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On the Status of *Pylopaguropsis zebra* (Henderson), *P. magnimanus* (Henderson), and *Galapagurus teevanus* Boone, with descriptions of seven new species of *Pylopaguropsis* (Crustacea: Anomura: Paguridae)

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Abstract—*Pylopaguropsis* Alcock was established for a single IndoPacific species, *Pylopaguropsis magnimanus* (Henderson). A half century later a second IndoPacific species, *Pagurus zebra* (Henderson), was transferred to the genus. With the addition of *Pylopaguropsis atlantica* Wass, described from the western Atlantic, the genus as presently constituted includes only three species. *Galapagurus teevanus* Boone, from the eastern Pacific is herein rediagnosed and transferred to *Pylopaguropsis* and seven new Indopacific species are described. Illustrations and a key to the species of this genus are presented.

Introduction

The three described species of *Pylopaguropsis* Alcock, 1905, i.e., *P. magnimanus* (Henderson, 1896), *P. zebra* (Henderson, 1893) and *P. atlantica* Wass, 1963, are very distinctive in morphology and coloration. The species have 13 pairs of trichobranchiate gills, paired first pleopods in the females, a characteristically massive, operculate or semi-operculate right cheliped, and typically brilliant colors and patterns. Therefore, the initial discovery of a presumably undescribed species of the genus from the shallow waters of Kahe Point, Oahu, Hawaii, at first seemed to warrant only a routine description of this vividly magenta-and white-colored hermit crab. However, when we attempted to compare and contrast it with the two other IndoPacific species assigned to *Pylopaguropsis,* we found that several authors had incorrectly identified and/or attributed their specimens to *Pylopaguropsis zebra* (Henderson) or *P. magnimanus* (Henderson). It quickly became apparent that no evaluations could be made until the actual identities of Henderson's (1893, 1896) taxa were determined.

Among specimens collected in the Gulf of Manaar, Ceylon (Sri Lanka), Henderson (1893) had a single specimen which he identified as *Eupagurus zebra* new species. However, he based his description and figures of this taxon on a specimen he had seen from northern Australia that was included in the collections of the British Museum (Natural History). Although the Australian specimen was a female, Henderson failed to observe its paired first pleopods, thus his assignment of the species to *Eupagurus* (= *Pagurus*). He

believed that the color pattern (. . . "dark blood-red parallel lines along both surfaces of the two pairs of ambulatory legs . . .") was sufficiently striking to distinguish this species from all others known. However, during the course of the present study, four of the seven new species were found to have similarly striped ambulatory legs.

In a later publication, Henderson (1896) described *Pylopagurus magnimanus* from two individuals collected from deep water off Madras, India. His reportedly "hesitant assignment" of this species to *Pylopagurus* was because, despite the presence of the paired first pleopods characteristic of this genus, it morphologically resembled *Eupagurus* and, in the development of the right cheliped, particularly *E. zebra*. Alcock and Anderson (1897) figured *Pylopagurus magnimanus*, but subsequently Alcock (1905) erected the genus *Pylopaguropsis* for this species, distinguishing it from *Pylopagurus* by the presence of 13 rather than 11 pairs of gills. In the same publication he redescribed *E. zebra* and reported an unnamed variety of it from the Andaman Islands thus extending the range of this taxon both northeast to the Andaman Islands and northwest to the Persian Gulf. Alcock, like Henderson (1893), did not describe paired first pleopods on his ovigerous female.

Southwell (1906) again reported *E. zebra* from Ceylon, but gave no further details regarding the species. Balss (1912) assigned a specimen from Agulhas Bank, South Africa, to *E. zebra*, but remarked that the specimen was completely colorless. Balss attributed the specimen to "Henderson's" (sic) Andaman Islands variety. Stebbing (1920) reported *E. zebra* from South Africa, but noted several characters in which his specimens differed from the descriptions and figures given by Henderson (1893) and Alcock (1905). Stebbing (1920) proposed the name *parazebra* for the South African taxon, in the event that those characters proved to justify specific distinction. After reviewing Stebbing's material, Barnard (1950) stated that the specimens returned to the South African Museum under Stebbing's autographic label could not possibly be those referred by Stebbing to *E. zebra* since they did not even represent *Eupagurus*. Although he did not explain why they could not be assigned to *Eupagurus*, we assume that he observed the paired pleopods of the female. Forest (1955) clarified this confusion by reexamining the female type of *E. zebra* in the collections of the British Museum and, noting the paired pleopods, transferred the species to *Pylopaguropsis*. Forest remarked that without doubt the specimens returned to the South African Museum were in fact those examined by Stebbing (1920); the problem was that *Eupagurus zebra* was in fact a species of *Pylopaguropsis*. Edmondson (1925, 1933) reported *Pagurus zebra* from the French Frigate Shoals and subsequently (Edmondson, 1946) cited the same specimens as "a form probably representing *Pagurus zebra* (Henderson)". *Pagurus zebra* also has been reported from Japan by Miyake (1975; 1978; 1982). *Pylopaguropsis zebra* has been reported from Kosrae Island, Caroline Islands by Eldredge et al. (1979) and from Guam by Wooster (1979).

Following Alcock's (1905) redescription of *Pylopagurus magnimanus* and assignment of it to *Pylopaguropsis*, this species apparently was not seen again until Thompson (1943) reported it from the "John Murray" collections from the Gulfs of Oman and Aden. More than twenty years later, Lewinsohn (1969) attributed a single specimen from the Red Sea to *P.* cf. *magnimanus*, remarking that despite the several differences from the original descriptions of Henderson (1896) and Alcock (1905), he was provisionally assigning it to Henderson's taxon. He considered that the size differences between his small specimen and those of both Henderson and Alcock could account for the observed morphological

differences. Baba (1982) questionably referred a small male specimen from off Inuf, Yap, Caroline Islands to *P. magnimanus,* stating that it was undoubtedly the same taxon that had been reported by Lewinsohn (1969). Baba remarked that the differences these two specimens exhibited suggested that they might be distinct from the true *P. magnimanus.*

Boone (1932) established the genus *Galapagurus* for a single male specimen of a new species from the Galapagos Islands. Her generic description did not include a count of the gills and, as the female of the species was unknown, she did not consider the possible relationship of this species to *Pylopaguropsis.* From subsequent collections of *Galapagurus teevanus* Boone we have found that 13 pairs of trichobranchiate gills are present and that the females possess paired first pleopods. In these and all other characters, *Galapagurus* agrees with *Pylopaguropsis* as herein redefined.

Specimens for this study have been obtained from, or are deposited in, the following institutions: Allan Hancock Foundation (AHF); American Museum of Natural History (AMNH); British Museum (Natural History) (BMNH); Bernice P. Bishop Museum (BPBM); California Academy of Sciences (CAS); East African Marine Fisheries Research Organization (EAMFRO); Florida Department of Natural Resources (DNR); Marine Laboratory, University of Guam (GUM); Museum für Naturkunde, Humboldt-Universität, Berlin (MNHU); National Institute of Oceanology, Jakarta (NIOJ); National Museum of Natural History, Smithsonian Institution (USNM); National Science Museum, Tokyo (NSMT); Rijksmuseum van Natuurlijke Historie, Leiden (RMNH); Rosenstiel School of Marine and Atmospheric Sciences, University of Miami (RSMAS); Smithsonian Oceanographic Sorting Center (SOSC); Tel-Aviv University (TAU); and the Zoological Laboratory, Kyushu University (ZLKU). A single measurement, shield length (SL) is recorded.

Pylopaguropsis Alcock 1905

Pylopaguropsis Alcock, 1905: 133.—De Saint Laurent-Dechancé, 1966: 259. Type species, by monotypy, *Pylopagurus magnimanus* Henderson, 1896.

Galapagurus Boone, 1932: 12. Type species, by monotypy, *Galapagurus teevanus* Boone, 1932.

Gender: Feminine.

DIAGNOSIS: Cephalothoracic shield with well developed rostrum. Thirteen pairs of trichobranchiae.

Ocular acicles triangular, sometimes slender.

Antennal peduncle with supernumerary segmentation; acicle well developed, arcuate; flagellum with scattered long setae.

Maxillule (Fig. 1a–f) with external lobe of endopod very weakly to moderately well developed. Maxilla (Fig. 1g–l) with scaphognathite narrow to exceptionally broad. First maxilliped (Fig. 2a–f) with basal portion of exopod varying from very narrow to extremely broad. Third maxilliped with 1 accessory tooth on well developed crista dentata.

Right cheliped usually massive, chela operculate or semioperculate; dactyl frequently articulating obliquely with palm.

Left cheliped moderately elongate, slender; propodal-carpal articulation usually twisted counterclockwise 30–70° from perpendicular when viewed dorsally; dactyl and fixed finger opening obliquely.

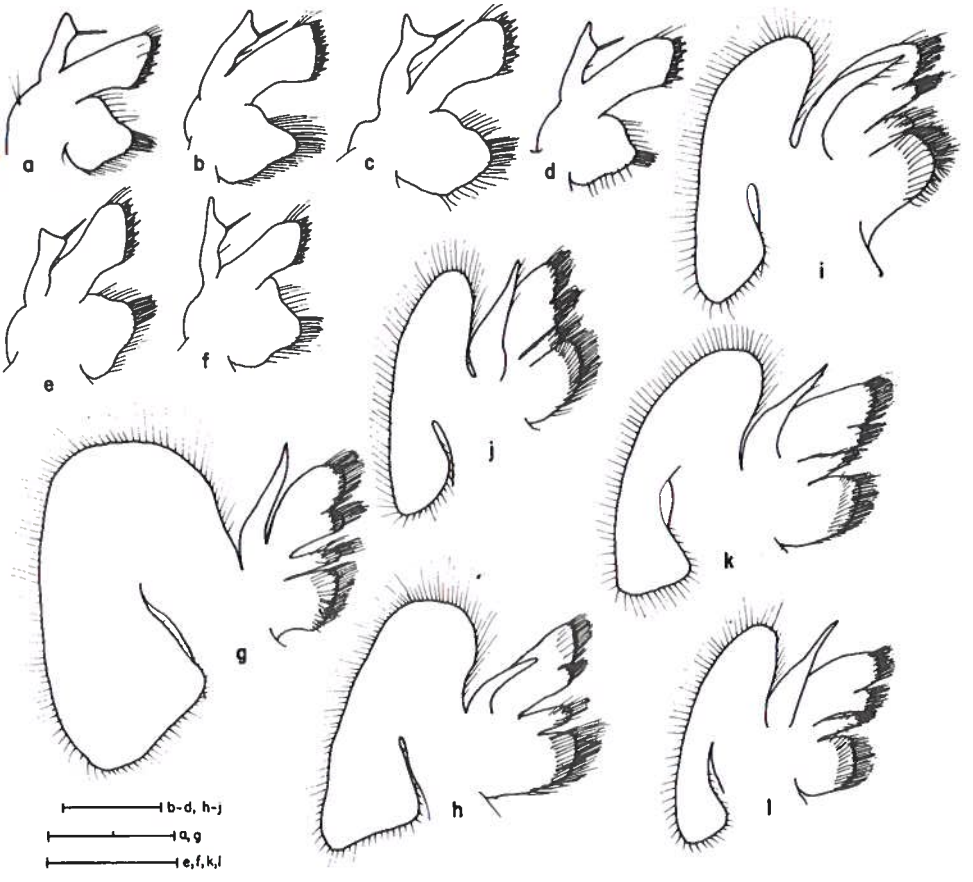

Figure 1. a–f, maxillule (right, external view); g–l, maxilla (right, external view): a, *P. magnimanus;* b, *P. atlantica;* c, *P. speciosa;* d, *P. teevana;* e, *P. pustulosa;* f, *P. fimbriata;* g, *P. magnimanus;* h, *P. atlantica;* i, *P. speciosa;* j, *P. teevana;* k, *P. pustulosa;* l, *P. fimbriata.* Scales equal: 2 mm – a, g; 1 mm – b, e, f, h, k, l; 0.5 mm – c, d, i, j.

Ambulatory legs with dactyls and propodi of 2nd pair (P_3) frequently dissimilar. Fourth pereopods with or without preungual process; propodal rasp (Fig. 2g–l) of 1 to 4 rows of corneous scales. Sternite of 5th pereopods weakly subdivided into two low lobes, each with tuft of long setae; anterior margin almost straight.

Females with paired gonopores. First pleopods paired and modified as gonopods; 2nd to 5th pleopods unpaired, 2nd to 4th with both rami well developed, 5th with internal ramus reduced. Males with paired gonopores; no paired gonopods or sexual tubes. Third to 5th pleopods unpaired, with rami unequal.

Uropods asymmetrical. Telson with transverse suture; posterior lobes subrectangular to subtriangular, often asymmetrical; terminal margins oblique, concave or horizontal, usually armed with 1 to many spines; lateral margins unarmed or with 1 to 3, sometimes row, of small spines.

Table 1. Summary of selected characters among species of *Pylopaguropsis*

Species	Shape right/left P_3	P_3 lateral face: Dactyl	P_3 lateral face: Propodus	Telson terminal margin	Propodal rasp P_4	Left Chela	Carpi[1] P_2 & P_3	Maxilla Scapho-gnathite	MXP_1 Exopod	Color pattern of ambulatory legs
P. magnimanus	dissimilar	sulcus	flattened	oblique	3 or 4 rows	spines	spines	very broad	ext. broad	solid red or spotted
P. zebra	dissimilar	sulcus	1 sulcus	oblique	1 or 2 rows	unarmed[2]	unarmed	mod. broad	mod. broad	red and white striped
P. atlantica	dissimilar	sulcus	flattened/ 1 sulcus	oblique	3 or 4 rows	spines	spines	very broad	mod. broad	pink-red speckled with red
P. keijii	dissimilar	sulcus	1 sulcus	horizontal/ oblique	1 partial row	unarmed	unarmed	mod. broad	mod. broad	solid magenta
P. speciosa	dissimilar	sulcus	2 sulci	oblique	1 partial	unarmed	unarmed	mod. broad	mod. broad	yellow and white striped
P. lewinsohni	dissimilar	sulcus	3 sulci	horizontal/ oblique	1 or 2 rows	unarmed	unarmed	narrow	mod. broad	red and white striped
P. teevana	similar	sulcus	convex	oblique	1 partial	unarmed	unarmed	mod. narrow	mod. broad	brown and cream striped
P. pustulosa	similar	sulcus	flattened	oblique	2 rows	unarmed	unarmed	average	mod. broad	unknown
P. garciai	similar	convex	convex	oblique	1 partial	unarmed	unarmed	average	average	red and white striped
P. fimbriata	similar	convex	convex	horizontal	1 row	spines	unarmed	narrow	very narrow	red and white striped
P. laevispinosa	similar	convex	convex	oblique	1 partial	spines	spines	mod. narrow	mod. narrow	orange and white striped

[1] Exclusive of spine at dorsodistal margin;

[2] Unarmed includes presence of spinulose tubercles as opposed to well developed spines

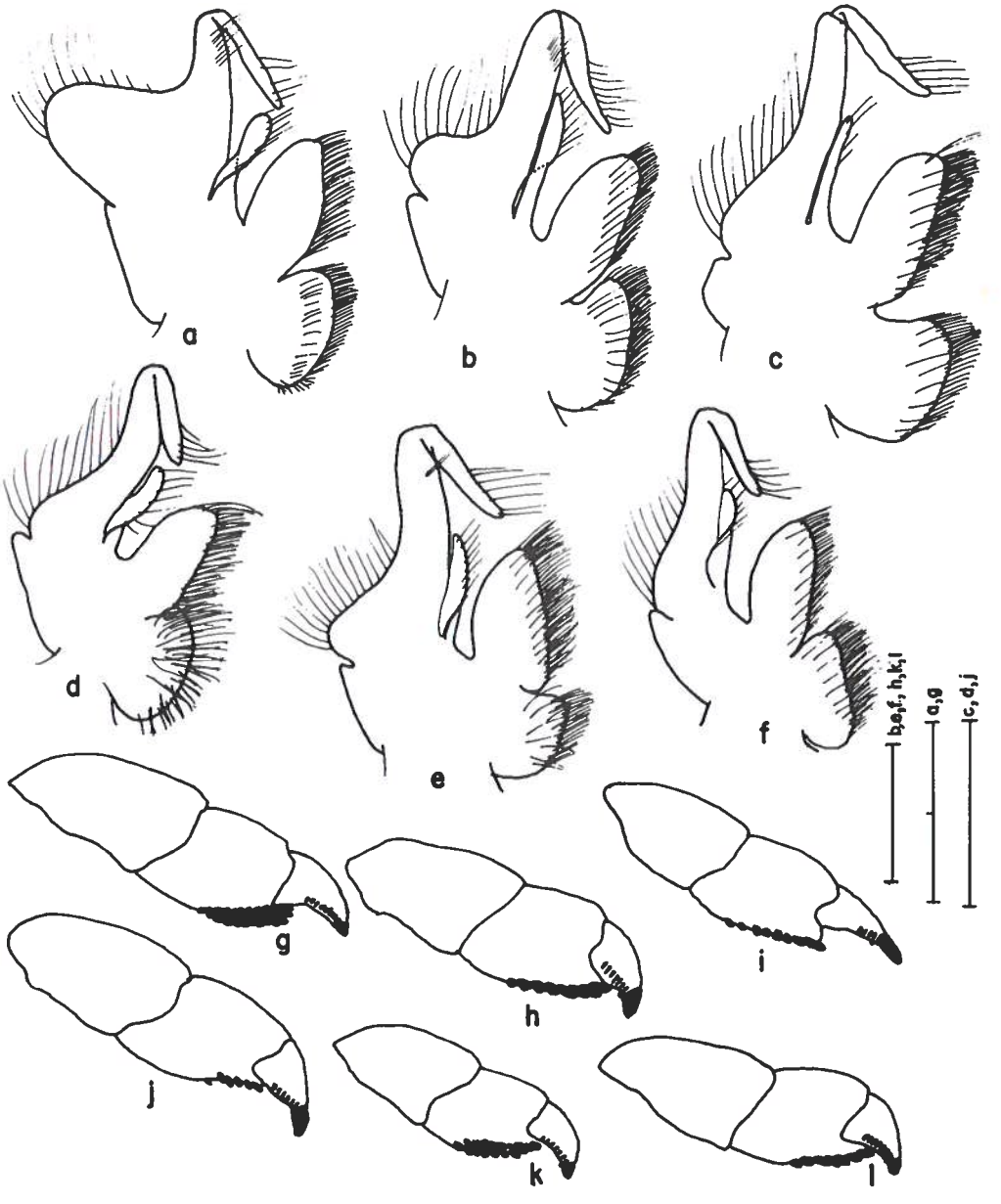

Figure 2. a–f, 1st maxilliped (right, external view); g–l, distal segments of right 4th pereopod (lateral view): a, *P. magnimanus;* b, *P. atlantica;* c, *P. speciosa; d*, *P. teevana;* e, *P. pustulosa;* f, *P. fimbriata;* g, *P. magnimanus;* h, *P. zebra;* i, *P. keijii;* j, *P. teevana;* k, *P. pustulosa;* l, *P. laevispinosa*. Scales equal: 2 mm – a, g; 1 mm – b, e, f, h, k, l.; 0.5 mm – c, d, i, j.

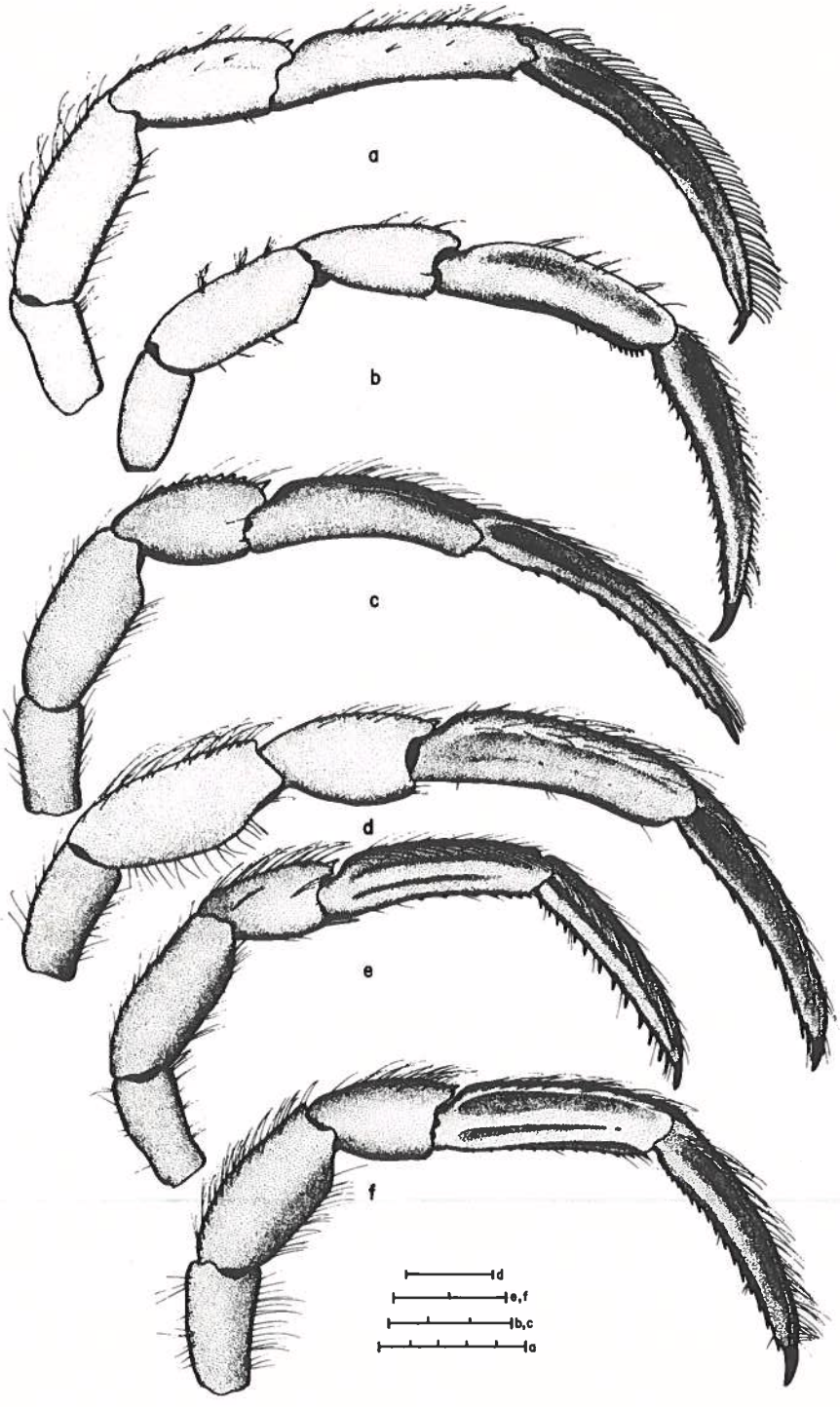

Figure 3. Right 3rd pereopod (lateral view): a, *P. magnimanus* (lectotype); b, *P. zebra* (lectotype); c, *P. atlantica* (French Guiana); d, *P. keijii* (paratype); e, *P. speciosa* (paratype); f, *P. lewinsohni* (paratype). Scales equal: 5 mm – a; 3 mm – b, c; 2 mm – e, f; 1 mm – d.

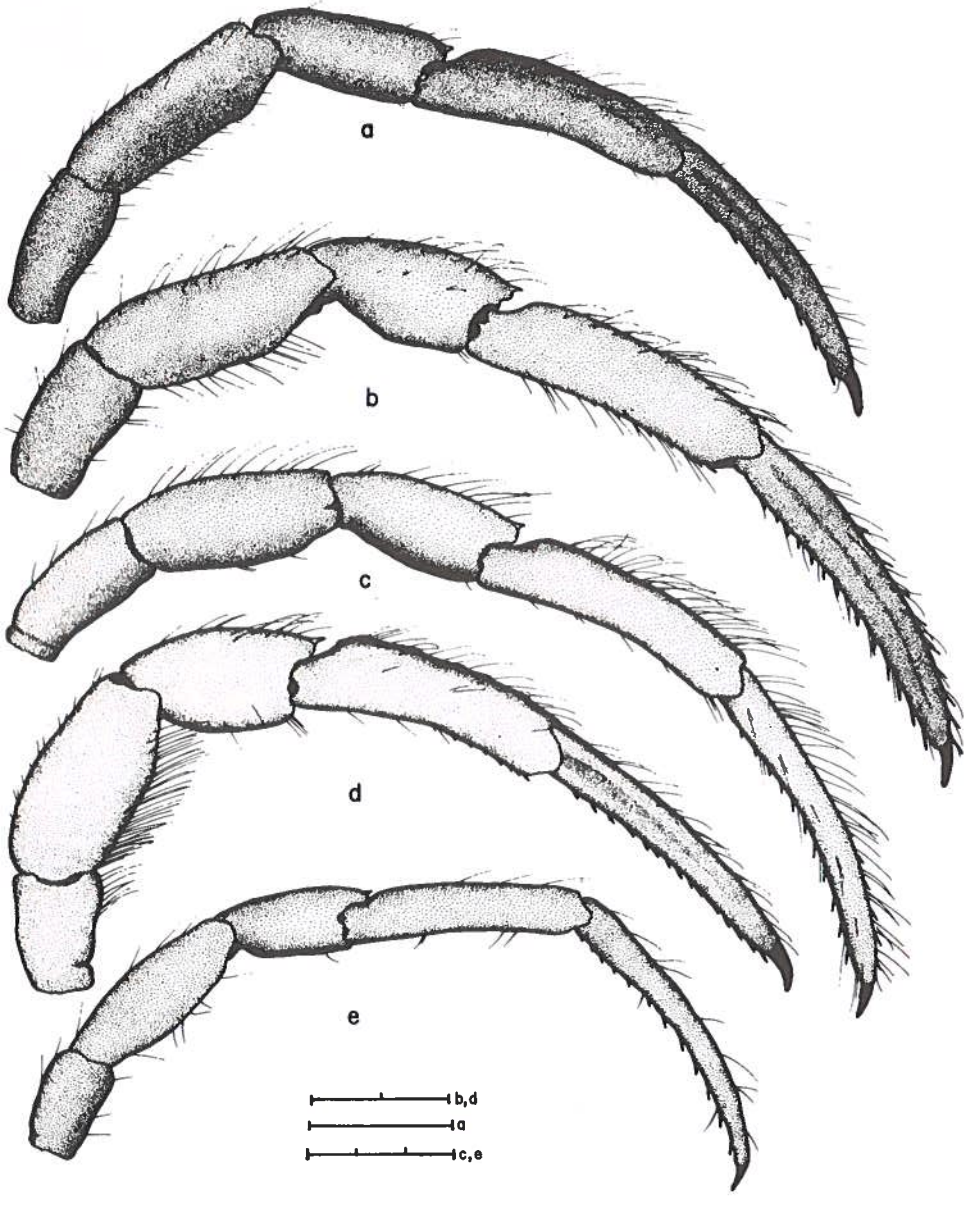

Figure 4. Right 3rd pereopod (lateral view: a, *P. teevana* (Colombia); b, *P. pustulosa* (holotype); c, *P. garciai* (holotype); d, *P. fimbriata* (paratype); e, *P. laevispinosa* (paratype). Scales equal: 3 mm – c, e; 2 mm – b, d; 1 mm – a.

REMARKS: Alcock's (1905) definition of *Pylopaguropsis*, although quite general in a number of characters of little diagnostic significance, is specific in several pertinent characters, i.e., gill number and structure, paired 1st pleopods in females, number of unpaired pleopods in both sexes and development of the external lobe ("flagellum") of the endopod of the maxillule. It was the gill number and structure, together with the presence of paired pleopods in the female, that convinced Forest (1955) that the similarities observed by both Henderson (1896) and Alcock (1905) between *Pylopagurus* (= *Pylopaguropsis*) *magnimanus* and *Eupagurus* (= *Pagurus*) *zebra* reflected a generic relationship. Wass (1963) recognized that his new Atlantic species shared these same characters and assigned the third species to *Pylopaguropsis*. In an examination of specimens of *Galapagurus teevanus* from the west coast of South America, one of us (JH) observed these same characters in Boone's (1932) monotypic genus. Further comparison of *G. teevanus* with *P. magnimanus*, *P. zebra* and *P. atlantica* revealed several differences, which at first suggested that more than one genus with 13 pairs of trichobranchiate gills and female paired 1st pleopods might exist. For example: 1) Dissimilarities between the dactyls and propodi of the right and left 3rd pereopods were observed in *P. magnimanus*, *P. zebra*, and *P. atlantica*. In these species the right dactyls and propodi are broader and more elongate, the dorsolateral margins are prominently angular, and the lateral faces are flattened or with a longitudinal sulcus developed. In contrast, in *G. teevanus* the dactyls and propodi of the right and left 3rd pereopods are generally similar in length and breadth, the lateral faces are convex with only faint longitudinal sulci on the dactyls, and only in large specimens is there a very slight tendency toward angulation in the dorsolateral margins of the propodi. 2) In *P. magnimanus*, *P. zebra* and *P. atlantica* the propodal rasp of the 4th pereopod consists of 1 to 4 complete rows of corneous scales, whereas in *G. teevanus* only 1 partial row of scales is present. 3) The scaphognathite of the maxilla is extremely broad in *P. magnimanus*, very broad in *P. atlantica*, and moderately broad in *P. zebra*, but moderately narrow in *G. teevanus*. 4) The basal portion of the exopod of the 1st maxilliped is exceptionally broad in *P. magnimanus*, very broad in *P. atlantica*, and moderately broad in *P. zebra*, and only average in *G. teevanus*. However, when these same characters are evaluated for the seven newly discovered species as well (Table 1), only the general dissimilarity/similarity (Figs. 3, 4) of the dactyls of the right 3rd pereopods is sufficiently consistent to permit the clustering of species into the *magnimanus* and *teevanus* groups. As character-state overlap and within-group variations in several other diagnostic characters are considerable, the dissimilarity/similarity of the dactyls of the 3rd pereopods is not considered justification for distinguishing two genera. Therefore, we consider *Galapagurus* a junior synonym of *Pylopaguropsis*.

Key to the Species of *Pylopaguropsis*

1. Palm of right chela fringed with spines and long setae; carpus of 4th pereopod with dorsodistal spine ..... *P. fimbriata* n. sp.
1. Palm of right chela not fringed with spines and long setae; carpus of 4th pereopod without dorsodistal spine 2
    2. Left chela with 1 or more rows of spines on dorsal surface 3
    2. Left chela unarmed or with few scattered spinules or spinulose tubercles on dorsal surface 5

3. Propodal rasp of 4th pereopod with 1 short or partial row of corneous scales; carpus of P_2 with spine at dorsodistal angle and no additional spines on dorsal surface .... *P. laevispinosa* n. sp.
3. Propodal rasp of 4th pereopod with 2 to 4 complete rows of corneous scales; carpus of P_2 with spine at dorsodistal angle and 1 to several additional spines on dorsal surface 4
   4. Carpus of right cheliped with dorsolateral surface weakly armed, margin upturned; telson with terminal margins concave (Atlantic) ..... *P. atlantica*
   4. Carpus of right cheliped with dorsolateral surface moderately to strongly armed, margin not upturned; telson with terminal margins oblique (IndoPacific) ..... *P. magnimanus*
5. Dactyl of right P_3 appreciably broader than left; anterior lobe of sternite of 3rd pereopods subrectangular or oblong 6
5. Dactyl of right P_3 not appreciably broader than left; anterior lobe of sternite of 3rd pereopods subtriangular or rounded 9
   6. Propodus of right P_3 with 1 longitudinal sulcus on lateral face 7
   6. Propodus of right P_3 with 2 or 3 longitudinal sulci on lateral face 8
7. Ocular peduncles appreciably broader proximally than at base of corneae; propodus of right P_3 with sulcus on lateral face not delimited by broad, flattened median ridge .... *P. keijii* n. sp.
7. Ocular peduncles not appreciably broader proximally than at base of corneae; propodus of right P_3 with sulcus on lateral face delimited by broad, flattened median ridge .... *P. zebra*
   8. Dactyl of right chela with closely-spaced, low, flattened tubercles on dorsal surface, dorsomesial margin with plate-like tubercles; merus of left cheliped with prominent tubercle at ventromesial proximal angle ..... *P. speciosa* n. sp.
   8. Dactyl of right cheliped with scattered, small, spinulose tubercles, dorsomesial margin with row of acute spines; merus of left cheliped with row of spines on ventromesial margin .... *P. lewinsohni* n. sp.
9. Propodus of right P_3 with lateral face flattened; propodal rasp of 4th pereopod with 2 rows of corneous scales .... *P. pustulosa* n. sp.
9. Propodus of right P_3 with lateral face convex; propodal rasp of 4th pereopod with 1 partial row of corneous scales 10
   10. Right chela with mesial face strongly produced ventrally in proximal half, ventral surface strongly excavated in lateral half; dactyl of right P_3 with longitudinal sulcus .... *P. teevana*
   10. Right chela with mesial face not strongly produced ventrally in proximal half, ventral surface not strongly excavated in lateral half; dactyl of right P_3 without longitudinal sulcus .... *P. garciai* n. sp.

Pylopaguropsis magnimanus (Henderson)

Figures 1a, g; 2a, g; 3a; 5a; 7a; 9a; 11a; 13a.

Pylopagurus magnimanus Henderson, 1896: 522.—Alcock and Anderson, 1897, pl. 31, fig. 2.

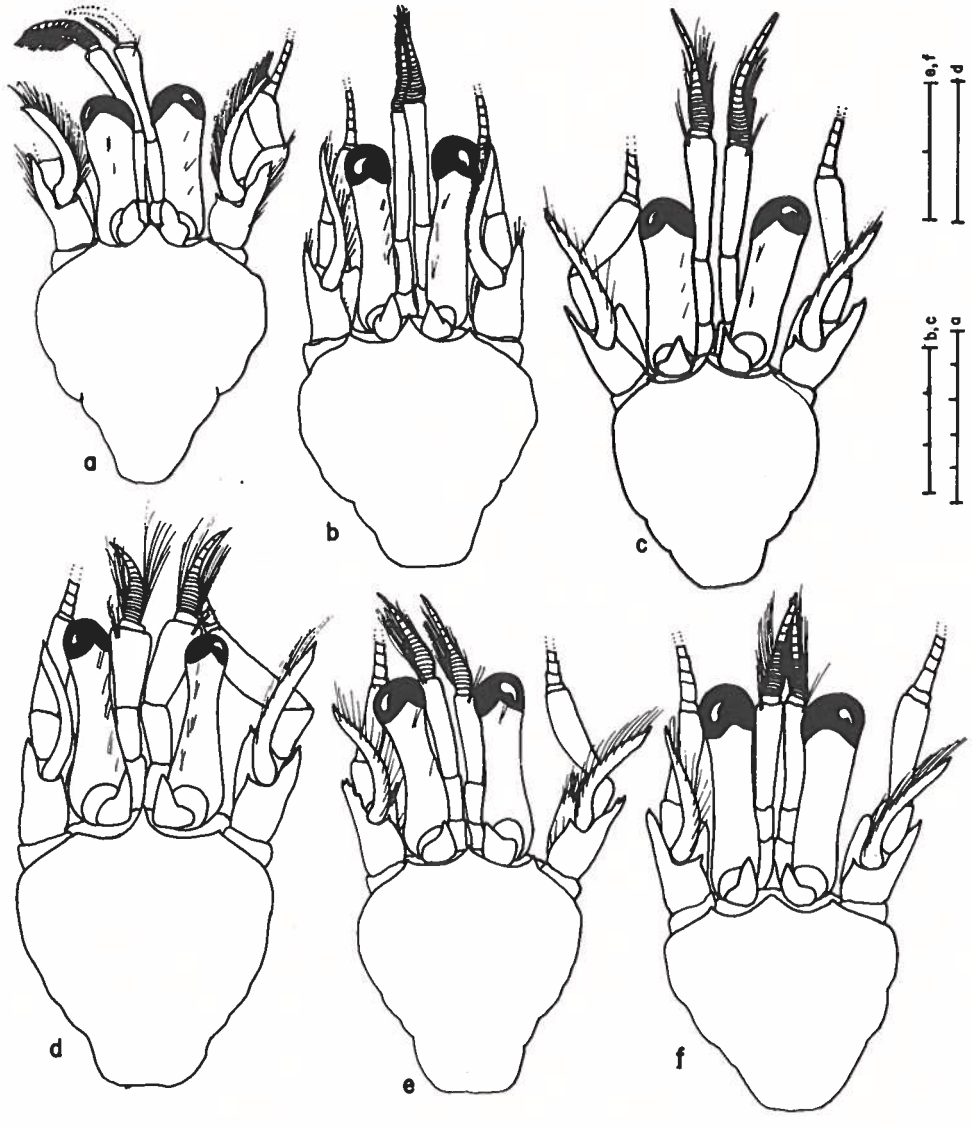

Figure 5. Shield and cephalic appendages: a, *P. magnimanus* (lectotype); b, *P. zebra* (lectotype); c, *P. atlantica* (French Guiana) d, *P. keijii* (paratype); e, *P. speciosa* (paratype); f, *P. lewinsohni* (paratype). Scales equal: 5 mm – a; 3 mm – b, c; 2 mm – e, f; 1 mm – d.

Pylopaguropsis magnimanus: Alcock, 1905: 134, p. 13, fig. 2.—Thompson, 1943: 125.—Forest, 1955: 107.—Gordan, 1956: 340.

not *Pylopaguropsis* cf. *magnimanus:* Lewinsohn, 1969: 58, fig. 9 (= *Pylopaguropsis lewinsohni* n. sp.).

not ?*Pylopaguropsis magnimanus:* Baba, 1982: 67, fig. 2 (= *Pylopaguropsis keijii* n. sp.).

LECTOTYPE (herein selected): ♀, "Investigator" Station 166; BMNH.

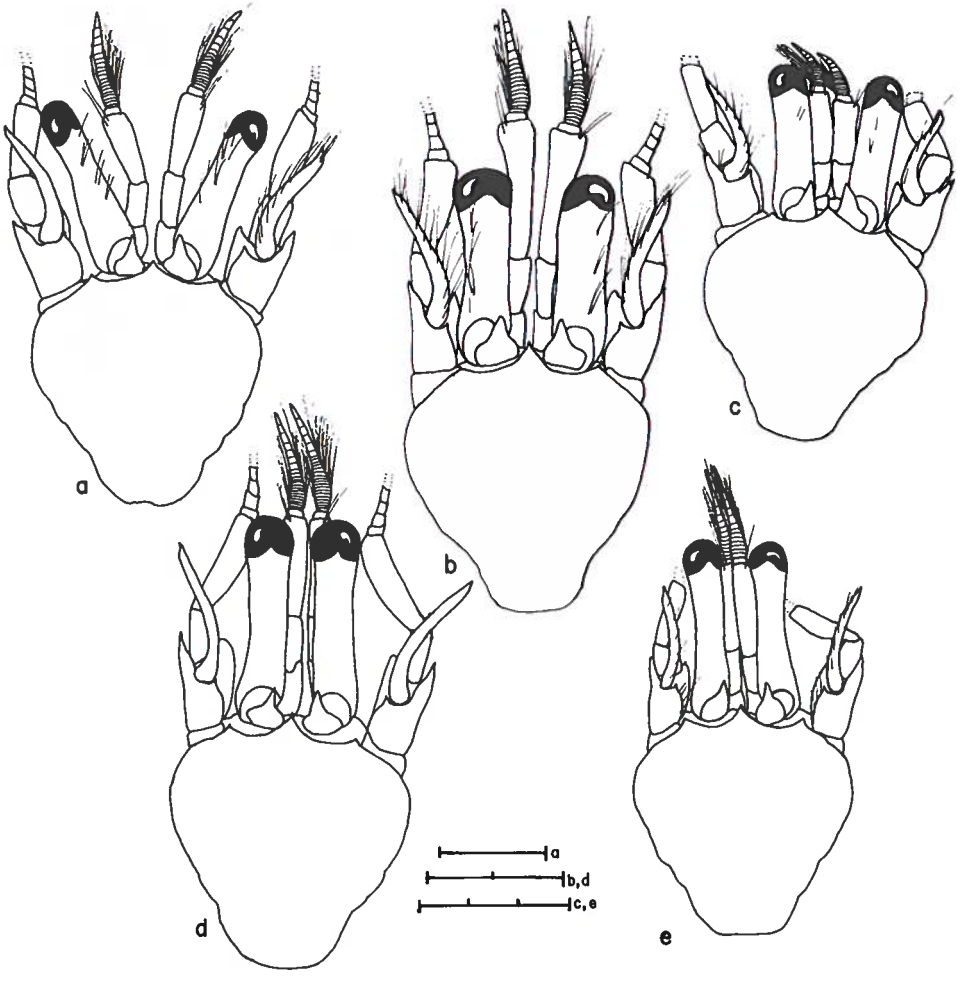

Figure 6. Shield and cephalic appendages: a, *P. teevana* (Colombia); b, *P. pustulosa* (holotype); c, *P. garciai* (holotype); d, *P. fimbriata* (paratype); e, *P. laevispinosa* (paratype). Scales equal: 3 mm – c, e; 2 mm – b, d; 1 mm – a.

TYPE LOCALITY: Off Madras, India

DIAGNOSIS: Shield (Fig. 5a) longer than broad. Rostrum prominent, triangular, acute, terminating in small spine. Lateral projections obtusely triangular, each usually with small terminal spinule.

Ocular peduncles moderately short to moderately long, two-thirds to four-fifths length of shield, moderately stout, corneae slightly dilated, often with longitudinal row of sparse tufts of setae on dorsal surface. Ocular acicles triangular, acute, usually terminating in minute, submarginal spinule and with tuft of setae; separated by approximately basal width of one acicle.

Antennular peduncles long; when extended, exceeding ocular peduncles by approximately four-fifths length of ultimate segment.

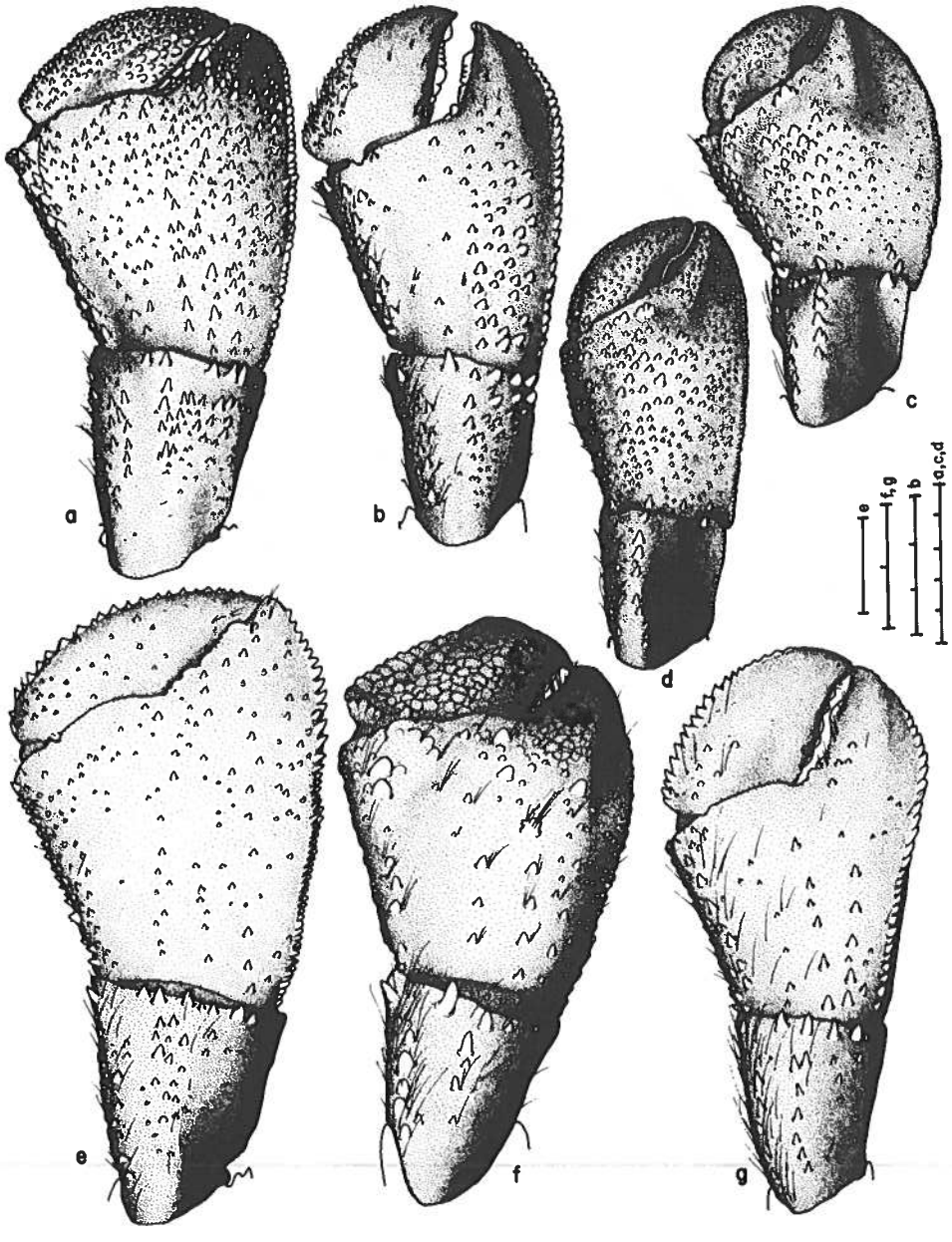

Figure 7. Right chela and carpus (dorsal view): a, *P. magnimanus* (lectotype); b, *P. zebra* (lectotype); c, d, *P. atlantica* (French Guiana); e, *P. keijii* (paratype); f, *P. speciosa* (paratype); g, *P. lewinsohni* (paratype). Scales equal: 5 mm – a, c, d; 3 mm – b; 2 mm – f, g; 1 mm – e.

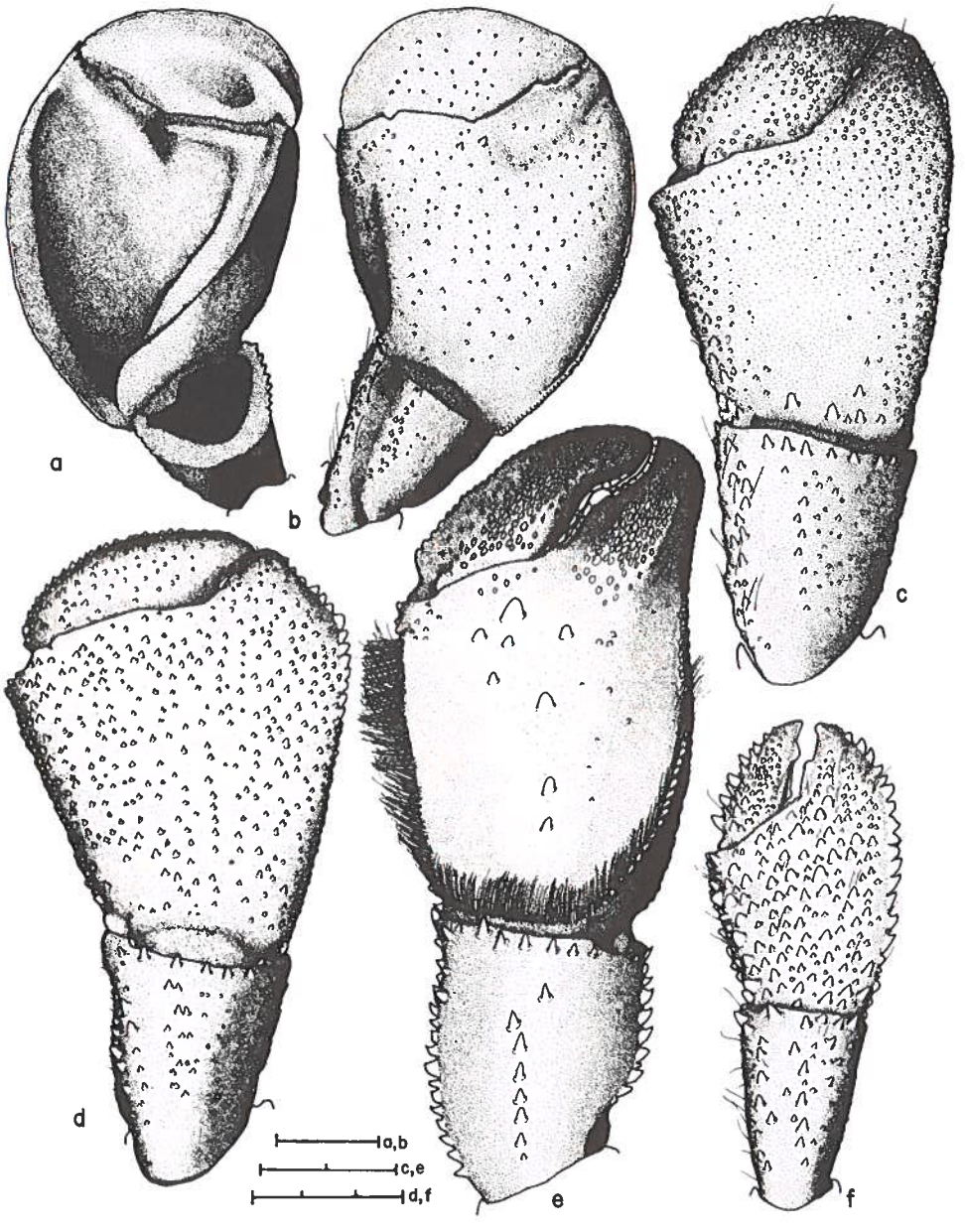

Figure 8. Right chela and carpus (dorsal view): a, b, *P. teevana* (Colombia); c, *P. pustulosa* (holotype); d, *P. garciai* (holotype); e, *P. fimbriata* (paratype); f, *P. laevispinosa* (paratype). Scales equal: 3 mm – d, f; 2 mm – c, e; 1 mm – a, b.

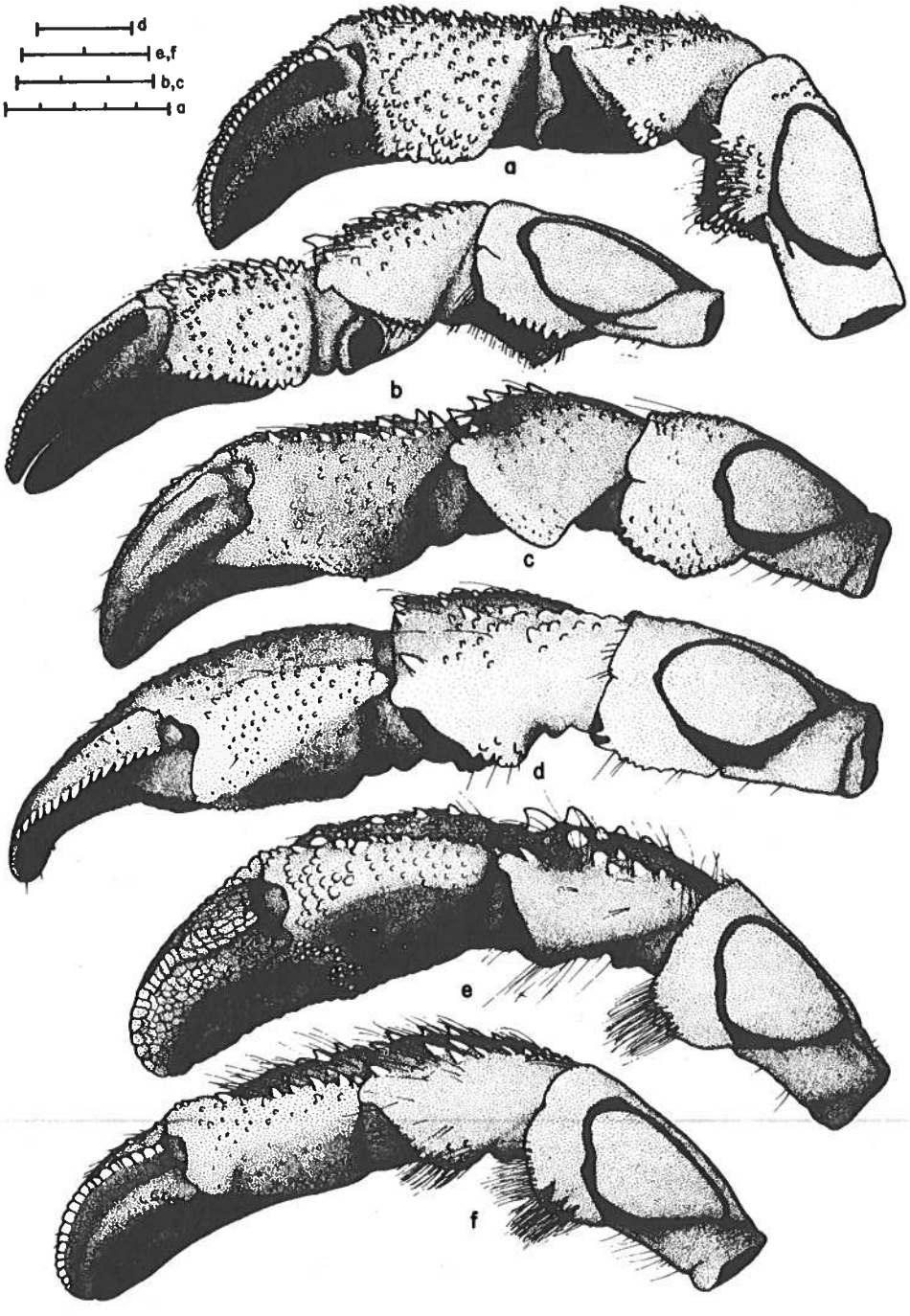

Figure 9. Right cheliped (mesial view): a, *P. magnimanus* (lectotype); b, *P. zebra* (lectotype); c, *P. atlantica* (French Guiana); d, *P. keijii* (paratype); e, *P. speciosa* (paratype); f, *P. lewinsohni* (paratype). Scales equal: 5 mm – a; 3 mm – b, c; 2 mm – e, f; 1 mm – d.

Third maxilliped with dorsodistal spine on merus. Sternite of 3rd maxillipeds unarmed.

Right cheliped (Figs. 7a; 9a) with dactyl moderately broad, dorsoventrally flattened, set very obliquely to palm; dorsal surface tuberculate, tubercles frequently capped with minute corneous spinules; dorsomesial margin with row of closely-spaced spinulose tubercles; ventral surface strongly concave on mesial side, sloping on lateral side of prominently produced midline, surface with closely-spaced, low tubercles in small specimens or generally smooth and armed with few small tubercles near cutting edge and on midline near articulation with palm in large individuals. Palm broad, particularly distally; dorsal surface slightly convex, armed with irregular rows of small to moderately prominent spines or spinulous tubercles extending onto fixed finger, double row of spinulous tubercles laterad of cutting edge; dorsolateral margin with irregular row of small spines or spinulose tubercles; dorsomesial margin with double row of small spines; mesial face produced beyond ventral surface and forming broad, spinulose ridge, surface spinulose or tuberculate; ventral surface minutely granular, concave on mesial side, sloping on lateral side. Carpus with dorsal surface triangularly convex, considerably broader distally; dorsolateral half delimited medially by row of moderately strong spines; surface with transverse rows of small spines, becoming stronger distally and with 3 to 6 strong spines on distal margin; dorsomesial side delimited medially by row of smaller spines, surface with less pronounced transverse rows of small spines; mesial face with few minute spinules dorsally, distal margin spinulose in ventral half; ventral surface produced in region of mesial margin and armed with several moderately prominent spines, surface minutely spinulose or granular; few scattered setae on all surfaces. Merus triangular; mesial face with spines or spinulose tubercles near ventral margin; ventromesial margin with several strong spines distally, produced proximally and armed with numerous tubercles; ventral surface with blunt tubercles more prominent distally; ventrolateral margin also produced proximally although not as prominently; lateral surface with small blunt spines or small tubercles in ventral half, becoming stronger marginally.

Left cheliped (Fig. 11a) long, slender; propodal-carpal articulation twisted counterclockwise approximately 30°; dactyl and fixed finger bent downward; dactyl slightly exceeding length of palm; dorsal surface slightly elevated in midline and with low protuberances and tufts of setae. Palm with row of prominent spines on elevated dorsomesial margin; dorsal surface sloping laterally, row of low spinulose protuberances laterad of midline, extending onto fixed finger proximally; few low, sometimes spinulose, protuberances on not well delimited dorsolateral margin; fixed finger with few spinules in proximal half and with tufts of long setae. Carpus moderately long, slender; dorsomesial margin with row of strong acute spines; dorsolateral margin with 1 strong spine at distal margin and few much smaller spines proximally, and with numerous tufts of long setae. Merus with mesial and lateral faces minutely spinulose or granular ventrally; ventrolateral margin with row of strong acute spines; ventromesial margin with few spinules on proximal half.

Second and 3rd pereopods moderately long, dissimilar from right to left. Dactyls two-thirds to twice length of propodi; terminating in moderately long corneous claws; ventral surfaces each with row of moderately strong corneous spines; lateral faces of 2nd and 3rd left slightly convex, right 2nd slightly broader than left, surface somewhat flattened; right 3rd (Fig. 3a) appreciably broader, lateral surface weakly concave, forming

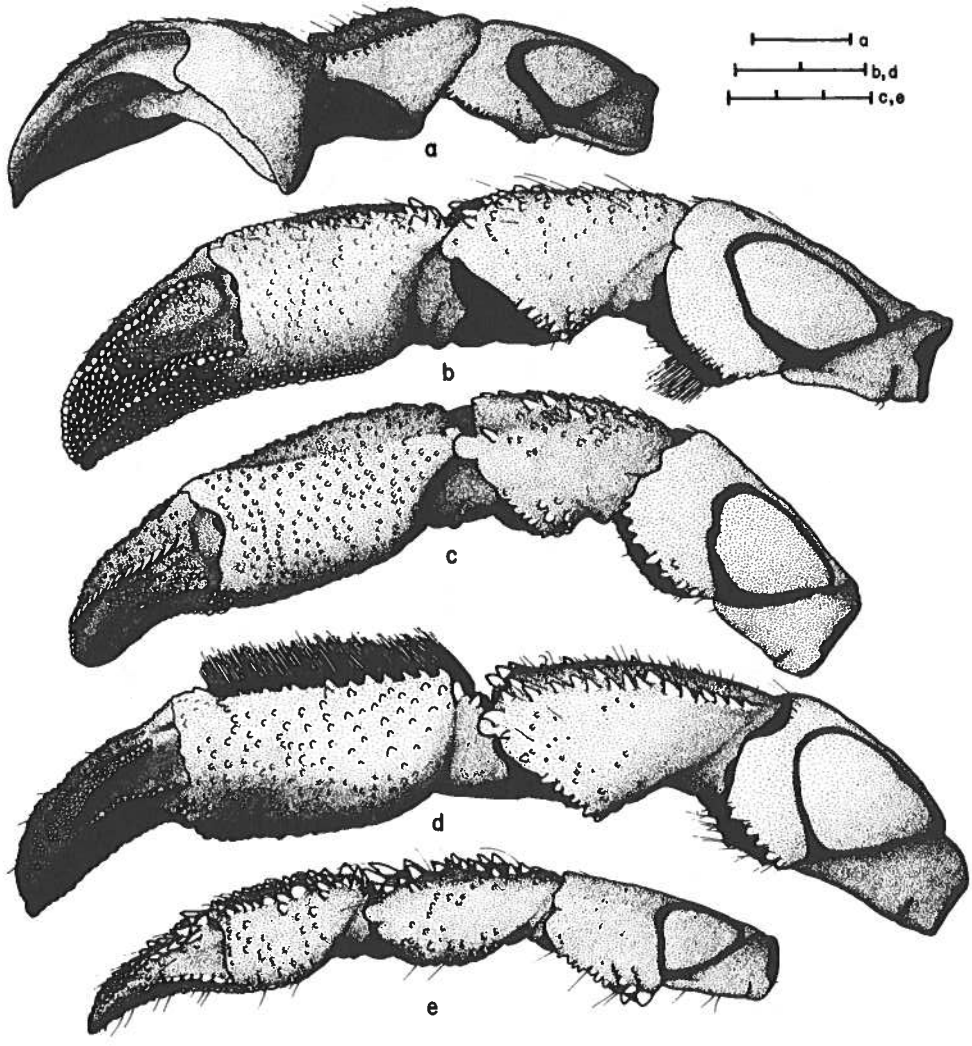

Figure 10. Right cheliped (mesial view): a, *P. teevana* (Colombia); b, *P. pustulosa* (holotype); c, *P. garciai* (holotype); d, *P. fimbriata* (paratype); e, *P. laevispinosa* (paratype). Scales equal: 3 mm – c, e; 2 mm – b, d; 1 mm – a.

broad, shallow longitudinal sulcus. Propodi of 2nd longer than carpi, propodi of 3rd approximately equal to length of carpi; lateral faces of propodi of females evenly convex, right 3rd of males somewhat flattened. Carpi of 2nd each with moderately prominent spine at dorsodistal margin and 1 to 4 smaller spines on dorsal surface proximally; carpi of 3rd usually with spine at dorsodistal margin and frequently with 1 to 3 much smaller spines on dorsal surface proximally. Meri unarmed or 2nd right occasionally with 1 or 2 small spinules on ventral margin.

Anterior lobe of sternite of third pereopods roundly triangular and with tuft of long

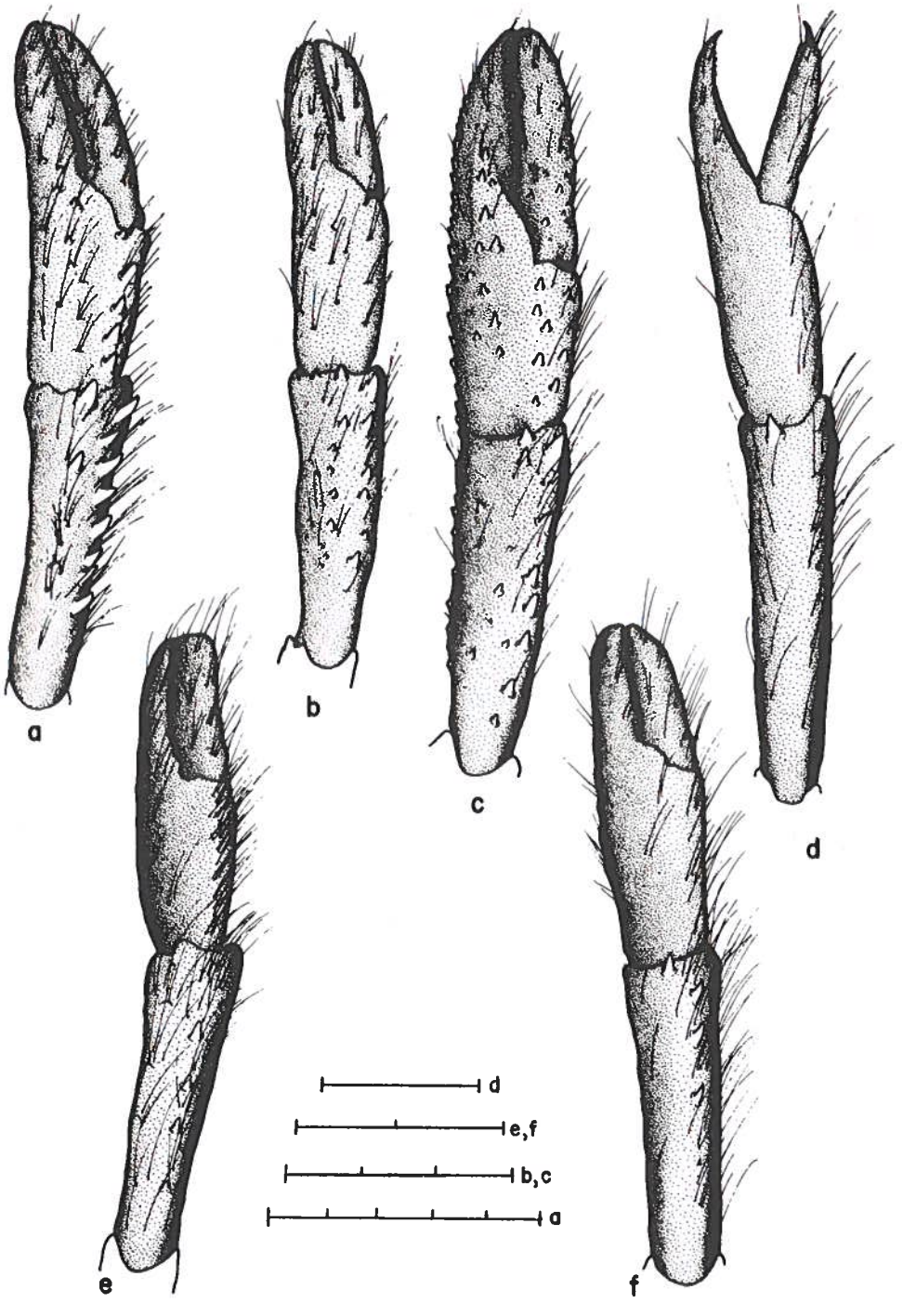

Figure 11. Left chela and carpus (dorsal view): a, *P. magnimanus* (lectotype); b, *P. zebra* (lectotype); c, *P. atlantica* (French Guiana); d, *P. keijii* (paratype); e, *P. speciosa* (paratype); f, *P. lewinsohni* (paratype). Scales equal: 5 mm – a; 3 mm – b, c; 2 mm – e, f; 1 mm – d.

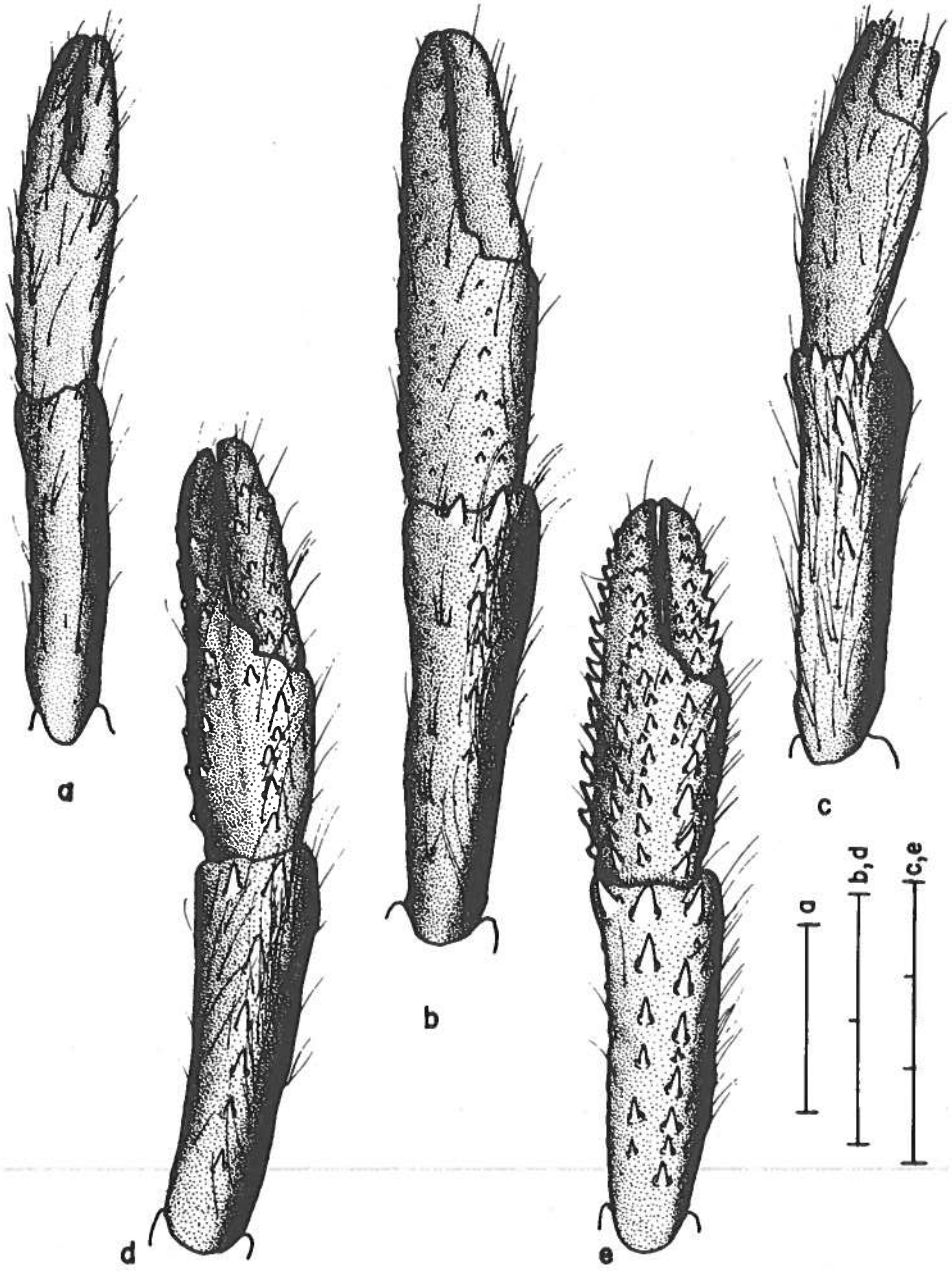

Figure 12. Left chela and carpus (dorsal view): a, *P. teevana* (Colombia); b, *P. pustulosa* (holotype); c, *P. garciai* (holotype); d, *P. fimbriata* (paratype); e, *P. laevispinosa* (paratype). Scales equal: 3 mm – c, e; 2 mm – b, d; 1 mm – a.

setae. Fourth pereopods with no preungual process apparent; propodal rasp of 3 or 4 rows of corneous scales (Fig. 2g).

Telson (Fig. 13a) with posterior lobes subtriangular, separated by shallow median cleft; terminal margins oblique, left usually armed with 2 to 4 strong spines, occasionally only few small spines, right with 2 to 5 moderately strong to strong spines; lateral margins unarmed or with few to numerous small spinules; anterior lobes with marginal short setae.
COLORATION: "in spirit biscuit yellow: in life, either bright red like the *Rostellaria* whose shell it inhabits, or 'legs crimson dotted with yellowish white, under surface of joints white'" (Alcock, 1905: 135).
MATERIAL EXAMINED: Lectotype: non-ovigerous ♀ (SL = 6.9 mm), BMNH, "Investigator" sta. 166, off Madras, India. 5 non-ovigerous ♀ (SL = 3.4 − 6.1 mm), BMNH, off Ganjam coast, Bay of Bengal, nos. 1765/7, 1766/7, 162–170 m. 2 non-ovigerous ♀ (SL = 6.0, 6.1), BMNH, Marine Survey of India, no. 1911.1.17. 1 non-ovigerous ♀ (SL = 5.8 mm) 1 ♂ (SL =3.9 mm), BMNH, nos. 1903.4.6.237–239. 1 non-ovigerous ♀ (SL = 6.4 mm), 1 ♂ (SL = 4.4 mm), BMNH, nos. 1903.4.6.237–239. 1 ♂ (SL = 6.5 mm) BMNH, Bay of Bengal, 129 m. Remnants from "John Murray" station 24, BMNH, Gulf of Oman, stations 72, 194, Gulf of Aden, 1933–34.
AFFINITIES: *Pylopaguropsis magnimanus* is most closely allied to *P. atlantica*. Although *P. magnimanus* appears to consistently lack a longitudinal sulcus on the lateral face of the propodus of the 3rd right pereopod, this sulcus may also be lacking in large specimens of *P. atlantica*. However, the two species are easily distinguished from one another by the absence, in *P. magnimanus*, of the upturned and "wing-like" dorsolateral margin of the carpus of the right cheliped.
REMARKS: Although Alcock's (1905) specimens apparently were "bright red", he also quoted Henderson's (1896) note by the collector when he reported the legs as being "crimson dotted with yellowish white, under surface of joints white" when he described the color of *P. magnimanus*. We have been able to examine both the specimen from station 166 off the Madras coast (herein designated as the lectotype) listed by Henderson in his original description of *Pylopagurus magnimanus* and two of the lots listed by Alcock (1905) in his redescription of the species. Despite the apparent differences in color between Henderson's and Alcock's specimens, all of the specimens examined are within the expected range of variation for the species.

All that remain of the specimens reported by Thompson (1943) as *P. magnimanus* from the Gulfs of Aden and Oman (stations 24, 72 and 194 of the "John Murray" Expedition, BMNH 1952:6:17:59–61) are fragments. Thompson remarked that the specimens from the Gulf of Aden were broken and that identifications were "not at all satisfactory." From the remains of the appendages of specimens from station 194 in the Gulf of Aden, we have been able to confirm the identity of at least one specimen as *P. magnimanus*.

As previously indicated, Lewinsohn (1969) noted differences between his single female specimen from the Red Sea and Henderson's (1896) and Alcock's (1905) descriptions of *P. magnimanus*. However, he attributed these differences to size-related variations. We have examined Lewinsohn's specimen and confirmed that it is not conspecific with *P. magnimanus* but represents the species herein described as *Pylopaguropsis lewinsohni* n. sp. Baba (1982) was of the opinion that his specimen from Inuf, Yap, and Lewinsohn's (1969) specimen probably represented the same species. However, our examination of Baba's (1982) male specimen has proved that it is neither *P. magnimanus* nor *P. lewin-*

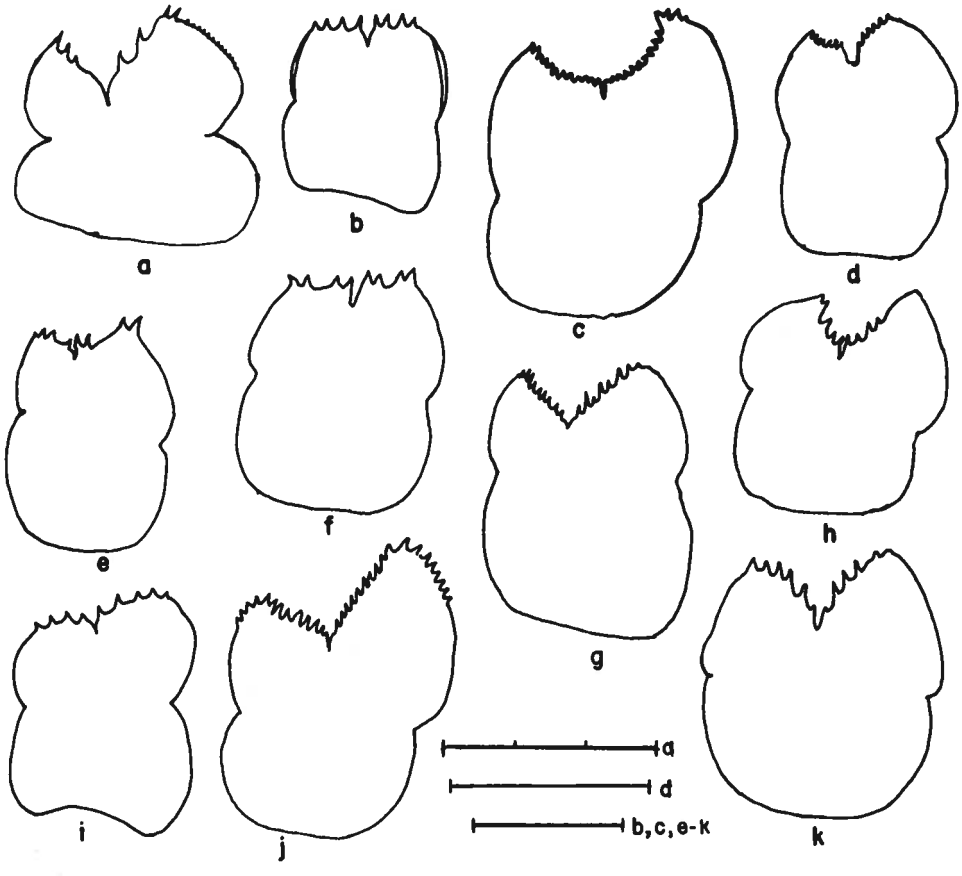

Figure 13. Telson: a, *P. magnimanus* (Bay of Bengal); b, *P. zebra* (Japan); c, *P. atlantica* (French Guiana); d, *P. keijii* (paratype); e, *P. speciosa* (paratype); f, *P. lewinsohni* (paratype); g, *P. teevana* (Colombia); h, *P. pustulosa* (holotype); i, *P. fimbriata* (paratype); j, *P. laevispina* (paratype); k, *P. garciai* (holotype). Scales equal: 3 mm – a; 1 mm – b–f, h–k; 0.5 mm – g.

sohni n. sp., but rather another undescribed species, *Pylopaguropsis keijii* n. sp. (described herein).

DISTRIBUTION: Bay of Bengal to Sri Lanka (Ceylon); northern Arabian Sea; 119–397 meters.

Pylopaguropsis zebra (Henderson, 1893)

Figures 3b; 5b; 7b; 9b; 11b; 13b.

Eupagurus zebra Henderson, 1893: 425 (? in part), pl. 39, figs. 12–15 (see remarks).—Forest, 1955: 107.

? *Eupagurus zebra:* Henderson, 1896: 520.—Alcock, 1905: 126, pl. 11, fig. 5.—Southwell, 1906: 216 (see remarks).

Eupagurus zebra: Balss, 1912: 22.
Pagurus zebra: Gordan, 1956: 337 (in part, see remarks).
? *Pagurus zebra:* Sankolli, 1962: 141 (see remarks).
Pagurus zebra: Miyake, 1975: 260, pl. 116, fig. 2; 1978: (in part) 108, fig. 43; 1982: 225 (see remarks).
not *Eupagurus zebra:* Stebbing, 1920: 259.—Barnard, 1950: 459 (see remarks).
not *Pagurus zebra:* Edmondson, 1925: 29; 1933: 228; 1946: 263 (= *Pylopaguropsis keijii* n. sp.).
not *Pylopaguropsis zebra:* Eldredge et al., 1979: 18 [= *Pagurixus laevimanus* (Ortmann)].
not *Pylopaguropsis zebra:* Wooster, 1979: 173 (= *Pylopaguropsis fimbriata* n. sp.).
LECTOTYPE (by implication of Forest, 1955: 107): BMNH.
TYPE LOCALITY: Holothuria Bank, Northwest Australia.
DIAGNOSIS: Shield (Fig. 5b) approximately as broad as long or slightly longer than broad. Rostrum prominent, acute, terminating in small spinule. Lateral projections triangular, each with small terminal spinule.

Ocular peduncles moderately long, two-thirds to four-fifths length of shield, moderately slender, cornea only slightly dilated, few tufts of setae on dorsal surface mesially. Ocular acicles triangular, acute; separated basally by breath of rostrum.

Antennular peduncles long, when extended, exceeding ocular peduncles by one-half length of ultimate segment.

Sternite of 3rd maxillipeds with strong spine on either side of midline.

Right chela (Figs. 7b; 9b) with dactyl slightly longer than palm, compressed dorsoventrally; dorsomesial margin expanded and armed with row of strong spines; dorsal surface slightly convex and with several spines at dorsomesial proximal angle, few extending onto dorsal surface, or with several irregular rows of small spines on mesial half; ventral surface concave at margin, convex medianly. Palm with irregular double row of low spines or spinulose tubercles on dorsomesial margin; dorsolateral margin with row of strong toothlike spines; dorsal surface with few low spinulose tubercles or small spines in mesial half and more irregular rows on lateral half, few to several extending onto fixed finger as spinulose tubercles; mesial face roughened or spinulose, row of blunt, but spiniform tubercles on ventromesial margin; ventral surface sloping upward laterally from prominent ventromesial margin. Carpus approximately equaling length of palm, trapezoidal; with scattered conical spines on dorsal surface mesially and rows of spines dorsolaterally, few strong spines on dorsodistal margin; mesial face strongly produced ventrally, ventromesial margin tuberculate. Merus with dorsolateral surface minutely spinulose; ventromesial margin produced and with row of strong conical spines and frequently tufts of long setae; ventral surface with transverse ridges armed with spinulose tubercles.

Left cheliped (Fig. 11b) long and slender, reaching almost to middle of palm of right; propodal-carpal articulation twisted counterclockwise approximately 45°; palm and fixed finger bent downward. Dactyl slightly shorter than palm, unarmed. Palm with low protuberances, some occasionally slightly spinulose, and tufts of setae. Carpus slightly longer than palm; dorsal surface with row of acute spines on dorsomesial margin, more regular row of slightly more conical, blunt spines or spinules on dorsolateral margin and tufts of long setae. Merus long; ventromesial margin with row of small widely spaced spines; ventrolateral margin with row of moderately weak to very strong, acute spines.

Second and 3rd pereopods moderately stout (2nd right missing in holotype), 3rd pair dissimilar. Dactyls longer than propodi; 2nd and 3rd left each with row of corneous spines on mesial face close to dorsal margin; ventral margins each with row of strong corneous spines. Propodi unarmed (2nd) or with 2 corneous spinules at ventrodistal margin (3rd left). Carpi each with small spine at dorsodistal margin. Meri with acute spine on lateral face near distal margin; few small spinules on ventrolateral margin and ventromesial margin with 3 small spines distally (2nd) or unarmed (3rd). Third right pereopod (Fig. 3b) with dactyl longer than left, approximately twice as deep; laterally compressed; dorsal surface with transverse rows of long, stiff spine-like setae; lateral face with prominent longitudinal sulcus; ventral margin with row of strong corneous spines; mesial face with upper and lower row of strong corneous spines. Propodus with prominent dorsolateral margin, lateral face concave dorsally and with broad, flattened median ridge; ventromesial margin with row of corneous spines in distal half. Carpus and merus of 3rd right similar to left.

Anterior lobe of sternite of 3rd pereopods long, narrow, with slight protrusion medially. Fourth pereopods with small preungual process; propodal rasp (Fig. 2h) with 1 or 2 rows of strong, sharp corneous scales.

Telson (Fig. 13b) (missing in lectotype) with posterior lobes separated by shallow median cleft; terminal margins horizontal or slightly oblique, each with 3 or 4 strong spines; lateral margins each with narrow corneous plate.

COLORATION: ". . . dark blood-red parallel lines along both surfaces of the two pairs of ambulatory legs, on the left or smaller cheliped, on the merus and inner margin of the right chelipede, on the sides of the anterior portion of the carapace, on the upper surface of the antennal peduncles, and as a thin line, interrupted on each segment, along either side of the entire antennal flagella. The ocular corneae are dark green, and the contiguous portion of the eye-stalk is encircled by a yellow band. The median frontal projection and the ophthalmic scales are yellow." (Henderson, 1893).

MATERIAL EXAMINED: Lectotype: ♀ (SL = 4.9 mm), BMNH, Holothuria Bank, Australia. 1 ♂ (SL = 2.9 mm), MNHU, Deutsche Tiefsee Exp. sta. 105, Agulhas Bank, Africa, Nov. 3, 1898, 102 m. 1 ♂ (SL = 2.7 mm), NSMT, Tsushima Exp. sta. 11, Korea Strait off Tsutsu-zaki, Tsushima Islands, 34°3.3′N 129°4.5′E, Jul. 26, 1968, 125 m.

AFFINITIES: *Pylopaguropsis zebra* appears most closely related to *P. keijii* n. sp. It may be distinguished from the latter primarily by its longer and basally more slender ocular peduncles, the sulcus on the lateral face of the propodus of the 3rd right pereopod that is delineated medially by a broad ridge, and in color by its striped left cheliped and ambulatory legs. The shallow, longitudinal sulcus on the lateral face of the propodus of the right 3rd pereopod is characteristic not only of *P. zebra* and *P. keijii* but of small specimens of *P. atlantica*. However, in the latter two species the sulcus is broad and encompasses the entire lateral face, whereas in *P. zebra* the sulcus is moderately narrow and is separated from the ventral portion of the surface by a broad, flattened ridge. The presence of spines on the left chela of *P. atlantica* makes it easily distinguishable from the other two species. *P. zebra* also is the only species of the three that has stripes on the left cheliped and ambulatory legs.

REMARKS: As we remarked previously, specimens with broad, operculate or semioperculate right chelipeds and red and white striped ambulatory legs have almost routinely been assigned to *Pylopaguropsis zebra* sensu lato. The type lot of *P. zebra* consisted of a

female specimen collected off the northwest coast of Australia and a male specimen collected off Ceylon. Having examined the lectotype of *P. zebra*, we can confirm that Henderson (1893) did overlook the presence of paired first pleopods in this female specimen. According to Henderson, it is the Australian specimen upon which he based his description and figures, although his figure (plate 39, fig. 12) does not clearly show the dissimilarity between the third pereopods mentioned in his description. In subsequent collections taken off Ceylon, Henderson (1896) again reported *P. zebra* (as *Eupagurus*), remarking only that the species ". . . is easily distinguished by its colour markings . . .". Once more Henderson had a female specimen but made no mention of it having paired first pleopods. It has been presumed that in his redescription of "*Eupagurus zebra*" from the Bay of Bengal and Persian Gulf, Alcock (1905) similarly overlooked the paired first pleopods of his ovigerous female; however, Forest (1955) may have been correct in his query ". . . ou ces appendices peuvent-ils manquer?" Although Alcock's (1905) description of the color patterns of his specimens agrees with those of Henderson (1893, 1896), his morphological description and illustration do not agree with the lectotype, and other specimens that we have examined, in several important points. Alcock described the merus of the right cheliped as unarmed and with a hirsute, crest-like inner lower margin; however, the lectotype has a row of strong, conical spines on this margin, the ventral surface is provided with transverse ridges and spinulose tubercles and the dorsolateral surface is minutely spinulose. More important, he makes no mention of the broader, longer, right third pereopod with the concave lateral faces of the dactyl and propodus, nor does his figure show any dissimilarities between this appendage and the other ambulatory legs. We have been unsuccessful in our attempts to examine any of the Henderson (1893, 1896) or Alcock (1905) Indian specimens of this taxon. However, in view of the fact that both Henderson (1896) and Alcock (1905) observed paired first pleopods on the relatively similar *Pylopaguropsis magnimanus*, it is possible that their Indian Ocean specimens represent a species in which females do lack paired first pleopods. Consequently, until Henderson's (1893) male and representatives of Henderson's (1896) and Alcock's (1905) material can be examined and compared to the lectotype of *P. zebra*, these specimens can only be questionably assigned to this taxon.

Alcock also distinguished an unnamed variety of "*E. zebra*" from the Andaman Islands, characterized by having the outer surfaces of the right carpus and chela granular and the left chela provided with longitudinal rows of granules or spinules. As he did not describe a different color pattern for this specimen, it is reasonable to assume that it too had striped ambulatory legs. Again, we have been unsuccessful in our attempts to examine this specimen; however, should it prove to represent a species of *Pylopaguropsis*, it is possible that it will be found to be conspecific with *Pylopaguropsis laevispinosa* n. sp., a striped species also having rows of spines on the left chela.

Southwell (1906) reported *E. zebra* from the coast of Ceylon without comment. Although it is not possible to determine the accuracy of his identification, it is probable that it was based on the descriptions of Henderson (1896) and Alcock (1905). On this premise, we can only questionably assign this material to *P. zebra* s.s.

Balss (1912) reported *E. zebra* from the Agulhas Bank, South Africa, but remarked that his specimen was completely colorless. Presumably it was for this reason that he assigned it to "Henderson's" (sic) Andaman variety. We have examined Balss' male speci-

men and found that it differs from the lectotype of *P. zebra* only in having a much weaker row of spines on the dorsolateral margin of the carpus of the left cheliped, stronger spination on the right chela, and a tuft of setae on the ventromesial margin of the merus of the right cheliped. As we have found considerable variation in armature in *P. atlantica,* these differences in the strength of spination are not surprising. Although in having a tuft of setae on the ventromesial margin on the merus of the right cheliped this specimen agrees with Alcock's (1905) description of ? *P. zebra,* the margin itself is spinose as it is in the lectotype. Therefore, we believe that Balss' (1912) assignment of this specimen to *P. zebra* (as *Eupagurus*) was correct. Coloration undoubtedly had been lost in preservation, a possibility considered by Balss.

Stebbing (1920) also assigned specimens from off the African coast to Henderson's (1893) taxon, despite the fact that he found differences that he believed might eventually prove distinct. Barnard's (1950) remarks regarding the inappropriate assignment of Stebbing's (1920) presumed *E. zebra* to *Eupagurus* suggest that Stebbing's taxon apparently did have paired first pleopods in the females. Most of the characters cited by Stebbing were length-width ratios, which do not accurately distinguish any of the species of *Pylopaguropsis.* However, from his reference to the ". . . slenderness of the second and third peraeopods . . ." it is clear that he did not have *P. zebra* s.s. Unfortunately his specimens are not in the collections of the South African Museum (E. Louw, personal communication), nor in the British Museum (Natural History) where the majority of Stebbing's material was finally deposited (R.W. Ingle, personal communication) and where Barnard suggested they would be found (J. Forest, personal communication). All further efforts to locate these specimens have been unsuccessful; therefore, Stebbing's taxon must be considered *incertae sedis.*

Gordan's (1956) references to *Pagurus zebra* (Henderson) are a compilation from the literature and include taxa other than *P. zebra* s.s.

Sankolli (1962) presented, in tabular form, a number of characters that distinguished his new species *P. kulkarnii* Sankolli from other *Pagurus* species of the region, including *Pagurus zebra.* It is unclear whether Sankolli actually examined specimens of what he referred to as *P. zebra;* however, as his character descriptions agree with those of Alcock's (1905) for *Eupagurus zebra,* it is not certain that *Pylopaguropsis zebra* was the species he compared with *Pagurus kulkarnii.*

We have not seen Miyake's 1975 description and figure of *Pagurus zebra,* and his 1982 citation occurs only in a species list and in a key (in Japanese) to the Japanese decapod crustaceans. However, in his account of the Anomura of Sagami Bay, Miyake (1978) included in his synonymy taxa now known not to represent *Pylopaguropsis zebra,* i.e., *Eupagurus parazebra* Stebbing, 1920; *Eupagurus zebra:* Barnard 1950; and *Pagurus zebra:* Edmondson, 1925. In his diagnosis of "*Pagurus zebra,*" Miyake (1978) described the ambulatory legs as slender and smooth, and implied that all were similar in structure. He made no mention of paired 1st pleopods in his female specimens. Although he stated that four unpaired pleopods were present in both sexes, he grouped *Pagurus zebra* with species having three pairs of pleopods in the male in his key to the species of *Pagurus.* We have examined one of the specimens listed in his material examined (ZLKU 16131) and confirmed that it is *Pylopaguropsis zebra.* As the specimen is a male, it has not been possible to verify the apparent absence of paired 1st pleopods in the female, but it

is probable that because the species was assumed to belong to *Pagurus*, where female gonopods do not occur, the females were not examined for these structures. His illustration of the 2nd right pereopod also disagrees with the specimens of *P. zebra* that we have examined in having a spine on the posterior half of the dorsal margin of the carpus. Thus, it is possible that his diagnosis was based on specimens from other localities that do not represent *Pylopaguropsis zebra*, although in the other characters he described, his specimens fall within the range of variation of species of this genus.

The specimens identified as *Pylopaguropsis zebra* by Eldredge et al. (1979) have been reexamined and found to represent *Pagurixus laevimanus* (Ortmann), whereas the specimen identified as *P. zebra* by Wooster (1979) has proved to be *P. fimbriata* n. sp.

Pylopaguropsis atlantica Wass

Figures 1b, h; 2b; 3c; 5c; 7c, d; 9c; 11c; 13c.

Pylopaguropsis atlantica Wass, 1963: 153, fig. 10.—Provenzano, 1971: 238, figs. 1, 2.
HOLOTYPE: USNM 103370.
TYPE LOCALITY: Off Suriname, 07°25'N, 54°35'W.
DIAGNOSIS: Shield (Fig. 5c) longer than broad. Rostrum rounded or acute, with or without terminal spine. Lateral projections obtusely triangular, terminating in small marginal or submarginal spine.

Ocular peduncles three-fourths to five-sixths length of shield, sometimes slightly inflated basally, and with corneae slightly dilated, dorsal surface frequently with row of setae. Ocular acicles triangular, acute; separated basally by slightly less to slightly more than basal width of 1 acicle.

Antennular peduncles overreaching ocular peduncles by approximately one-half length of ultimate segment; ultimate segment with tuft of setae on dorsolateral surface near distal margin.

Sternite of 3rd maxillipeds with small spinule on either side of midline.

Right chela (Figs. 7c, d; 9c) dorsoventrally compressed on lateral half; mesial face strongly produced ventrally. Dactyl approximately equaling length of palm; with strongly oblique articulation; dorsomesial margin crenulate; dorsal surface with numerous very small tubercles; ventral surface produced in midline. Palm with irregular double row of small spines near dorsomesial distal angle and 1 strong spine at angle; dorsal surface with several irregular rows of small tubercles or spines; dorsolateral margin weakly spinulose; ventral surface with prominent, unarmed longitudinal ridge extending from tip of fixed finger to proximal margin; mesial face minutely granular. Carpus subtriangular to trapezoidal; dorsal surface elevated in midline and with row of small spines; dorsomesial surface with scattered small spines or spinules, margin not well delimited; dorsolateral surface with few small spinules or tubercles and 1 strong spine distally, margin weakly crenulate and prominently elevated; mesial face strongly produced ventrally, distal margin weakly tuberculate. Merus triangular; dorsal margin with irregular, transverse rows of low tuberculate ridges extending onto lateral face, distal margin minutely spinulose; lateral face granular; ventrolateral distal margin produced forming weakly tuberculate ridge; ventromesial margin with row of small, blunt spines; ventral surface with prominent transverse ridge.

Left cheliped (Fig. 11c) long, slender; propodal-carpal articulation twisted counterclockwise approximately 35°; dactyl with row of spinules in midline and few spinules marginally. Palm with double row of small spines on dorsomesial margin; dorsal surface with irregular row of spinules extending onto fixed finger on raised ridge; dorsolateral margin with few spinules. Carpus shorter than merus; dorsomesial margin with row of strong spines; dorsolateral margin with few low protuberances and 1 or 2 strong spines distally. Merus with row of spines on ventrolateral margin, stronger and more acute distally; ventromesial margin with row of small spinules.

Ambulatory legs with 3rd right dissimilar. Second and 3rd left pereopods each with faint longitudinal sulcus of lateral face of dactyl; ventral margins each with row of corneous spines. Propodi with setae and frequently few low protuberances on dorsal surfaces; ventral and mesial surfaces each with row of corneous spinules. Right 3rd pereopod (Fig. 3c) with slightly broader dactyl and usually much broader propodus; dactyl with wide, shallow, longitudinal sulcus on lateral face; ventral margin with row of strong corneous spines; mesial face with scattered corneous spinules and row of corneous spines dorsally. Propodus with dorsal surface flattened; dorsolateral margin angular; ventral margin with row of corneous spines; lateral face flattened (large specimens) or with shallow longitudinal sulcus, at least in small individuals. Carpi each with row of spines on dorsal surface (2nd and 3rd right) or spinules (3rd left), strongest at distal margin. Meri unarmed.

Sternite of 3rd pereopods with semisubcircular anterior lobe. Fourth pereopod with preungual process; propodal rasp of 4 rows of corneous scales.

Telson (Fig. 13c) with subtriangular posterior lobes separated by shallow median cleft; terminal margins concave or oblique, each with row of closely-spaced small spines.

COLORATION: "Shield generally rose with light stripes behind rostrum and lateral teeth. Eye scales outlined with scarlet anteriorly. Antennal flagella with a scarlet line on each side. Pereiopods peach-red dorsally to pink ventrally, liberally speckled with red" (Wass, 1963: 155).

MATERIAL EXAMINED: 1 ♂ (SL = 4.6 mm), DNR, sta. EJ-84-12, off Sebastian Inlet, Florida, 27°49.3′N, 79°57.6′W, May 18, 1984, 95–99 m, coll. W. Lyons, D. Camp, J. Quinn. 22 ♂ (SL = 1.5–4.1 mm), 4 non-ovigerous ♀ (SL = 2.1–3.2 mm), 15 ovigerous ♀ (SL = 2.2–3.5 mm), RMNH, Luymes Guyana Shelf, 07°10′N, 58°35′W, Aug. 24, 1970, 104–130 m. 5 ♂ (SL = 2.2–4.6 mm), 2 non-ovigerous ♀ (SL = 2.8, 4.2 mm), RSMAS, Pillsbury sta. 650, 06°07′N, 52°19′W, Jul. 8, 1968, 135–155 m.

AFFINITIES: As previously indicated, *P. atlantica* appears to be most closely related to *P. magnimanus* but is easily separated from that species by the upturned carpal margin of the right cheliped. In those individuals that have a longitudinal sulcus on the lateral face of the propodus of the 3rd right pereopod, *P. atlantica* resembles *P. zebra* and *P. keijii* n. sp., and like *P. keijii* it lacks the red and white stripes of *P. zebra*. However, the armature of the left chela and the carpi of the 2nd and 3rd pereopods immediately separates *P. atlantica* from both species.

REMARKS: Variations in the shape and armature of the right cheliped related to size and sexual dimorphism have been reported in several paguroid genera (See McLaughlin, 1974; Lemaitre et al., 1982; McLaughlin and Haig, 1984; Lemaitre, 1986). In the series of specimens of *P. atlantica* examined, similar types of variation in cheliped shape were observed; however, these variations did not appear to be a function of size or sexual di-

morphism. As may be seen in figures 7c and 7d, the right chela varied from one with an almost equal width overall to one that was much narrower at the proximal margin than at the base of the dactyl. Although the latter condition was found exclusively in females and small males, large males exhibited both conditions. The number of spines and tubercles on the chela appeared to increase with size, whereas acuteness usually decreased. [The reverse was found in the three specimens of *P. zebra* examined.] Variations were also observed in the number of rows and the strength of the spines on the chela of the left cheliped. The presence of a well defined longitudinal sulcus on the lateral face of the propodus of the right 3rd pereopod, a character found to be constant in *P. keijii* (the other species in which a large series was available) was much more clearly developed in small individuals and commonly became obsolete with increasing size.

This is the only western Atlantic representative of the genus and until now had been reported only from the type locality. The occurrence of *P. atlantica* off the east coast of Florida is a significant range extension.

DISTRIBUTION: Southeast coast of Florida to Suriname.

Pylopaguropsis keijii new species

Figures 2i; 3d; 5d; 7e; 9d; 11d; 13d.

Pagurus zebra: Edmondson, 1925: 29; 1933: 228; 1946: 265 [not *Pagurus zebra* (Henderson)].

?*Pylopaguropsis magnimanus:* Baba, 1982: 67, fig. 2 [not *Pylopaguropsis magnimanus* (Henderson)].

HOLOTYPE: BPBM

TYPE LOCALITY: Kahe Point, Oahu, Hawaii.

DESCRIPTION: Shield (Fig. 5d) broader than long to longer than broad; anterior margin between rostrum and lateral projections straight or slightly concave; anterolateral margins sloping; posterior margin roundly truncate; dorsal surface glabrous. Rostrum prominent, acute, often reaching to distal half of ocular acicles; terminating in small spinule. Lateral projections obtusely triangular, terminating in marginal or submarginal spinule.

Ocular peduncles moderately short, proportionately longer in large specimens, two-thirds to three-fourths length of shield; appreciably inflated basally and tapering to base of slightly dilated corneae; usually with row of sparse setae on dorsomesial face. Ocular acicles narrowly triangular, acute and sometimes with tiny terminal spinule; separated basally by less than basal width of 1 acicle.

Antennular peduncles moderately short; when extended, usually only slightly overreaching ocular peduncles. Ultimate segment with tuft of setae on dorsolateral distal margin. Penultimate segment unarmed. Basal segment with slender, acute spine on lateral face dorsally.

Antennal peduncles moderately short, overreaching ocular peduncles by one-fourth to one-third length of ultimate segment. Fifth and fourth segments with few scattered setae. Third segment with moderately strong spine and tuft of setae at ventrodistal margin. Second segment with dorsolateral distal angle produced, terminating in small spine, mesial and lateral faces with few setae; dorsomesial distal angle with small spine, mesial face with few setae. First segment with ventral margin produced, with 2 to 4 small spinules

laterally. Antennal acicle moderately short, not overreaching ocular peduncles; somewhat arcuate; terminating in small spine; dorsomesial margin with row of long setae. Flagellum with long setae every 2 or 3 articles, interspersed with short setae.

Sternite of 3rd maxillipeds with small spine on either side of median suture.

Right chela (Figs. 7e; 9d) with dactyl slightly longer than palm and frequently much longer than fixed finger; dorsoventrally compressed, articulating obliquely; terminating in small corneous claw; cutting edge with row of small calcareous teeth distally and proximally, separated by 1 large median calcareous tooth and with slightly larger tooth at proximal angle; dorsomesial margin with row of thin spines; dorsal surface slightly convex and with few scattered spinules and short setae; ventral surface convex, slightly granular. Palm slightly shorter than carpus; dorsomesial margin with row of small spines; dorsal surface weakly convex, with few scattered spinules mesiad of midline and also on fixed finger, 1 or 2 rows of small spinules laterad of midline; dorsolateral margin slightly elevated on palm but not on fixed finger and with row of closely-spaced small spines; mesial face granular or weakly tuberculate, produced ventrally to form slight, weakly tuberculate ridge at ventromesial margin; ventral surface faintly rugose. Carpus approximately equaling length of merus; trapezoidal, with dorsodistal margin usually twice as long as dorsoproximal margin; elevated in midline and armed with row of acute spines; dorsomesial surface sloping and with irregular double row of spines in proximal two-thirds, 1 small spine at distal angle; dorsolateral surface spinulose and strongly sloping, dorsolateral distal angle with few acute spines; ventral surface spinulose or tuberculate; mesial face spinulose dorsally and with few spinules on ventromesial margin. Merus triangular; dorsal surface and lateral face slightly granular; ventromesial margin with row of acute spines; ventrolateral margin minutely spinulose; ventral surface weakly tuberculate. Ischium with few granules on ventral margin.

Left cheliped (Fig. 11d) elongate, slender; propodal-carpal articulation twisted counterclockwise approximately 30 to 40°. Dactyl approximately as long as palm; terminating in strong corneous claw; surfaces unarmed but with tufts of setae dorsally and ventrally. Palm two-thirds length of carpus; surfaces of palm and fixed finger unarmed, but with tufts of long setae, more numerous ventrally; fixed finger terminating in corneous claw. Carpus equaling or slightly longer than merus; dorsomesial margin with low protuberances or small spines and tufts of long setae; dorsolateral margin with spine at distal angle and row of low, occasionally protuberances and tufts of setae proximally; ventral, mesial and lateral surfaces with few tufts of setae. Merus laterally compressed; dorsal surface with row of long setae; mesial and lateral faces with scattered setae; ventromesial margin minutely spinulose; ventrolateral margin with row of acute spines distally, less prominent in large males. Ischium with tuft of setae on ventral margin.

Second and left 3rd pereopods generally similar, dactyl and propodus of 3rd right (Fig. 3d) dissimilar; terminating in strong corneous claws. Dactyls each with row of strong corneous spines on ventral margin; each with faint longitudinal sulcus on lateral face (2nd) or without (3rd left); dorsal surfaces with long setae; mesial face of 3rd with dorsal and ventral rows of corneous spinules. Propodi each with row of tufts of setae on dorsal margin; ventral surfaces with scattered setae. Third right with dactyl and propodus distinctly broader; dactyl with broad longitudinal sulcus on lateral face; mesial face with dorsal and ventral rows of widely-spaced corneous spinules. Propodus with dorsolateral

margin clearly delineated; lateral face with broad, longitudinal sulcus, sometimes with faint longitudinal elevation in midline, but without distinct ridge; ventral margin with row of corneous spinules. Carpi with scattered setae on dorsal surfaces, dorsodistal margin with small spine. Meri with small spine at ventrolateral distal angle or unarmed but with setae on dorsal and ventral margins. Ischia with setae on ventral margins.

Sternite of 3rd pereopods with anterior lobe subrectangular. Fourth pereopods with small preungual process at base of claw, obscured by tuft of setae; propodal rasp (Fig. 2i) with 1 short row of corneous scales.

Telson (Fig. 13d) with subrectangular posterior lobes separated by shallow median cleft; terminal margins horizontal to oblique, each with row of several strong spines or row of small spines, sometimes extending onto lateral margins.

COLORATION: "In life, posterior carapace clear, with some yellow flecks near anterolateral angles. Shield rimmed with white, centrally clear with some yellow flecks. Ocular peduncles white proximally but predominantly light purple, with thin longitudinal dark purple bands extending from within white area to silver-white corneae; base of cornea with thin red peripheral band. Antennal flagella clear with thin longitudinal purple stripes. Right cheliped fawn, gradually becoming white on fingers. Left cheliped and ambulatory legs deep magenta on dactyls, propodi, carpi and distal margins of meri; remainder off-white" (R. Kropp color notes). In preservative: Magenta coloring of ambulatory legs and left cheliped often retained for several years.

MATERIAL EXAMINED: Holotype: ovigerous ♀ (SL = 2.1 mm), BPBM, Kahe Point, Oahu, 22°22′N, 158°08′W, 6 m, from base of *Pocillopora meandrina* Dana; April 14, 1977, coll. S.L. Coles, Hawaiian Electric Co. Survey, Sta. 7C. Paratypes: 47 ♂ (0.5–2.9 mm), 21 non-ovigerous ♀ (SL = 0.7–2.2 mm), 12 ovigerous ♀ (SL = 1.8–2.5 mm), 1 juv. (SL = 0.3 mm) BPBM, AHF, RMNH, USNM, Kahe Point, Oahu, 2.5–6 m, from bases of *Pocillopora meandrina,* 1976–1977, coll. S.L. Coles. 1 ♂ (SL = 2.8 mm), 1 ♀ (SL = 1.2 mm), 1 juv. (SL = 0.6 mm), BPBM S5195, Waikiki, Hawaii, 5 m, January 1, 1945. 1 ♂ (SL = 2.3 mm), BPBM S6958, Makua, Oahu, May 29, 1964, coll. D.P. Fellows; 1 ♀ (SL = 2.1 mm), BPBM S5513, northwest of Kaula Rocks, Hawaii, 70 m, April 28, 1949. 1 non-ovigerous ♀ (SL = 1.8 mm), 1 ovigerous ♀ (SL = 2.4 mm), BPBM 1817, French Frigate Shoals, Tanager Expedition, 1923. 1 ♀ (SL = 3.2 mm), USNM, GUM sta. 119D, Uruno Point, Guam, 13°37′N, 144°48′E, 13–17 m, May 4, 1984, coll. V. Tyndzik. 1 ♂ (SL = 2.0 mm), NSMT, off Inuf, Yap, June 29, 1980, coll. K. Baba. 1 ♂ (SL = 2.6 mm), AHF, Range Reef, Zanzibar, 6 m, May 2, 1971, coll. EAMFRO.

AFFINITIES: As previously indicated, *Pylopaguropsis keijii* is most closely related to *P. zebra*. It does not appear to attain the large size of *P. zebra,* as reflected by the lectotype, and it inhabits shallower depths.

REMARKS: Although Edmondson (1925, 1933) identified specimens from the Frigate Shoals as *Pagurus zebra* (Henderson), he later (Edmondson, 1946) referred to these specimens as probably representing *P. zebra*. We have examined Edmondson's specimens and found them to be identical with the Hawaiian specimens of *Pylopaguropsis keijii*.

We also have examined Baba's (1982) ? *Pylopaguropsis magnimanus* from Yap and found that it too is *P. keijii*.

DERIVATION OF NAME: The species is named in honor of the eminent Japanese carcinologist Dr. Keiji Baba.

DISTRIBUTION: Hawaiian Islands; Guam; Yap, West Caroline Islands; Zanzibar.

Pylopaguropsis speciosa new species

Figures 1c, i; 2c; 3e; 5e; 7f; 9e; 11e; 13e.

HOLOTYPE: USNM 231411.
TYPE LOCALITY: Okinawa, 26°30.0′N, 127°59.9′E.
DESCRIPTION: Shield (Fig. 5e) longer than broad; anterior margin between rostrum and lateral projections concave; anterolateral margins sloping; posterior margin roundly truncate; dorsal surface with few tufts of short setae. Rostrum triangular, acute, with or without terminal spinule. Lateral projections obtusely triangular, terminating in marginal or submarginal spinule.

Ocular peduncles moderately short, approximately two-thirds length of shield; slightly inflated basally and with corneae slightly dilated, dorsal surface with few tufts of setae. Ocular acicles triangular, acute, without terminal spinule; separated basally by slightly less than basal width of 1 acicle.

Antennular peduncles moderately short, when extended slightly overreaching corneae. Ultimate segment with sparse tuft of long setae at dorsolateral distal angle. Penultimate segment unarmed. Basal segment with acute spine on dorsolateral surface.

Antennal peduncles moderately short, slightly overreaching ocular peduncles. Fifth and fourth segments with tufts of setae. Third segment with tuft of setae and very small spinule at ventrolateral distal angle. Second segment with dorsolateral distal angle produced, terminating in strong bifid or trifid spine, mesial margin sometimes with small spine, lateral margin with few setae; dorsomesial distal angle with strong spine. First segment produced ventrally and with 3 or 4 spines laterally. Antennal acicle reaching or slightly overreaching ocular peduncle; strongly arcuate; terminating in small spine. Flagellum long, with 1 to 4 long setae every 2 or 3 articles and 1 or 2 short setae each article, at least in proximal half.

Sternite of 3rd maxillipeds with strong spine on either side of midline.

Right chela (Figs. 7f; 9e) only moderately dorsoventrally compressed; dactyl slightly shorter than palm; articulating obliquely; dorsomesial margin formed of closely-spaced, flattened, marginally spinulose plate-like tubercles; dorsal and ventral surfaces of both dactyl and fixed finger also with closely-spaced, low, flattened, marginally spinulose tubercles, less clearly defined ventrally. Palm longer than carpus; dorsomesial margin not clearly delimited but with adjacent irregular row of tubercles; dorsal surface somewhat elevated in midline and with row of blunt or spinulose tubercles and tufts of setae, also with row of tubercles or small spines laterally, not extending onto fixed finger; dorsolateral margin with row of tubercles proximally, becoming closely-spaced, flattened, marginally spinulose tubercles on fixed finger; ventral surface with weak, transverse ridge from point of articulation of dactyl to prominent, centrally located indentation; mesial face weakly tuberculate. Carpus not appreciably broadened distally; dorsomesial margin with row of strong spines; dorsodistal margin with 2 or 3 strong spines, dorsal midline with row of small spines; dorsolateral surface strongly sloping ventrally and with very low, flattened tubercles; mesial face unarmed; ventral surface with few scattered tubercles and row of long setae on distal margin. Merus triangular; dorsal surface unarmed; lateral face granular or tuberculate, ventrolateral distal angle with 1 or 2 acute spines; mesial face with scattered setae and prominent tuft of dense, thick, long setae at ventromesial distal angle, extending onto ventromesial margin and partially obscuring 2 or 3 small marginal

spines; ventral surface with few low tubercles and row of tufts of setae on ventrodistal margin. Ischium with few short setae.

Left cheliped (Fig. 11e) slender, moderately long; propodal-carpal articulation twisted counterclockwise approximately 60°. Dactyl and fixed finger each terminating in small corneous claw. Dactyl approximately equaling palm in length; surface unarmed but with tufts of setae, particularly ventrally. Palm shorter than carpus; with few low projections and tufts of long stiff setae; fixed finger with scattered setae, terminating in corneous claw. Carpus with row of spines on dorsomesial margin; dorsolateral margin with few low spinulose protuberances or small tubercles distally and numerous long, stiff setae; remaining surfaces unarmed but with tufts of long setae, particularly ventrally. Merus approximately equaling length of carpus; unarmed dorsally, laterally and mesially; ventrolateral margin with row of strong spines and very long, stiff setae; ventromesial margin with prominent tubercle at proximal margin and row of long, stiff setae. Ischium with long setae on ventral margin.

Second and left 3rd pereopods generally similar, dactyl and propodus of right 3rd (Fig. 3e) markedly dissimilar; all terminating in strong corneous claw. Dactyls of 2nd and 3rd left each with row of strong corneous spines on ventral margin; mesial faces with few corneous spinules and dorsal row of long setae; dorsal surfaces with row of long setae; lateral faces convex, and with scattered setae. Propodi each with row of long setae on ventral margins and corneous spinule at ventrodistal margin; dorsal surfaces with row of tufts of long setae; mesial and lateral faces with scattered setae. Dactyl of right 3rd with dorsolateral margin well marked and with row of tufts of long setae, lateral face flattened, with broad, moderately deep, longitudinal sulcus; ventral margin with row of strong corneous spines; mesial face with dorsal and ventral row of strong corneous spines; dorsal surface with few tufts of setae. Propodus with dorsolateral margin clearly delineated and with row of tufts of long setae; lateral face flattened, with dorsal longitudinal sulcus extending entire length and ventral longitudinal sulcus not reaching to distal margin; ventral surface with row of small corneous spinules in distal half. Carpi each with small spine at dorsodistal angle and row of long setae on dorsal surface. Meri with tufts of long setae on dorsal margins; ventrolateral distal angles each with small spinule (2nd) or unarmed (3rd). Ischia with long setae on dorsal and ventral margins.

Sternite of 3rd pereopods with anterior lobe oblong and with few setae. Fourth pereopod with short claw, without preungual process; propodal rasp with 1 moderately short row of corneous scales.

Telson (Fig. 13e) with posterior lobes separated by shallow median cleft; terminal margins oblique, each with 4 or 5 spines, sometimes not equidistantly spaced. Anterior lobes with marginal setae.

COLORATION: In preservative: shield mottled yellow and white with few splotches of reddish-purple. Ocular peduncles light reddish purple in proximal third, reddish brown distally. Antennular peduncles purplish brown. Antennal peduncles with 1st through 4th segments yellow with few splotches of white; 5th segment red or maroon dorsally and ventrally, clear or white laterally and mesially; antennal flagellum with white longitudinal stripe dorsally and ventrally, red or reddish purple laterally and mesially. Maxillipeds, thoracic sternites and coxae of pereopods reddish pink. Setae of body and appendages dark red, at least in basal half. Right cheliped with chela purplish red or magenta with few

splotches of yellow; dorsal surface of carpus pinkish purple, lighter distally and with splotch of bright yellow at proximal margin and extending onto lateral face; mesial face purple with longitudinal yellow stripe and few splotches of yellow ventrally. Merus yellow dorsally with thin white longitudinal stripe; mesial face purple with large median splotch of bright yellow; lateral face with yellow dorsally and purple with few white spots ventrally. Let cheliped and ambulatory legs bright yellow or gold with longitudinal white stripes. Color, particularly yellow, fading to cream or white with time.

MATERIAL EXAMINED: Holotype: ♂ (SL = 3.2 mm), USNM, RFB sta. 922, 1 km WNW Onna Village (Horseshoe Cliffs), Okinawa, 61.0 m, Sep. 23, 1981, coll. R. Bolland (SOSC). Paratype: 1 ♂ (SL = 2.1 mm), USNM 231412, RFB sta. 922, 1 km WNW Onna Village, Okinawa, 61.0 m, Sep. 23, 1981, coll. R. Bolland (SOSC).

AFFINITIES: As previously stated, *Pylopaguropsis speciosa* closely resembles *P. lewinsohni* n. sp. in the sculpturing of the lateral faces of the dactyl and propodus of the 3rd right pereopod. However, *P. speciosa* is easily distinguished from the latter species by the distinctive armature of its right chela, which is reminiscent of the "mushroom-shaped" tubercles characteristic of *Agaricochirus* McLaughlin, 1982, the lack of several spines on the ventral margin of the merus of the second right pereopod and the very distinctively different coloration.

REMARKS: This species agrees with *Pylopaguropsis* in all characters that can be ascertained from male specimens. Thus, despite the fact that this species has been described on only two males, we are confident that its generic assignment is correct and that females, when found, will possess paired first pleopods.

DERIVATION OF NAME: The specific name has been derived from the Latin *speciosus* meaning strikingly beautiful, and reflects the truly spectacular coloration of this species.

DISTRIBUTION: Known only from the type locality at a depth of 60 meters.

Pylopaguropsis lewinsohni new species

Figures 3f; 5f; 7g; 9f; 11f; 13f.

Pylopaguropsis cf. *magnimanus:* Lewinsohn, 1969: 58, fig. 9 [not *Pylopaguropsis magnimanus* (Henderson)].

Pylopaguropsis undescribed sp. 1: Haig and Ball, 1988: 190.

HOLOTYPE: TAU NS 122.

TYPE LOCALITY: Eilat, Gulf of Aqaba, Israel

DESCRIPTION.—Shield (Fig. 5f) slightly broader than long to slightly longer than broad; anterior margin between rostrum and lateral projections concave; anterolateral margins sloping; posterior margin truncate; dorsal surface with few tufts of short setae. Rostrum well developed, acute, often considerably exceeding lateral projections, usually terminating in moderately well developed spine. Lateral projections obtusely triangular, terminating in small spinule.

Ocular peduncles moderately short to moderately long, two-thirds to seven-eights length of shield, slender to moderately stout, cornea frequently dilated. Ocular acicles acute, slender, triangular, sometimes with tiny submarginal terminal spinule.

Antennular peduncles moderately long; when extended, exceeding ocular peduncles by one-fourth to one-third length of ultimate segment. Ultimate segment with sparse tuft

of long setae at dorsolateral distal angle. Penultimate segment unarmed. Basal segment with strong spine on lateral face.

Antennal peduncles short, usually not overreaching ocular peduncles, occasionally slightly longer. Fifth and fourth segments with few setae. Third segment unarmed or with very minute spinule on anterior margin distally. Second segment with dorsolateral distal angle produced, terminating in small simple or bifid spine, mesial and lateral margins unarmed; dorsomesial distal angle with acute spine. Basal segment produced ventrolaterally and with 2 or 3 small, acute spines laterally. Antennal acicle moderately short, strongly arcuate; terminating in small spine and tuft of fine setae; dorsomesial margin with row of fine setae. Antennal flagellum long, each article with few very short setae and longer setae every 2–4 articles except at tip.

Sternite of 3rd maxilliped unarmed.

Right chela (Figs. 7g; 9f) somewhat dorsoventrally flattened. Dactyl slightly longer than palm; set on strongly oblique angle; terminating in strong, corneous claw; cutting edge with row of small calcareous teeth; dorsomesial margin with row of acute, corneous-tipped spines; dorsal surface with scattered small spinulose tubercles and very few sparse setae; ventral surface minutely granular. Palm approximately as long as carpus, narrower proximally; dorsomesial margin not well delineated but with row of small spinulose tubercles and 2 additional irregular rows of spinulose tubercles extending onto weakly tuberculate mesial face; dorsal surface faintly convex, with few widely-spaced spinules on mesial half, 2 rows of stronger spines on lateral half, not extending onto fixed finger; dorsolateral margin slightly elevated and with row of small tooth-like spines; fixed finger with 2 or 3 small tubercles and tufts of setae; ventral surface sloping to margin; ventromesial margin not notably delimited as protuberant ridge. Carpus approximately as long as merus, trapezoidal; dorsodistal margin with row of acute spines; dorsomesial margin weakly delimited, with 1 spine near distal margin, 2 or 3 stronger spines at proximal margin, 1 or 2 spines inset from margin; dorsal surface with short row of spines in midline, spines distally, spinules or granules laterad of midline and extending onto lateral face; dorsolateral margin not delimited; mesial face with few tufts of setae; mesial margin crenulate in ventral half, becoming spinulose ventrally; ventral surface granular, ventromesial and ventrolateral margins not noticeably delimited. Merus triangular; dorsal surface with few tufts of setae; mesial face glabrous; lateral face granular or minutely spinulose; ventromesial margin with row of acute spines; ventral surface minutely spinulose, stronger distally; ventrolateral margin not delimited; ventral surface protuberant distally to form ridge. Ischium with few scattered setae.

Left cheliped (Fig. 11f) moderately long, slender; propodal-carpal articulation twisted counterclockwise approximately 30°. Dactyl somewhat shorter than palm; dorsal surface with row of tufts of setae in midline and laterally; ventral surface with 2 rows of setae. Palm approximately two-thirds length of carpus, with dorsal surface weakly convex, unarmed, but with row of tufts of fine setae mesially and row on dorsolateral surface extending onto fixed finger; fixed finger unarmed but with scattered setae; ventral surface also with tufts of setae. Carpus slender, somewhat laterally compressed; approximately equaling length of merus; dorsomesial margin with row of spines and tufts of long setae; dorsolateral margin with spine at distal margin; other surfaces unarmed but with numerous tufts of setae. Merus subtriangular; dorsal surface with few tufts of setae; ventrolateral

margin with row of small to moderately strong acute spines; ventromesial margin with short row of small acute spines. Ischium unarmed but with tufts of fine setae.

Second pereopods and 3rd left generally similar, dactyl and propodus of 3rd right markedly different; terminating in strong corneous claws. Dactyls of 2nd and left 3rd with dorsal, mesial and lateral faces with tufts of fine setae; ventral margins each with row of 11 or 12 strong corneous spines. Propodi one-half to two-thirds longer than carpi; all surfaces with numerous tufts of setae, ventrodistal margin with corneous spine. Third right (Fig. 3f) considerably larger; dactyl almost twice as broad, dorsally flattened, crenulate; lateral face concave dorsally and ventrally with intervening prominent ridge; mesial face with row of corneous spinules in ventral half and second row dorsally; ventral margin with row of corneous spines. Propodus broad, laterally compressed; lateral face deeply concave in upper third, deep concavity in midline and small concavity near ventral margin producing 3 prominent, longitudinal sulci; mesial face with 2 rows of tufts of setae; ventral margin with row of corneous spinules. Carpi one-half to two-thirds length of meri; each with spine at dorsodistal margin and numerous tufts of fine setae. Meri laterally compressed; dorsal surfaces with low protuberances and tufts of setae; ventral margins each with few acute spines distally (2nd) or unarmed (3rd). Ischia with tufts of setae on ventral margins.

Sternite of 3rd pereopods with anterior lobe oblong. Fourth pereopods without preungual process; propodal rasp with single row of corneous scales or with single row proximally, double row distally.

Telson (Fig. 13f) with subrectangular or subtriangular posterior lobes, separated by moderately narrow to moderately broad median cleft; terminal margins subhorizontal or oblique; left lobe with 2 or 3 acute spines near cleft and 2 or 3 near distolateral angle; right lobe with 3 to 5 spines, sometimes unequally spaced; lateral margins sometimes plate-like.

COLORATION: In preservative, right cheliped white on the dorsal surfaces of chela and carpus; mesial face of carpus red and white striped; merus red dorsally and red and white striped mesially and laterally. Left cheliped and ambulatory legs with red and white stripes.

MATERIAL EXAMINED: Holotype: ♀ (SL = 2.8 mm), TAU, Eilat, Gulf of Aqaba, Israel, Sep. 1952, coll. Ch. Lewinsohn. Paratypes: 1 ♂ (SL = 2.6 mm), 1 non-ovigerous ♀ (SL = 2.9 mm), 1 ovigerous ♀ (SL = 3.0 mm), NIOJ, AHF, Saparua sta. 1, Pulau Saparua, Indonesia, 3°36′S, 128°39.5′E, Mar. 29, 1975, coll. "Alpha Helix". 1 ♂ (SL = 3.2 mm), 1 ovigerous ♀ (SL = 3.5 mm), NIOJ, Saparua sta. 3, Pulau Saparua, Indonesia, 3°37.9′S, 128°39.6′E, Mar. 29, 1975, 0–5 m, coll. "Alpha Helix". 1 non-ovigerous ♀ (SL = 2.7 mm), NIOJ, Seram sta. 2, Pulau Marsegu off Seram, Indonesia, 3°00′S, 128°02.5′E, Mar. 31–Apr. 1, 1975, 0–15 m, coll. "Alpha Helix".

AFFINITIES: *Pylopaguropsis lewinsohni* appears most closely related to *P. speciosa* n. sp., as evidenced by the similarities in the sculpturing of the lateral faces of the propodi of the right 3rd pereopods in both species. Although both species also have striped left chelipeds and ambulatory legs, the stripes of *P. lewinsohni* are red and white, whereas those of *P. speciosa* are brilliant yellow and white. The two species are easily separated by the armature of the dactyl and fixed finger of the right cheliped. In *P. lewinsohni* the dorsal surfaces are armed with scattered spines or spinules; the dorsomesial margin has a row of strong spines. In *P. speciosa* these surfaces are covered by closely-spaced, flattened tubercles; the dorsomesial margin is formed by a row of plate-like tubercles.

REMARKS: Neither Henderson's (1896) nor Alcock's (1905) descriptions of *P. magni-*

manus made any mention of the characteristic differences between the dactyls and propodi of the third right and left pereopods, although these differences are apparent in the figure given by Alcock and Anderson (1897). Lewinsohn (1969) described and figured the sculpturing of the lateral faces of the dactyl and propodus of the third right pereopod of his Red Sea specimen; however, he attributed these and other observed differences from the characters described for *P. magnimanus* to the smallness of his specimen. This specimen, assigned to *Pylopaguropsis* cf. *magnimanus* by Lewinsohn, has proved to be this undescribed species. As previously stated, color or color patterns have been the primary characters used in the identifications of specimens as either *P. zebra* (striped) and *P. magnimanus* (solidly colored). With the discovery of additional solidly colored and striped species, the exclusive use of color proved invalid. Lewinsohn collected the Red Sea specimen himself; however, it was more than a decade later when he finished his study of the Red Sea Anomura. As he made no mention of coloration in his specimen, it is probable that it had, by that time, lost all color. Had he been able to observe the striped legs of *P. lewinsohni*, it is probable that Lewinsohn would have attributed this species to *P. zebra* or described it as a new species.

DERIVATION OF NAME: This species is named for the late Dr. Chanan Lewinsohn, outstanding carcinologist and deeply respected colleague.

DISTRIBUTION: Red Sea; Indonesia; 0–10 meters.

Pylopaguropsis teevana (Boone) new combination

Figures 1d, j; 2d, j; 4a; 6a; 8a, b; 10a; 12a; 13g.

Galapagurus teevanus Boone, 1932: 12, fig. 4.—Gordan, 1956: 318.

HOLOTYPE: AMNH 12239.

TYPE LOCALITY: "Arcturus" sta. 54, Gardner Bay, off Hood Island, Galapagos Islands.

DIAGNOSIS: Shield (Fig. 6a) longer than broad. Rostrum acutely triangular, terminating in small spine. Lateral projections broadly triangular, each terminating in small spine.

Ocular peduncles moderately long, inflated basally and tapering to base of slightly dilated cornea, dorsal surface with row of tufts of long setae. Ocular acicles narrow, acutely triangular, with terminal spine; separated basally by less than or basal width of 1 acicle.

Antennular peduncles moderately short; when extended, overreaching ocular peduncles by one-third to one-half length of ultimate segment.

Sternite of 3rd maxillipeds with acute spine on either side of midline.

Right chela (Figs. 8a, b; 10a) with ventral surface of dactyl and lateral half of ventral surface of palm strongly excavated. Dactyl approximately equaling palm in length; set very obliquely; dorsoventrally flattened; dorsal surface weakly convex and with few widely scattered spinules; dorsomesial margin thin, plate-like. Palm convex on dorsal surface, with scattered minute to small tubercles or spinules, and with moderately short, longitudinal groove in the mesial half; dorsolateral margin with row of very tiny, closely-spaced, flattened tubercles; mesial face strongly produced ventrally in proximal half, surface with minute spinules or granules; ventromesial margin developed into crenulate or denticulate ridge; ventral surface minutely granular and slightly depressed mesially, smooth and strongly excavated in lateral half. Carpus subtriangular, elevated in midline and with

irregular double row of small, tuberculate spines; dorsomesial margin with few, low, spinulose tubercles proximally and stronger spines distally; ventromesial margin with row of small spines; ventrolateral margin with irregular row of small granules. Merus triangular; dorsal margin weakly granular and with few short setae; mesial and lateral surfaces somewhat granular, at least ventrally; ventromesial margin with row of spines, strongest distally; ventrolateral margin spinulose proximally and with moderately strong spines distally.

Left cheliped (Fig. 12a) moderately long, slender, reaching approximately to base of dactyl of right. Dactyl approximately length of palm; surfaces unarmed but with numerous tufts of long setae. Palm with sloping dorsal surface; all surfaces unarmed but with tufts of long setae. Carpus slender; dorsal surface with spine at dorsomesial and dorsolateral distal angles and rows of tufts of long setae. Merus with row of acute spines on distal half of ventrolateral margin; ventromesial margin with few, widely-spaced small spines.

Second and 3rd left pereopods with lateral faces of dactyls and propodi evenly convex, lateral face of dactyl of 3rd right (Fig. 4a) slightly flattened; propodus with dorsolateral margin somewhat angular. Dactyls terminating in strong corneous claws; ventral margins each with row of 7 to 9 corneous spines; mesial faces with 2 to 4 corneous spinules distally. Propodi each with 1 or 2 corneous spinules on ventral margins distally. Carpi each with 1 very small spine at dorsodistal margin. Meri unarmed.

Sternite of 3rd pereopods with anterior lobe weakly rounded. Fourth pereopods without preungual process; propodal rasp with 1 very short row of corneous scales.

Telson (Fig. 13g) with posterior lobes subtriangular; separated by shallow median cleft; terminal margins oblique, each with row of small spines.

COLORATION: Right cheliped light yellowish brown, with alternating light tan and dark brown stripes on merus and carpus. Ambulatory legs (laterally) striped with light cream and brown (A. J. Provenzano, Jr. color notes).

MATERIAL EXAMINED: 1 non-ovigerous ♀ (SL = 1.8 mm), 2 ovigerous ♀ (SL = 1.6 mm, 2.0 mm), AHF, Gorgona I., Colombia, Sep. 22, 1961, coll. A. J. Provenzano, Jr. 1 ♂ (SL = 1.5 mm), AHF, "Argosy" sta. 35, east side Gorgona I., Colombia, Sep. 22, 1961, 0.3–3.6 m, coll. A. J. Provenzano, Jr. 2 ♀ (SL = 1.8, 1.9 mm), AHF, east side La Plata I., Ecuador, Oct. 8, 1961, 7.6–9.7 m, coll. A. J. Provenzano, Jr.

AFFINITIES: In the general similarity of the 2nd and 3rd pereopods, *Pylopaguropsis teevana* appears most closely related to four of the new species herein described. However, the structure of its right chela readily separates it from all other species in the genus.

REMARKS: Heretofore, *P. teevana* was known from a single male specimen collected in the Galapagos Islands. Its discovery along the western coast of South America represents a significant extension of its range.

DISTRIBUTION: Pacific coast of Colombia and Ecuador; Galapagos Islands; 0.3–9.7 meters.

Pylopaguropsis pustulosa new species

Figures 1e, k; 2e, k; 4b; 6b; 8c; 10b; 12b; 13h.

HOLOTYPE: USNM 143813.

TYPE LOCALITY: Off Cape Guardaful, Somali, 09°20′N, 50°54′E.

DESCRIPTION: Shield (Fig. 6b) longer than broad; anterior margin between rostrum and lateral projections nearly straight; anterolateral margins sloping; posterior margin truncate; dorsal surface glabrous. Rostrum prominent, acute, reaching beyond bases of ocular acicles. Lateral projections obtusely triangular, with terminal spinule.

Ocular peduncles moderately long, approximately three-fourths length of shield; moderately stout, with corneae slightly dilated; dorsomesial surface with tufts of long setae. Ocular acicles triangular; separated basally by less than basal width of 1 acicle.

Antennular peduncles moderately long, overreaching ocular peduncles by approximately half length of ultimate segment. Ultimate segment with tuft of setae on distal margin and row of setae on dorsal surface laterally. Penultimate segment with scattered setae. Basal segment with acute spine on lateral face.

Antennal peduncles short, only slightly overreaching ocular peduncles. Fifth and fourth segments with few tufts of setae. Third segment with small spine at ventrodistal margin. Second segment with dorsolateral distal angle produced, terminating in small, simple or weakly bifid spine, mesial and lateral margins with few setae; dorsomesial distal angle with small spine, mesial face with few setae. First segment with ventral margin produced, 1 acute spine laterally. Antennal acicle moderately long, almost reaching to extremity of cornea; arcuate; terminating in small spine; dorsomesial margin with row of long setae. Antennal flagellum with long setae every 2 to 4 articles, interspersed with numerous short setae.

Sternite of third maxillipeds with median suture. Merus of third maxilliped with distal spine.

Right cheliped (Figs. 8c; 10b) with dactyl slightly shorter than palm, not appreciably compressed dorsoventrally, articulating obliquely; terminating in small corneous claw; cutting edge with row of small calcareous teeth; dorsomesial margin with irregular double row of very small blister-like tubercles, dorsal surface slightly convex and with scattered tiny tubercles or granules and with few scattered short setae; mesial face not delimited ventrally; mesial and ventral surfaces with numerous blister or pimple-like small tubercles or granules. Palm slightly longer than carpus; dorsomesial margin delimited proximally by irregular row of small tubercles; dorsal surface slightly convex, roughened, and with few, scattered very tiny tubercles, row of stronger tubercles on proximal margin; dorsolateral margin delimited by double row of small tubercles only on fixed finger; mesial face with scattered low protuberances and tufts of setae; ventromesial margin not delimited; ventral surface with rows of closely-spaced small tubercles. Carpus approximately equaling merus in length; dorsomesial margin with irregular double row of small spines; dorsodistal margin with row of small spines extending onto lateral face, dorsal midline with row of small spines; dorsolateral margin not delimited, dorsolateral surface and lateral face dorsally minutely spinulose; mesial face minutely spinulose dorsally and with several blunt tubercles ventrally; ventromesial margin somewhat produced and with few tubercles; ventral surface minutely tuberculate. Merus with very low, transverse ridges and short setae on dorsal margin; mesial and lateral faces with few tubercles, smaller but more numerous laterally; ventromesial margin with few spinules and tuft of setae distally; ventral surface with scattered tubercles and row of tubercles on distal margin; ventrolateral margin with row of spines. Ischium unarmed.

Left cheliped (Fig. 12b) elongate, slender; propodal-carpal articulation twisted counterclockwise approximately 70°; dactyl and fixed finger slightly longer than palm. Dactyl with few low protuberances and tufts of setae on all surfaces. Palm approximately two-thirds length of carpus; dorsal surface with few spinulose tubercles and tufts of long setae dorsally, and scattered setae on all surfaces of palm and fixed finger. Carpus slightly shorter than merus; dorsomesial margin with row of spines, strongest distally; dorsolateral margin with 2 spines distally, dorsal surface with tufts of long setae; ventral, mesial and lateral surfaces with few scattered tufts of setae. Merus laterally compressed; dorsal surface with scattered setae; ventrolateral margin with row of acute spines, strongest distally; ventromesial margin with few spinules proximally. Ischium unarmed.

Second right pereopod missing; 3rd right (Fig. 4b) with very faint longitudinal sulcus on lateral face of dactyl; 2nd left and 3rd pereopods otherwise generally similar. Dactyls long, terminating strong corneous claws; ventral margins each with row of very strong, closely-spaced corneous spines; dorsal margins each with row of small to moderately strong, corneous spines and tufts of long setae; mesial faces each with dorsal and ventral rows of strong corneous spines; lateral faces each with row of corneous spines. Propodi with tufts of setae on dorsal surfaces; ventral surfaces with row of small corneous spinules (3rd right) or few corneous spinules distally (2nd and 3rd left). Carpi with scattered setae on dorsal surface, dorsodistal margin with small spine. Meri with setae on dorsal and ventral surfaces. Ischia unarmed.

Sternite of third pereopods with anterior lobe subsemicircular. Fourth pereopods with small preungual process at base of claw; propodal rasp (Fig. 2k) with 2 rows of corneous scales.

Telson (Fig. 13h) with posterior lobes distinctly asymmetrical; separated by narrow median cleft; terminal margins oblique, each with several strong spines.

COLORATION: Not known.

MATERIAL EXAMINED: Holotype: ♂ (SL = 3.7 mm), USNM, Anton Bruun sta. 9-437, 09°20′N, 50°54′E, 90 m, December 16, 1964, coll. H.A. Feldmann.

REMARKS: In his doctoral dissertation, Witherington (1973: 134, pl. 14, figs. 1–3) described this specimen under the manuscript name *Pylopagurus mabberensis*. According to the International Code of Zoological Nomenclature (1985) this name is not available (Article 10) as his study was not issued in an edition containing simultaneously obtainable copies and, therefore, does not constitute a publication [Article 8(a)].

Contrary to Witherington's (1973: 135) description, this species has 13 pairs of trichobranchiate gills. The species is described from a single male specimen; however, it agrees, in all characters exhibited by males, with *Pylopaguropsis*.

In the uniformity of shape of the 3rd pereopods, *P. pustulosa* agrees with species of the *teevana*-group of this genus. A faint longitudinal sulcus is present on the lateral face of the 3rd right pereopod as it is in *P. teevana* and *P. fimbriata* but not in *P. garciai* n. sp. or *P. laevispinosa* n. sp..

DERIVATION OF NAME: The specific name is from the Latin *pustulosus* meaning full of pimples or blisters, and reflects the blister or pustule-like armature of the dactyl and fixed finger of the right chela in this species.

DISTRIBUTION: Known only from the type locality, Ras Mabber, Somalia.

Pylopaguropsis garciai new species

Figures 4c; 6c; 8d; 10c; 12c; 13k.

HOLOTYPE: AHF 851.
TYPE LOCALITY: Off Hanga Roa, Easter Island.
DESCRIPTION: Shield (Fig. 6c) slightly longer than broad; anterior margin between rostrum and lateral projections slightly concave; anterolateral margins sloping; posterior margin truncate; dorsal surface with few tufts of setae. Rostrum acutely triangular, exceeding lateral projections and reaching approximately to midpoint of ocular acicles; terminating in small spinule. Lateral projections obtusely triangular, terminating in minute spinule.

Ocular peduncles moderately short; corneae not dilated. Ocular acicles slender, triangular, terminating acutely; separated basally by approximately basal width of 1 acicle.

Antennular peduncles moderately short, when extended over-reaching ocular peduncles by approximately one-fourth length of ultimate segment. Ultimate segment with tuft of setae near dorsolateral distal margin and few scattered setae on dorsal surface mesially. Penultimate segment unarmed. Basal segment with slender, acute spine on lateral face distally.

Antennal peduncles moderately short, overreaching ocular peduncles by one-third length of ultimate segment. Fifth and fourth segments with few setae. Third segment with small spinule at ventrodistal margin. Second segment with dorsolateral distal angle produced, terminating in acute spine; lateral margin with few long, stiff setae, mesial margin with few shorter setae; dorsomesial distal angle with acute spine, mesial margin with few setae. First segment with ventral margin produced and with 2 small spines laterally. Antennal acicle moderately long, arcuate; terminating in strong spine; dorsomesial margin with double row of long, stiff setae. Antennal flagella missing.

Sternite of 3rd maxillipeds with small cleft in midline. Third maxilliped with small spine on dorsodistal margin of merus.

Right cheliped (Figs. 8d; 10c) with chela somewhat dorsoventrally flattened. Dactyl approximately as long as palm and set at strongly oblique angle; terminating in small calcareous tooth; cutting edge with interrupted row of small calcareous teeth; dorsal surface convex and with numerous small, blunt tubercles; dorsomesial margin with row of acute spines; ventral surface also convex, with closely-spaced, low, flattened tubercles. Palm approximately one-third longer than carpus; dorsal surface with numerous, low, spinulose tubercles; dorsomesial margin not well defined; dorsolateral margin with row of low spines, strongest on fixed finger; mesial and ventral surfaces with low spinulose or blunt tubercles. Carpus trapezoidal; dorsal surface elevated in midline and with short transverse rows of low spinulose tubercles; dorsomesial surface sharply sloping distally, dorsomesial margin weakly delimited, 2 moderately strong spines and few smaller spines in general area of margin and irregular row of low tubercles proximally; dorsolateral surface also sloping, dorsolateral margin not delimited; dorsodistal margin with 5 spinulose tubercles; mesial face with low, flattened tubercles dorsally; ventromesial margin and ventral surface produced, and with closely-spaced, low, flattened tubercles. Merus triangular, slightly longer than carpus; dorsal surface with low protuberances; mesial and lateral faces glabrous; ventromesial margin with row of tubercles becoming spiniform distally; ventral surface with numerous low tubercles; ventrolateral margin with strong acute spine and few

spinules distally, few low tubercles or spinules proximally. Ischium with row of minute spinules on ventral margin.

Left cheliped (Fig. 12c) small, slender; propodal-carpal articulation with slight counterclockwise twist. Dactyl and fixed finger broken. Palm approximately one-half length of carpus; all surfaces unarmed, but with scattered moderately long to long setae. Carpus slightly longer than merus; dorsomesial margin with row of acute spines distally becoming low, spinulose protuberances proximally; 1 small acute spine on dorsolateral margin distally; all surfaces with scattered tufts of long, stiff setae. Merus laterally compressed; dorsal margin with scattered setae; ventromesial margin with acute spine on distal half, small blunt spines proximally; dorsolateral margin with row of spines and tufts of long, stiff setae. Ischium with row of setae on ventral margin.

Second and 3rd pereopods (Fig. 4c) generally similar from right to left. Dactyls of 3rd slightly longer than 2nd; each terminating in strong corneous claw; dorsal surfaces with tufts of short, stiff setae; ventral margins each with row of 11 to 15 corneous spines; mesial faces with tufts of setae (2nd) or dorsal and ventral rows of small corneous spines and shallow, longitudinal sulcus proximally (3rd). Propodi slightly longer than carpi; ventrodistal margins each with 1 or 2 corneous spinules, ventral margins each with row of very small corneous spinules. Carpi two-thirds length of meri (2nd) or only slightly shorter (3rd); dorsal surfaces each with low protuberances and tufts of moderately long setae, distal margins each with acute spine. Meri laterally compressed; ventral margins with tufts of short to moderately long setae. Ischia with long setae on ventral margins.

Sternite of 3rd pereopods with moderately broad, subtriangular anterior lobe. Fourth pereopod without preungual process; propodal rasp with 1 short row of corneous scales.

Telson (Fig. 13k) with posterior lobes subtriangular; separated by moderately deep median cleft; terminal margins oblique, each with several strong spines; anterior lobes with stiff marginal setae.

COLORATION: In life (from 35 mm photographic slide): Shield white. Ocular peduncles with basal third reddish orange, distal two-thirds golden. Antennular and antennal peduncles red. Right cheliped with palm golden yellow with darker splotches of yellow orange. Left cheliped and ambulatory legs with red and white longitudinal stripes. In preservative: shield white. Ocular peduncles with basal third white, distal two-thirds yellowish cream; ocular acicles pinkish red basally, opaque distally. Antennular peduncles pinkish red. Antennal peduncles pinkish red or whitish with pink splotches on first through fourth segments, fifth segment pink dorsally and ventrally, white laterally and with white longitudinal stripe on mesial face; acicles pinkish red. Right cheliped with palm whitish with splotches of yellow-orange; carpus light pinkish-yellow dorsally, darker ventrally; merus pink with 2 longitudinal white stripes on lateral face, 3 darker red stripes on mesial face. Left cheliped with pink and white longitudinal stripes on all segments. Ambulatory legs with dactyls and propodi white ventrally and dorsally, mesial and lateral faces red with white longitudinal stripe; carpi pinkish-red ventrally and with red and white stripes mesially and laterally; meri white ventrally, red dorsally and with mesial and lateral faces red and white striped.

MATERIAL EXAMINED: Holotype: ♂ (SL = 4.9 mm), AHF, National Geographic Expedition, 25-85-1, off Hanga Roa, Easter Island, Feb. 1985, 40 meters, coll. H. Garcia.

AFFINITIES: In the relative thinness and general similarity of the dactyls and propodi of

the 2nd and 3rd pereopods, *Pylopaguropsis garciai* appears close to *P. teevana, P. fimbriata* and *P. laevispinosa.* However, *P. garciai* lacks the distinctive shape (*P. teevana*) or ornamentation (*P. fimbriata*) of the right cheliped of the former two species and the spination of the left chela of the latter species.

REMARKS: As with *P. fimbriata* and *P. pustulosa, P. garciai* is described from a male specimen. Although this species lacks the dissimilar, and distinctive, dactyl and propodus of the 3rd right pereopod, it agrees in all characters with the *teevana*-type group of species in the genus. Therefore, we believe that placement of this species in *Pylopaguropsis* is correct.

DERIVATION OF NAME: This species is named for its collector, H. Garcia.

DISTRIBUTION: Known only from type locality, Easter Island; 40 meters.

Pylopaguropsis fimbriata **new species**

Figures 1f, 1; 2f; 4d; 6d; 8e; 10d; 12d; 13i.

Pylopaguropsis zebra: Wooster, 1979: 173 [not *Pylopaguropsis zebra* (Henderson)].

Pylopaguropsis undescribed sp. 2: Haig and Ball, 1988: 190.

HOLOTYPE: USNM 231413.

TYPE LOCALITY: Fafai Beach, Guam, 13°31′N, 144°48′E.

DESCRIPTION: Shield (Fig. 6d) slightly longer than broad; anterior margin between rostrum and lateral projections straight or slightly concave; anterolateral margins terraced; posterior margin roundly truncate; dorsal surface glabrous. Rostrum triangular, acute; terminating in small spine and considerably overreaching lateral projections. Lateral projections obtusely triangular; terminating in small margin spinule.

Ocular peduncles moderately long, approximately three-fourth length of shield; corneae slightly dilated. Ocular acicles narrowly triangular, acute terminating in small spinule; separated basally by own width or slightly more than basal width of 1 acicle.

Antennular peduncles moderately short, only slightly overreaching ocular peduncles. Ultimate segment with 1 or 2 setae near dorsolateral distal angle. Penultimate segment with few scattered setae. Basal segment with slender, acute spine on dorsolateral margin.

Antennal peduncles slightly overreaching ocular peduncles. Fifth and fourth segments with few scattered setae. Third segment with very small spinule on ventrodistal margin. Second segment with dorsolateral distal angle produced, terminating in small spine, mesial and lateral margins glabrous; dorsomesial distal angle with slender, acute spine, mesial margin with few setae. First segment with ventral margin produced and with 1 acute spine laterally. Acicle reaching approximately to base of corneae, somewhat arcuate; unarmed. Flagellum with 1 or 2 long setae every 2 or 3 articles and very short setae on some articles.

Sternite of 3rd maxillipeds with 1 spine on either side of midline.

Right cheliped (Figs. 8e; 10d) with dactyl slightly shorter than palm; articulation weakly to strongly oblique; slightly compressed dorsoventrally; terminating in small calcareous tooth; cutting edge with row of moderately small, calcareous teeth; dorsomesial margin usually with row of moderately closely-spaced spines or spinulose tubercles, occasionally only weakly crenulate; dorsal surface somewhat elevated in midline and with moderately closely-spaced small tubercles. Palm approximately equaling length of carpus;

dorsal surface rounded centrally and with two rows of widely-spaced blunt tubercles or acute spines, margins elevated and armed with small to moderately prominent spines and fringed with row of long setae, not extending onto fixed finger; mesial and lateral faces not well defined; ventral surface usually tuberculate, occasionally almost smooth; fixed finger with elevated midline forming rounded ridge armed with low tubercles and with marginal row of closely-spaced tubercles. Carpus equaling merus in length; subtriangular to trapezoidal; dorsal surface elevated in midline and with row of spines or tubercles, distal margin with widely-spaced tuberculate spines; dorsomesial margin with row of small spines, more widely spaced distally, mesial face minutely tuberculate dorsally; dorsolateral margin with row of acute to blunt spines; ventromesial margin with few tubercles distally; ventral surface granular. Merus triangular; dorsal surface with few low protuberances; mesial surface with few minute granules in dorsal half, ventromesial margin with row of small tubercles, becoming acute spines distally; ventral surface weakly tuberculate; ventrolateral margin with row of small spines, strongest proximally. Ischium unarmed.

Left cheliped (Fig. 12d) reaching to base of fixed finger of right; propodal-carpal articulation twisted counterclockwise 30 to 60°. Dactyl slightly longer than palm; dorsal surface with short row of spinules in midline and in proximal half and marginal row proximally. Palm approximately half length of carpus; dorsomesial and dorsolateral margins each with row of small spines; dorsal midline usually with irregular double row of small spines, extending onto fixed finger; mesial face spinulose or granular; ventral surface with few spinules or granules and numerous tufts of setae. Carpus approximately equaling length of merus; dorsal surface with row of moderately strong, acute spines on dorsomesial margin; dorsolateral margin with row of low protuberances and 1 strong spine at distal angle; lateral face minutely tuberculate; mesial face with few transverse rows of low protuberances and short setae; ventral surface with scattered setae. Merus triangular, dorsal surface unarmed; ventromesial margin with 2 or 3 spines, strongest proximally; ventrolateral margin with row of small spines, also strongest proximally. Ischium with 1 or 2 tiny spinules on ventral margin.

Ambulatory legs not markedly dissimilar from right to left. Dactyls moderately long, overreaching propodi by one-third own length; terminating in strong corneous claws; ventral margins each with row of strong corneous spines; dorsal surfaces each with row of tufts of long, moderately stiff setae; lateral faces glabrous or with few scattered setae (Fig. 4d); mesial faces each with dorsal and ventral rows of corneous spines, strongest on 3rd. Propodi one-half to two-thirds longer than carpi; dorsal surfaces each with row of tufts of short setae; ventral margins each with row of corneous spinules; mesial and lateral faces glabrous. Carpi approximately two-thirds length of meri; dorsodistal margins each with small spinule; dorsal and ventral surfaces with scattered setae; mesial and lateral faces glabrous. Meri with few scattered setae dorsally and ventrally. Ischia with few setae on ventral margins.

Sternite of 3rd pereopods with anterior lobe subsemicircular. Fourth pereopods with short dactyls and claws, preungual process prominent; propodal rasp with 5 or 6 widely-spaced corneous scales; carpus with small spinule at dorsodistal margin.

Telson (Fig. 13i) with posterior lobes somewhat subrectangular; separated by shallow median cleft; terminal margins almost horizontal, each with moderately widely-separated spines, often extending onto lateral margins.

COLORATION: In life: Shield white with transparent brownish mottling and yellow brown specks behind ocular acicles, large brownish area centrally. Ocular acicles white; ocular peduncles and corneae bright yellow. Antennal acicles with parallel stripes of red and white; first segments of peduncle white, distal segments with parallel red and white stripes; flagella red dorsally, lighter ventrally, with yellow setae. Antennular peduncles and flagella pale bluish purple. Merus and inner surface of carpus of right cheliped with parallel red and white stripes, other surfaces whitish; palm white with few yellow spots. Left cheliped with dactyl and fixed finger tipped with brown, palm reddish white, carpus and merus with parallel red and white stripes. Ambulatory legs with parallel red and white stripes on all segments, setae yellow (Wooster, 1979). In preservative: Striping often apparent for more than one year.

MATERIAL EXAMINED: Holotype: ovigerous ♀ (SL = 2.9 mm), USNM, GUM sta. 102-A, Fafai Beach, Guam, 13°31′N, 144°48′E, Apr. 12, 1984, 15 m, coll. R. Kropp. Paratypes: 1 non-ovigerous ♀ (SL = 3.4 mm), AHF, Tanguisson, Guam, 13°33′N, 144°49′E, Mar. 25, 1976, 11 m., coll. D. Wooster. 2 ♂ (SL = 3.4, 2.4 mm), 1 non-ovigerous ♀ (2.3 mm), USNM, GUM sta. 104, Orote Cliffs, Guam, 13°26′N, 144°38′E, Apr. 16, 1984, 30 m, coll. R. Kropp & V. Tyndzik. 1 non-ovigerous ♀ (SL = 3.2 mm), NIOJ, Saparua sta. 3, Pulau Saparua, Indonesia, 3°37.9′S, 128°39.6′E, Mar. 29, 1975, 0–5 m, coll. "Alpha Helix". 1 ♂ (SL = 1.6 mm), NIOJ, Seram sta. 2, Pulau Marsegu off Seram, Indonesia, 3°00′S, 128°02.5′E, Mar. 31–Apr. 1, 1975, 0–15 m, coll. "Alpha Helix". 1 non-ovigerous ♀ (SL = 2.5 mm), CAS 003960, Borneo (Kuching area, east Malaysia), Nov., 1975, coll. F. Steiner.

AFFINITIES: Like *P. teevana, P. garciai, P. laevispinosa* n. sp. and *P. pustulosa, P. fimbriata* lacks the often prominent sculpturing of the lateral faces of the dactyl and propodus of the 3rd right pereopod characteristic of the *magnimanus*-like species of *Pylopaguropsis*. However, it is immediately distinguished from the other *teevana*-group species, and all from others in the genus, by the palm of its right cheliped, which bears a fringe of spines and long setae.

REMARKS: *Pylopaguropsis fimbriata* is one of the five species of the genus now known to have a pattern of red and white longitudinal stripes on the ambulatory legs, and it presumably was this color pattern that led Wooster (1979) to identify his specimen as *Pylopaguropsis zebra*.

DERIVATION OF NAME: The specific name is taken from the Latin *fimbriatus* meaning fringed and refers to the fringe of spines and setae on the palm of the right cheliped diagnostic of this species.

DISTRIBUTION: Guam; east Malaysia; Indonesia; to 15 meters.

Pylopaguropsis laevispinosa new species

Figures 21; 4e; 6e; 8f; 10e; 12e; 13j.

HOLOTYPE: USNM 231412.

TYPE LOCALITY: Okinawa, 26°30.0′N, 127°50.9′E.

DESCRIPTION: Shield (Fig. 6e) longer than broad; anterior margin between rostrum and lateral projections concave; anterolateral margins slightly terraced; posterior margin truncate; dorsal surface very slightly rugose. Rostrum obtusely triangular, slightly overreach-

ing lateral projections; terminating in very small spinule. Lateral projections obtusely triangular; terminating in small, acute, marginal spine.

Ocular peduncles moderately long, only slightly shorter than shield, slender; very slightly inflated basally and with corneae only very slightly dilated. Ocular acicles triangular, acute; separated by slightly more than basal width of 1 acicle.

Antennular peduncles long; when extended, exceeding ocular peduncles by approximately one-half length of ultimate segment. Ultimate segment with 1 or 2 setae at dorsolateral distal angle. Penultimate segment unarmed. Basal segment with tiny spinule at ventrodistal margin; slender, acute spine on lateral face dorsally.

Antennal peduncles moderately short, reaching approximately to base of corneae. Fifth and fourth segments with few scattered setae. Third segment with strong spine at ventrodistal margin. Second segment with dorsolateral distal angle produced, terminating in strong simple or weakly bifid spine, mesial and lateral margins with few scattered setae; dorsomesial distal angle with small spine, mesial margin with few setae. First segment with ventrodistal margin produced and with 1 spine laterally. Antennal acicle moderately long; strongly arcuate; terminating in small spine; dorsomesial margin with row of moderately long setae. Flagella with 2–4 long setae every 2 or 3 articles, interspersed by short setae, at least proximally.

Sternite of 3rd maxillipeds unarmed.

Right chela (Figs. 8f; 10e) somewhat dorsoventrally compressed; dactyl as long as palm or slightly shorter; articulation only slightly oblique; terminating in small corneous claw; cutting edge with row of small calcareous teeth proximally and distally, separated by 1 larger calcareous tooth; dorsomesial margin with row of strong spines; dorsal surface with scattered spines; mesial face with scattered setae, ventromesial margin with row of spinulose tubercles. Palm approximately equaling carpus in length; dorsomesial margin with irregular single or double row of moderately strong spines; dorsal surface of palm and fixed finger with numerous spines, sometimes forming irregular rows; dorsolateral margin with row spines, strongest on fixed finger; ventral surface convex, tuberculate laterally and granular medially. Carpus two-thirds to three-fourths length of merus; dorsomesial and dorsolateral margins not clearly delimited; dorsal surface with row of strong spines mesially and laterally and irregular transverse row of strong spines on distal margin, extending onto mesial and lateral faces; mesial face tuberculate; lateral face spinulose; ventral surface tuberculate. Merus triangular; dorsal margin unarmed; lateral face granular ventrally, ventrolateral margin with row of acute spines; mesial face weakly granular ventrally, ventromesial margin with row of acute spines; ventroproximal margin with prominent blunt tubercle, ventral surface weakly tuberculate. Ischium with few scattered setae.

Left cheliped (Fig. 12e) long, slender; propodal-carpal articulation twisted counterclockwise 30 to 40°. Dactyl slightly longer than palm; dorsal surface with row of small spines; dorsomesial margin with row of strong spines, not extending to tip. Palm with 2 irregular rows of strong spines in midline of sloping dorsal surface, 1 extending onto fixed finger as small spinulose tubercles; dorsal surface mesially and laterally each with row of moderately strong spines; ventral surface with low protuberances and tufts of setae, 1 row of small spines laterally in distal portion of palm and proximal portion of fixed finger; mesial face tuberculate. Carpus slightly shorter than merus; dorsal surface with 2 rows of corneous-tipped spines, strongest distally; mesial and lateral faces with scattered setae;

ventral surface with scattered low tubercles. Merus with dorsal margin, mesial and lateral faces unarmed; ventrolateral margin with row of strong, acute spines; ventromesial margin with row of smaller, subacute spines and prominent spinulose tubercle at ventromesial proximal angle. Ischium with few scattered setae.

Second and 3rd (Fig. 4e) pereopods generally similar. Dactyls long, slender; exceeding propodi by one-third to one-half own length; terminating in strong corneous claws; ventral margins each with row of strong, corneous spinules; mesial faces each with dorsal row of corneous spinules and few corneous spinules ventrally, left also with faint longitudinal sulcus; dorsal surfaces with few scattered setae; lateral faces each with faint longitudinal sulcus. Propodi approximately one-third longer than carpi; dorsal surfaces with scattered setae; ventral surfaces with few corneous spinules; lateral faces evenly convex, unarmed. Carpi two-thirds length of meri (2nd) or only slightly shorter than meri (3rd); dorsal surfaces each with row of small spines or spinules (2nd) or with only dorsodistal spine (3rd). Meri unarmed, with few scattered setae. Ischia with scattered setae.

Sternite of 3rd pereopods with anterior lobe subsemicircular. Fourth pereopods with moderately short dactyl, no preungual process; propodal rasp (Fig. 21) with 1 short row of corneous scales.

Telson (Fig. 13j) with posterior lobes separated by shallow median cleft; terminal margins oblique, each with row of small spines, extending onto lateral margins, particularly on left.

COLORATION: In preservative: Shield orange tinged, rostral margin accentuated in dark orange. Ocular peduncles cream; acicles with margins accentuated in orange. Antennular peduncles cream, with faint yellowish brown in distal third of ultimate segment. Antennal peduncles with orange stripe on ultimate segment dorsally and on mesial face ventrally; fourth segment orange and white striped dorsally and white ventrally; acicle with broad orange longitudinal stripe on dorsal surface. Right cheliped with chela faint orange or cream-colored; carpus generally with faint orange hue, mesial, lateral and dorsal surfaces orange with white stripe proximally. Merus orange and white striped dorsally and on dorsal halves of mesial and lateral faces; ventral surface with faint orange hue. Left cheliped with chela very faint orange; carpus and merus with orange and white longitudinal stripes. Second and third pereopods with orange and white longitudinal stripes.

MATERIAL EXAMINED: Holotype: ovigerous ♀ (SL = 3.8 mm), USNM, sta. RFB 886, 1 km WNW Onna Village (Horseshoe cliffs), Okinawa, Aug. 9, 1981, 3–12.2 m, coll. R. Bolland (SOSC). Paratype: 1 non-ovigerous ♀ (SL = 4.2 mm), USNM 231410, sta. RFB 898, 1 km WNW Onna Village, Okinawa, Aug. 16, 1981, 70.1 m, coll. R. Bolland (SOSC).

AFFINITIES: In the similarity of the ambulatory legs, *Pylopaguropsis laevispinosa* appears to be most closely related to the *teevana*-group species of the genus. However, it differs from all other species in having only a slightly oblique articulation of the dactyl of the semioperculate right chela and in possessing strongly spinose right and left chelae.

REMARKS: As commented upon in the discussion of Alcock's (1905) unnamed variety of *P. zebra* from the Andaman Islands (p. 124), the possibility exists that *P. laevispinosa* is actually that taxon. Both apparently possess the "zebra-like" striping of the left cheliped and ambulatory legs and a spinose left chela. However, as there is some question about the accuracy of Alcock's identification of Henderson's "*E. zebra*", the matter can be resolved only by an examination of Alcock's specimen.

DERIVATION OF NAME: The specific name is from the Latin *laevus*, meaning of the left hand; and *spina*, meaning thorn, and reflects the uncommonly spinous left chela of this species.
DISTRIBUTION: Known only from the type locality, Okinawa, 3 to 70 meters.

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