 878 m; green mud; 20 October 1898, *Investigator* stn 250.

Indonesia—1 ♀, MP, Strait of Makassar; 2°04'24"S, 118°46'54"E; 1,710-1,730 m; 9 November 1980; *Corindon II* stn 286.

Diagnosis.—Optic calathus relatively short, mesial margin 0.9-1.1 times distal width. Anterolateral carina lacking. Ventral extremity of cervical carina forming sharp-edged arc. Posterior extremity of hepatic sulcus turned ventrally. Third article of antennular peduncle not expanded laterally; males with ventral antennular flagellum not sinuous and ultimate article of third maxilliped twisted, markedly dilated proximally, less so distally, and bearing ventrolateral rows of minute spines. Pereopods not covered with minute setae. Petasma with distal two-thirds of ventral costa turned rather abruptly distomesially and ventral surface of dorsolateral lobule lacking setae. Thelycum with plate of sternite XIV long and produced in short anterolateral hoods; median plate of sternite XIII moderately long (not nearly reaching spine on sternite XII), rather narrow (maximum width 0.45-0.55 length), and not expanded posterolaterally in conspicuous prominences.

Description.—Body slender, densely studded with minute setae. Rostrum in males (complete only in two) relatively short, its length 0.2 and 0.7 CL, and tapering gradually to sharp apex; in females longer,

²Mayo Deb, Zoologist, Zoological Survey of India, Calcutta, India, pers. commun. 24 November 1984.

1.15-1.25 CL, moderately deep and convex basally, styliform and slightly upturned anteriorly, but occasionally with apical extremity curving downward. Rostral plus epigastric teeth 3; rostral teeth, situated variably in males, basally in females. Adrostral carina strong, in males with short rostrum almost reaching apex, in females and in male with long rostrum extending just anterior to second tooth. Antennal spine sharp; branchiostegal spine longer than antennal, acutely pointed. Cervical sulcus crossing postrostral carina (rarely only reaching it) at about 0.45 CL from orbital margin, with ventral part turning anteriorly; accompanying carina blunt, except for sharp, strongly arched ventral extremity; postcervical sulcus reaching, but not crossing, postrostral carina at about 0.7 CL from orbital margin. Postrostral carina, extending 0.8-0.9 CL from orbital margin, well marked and sharp to cervical sulcus, low and blunt posteriorly, followed by small tubercle situated near posterior margin of carapace. Anterolateral carina lacking; gastro-orbital carina strong; antennal carina relatively

short; branchiostegal-hepatic carina long, raised and sharp. Orbito-antennal sulcus shallow; deep hepatic sulcus fusing with branchiocardiac sulcus before turning obliquely almost ventrad, forming small branch nearly reaching margin of branchiostegite; branchiocardiac sulcus, accompanied by strong carina, deep and long, extending posteriorly to near margin of carapace; blunt, dorsally concave ridge (disposed dorsal to posterior part of hepatic sulcus and anterior part of branchiocardiac sulcus) delimited dorsally by shallow groove, latter extending anterodorsally almost to cervical sulcus and continuous posteriorly with postcervical sulcus.

Eye (Fig. 4A) with optic calathus relatively short, length of mesial margin 0.9-1.1 times distal width; mesial tubercle strong and situated between 0.30 and 0.45 length of mesial margin from cornea.

Antennular peduncle with stylocerite produced in sharply pointed spine falling distinctly short of, to almost reaching, mesial base of distolateral spine; latter slender and sharp. Third article never produced laterally (Fig. 10C); dorsal flagellum reach-

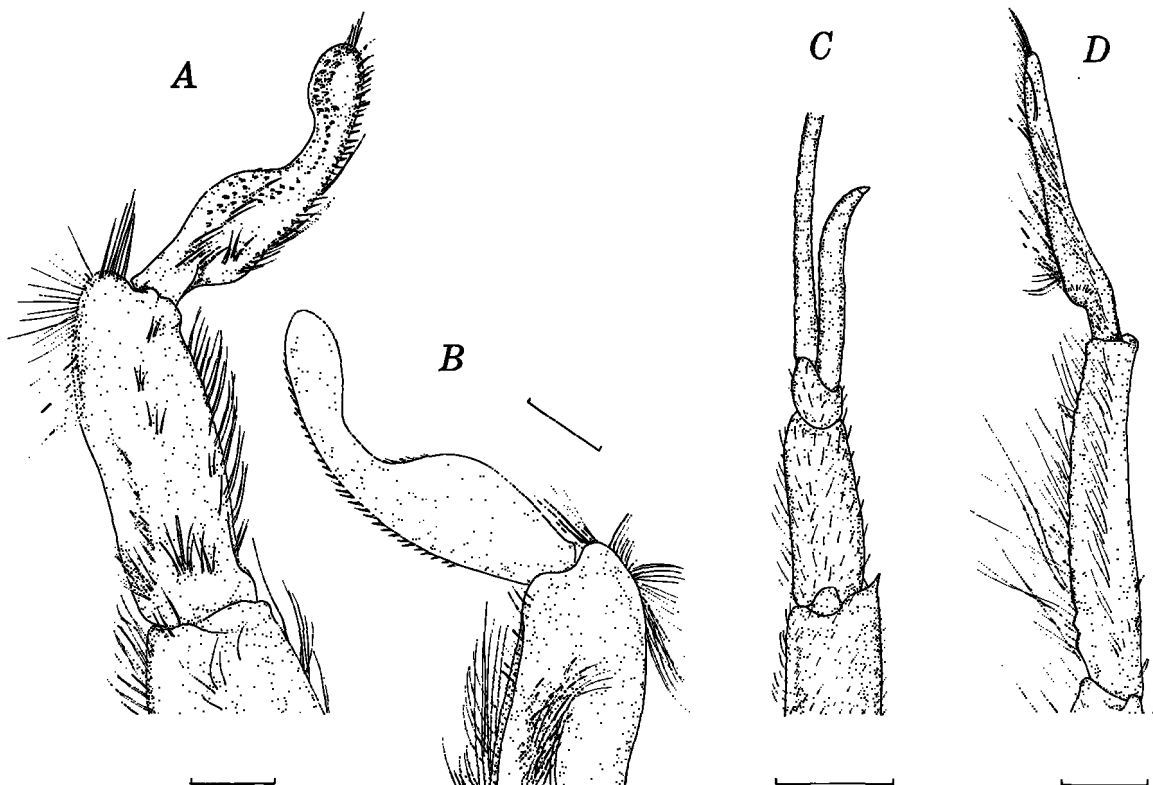


FIGURE 10.—*Pseudaristeus crassipes* (Wood-Mason): A, ♂ 26.5 mm CL, south of Cape Comorin, India, distal articles of right third maxilliped, ventral view. B, Same ♂ distal articles of right third maxilliped, dorsal view. C, Lectotype ♀, Andaman Sea, India, distal articles of right antennular peduncle and flagella, dorsal view (prepared from camera lucida drawings by H. C. Ghosh). D, ♀ 25 mm CL, south of Andaman Islands, India, distal articles of left third maxilliped, ventral view. Scales: A, B, D = 1 mm, C = 4 mm.

ing between base of distal 0.25 and end of scaphocerite; ventral flagellum straight and long, although broken in all specimens studied, in male with 22 mm CL its length 2.1 times CL.

Scaphocerite extremely long, surpassing antenular peduncle by as much as 0.4 its own length; strong lateral rib ending in sharp spine falling considerably short of distal end of lamella. Antennal flagellum incomplete in all specimens examined.

Third maxilliped sexually dimorphic: Males (Fig. 10A, B) with penultimate article subtriangular in cross section, its distomesial margin not produced in conspicuous process but bluntly rounded; ultimate article twisted, expanding from short, narrow base, then narrowing and becoming concave laterally before again expanding (sometimes almost imperceptibly) distally; ventral surface with proximal, transverse comb of long setae continuous with lateral rows of minute spines extending to and around distal extremity. Females with ultimate article (Fig. 10D), slender, but broadening slightly mesially from short, narrow base, then tapering to blunt apex.

Pereopods not covered with setae; first and second pereopods with broad depressed merus bearing small, slender, distomesial spine.

Abdomen with sharp dorsomedian carina extending along posterior 0.75 of fourth somite through sixth, and produced in spine on posterior margin of last 3 somites; sixth somite also bearing pair of minute posteroventral spines and 2 elongate cica-trices. Telson with median sulcus shallow, usually distinct only along anterior 0.25 length of telson, and flanked by pair of longitudinal dorsolateral ridges; bearing 4 pairs of movable spines: 3 situated at about 0.60, 0.75, 0.85 length from basal margin of telson, fourth flanking short terminal part. Mesial ramus of uropod surpassing apex of telson by as much as 0.40 its own length; lateral ramus over-reaching mesial ramus by as much as 0.33 its length.

Petasma (Fig. 11A, B) with dorsomedian lobule cincinnulate along entire mesial margin. Ventro-median lobule extending distally almost as far as dorsolateral lobule and bearing elongate, lapel-like flap distoventrally along mesial margin. Dorsolateral lobule sclerotized, not expanded distolaterally, with lateral margin only slightly curved and distalmost part broadly rounded forming subelliptical mesial apex; ventral surface lacking setae, exhibiting conspicuous, slender, arched rib. Ventral costa almost straight basally along 0.4 of its length, then turning somewhat abruptly distomesially, its rather broad terminal part truncate (sometimes with disto-

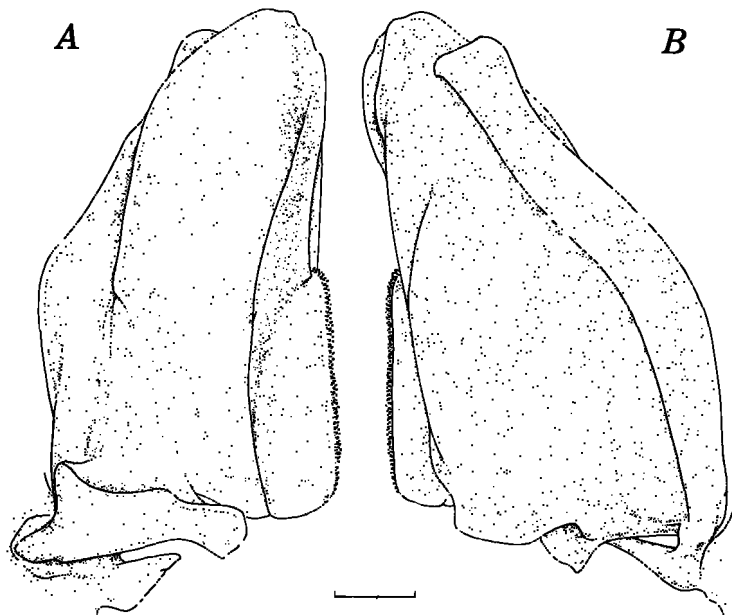


FIGURE 11.—*Pseudaristeus crassipes*, ♂ 26.5 mm CL, south of Cape Comorin, India. A, Petasma, dorsal view of left half. B, Ventral view (specimen slightly distended). Scale = 1 mm.

mesial angle slightly produced) lying free but against ventral surface of distolateral lobule.

Appendices masculina and interna like those of *P. kathleenae*. In males, plate of sternite XIII flat, ovate but produced in minute apical spine, its length 1.8-1.9 basal width; sternite XIV bearing antero-medial tubercle or low, anteriorly produced prominence.

Thelycum (Fig. 12A, B) with setose plate of sternite XIV long, transversely depressed (occasionally with median elevation), anteriomedian margin straight or slightly convex, plate produced at either side in short anterolateral hood; fossa immediately anterior to plate short and bearing pair of small, oblique, ridges. Median plate of sternite XIII, also covered with setae, moderately long (length 2.9-3.5 basal width) but falling distinctly short of spine on sternite XII, rather narrow (maximum width 0.45-0.55 length), lanceolate, tapering anteriorly from near base, occasionally from near midlength, and strongly produced in sharp apical spine; posterolateral margins of plate, usually turned ventrally, flanked by, or interlocking with, slender ridges curving laterally on margin of sternite XIII. Sternite XII minutely setose, strongly raised and crested by median carina ending anteriorly in minute spine.

Color in life crimson (Wood-Mason 1891).

Maximum lengths.—Males, 29 mm CL; females 37 mm CL.

Geographic and bathymetric ranges.—From the Gulf of Aden to the Strait of Makassar, Indonesia (Fig. 9). It has been found at depths between 741 and 1,710-1,730 m.

Variation.—This species exhibits marked variation in shape of the last 2 articles of the third maxilliped in armature of sternite XIV of males, and also in the shape of the thelycal plate of sternite XIII in females. Those articles range from moderate to very narrow widths and both the proximal and distal parts of the ultimate article may be imperceptibly to conspicuously dilated. Sternite XIV may bear either an anteromedian tubercle or a low, anteriorly produced prominence. In the few males examined, the presence of a very slender ultimate article of the third maxilliped seems to be correlated with the presence of a prominence, instead of a tubercle, on sternite XIV. Furthermore, in females the thelycal plate of sternite XIII, although always lanceolate, may be broadest near the base, (in most specimens), or as far anteriorly as midlength.

The female from the Strait of Makassar, Indonesia, cited in "Material", was made available to me

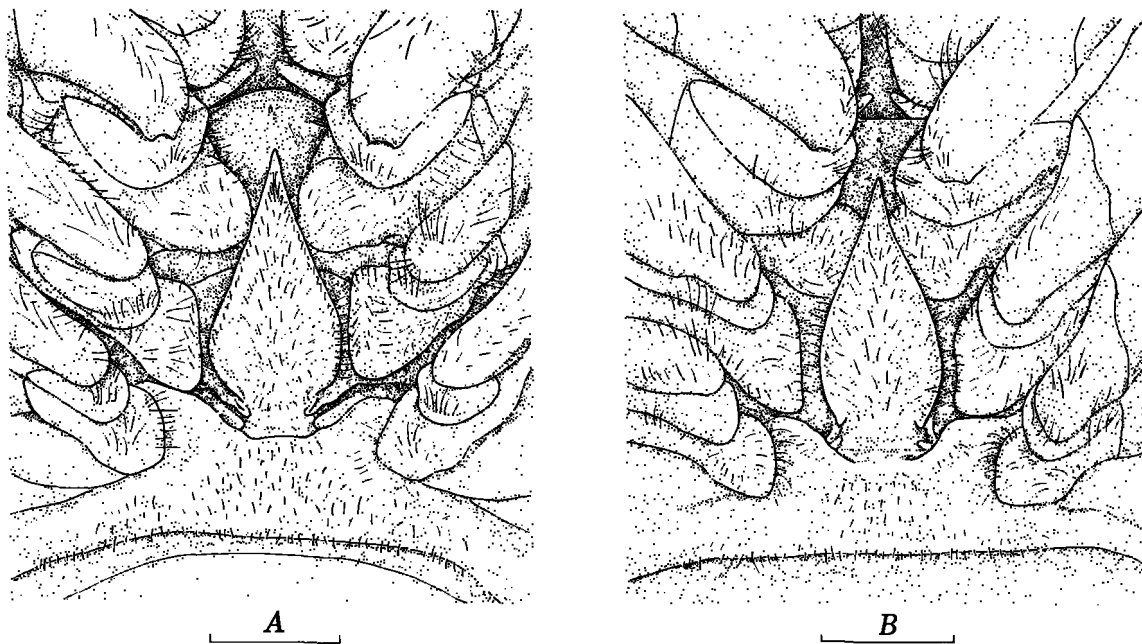


FIGURE 12.—*Pseudaristeus crassipes*: A, ♀ 35 mm CL, off Djibouti, Gulf of Aden. B, ♀ 35 mm CL, Gulf of Mannar, India. Thelyca. Scale = 2 mm.

through the kindness of A. Crosnier, who discussed this shrimp in his work of 1984. He pointed out features that he believed would distinguish it from *P. crassipes* and *P. sibogae*: the absence of setae from the integument; a narrower median plate on sternite XIII (Fig. 13); the absence of setae on the pereopods [typically present in *P. sibogae* but lacking in *P. crassipes*]; and a robust optic calathus which resembles that of *P. crassipes*.

The Indonesian specimen definitely does not belong to *P. sibogae*, but its relation to *P. crassipes* is not entirely clear. A few specimens of the latter species are glabrous, a condition, as noted by Crosnier, unlikely to have been attained accidentally, but absence of setae is not typical of any species of the genus. Variations in the length/width ratio of the optic calathus of *P. crassipes* embrace that of the Indonesian specimen, the mesial margin length of which is equal to the distal width. The maximum width of the median thelycal plate of sternite XIII in most females of *P. crassipes* ranges from 0.50 to 0.55 its length (in one setose specimen, Figure 12B, however, it is only 0.47), whereas the maximum width, 0.45, falls below this range in the Indonesian female. The latter exhibits on the plate of sternite XIV a median ridge that ends in a minute anterior spine, the plate is not produced at either side in an anterolateral hood, and the contour of the median plate on sternite XIII is almost uniformly broad from the base to about midlength. These features differ from those of typical *P. crassipes* females in which the plate of sternite XIV is unornamented, a well-developed anterolateral hood is produced at either side, and the contour of the median plate on sternite XIII broadens from a narrow base posterior to its midlength, then tapers to its apex (cf. Figs. 12, 13). Additional material from the Indonesian locality, including males, might provide evidence for assigning this form to a new taxon.

Discussion.—The males of *P. crassipes* differ strikingly from those of its congeners in that the ultimate article of the third maxilliped is twisted (forming a strong concavity laterally), conspicuously expanded proximally, weakly to markedly dilated distally, and studded with minute spines ventrolaterally. The petasma differs from that of *P. kathleenae* and *P. gracilis*, the other 2 species for which adult males are known; the dorsolateral lobe is not expanded distolaterally, as it is in the former, and it tapers gently to a broadly obtuse apex instead of narrowing rapidly as it does in *P. gracilis*. Furthermore, the ventral costa turns somewhat abruptly distomesiad rather than forming a gentle,

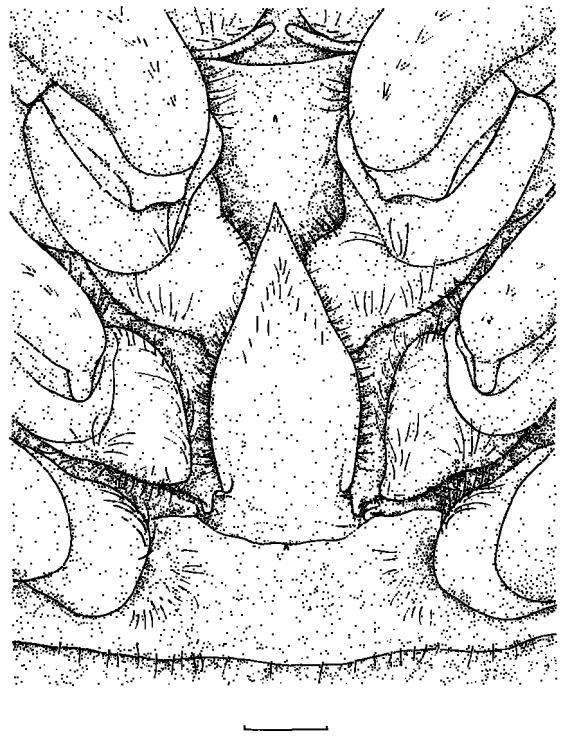


FIGURE 13.—*Pseudaristeus crassipes*, ♀ 35 mm CL, Strait of Makassar, Indonesia. Thelycum. Scale = 2 mm.

sinuous curve or simple arc, and, in contrast to the costa of *P. gracilis*, its terminal part, which is also truncate as it is sometimes in the latter species, is not set off by a conspicuous constriction.

The females of *P. crassipes* can be distinguished readily from those of *P. kathleenae* by the shape of the third article of the antennular peduncle, which in the former is uniform in width proximally and tapers distomesially, but in the latter is expanded laterally in a broadly rounded prominence. Also, although the thelyca of these 2 species exhibit a marked resemblance, the median plate of sternite XIII is narrower in *P. crassipes* than that in *P. kathleenae*, its maximum width ranging from 0.45 to 0.55 instead of 0.67 to 0.75.

Remarks.—In the original description of *Aristeus crassipes*, Wood-Mason (1891) cited two females, one from *Investigator* station 116 and another taken at lat. 6°29'N, long. 79°34'E [off southeastern Sri Lanka], perhaps collected by the *Investigator*. He did not designate either specimen as the holotype and consequently they must be considered syntypes. Later, Alcock (1901b) recorded the registration numbers of the various lots of specimens of this

species in the Zoological Survey of India, and next to the number 6713/9, corresponding to the first female cited by Wood-Mason, he added "Types of the species". Immediately following it is the registration number, 3175/9, of the second female (Maya Deb fn. 2). Alcock's referral to "Types" indicate that he did not intend to select the first female as a lectotype; moreover, since he did not specifically designate it as such, according to the Article 74a of the International Code of Zoological Nomenclature of 1961 it cannot be so considered. Maya Deb has also informed me that the female from *Investigator* station 116 is in the Zoological Survey of India accompanied by the registration number cited above, but that the other female recorded by Wood-Mason could not be located. Because two other species, *P. kathleenae* and *P. protensus*, have been confused with *A. crassipes* and conceivably because the missing syntype might prove to be conspecific with one of them, I hereby designate the female in the Zoological Survey of India assigned registration number 6713/9 as the lectotype of *Aristaeus crassipes* Wood-Mason, 1891.

Through the kindness of Maya Deb and H. C. Ghosh, both of the ZSI, who examined the lectotype and provided me with information on specific morphological features, clear drawings, and photographs, I have been able to ascertain the identity of *P. crassipes*. As stated above, the characters used by Wood-Mason in the description of *P. crassipes* were inadequate for distinguishing it from 2 other species and this deficiency was no doubt responsible for the assignments of closely allied forms to *P. crassipes* (De Man 1911, 1913; Kemp and Sewell 1912; Balss 1925). Kemp and Sewell, however, noted that among males of *P. crassipes* in the ZSI there were two types of third maxillipeds which they described and illustrated. They stated further that it was possible that the males exhibiting one of the maxilliped types should be recognized as belonging to a new variety. The "new variety" is described herein as *P. kathleenae*.

Pseudaristeus protensus, new species

Figures 4D, 9, 14

Material.

Holotype: ♀, USNM 42681, 40 mm CL, length of median plate of sternite XIII 7.1 mm, basal width 1.5 mm; type-locality W of Evēral Gujarāt, India (Arabian Sea); 19°51'30"N, 69°07'30"E; 1,569 m; sand and mud; 14 April 1906; *Investigator* stn 370.

Paratype: ♀, MP, off Godavar, India; 869 m; *Investigator*.

Diagnosis.—Optic calathus relatively short, mesial margin length equal distal width. Anterolateral carina lacking. Ventral extremity of cervical carina forming sharp-edged arc. Posterior extremity of hepatic sulcus turned ventrally. Third article of antennular peduncle in females not expanded laterally. Pereopods not covered with minute setae. Petasma unknown. Thelycum with plate of sternite XIV very short and produced in long anterolateral hoods; median plate of sternite XIII very long (almost reaching spine on sternite XII), narrow (maximum width 0.40 length), and not expanded posterolaterally in conspicuous prominences.

Description.—Body of holotype and paratype (only two specimens available) slender, studded with minute setiferous punctations and extremely minute setae. Rostrum broken. Antennal spine broken; branchiostegal spine long, slender, and acutely pointed. Cervical sulcus crossing or just reaching postrostral carina at about 0.45 CL from orbital margin, with ventral part turning anteriorly; accompanying carina blunt except for sharp, strongly arched ventral extremity; postcervical sulcus deep, almost reaching, but not crossing, postrostral carina at about 0.70 CL from orbital margin, and considerably extending anteriorly. Postrostral carina, extending to 0.85 CL from orbital margin, well marked and sharp to cervical sulcus, low and blunt posteriorly, and followed by small tubercle situated near posterior margin of carapace. Anterolateral carina lacking; gastro-orbital carina strong; antennal carina relatively short; branchiostegal-hepatic carina long, raised and sharp. Orbito-antennal sulcus shallow; deep hepatic sulcus fusing with branchiocardiac sulcus, where turning obliquely almost ventrally forming small branch nearly reaching branchiostegite; branchiocardiac sulcus, accompanied by sharp carina, deep and long, extending posteriorly to near margin of carapace; strong, arched ridge (disposal dorsal to posterior part of hepatic sulcus and anterior part of branchiocardiac sulcus) delimited dorsally by deep groove, latter continuous posteriorly with postcervical sulcus but not extending anteriorly to cervical sulcus.

Eye (Fig. 4D) with optic calathus relatively short, length of mesial margin equal width of distal extremity; mesial tubercle strong and situated at distal 0.33 length of mesial margin.

Antennular peduncle with stylocerite produced in sharply pointed spine almost reaching or falling

short of mesial base of well-developed, sharp, distolateral spine; third article not produced laterally; dorsal flagellum extending to distal 0.2 of scaphocerite; ventral flagellum although incomplete, long, and straight, not mesially curved (concave) just distal to apex of dorsal flagellum.

Scaphocerite extremely long, surpassing antennular peduncle by as much as 0.4 its own length, strong lateral rib ending in acutely pointed small spine falling considerably short of distal end of lamella. Antennal flagellum broken.

Third maxilliped with ultimate article slender but slightly broadening mesially from narrow base, then tapering gently to blunt apex.

Pereopods not covered with setae; first and second pereopods with broad, depressed merus armed with small, slender, distomesial spine.

Abdomen with sharp dorsomedian carina extending full length of fourth somite through sixth, and produced in spine on posterior margin of last 3 somites; sixth somite also bearing pair of minute posteroventral spines and 2 elongate cicatrices. Telson with median sulcus shallow anteriorly, indistinct posteriorly, and flanked by paired longitudinal dorsolateral ridges (posterior part of telson lacking in types). Lateral ramus of uropod surpassing mesial ramus by about 0.3 its own length.

Thelycum (Fig. 14) with setose plate of sternite XIV very short, deeply excavate transversely, bearing small anteromedian notch, and produced at either side in elongate anterolateral hood; fossa immediately anterior to plate very short and armed with pair of small, oblique lateral ridges. Median plate of sternite XIII very long (length 4.5-4.9 times basal width), narrowly lanceolate (maximum width 0.4 length), strongly produced in sharp apical spine, almost reaching anteromedian spine on sternite XII and covered by very thickly set setae; posterolateral margins of plate raised in slender ridges merging with similar ones extending posteromesially before curving laterally following margin of sternite XIII. Sternite XII minutely setose, strongly raised and bearing low median carina ending anteriorly in minute spine.

Geographic and bathymetric ranges.—Known only from the type-locality, located in the Arabian Sea, and from off Godavari, in the Bay of Bengal, at depths of 1,569 and 869 m respectively (Fig. 9).

Discussion.—Like *P. crassipes*, *P. kathleenae*, and *P. gracillis* but unlike *P. sibogae*, the anterodorsal extremity of the groove dorsal to the posterior part of the hepatic sulcus does not join the cervical sulcus

in *P. protensus*; the optic calathus is relatively short, and the pereopods are not covered by setae. *Pseudaristeus protensus* differs strikingly from all its congeners in several distinctive thelycal features: the plate of sternite XIV is short, bears a small median notch on the anterior margin, and is produced in long anterolateral hoods; the median plate of sternite XIII is very long (4.5-4.9 times the basal width, rather than 1.8-3.5), almost reaching the anteromedian spine on sternite XII, and narrower (maximum width 0.40 instead of 0.45-0.75) than its length. Moreover, it is very densely setose (more so than in its congeners) and bears a pair of very conspicuous, vertically directed posterolateral ridges.

Although I have examined only two specimens of *P. protensus*, distinct thelycal differences between this gamba prawn and those of other members of the genus leave no doubt that it represents a new species.

Etymology.—Latin *protensus*, stretched forth, referring to the unusual length of the thelycal plate of sternite XIII.

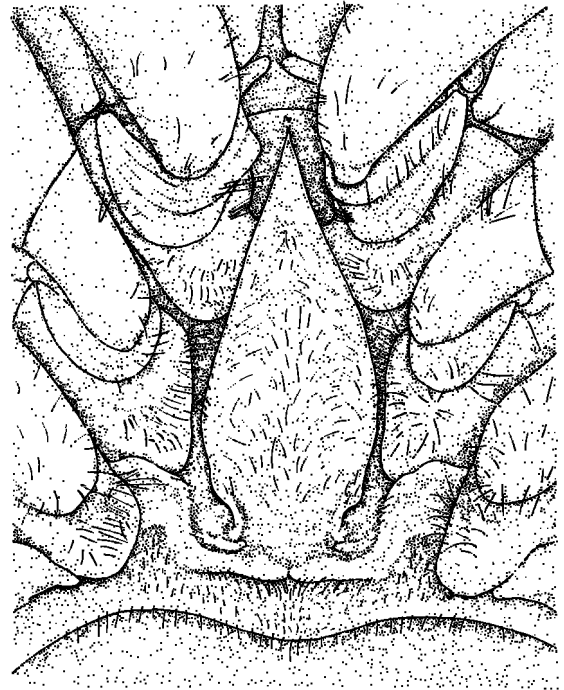


FIGURE 14.—*Pseudaristeus protensus*, n. sp., holotype ♀ 40 mm CL, west of Evēral Gujarāt, India. Thelycum. Scale = 2 mm.

Pseudaristeus gracilis (Bate 1888)

Figures 4B, 9, 15-17

Hemipenaeus gracilis Bate 1888:302, pl. 44, fig. 2 [syntypes 3 ♂ 3 ♀, BMNH; type-locality: off Tablas I, Philippines; 12°21'N, 122°15'E; 1,240 m; blue mud; 16 January 1975; *Challenger* stn 207]. De Man 1911:26. Estampador 1937:493. Anderson and Lindner 1945:301. Burukovsky 1974:48.

Hemipenaeus gracilis. Faxon 1895:198.

Pseudaristeus gracilis. Crosnier 1978:76, fig. 27 bis. 30e.

Material.

Philippines—8 ♀, USNM, Iligan Bay, northern Mindanao; 8°15'20"N, 123°57'E; 750 m; gray mud, sand; 7 August 1909; *Albatross* stn 5511. 1 ♀, USNM, Iligan Bay, northern Mindanao; 8°34'48"N, 124°01'24"E; about 1,280 m; 8 August 1909; *Albatross* stn 5515. 1 ♂, USNM, Macajalar Bay, northern Mindanao; 8°41'30"N, 124°35'40"E; 1,013 m; green mud, fine sand; 4 August 1909; *Albatross* stn 5499. 1 ♂ 2 ♀, USNM, eastern Mindanao Sea; 9°06'30"N, 125°00'20"E; 1,785 m; gray mud; 2 August 1909; *Albatross* stn 5495. 1 ♀, USNM, N of Siquijor I; 9°12'45"N, 123°45'30"E; 1,472 m; green mud, globigerina; 11 August 1909; *Albatross* stn 5526. 1 ♀, USNM, eastern Mindanao Sea; 9°12'45"N, 125°20'E; 1,344 m; gray mud; 1 August 1909; *Albatross* stn 5492. 1 ♀, USNM, between Bohol and Siquijor Is; 9°22'30"N, 123°42'40"E; 719 m; globigerina ooze; 11 August 1909; *Albatross* stn 5527. 2 ♂ 1 ♀, USNM, eastern Mindanao Sea; 9°24'N, 125°12'E; 1,346 m; green mud, coral; 1 August 1909; *Albatross* stn 5491. 1 ♀, USNM, off Panaon Is, S of Leyte; 9°58'00"N, 125°07'40"E; 1,417 m; green mud; 10 April 1908; *Albatross* stn 5203. 2 ♀, USNM, Sogod Bay, southern Leyte; 10°N, 125°06'45"E; 1,412 m; green mud; 31 July 1909; *Albatross* stn 5488. 1 ♂, USNM, Sogod Bay, southern Leyte; 10°02'45"N, 125°05'33"E; 1,339 m; green mud; 31 July 1909; *Albatross* stn 5487. 1 ♂ 1 ♀, ZSI, Sogod Bay, southern Leyte; 10°10'00"N, 125°04'15"E; 1,013 m; gray sand, mud; 10 April 1908; *Albatross* stn 5201. 2 ♀, MP, SW of Tablas I; 12°09'N, 122°14'E; 1,404 m; 6 June 1985; MUSORSTOM III, stn CP 136. 3 ♂ 3 ♀ syntypes. 1 ♀, MP, SE of Bondoc Point, Luzon; 13°02'08"N, 122°37.1'E; 1,030-1,190 m; 25 November 1980; MUSORSTOM II stn 39. 3 ♂ 3 ♀, MP, NE of Bondoc Point, Luzon; 13°23.2'N, 122°20.7'E; 820-760 m; 26 November 1980; MUSORSTOM II stn 44.

Diagnosis.—Optic calathus relatively short, mesial margin 1.0-1.3 times distal width. Anterolateral carina lacking. Ventral extremity of cervical carina forming sharp-edged arc. Posterior extremity of hepatic sulcus turned ventrally. Third article of antennular peduncle not expanded laterally; males with ventral antennular flagellum sinuous and ultimate article of third maxilliped straight and slightly broadening proximomesially before tapering to apex. Pereopods not covered with minute setae. Petasma with distalmost part of dorsolateral lobule narrowing to subangular apex, and ventral surface studded with minute setae; ventral costa slightly inclined distomesially and contracted just proximal to spatulate or paddlelike terminal process. Thelycum with plate of sternite XIV short and produced in moderately long anterolateral hoods; median plate of sternite XIII relatively short (not nearly reaching spine on sternite XII), broad (maximum width 0.80-0.93 length), thickened and expanded posterolaterally in conspicuous prominences.

Description.—Body slender, densely studded with minute setae. Rostrum in males short, its length 0.25-0.30 CL and tapering gradually to sharp apex; in females long, 0.90-1.50 CL, relatively deep and convex basally, styliform and slightly upturned anteriorly. Rostral plus epigastric teeth 3; rostral teeth situated variably in males, basally in females. Adrostral carina strong, in males almost reaching apex of rostrum, in females extending just anterior to second tooth. Antennal spine sharp; branchiostegal spine longer than antennal, acutely pointed. Cervical sulcus crossing postrostral carina (rarely only reaching it) at about 0.45 CL from orbital margin, ventral part turning anteriorly; accompanying carina blunt, except for sharp, strongly arched ventral extremity; postcervical sulcus reaching, but not crossing, postrostral carina at about 0.7 CL from orbital margin. Postrostral carina, extending to 0.8-0.9 CL from orbital margin, well marked and sharp to cervical sulcus, low and blunt posteriorly, and followed by small tubercle situated near posterior margin of carapace. Anterolateral carina lacking; gastro-orbital carina strong; antennal carina relatively short; branchiostegal-hepatic carina long, raised and sharp. Orbito-antennal sulcus shallow; deep hepatic sulcus fusing with branchiocardiac sulcus before turning obliquely almost ventrad forming small branch nearly reaching margin of branchiostegite; branchiocardiac sulcus, accompanied by carina, deep and long, extending posteriorly to near margin of carapace; blunt arched ridge, disposed dorsal to posterior part of hepatic sulcus and anterior part

of branchiocardiac sulcus, delimited dorsally by very shallow, sometimes indistinct, groove.

Eye (Fig. 4B) with optic calathus relatively short, length of mesial margin 1.0-1.3 times distal width; mesial tubercle strong and variably situated between 0.15 and 0.35 length of mesial margin from base of cornea.

Antennular peduncle with stylocerite produced in sharply pointed slender spine falling distinctly short of, or almost reaching, mesial base of distolateral spine; latter acutely pointed. Third article never produced laterally (Fig. 15A); dorsal flagellum about 0.4 length of antennular peduncle, reaching between distal 0.2 and terminal margin of scaphocerite; ventral flagellum long (although incomplete in all specimens examined, in one male 20 mm CL it length 3 times CL), uniquely sinuous, slightly broadened just distal to apex of dorsal flagellum and bearing narrow band of densely set small setae on mesial margin of broadened part (Fig. 15A).

Scaphocerite extremely long, surpassing anten-

nular peduncle by as much as 0.4 its own length; strong lateral rib ending in sharp spine falling considerably short of distal end of lamella. Antennal flagellum incomplete in all specimens examined.

Third maxilliped in males (Fig. 15B) with penultimate article subtriangular in cross section, and not produced in distal process; ultimate article slender, slightly broadening mesially from short, narrow base before tapering to apex (sometimes slightly dilated proximal to tip); in females (Fig. 15C) penultimate article more slender than in males, ultimate article broadening slightly from narrow base then tapering to blunt apex.

Pereopods not covered with setae; first and second pereopods with broad, compressed merus bearing small, slender, distomesial spine.

Abdomen with dorsomedian carina extending from fourth through sixth somite, carina low on fourth, sharp and somewhat higher posteriorly, and produced in small spine on caudal margin of each somite; sixth also bearing pair of minute postero-

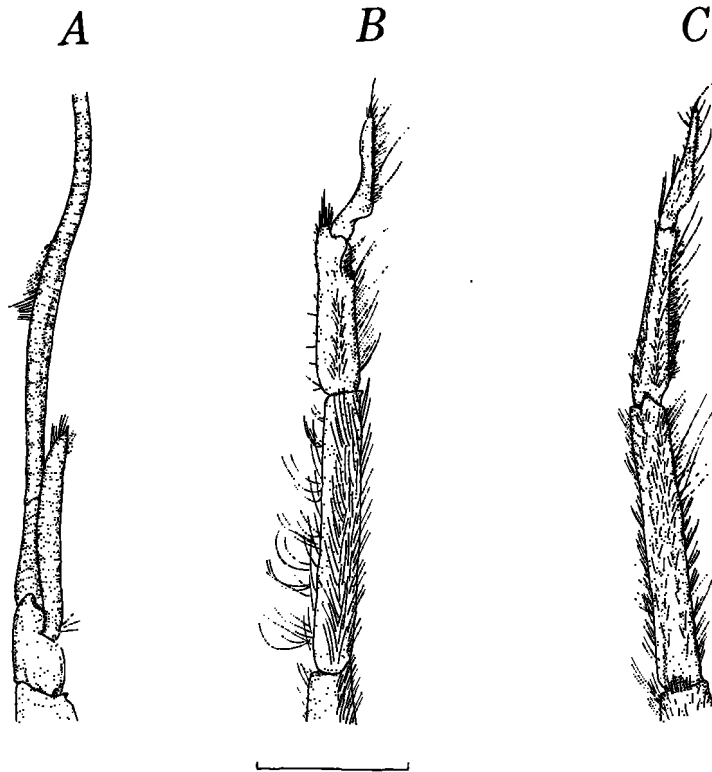


FIGURE 15.—*Pseudaristeus gracilis* (Bate): A, ♂ 20 mm CL, eastern Mindanao Sea, Philippines, last article of right antennular peduncle and flagella, dorsal view. B, same ♂, distal articles of left third maxilliped, dorsolateral view. C, ♀ 35.5 mm CL, between Bohol and Siquijor Islands, Philippines, distal articles of left third maxilliped, dorsal view. Scale = 2 mm.

lateral spines and 2 elongate cicatrices. Telson with median sulcus well defined only on anterior 0.33 length of telson and flanked by paired longitudinal, slender ridges reaching base of third of 4 pairs of movable, marginal spines: 3 situated at about 0.65, 0.80, and 0.90 length from basal margin of telson, fourth flanking short terminal part. Mesial ramus of uropod surpassing apex of telson by about 0.40 its own length; lateral ramus overreaching mesial ramus by about 0.33 its own length.

Petasma in adults (Fig. 16A, B) with dorsomedian lobule cincinnulate along entire mesial margin. Ventromedian lobule, extending distally as far as dorsolateral lobule, and bearing elongate, lapel-like flap distoventrally along mesial margin. Dorsolateral lobule sclerotized, broad proximally to about base of distal 0.25, then tapering to subacute mesial apex, ventrally bearing conspicuous longitudinal, arched rib and studded with setae. Ventral costa broadly curved along almost entire length, inclined disto-

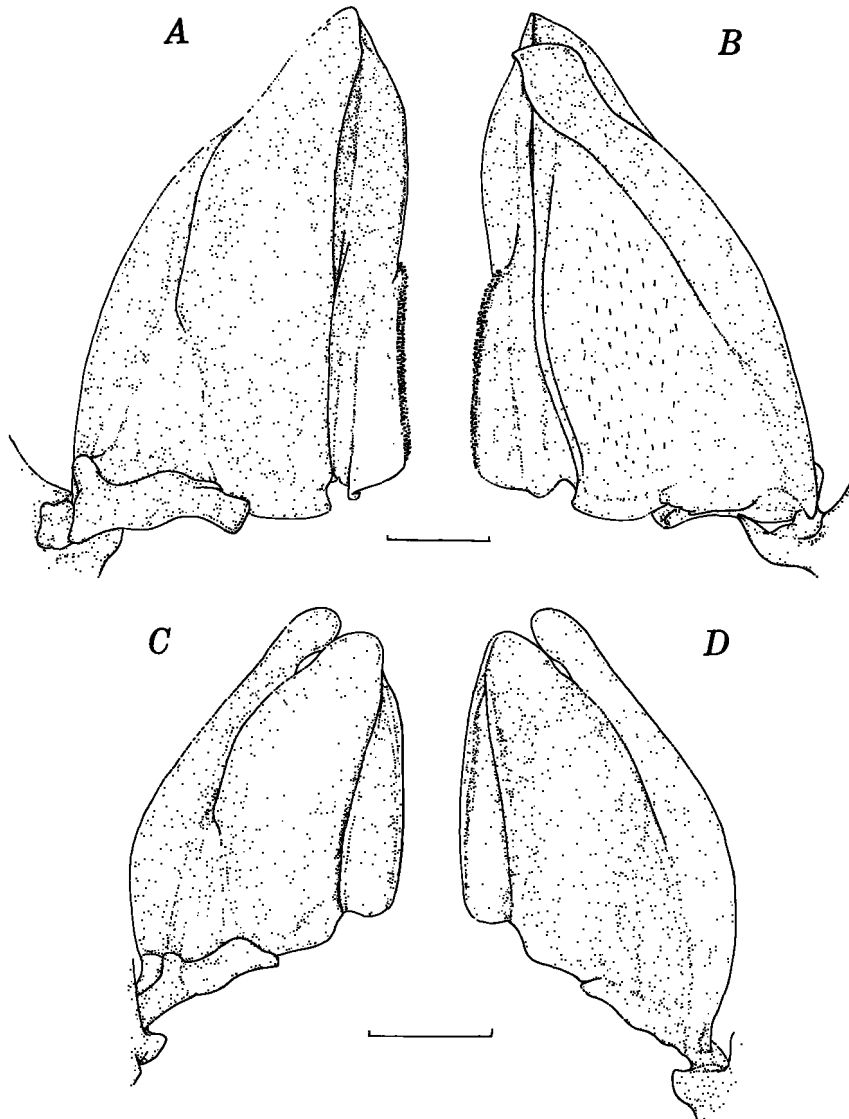


FIGURE 16.—*Pseudaristeus gracilis*, *Petasmata*: A, ♂ 20 mm CL, eastern Mindanao Sea, Philippines, dorsal view of left half. B, Ventral view. C, Syntype ♂ 13 mm CL, Tablas Island, Philippines, dorsal view of left half. D, Ventral view. Scales: A, B = 1 mm; C, D, = 0.5 mm.

mesially and with distal part, lying free but against ventral surface of dorsolateral lobule, markedly contracted just proximal to spatulate or paddlelike terminal process.

Petasma in juveniles lacking cincinnuli, specific characters seemingly absent (Fig. 16C, D): dorso-medial and ventromedial lobules not completely differentiated, but narrow, lapel-like flap present along ventromesial margin; dorsolateral lobule broad proximally, tapering gradually to rounded mesial tip, and with distolateral margin gently curved. Ventral costa arched throughout its length, narrower and contracted distally.

Appendixes masculina and interna as in *P. kathleenae*.

In males, plate of sternite XIV often bearing inconspicuous anteromedian tubercle; plate of sternite XIII flat, roughly lanceolate, produced in sharp spine, its length 1.5-2.3 basal width.

Thelycum (Fig. 17) with densely setose plate of sternite XIV short, deeply grooved transversely, its sharp anteromedian margin turned ventrally, plate produced at either side in moderately long, anterolateral hood; fossa preceding plate long, deep, and bearing pair of small, obliquely disposed ridges. Median plate of sternite XIII, also covered with thickly set setae, concave, and produced apically in acute spine; relatively short (length 2.0-2.7 basal width), falling considerably short of spine on sternite XII, broad (maximum width 0.80-0.93 length), and uniquely expanded in strong posterolateral prominences continuous with slender ridges extending into fossa of sternite XIV. Sternite XII minutely setose, strongly keeled and crested by median carina ending anteriorly in slender, anteroventrally directed spine.

The morphological account above is the first to include adult features. This gamba prawn was named by Bate (1888) on the basis of 6 small juveniles, and the characters pointed out by him have proven inadequate to recognize the species. Subsequent citations to *P. gracilis* have been based only on Bate's information. The material available to me have allowed the detailed descriptions of the petasma, thelycum, and the ventral flagellum of the male which is unique among the members of *Pseudaristeus*.

Maximum lengths.—Males, 21 mm CL; females, 35 mm CL.

Geographic and bathymetric ranges.—Known only from waters of the Philippines (Fig. 9). It has been taken at depths between 719 and 1,785 m.

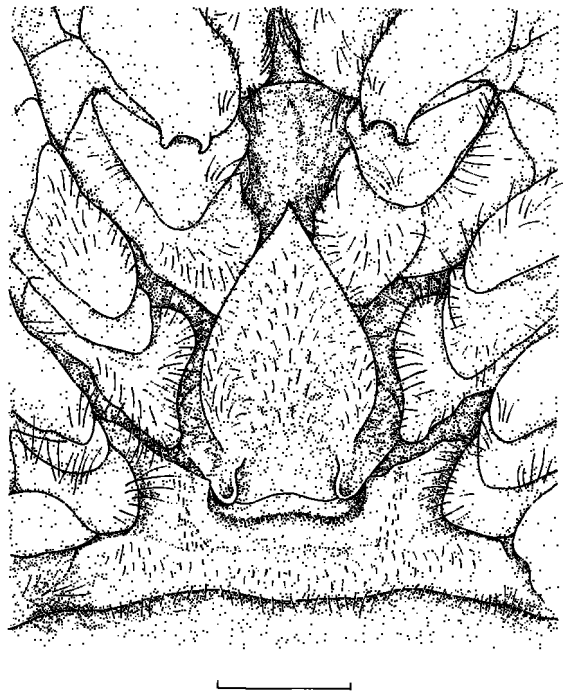


FIGURE 17.—*Pseudaristeus gracilis*, ♀ 35.5 mm CL, between Bohol and Siquijor Islands, Philippines. Thelycum. Scale = 2 mm.

Discussion.—Perhaps the most conspicuous difference between the males of *P. gracilis* and those of the other species of the genus of which males are known is in the ventral antennular flagellum, which is sinuous and bears a dense band of closely set setae on the mesial margin of the slightly broadened part. Males also may be distinguished from those of their congeners by the shape of the dorsolateral lobule of the petasma, which tapers rapidly to the subangular apex and exhibits a setose ventral surface, and also by the ventral costa, which is markedly contracted distally. Characteristic of the females are the short plate of sternite XIV, in which the anteromedian margin is turned ventrally, and the unique strong posterolateral prominences of the median plate of sternite XIII. The prominences are clearly defined in juveniles as small as the syntype with a 10.3 mm CL.

Pseudaristeus sibogae De Man 1911

Figures 4E, 9, 18

Hemipenaeus sibogae De Man 1911:25 [♀ holotype, ZMA De.102.462, E Savu Sea, Indonesia; 9°03'24"S, 119°56'42"E; 1,000 m; globigerina; 20

April 1899; Siboga Exped. stn 52]. De Man 1913, pl. 2, fig. 5, 5a-c. Ramadan 1938:48. Anderson and Lindner 1945:301. Burukovsky 1974:48.

Pseudaristeus sibogae. Crosnier 1978:83, figs. 27a, 30a-c; 1984:22. De Freitas 1985:12, fig. II-5, A-H.

Material.

Madagascar—1 ♀, MP, NW of Anzakomanga; 21°26'30"S, 43°11'00"E; 810-1,020 m; 26 November 1973; *Vauban* stn 92. 1 ♂ 1 ♀, MP, SW of Baie des Assassins; 22°16'48"S, 42°56'00"E; 1,200 m; 30 November 1973; *Vauban* stn 109.

Indonesia—♀ holotype. 1 ♀, USNM, S of Pulau Muna, Sulawesi (Celebes); 5°31'30"S, 122°22'40"E; 834 m; green mud; 16 December 1909; *Albatross* stn 5646. 1 ♂ 2 ♀, USNM, Selat Butung, Sulawesi (Celebes); 5°34'00"S, 122°18'15"E; 950 m; green mud; 16 December 1909; *Albatross* stn 5647. 1 ♀, USNM, off southern Buru; 3°47'15"S, 126°23'40"E; 946 m; fine gray sand; 10 December 1909; *Albatross* stn 5638.

Diagnosis.—Optic calathus long, mesial margin 1.5-1.7 times distal width. Anterolateral carina lacking. Posterior extremity of hepatic sulcus turned ventrally. Third article of antennular peduncle not expanded laterally; males with ventral antennular flagellum never sinuous; ultimate article of third maxilliped straight and slightly broadening proximomesially before tapering to apex. Pereopods covered with minute setae. Adult petasma unknown. Telycum with plate of sternite XIV moderately long and produced in short anterolateral hoods; median plate of sternite XIII relatively short (not nearly reaching spine on sternite XII) and broad (maximum width 0.60-0.70 length) but not expanded posterolaterally in conspicuous prominences.

Description.—Body slender, densely studded with minute setae. Rostrum in males straight, moderately long, 0.48 and 0.57 CL in 2 specimens, 21 and 22 mm CL, respectively, and roughly lanceolate; in females longer, in one 37 mm CL its length 1.07 CL, rather deep and usually convex, occasionally almost straight basally, styliform and moderately upturned anteriorly. Rostral plus epigastric teeth 3; 2 rostral teeth in males situated at 0.1-0.2 and 0.4 RL respectively, basally in females. Adrostral carina strong, in both males and females extending just anterior to second tooth. Antennal spine sharp; branchiostegal spine longer than antennal, acutely pointed. Cervical sulcus crossing postrostral carina at about

0.45 CL from orbital margin, with ventral part turning anteriorly; accompanying carina blunt, except for sharp, arched ventral extremity; rather weak postcervical sulcus reaching, but not crossing, postrostral carina at 0.7-0.8 CL from orbital margin. Postrostral carina, extending 0.8-0.9 CL from orbital margin, well marked and sharp to cervical sulcus, low and blunt posteriorly, and followed by small tubercle situated near posterior margin of carapace. Anterolateral carina lacking; gastro-orbital carina strong; antennal carina relatively short; branchiostegal-hepatic carina long, raised and sharp. Orbito-antennal sulcus shallow; deep hepatic sulcus fusing with branchiocardiac sulcus before turning obliquely almost ventrad, forming small branch nearly reaching margin of branchiostegite; branchiocardiac sulcus, accompanied by strong carina, deep and long, extending posteriorly to near margin of carapace; blunt, dorsally concave ridge (disposed dorsal to posterior part of hepatic sulcus and anterior part of branchiocardiac sulcus) delimited dorsally by groove, latter deep and abutting cervical sulcus anterodorsally but becoming shallow posteriorly and indistinct close to postcervical sulcus.

Eye (Fig. 4E) with optic calathus long, length of mesial margin 1.50-1.75 times distal width; mesial tubercle small and situated between distal 0.40 and 0.55 length of margin.

Antennular peduncle with stylocerite produced in sharp, slender spine falling conspicuously short to almost reaching mesial base of distolateral spine; latter acutely pointed; third article never produced laterally. Dorsal flagellum about 0.4 length of antennular peduncle, reaching between distal 0.25 and 0.20 of scaphocerite; ventral flagellum long and straight along entire length.

Scaphocerite extremely long, exceeding antennular peduncle by about 0.30-0.35 its own length; strong lateral rib ending in sharp spine falling considerably short of distal margin of lamella. Antennal flagellum broken in specimens examined.

Third maxilliped in both sexes with penultimate article convex dorsally, slightly flattened ventrally, and not produced in distal process; ultimate article also convex dorsally, slightly excavate ventrally, and slender but broadening slightly from relatively elongate, narrow base before tapering to rather blunt apex.

All pereopods covered with minute setae. First and second pereopods with compressed merus bearing distomesial spine.

Abdomen with dorsomedian carina extending from fourth through sixth somites, carina quite low

but clearly distinct on anterior part of fourth, sharp and rather high more posteriorly, and produced in short but strong spine on caudal margin of each somite; sixth also bearing pair of minute posteroventral spines and 2 elongate cicatrices. Telson with median sulcus weak, usually limited to anterior half, flanked by paired longitudinal ridges reaching base of second of 4 pairs of movable, marginal spines situated at about 0.55, 0.75, 0.85, and 0.90 length from basal margin. Mesial ramus of uropod surpassing apex of telson by as much as 0.40 its own length; lateral ramus overreaching mesial ramus by as much as 0.33 its own length.

Petasma of young individual lacking cincinnuli, similar to juvenile petasma of *P. gracilis*. Petasma of adults unknown. Curiously, only male available 21.5 mm CL with petasma still quite undeveloped.

Appendices masculina and interna as in *P. kathleenae*.

In small juvenile males, sternite XIV bearing large, minutely setose prominence, semicircular in outline; median plate of sternite XIII setose, elongate (length 2-3 times basal width), and produced in conspicuous apical spine.

Thelycum (Fig. 18) with setose, moderately long plate of sternite XIV broadly depressed and produced at either side in short anterolateral hood, anteromedian margin varying from weakly convex to concave or biconcave; fossa preceding plate relatively short and bearing pair of small, oblique ridges. Median plate of sternite XIII, also covered with setae, relatively short (length 1.8-2.1 times basal width), falling considerably short of anterior margin of sternite XII; broadly lanceolate (maximum width 0.60-0.70 length), produced apically in acute spine, and flat or slightly excavate; posterolateral margins of plate, lacking bosses, abutting slender ridges extending posteromesially before curving laterally on margin of sternite XIII. Sternite XII minutely setose, strongly convex and crested by slender median carina ending anteriorly in sharp spine.

Color, orange (Crosnier 1978).

Maximum lengths.—Males, 22 mm CL (only juveniles known; the 33.5 mm CL cited by Crosnier (1978) is a misprint, the specimen is a female); females, 47.5 mm CL.

Geographic and bathymetric ranges.—This species has been found off Natal, South Africa, western Madagascar, and in the waters of Indonesia to southern Buru (Fig. 9). It occurs at depths between 834 and 1,200 m and was also taken in a trawl between 810 and 1,020 m.

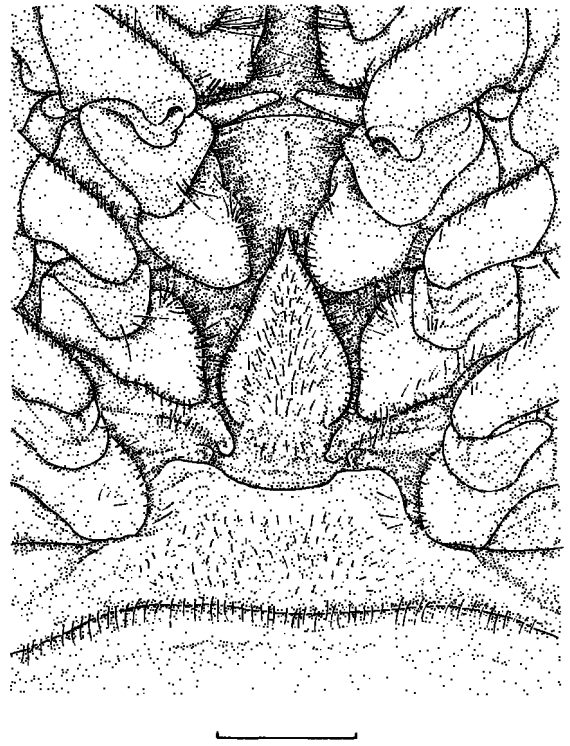


FIGURE 18.—*Pseudaristens sibogae* (De Man), holotype ♀ 34 mm CL, east Savu Sea, Indonesia. Thelycum. Scale = 2 mm.

Discussion.—The minutely setose pereopods and the disposition of the deep groove lying dorsal to the posterior part of the hepatic sulcus, which abuts the cervical sulcus, distinguish *P. sibogae* from all the species previously described. It also is distinctive in having a longer optic calathus, the length of the mesial margin being at least 1.45 times its distal width instead of not more than 1.30. The tubercle of the calathus in *P. sibogae* is almost always situated near its midlength, between the distal 0.4 and 0.6 length of the mesial margin rather than only as far as 0.4 or more often less, except in the eye of *P. protensus* in which it is placed about at midlength. In females of *P. sibogae* the median plate of sternite XIII is shorter, its length 1.8-2.1 times the basal width, than in females of its congeners, in which the ratio is usually more than 2.1; in occasional specimens of *P. gracilis* it is 2, overlapping the highest ratios observed in *P. sibogae*.

As stated above, the petasma of the adult of this species is not known; however, the very large prominence of sternite XIV, present in the 2 males examined, appears to be a diagnostic feature. These specimens are 21 and 21.5 mm CL and, curiously,

their petasmata are still little developed, lacking cinnuli and apparently exhibiting no specific character. In other species, males of this size may be identified by petasmat features. It seems worth mentioning that in the 2 males of this species examined by me, the rostrum is slightly longer, 0.48 and 0.47 CL, than it is in most of the males of its congeners in which it ranges between 0.25 and 0.45 CL.

De Man (1911) indicated that the rostral teeth were less prominent in the female holotype of *P. sibogae* than in the female of *P. crassipes* (= *P. kathleenae*) available to him, and that they were situated in a horizontal line, whereas in the latter "a line uniting the tips of the teeth appears distinctly arcuate". Actually, the arrangement of the teeth in females with the same carapace length varies slightly between individuals of the same species, they are usually disposed in an arc, including *P. sibogae*, but sometimes they are arranged in an almost straight line. De Man also noted that in the holotype of *P. sibogae* the rostrum is much shorter [RL/CL = 0.75] and less slender than in the female of "*P. crassipes*". Crosnier (1978), on the basis of the comparison of a female 37 mm CL (RL/CL = 1.07) with the holotype, believed that the difference in the length of the rostrum seemed invalid, that in the holotype the rostrum was in the process of being generated after having been broken.

Pseudaristeus speciosus (Bate 1881)

Figure 19

Hemipenaeus speciosus Bate 1881:186 [syntypes 1 ♂ 1 ♀ (BMNH); type-locality: E of Río de la Plata, Argentina; 36°44'S, 46°16'W; 2,650 fm (4,847 m); 2 March 1876; *Challenger* stn 325]. Bate 1888:

303, pl. 37, Fig. 3, pl. 44, fig. 3. Murray 1896: 388. De Man 1911:26. Estampador 1937:493. Anderson and Lindner 1945:301. Burukovsky 1974:48.

Hemipenaeus speciosus. Faxon 1895:198.

Material.—Argentina Basin—♂ syntype (BMNH).

Diagnosis.—Optic calathus relatively long, mesial margin 1.4 times distal width. Anterolateral carina present. Ventral extremity of cervical carina broad and blunt rather than forming sharp-edged arc. Third article of antennular peduncle in females not expanded laterally. Posterior extremity of hepatic sulcus extending posteriorly subparallel to branchio-cardiac sulcus, instead of turning ventrally. Petasma and thelycum unknown.

Description.—Based on few notes by Bate (1881), my observations of his illustration and examination of the incomplete cephalothorax of the male syntype. Body slender, lacking setae. Rostrum (Fig. 19) in male relatively short, its estimated length 0.40 CL and roughly lanceolate. Rostral plus epigastric teeth 3; rostral teeth situated at about 0.35 and 0.75 from orbital margin. Adrostral carina strong almost reaching apex. Antennal spine sharp; branchiostegal spine longer than antennal, acutely pointed. Cervical sulcus reaching but not crossing postrostral carina at about estimated 0.50 CL from orbital margin and well-marked dorsally; accompanying carina weak, its ventral extremity blunt instead of forming sharp-edged arc; postcervical sulcus reaching, but not crossing, postrostral carina at about estimated 0.70 CL from orbital margin. Postrostral carina well marked and sharp to cervical sulcus, low and blunt posteriorly. Anterolateral carina (ventral to gastro-

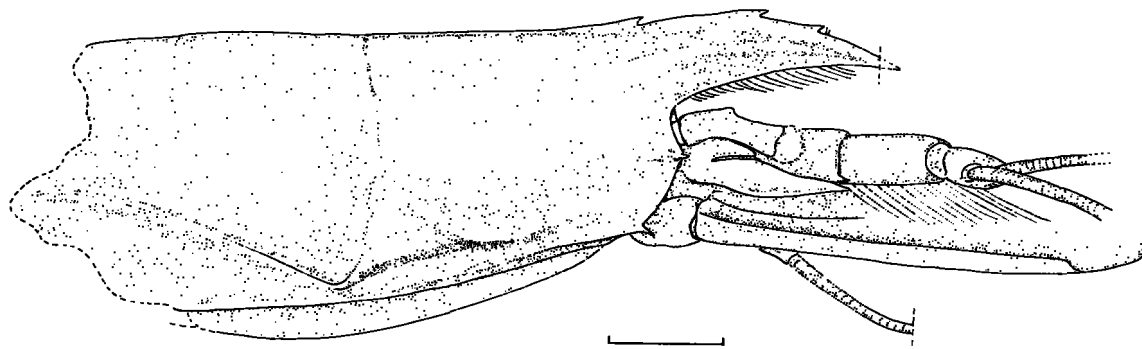


FIGURE 19.—*Pseudaristeus speciosus* (Bate), syntype ♂ "total length = 63 mm" (Bate 1881), off east coast of Buenos Aires. Anterior part of anterior region, lateral view. Scale = 1 mm.

orbital) dorsally concave, rather strong; gastro-orbital carina blunt but well defined; antennal carina relatively short, and branchiostegal-hepatic carina strong and sharp only anteriorly. Orbito-antennal sulcus quite shallow; hepatic sulcus not fusing with branchiocardiac sulcus and extending posteriorly, almost longitudinally rather than turning ventrally, subparallel to anterior part of branchiocardiac sulcus; branchiocardiac sulcus and accompanying carina long, extending posteriorly to near margin of carapace.

Eye with optic calathus relatively long, length of mesial margin 1.4 times distal width; mesial tubercle situated almost at midlength.

Antennular peduncle with stylocerite produced in sharp spine reaching mesial base of distolateral spine; latter small and sharp; third article in females not expanded laterally; dorsal and ventral flagella incomplete.

Scaphocerite long, conspicuously surpassing antennular peduncle; strong lateral rib ending in sharp spine falling considerably short of distal end of lamella. Antennal flagellum incomplete.

Geographic and bathymetric ranges.—*Pseudaristeus speciosus* is known only from the type-locality.

Discussion.—This species, tentatively assigned to the genus *Pseudaristeus*, can be readily distinguished from the other members of the genus in possessing an anterolateral carina; the branchiostegal-hepatic carina is strong and sharp only anteriorly; the ventral extremity of the cervical sulcus is almost straight, instead of turning anteroventrally, and is accompanied by a very weak, rather than sharp, and strongly arched carina; also the posterior part of the hepatic sulcus extends subparallel to the branchiocardiac sulcus instead of fusing with it before turning ventrally.

Pseudaristeus speciosus was described from 2 specimens, one of which is no longer extant and the other has disintegrated except for the anterior part of the carapace to which are attached the eyes, antennules and antennae, and the dismembered distal part of the third maxillipeds. Despite the poor condition of the available syntype, the distinctive features of the carapace, which are clearly represented in Bate's (1888) illustration of the entire animal, are sufficient to conclude that *P. speciosus* is a valid species. Because the branchiae of the syntype are lacking, it is not possible, as noted by Crosnier (1978), to determine with certainty the genus to which it should be assigned, but because of the supraspecific characters exhibited by the

carapace, I am almost convinced that it is congeneric with the five Indo-West Pacific species studied herein.

It should be noted that the syntypes of *P. speciosus* were found at 4,847 m, a depth considerably beyond the greatest depth, 1,785 m, at which any of the assumed relatives are known to occur.

ACKNOWLEDGMENTS

Without the generous cooperation of various colleagues this study would not have been possible. I am much indebted to Maya Deb of the Zoological Survey of India for providing descriptions, drawings and photographs of certain morphological features of the lectotype of *P. crassipes*, which permitted a confirmation of the true identity of the species, and for the loan of critical collections from the waters off India; to Alain Crosnier of the Office de la Recherche Scientifique et Technique Outre Mer and the Muséum National d'Histoire Naturelle for his hospitality during a working visit to the latter institution, for the loan of specimens, and for reviewing the manuscript; and to Anthony A. Fincham of the British Museum (Natural History), H.-E. Gruner of the Zoologisches Museum de Humboldt Universität, and S. Pinkster of the Zoologisch Museum, Amsterdam, for providing materials, including types, from their respective institutions; to H. C. Ghosh of the Zoological Survey of India for a drawing of the antennular peduncle of the lectotype of *P. crassipes*. Horton H. Hobbs, Jr. of the Smithsonian Institution once again offered invaluable advice and innumerable suggestions during the course of my studies and preparation of the paper; Fenner A. Chace, Jr. aided me in solving technical problems and commented on the first draft; Bruce B. Collette and Austin B. Williams of the National Marine Fisheries Service Systematics Laboratory critically read the manuscript. Keiko Hiratsuka Moore, with her artistic talent and devotion to accuracy, made all the illustrations except those of the eyes of various species and the gnathal appendages and of the carapace of *P. kathleenae* which were rendered by María M. Diéguez. Ruth E. Gibbons prepared the map. Virginia R. Thomas and Arleen S. McClain patiently typed several drafts of the manuscript. To all of them goes my deep gratitude.

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