

## A strikingly coloured new species of *Paragiopagurus* Lemaitre, 1996 (Crustacea: Decapoda: Anomura: Parapaguridae) from French Polynesia

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### Abstract

A new deep-water hermit crab species, *Paragiopagurus fasciatus*, is described from the Austral Islands, French Polynesia. This new species has a distinct colour pattern consisting of red stripes on the shield and ambulatory legs, and is also distinguished by having short antennal peduncles, strongly armed carpus of the left cheliped, and in females, laterally armed telson. This new species is the fourth of the genus, and the twelfth of the family, recorded from French Polynesia. The closest morphological affinities of *P. fasciatus* n. sp. are with *P. bougainvillei* (Lemaitre, 1994) and *P. wallisi* (Lemaitre, 1994), two species also known so far exclusively from French Polynesia. A taxonomically updated list of species from French Polynesia is presented.

**Key words:** Crustacea, Decapoda, Anomura, Parapaguridae, *Paragiopagurus*, deep-water, hermit crab, French Polynesia, Austral Islands, systematics, new species

### Introduction

A new species of Parapaguridae of the genus *Paragiopagurus* Lemaitre, 1996, with distinctly coloured shield, chelipeds, and pereopods, has been discovered while studying deep-water collections from a French expedition to the Austral Islands, the southernmost islands of French Polynesia. While a number of other parapagurids have striped colour patterns on the ambulatory legs, no other member of this family for which coloration is known, has the striking, striped colour pattern seen on the shield of this new species. This new species is the fourth in this genus known from French Polynesia, and the third, along with *P. bougainvillei* (Lemaitre, 1994) and *P. wallisi* (Lemaitre, 1994) to be known so far

exclusively from this Polynesian region. In addition to coloration, this new species is morphologically distinct in characters of the antennal peduncles, left cheliped, and telson in females.

With the addition of the new species described in this study, there is now a total of 12 parapagurids known from French Polynesia. The parapagurid fauna from this region is known based on a number of studies published only during the last 14 years (Poupin *et al.* 1990; Lemaitre 1994, 1998, 2004, in press; Poupin 1996a, b). Lemaitre (1994) and Poupin (1996b) have provided lists of species; however, one new species was described since then (Lemaitre 1998), and drastic taxonomic changes have occurred at the genus level over this period (Lemaitre 1996). To update the information on this parapagurid fauna, a taxonomically updated list of species is presented.

The BENTHAUS Expedition to the Austral Islands took place between October 28 and November 28, 2002, and was named using a combination of the words "BENTHos" and AUStral". It was organized by the Institut de Recherche pour le Développement (IRD, formerly ORSTOM) and the Muséum national d'Histoire naturelle, Paris (MNHN). The measurements in millimetres included in the material examined are of shield length, measured from tip of rostrum to posterior edge of the shield. Other abbreviations used in the manuscript are: DW, Warén dredge; CAS, from the French "Casier", meaning trap; CP, from the French "Chalut à perche"; juv, juvenile(s); ov, ovigerous; stn, station. In describing coloration, the term "stripes" indicates longitudinal portions.

## TAXONOMY

### Family Parapaguridae Smith, 1882

#### Genus *Paragiopagurus* Lemaitre, 1996

#### *Paragiopagurus fasciatus* n. sp. (Figs. 1–4)

*Material examined.* **BENTHAUS Expedition, Austral Islands, French Polynesia.** Holotype: ♂ 9.9 mm, stn CAS 1916, Neilson reef, 27°00.3'S, 146°03.6'W, 180 m, 11 Nov 2002 (MNHN Pg 6919). Paratypes: 1 ov ♀ 9.6 mm, stn CAS 1878, Marotiri Isles, 27°52.3'S, 143°31.7'W, 129–122 m, 5 Nov 2002 (MNHN Pg 6916); 1 juv ♂ 3.3 mm, stn DW 1881, Marotiri Isles, 27°54.6'S, 143°28.5'W, 112–121 m, 6 Nov 2002 (MNHN Pg 6917); 1 ov ♀ 8.6 mm, stn DW 1915, Neilson reef, 27°03.4'S, 146°03.9'W, 120–200 m, 11 Nov 2002 (USNM 1016947, ex MNHN Pg 6918); 1 ♀ 6.5 mm, stn CP 1918, Neilson reef, 27°03.4'S, 146°04.0'W, 130–140 m, 11 Nov 2002 (MNHN Pg 6920).

*Diagnosis.* Antennal peduncles and acicles at most reaching midpoint of corneas. Maxillule with external lobe of endopod obsolete, internal lobe with usually 4 long terminal setae. Right chela dorsoventrally flattened, somewhat operculate; dorsal surface with numerous blunt to sharp spines or tubercles. Carpus of left cheliped armed with strong row of spines. Propodal rasp of fourth pereopods with single row of scales at least distally. Tel-

son asymmetrical; rounded terminal projections armed distally with numerous corneous spines; female with left anterior ventrolateral margin with row of slender, corneous spinules. Male with well developed paired first and second gonopods. Shield coloration white in life, with pair of broad red stripes.

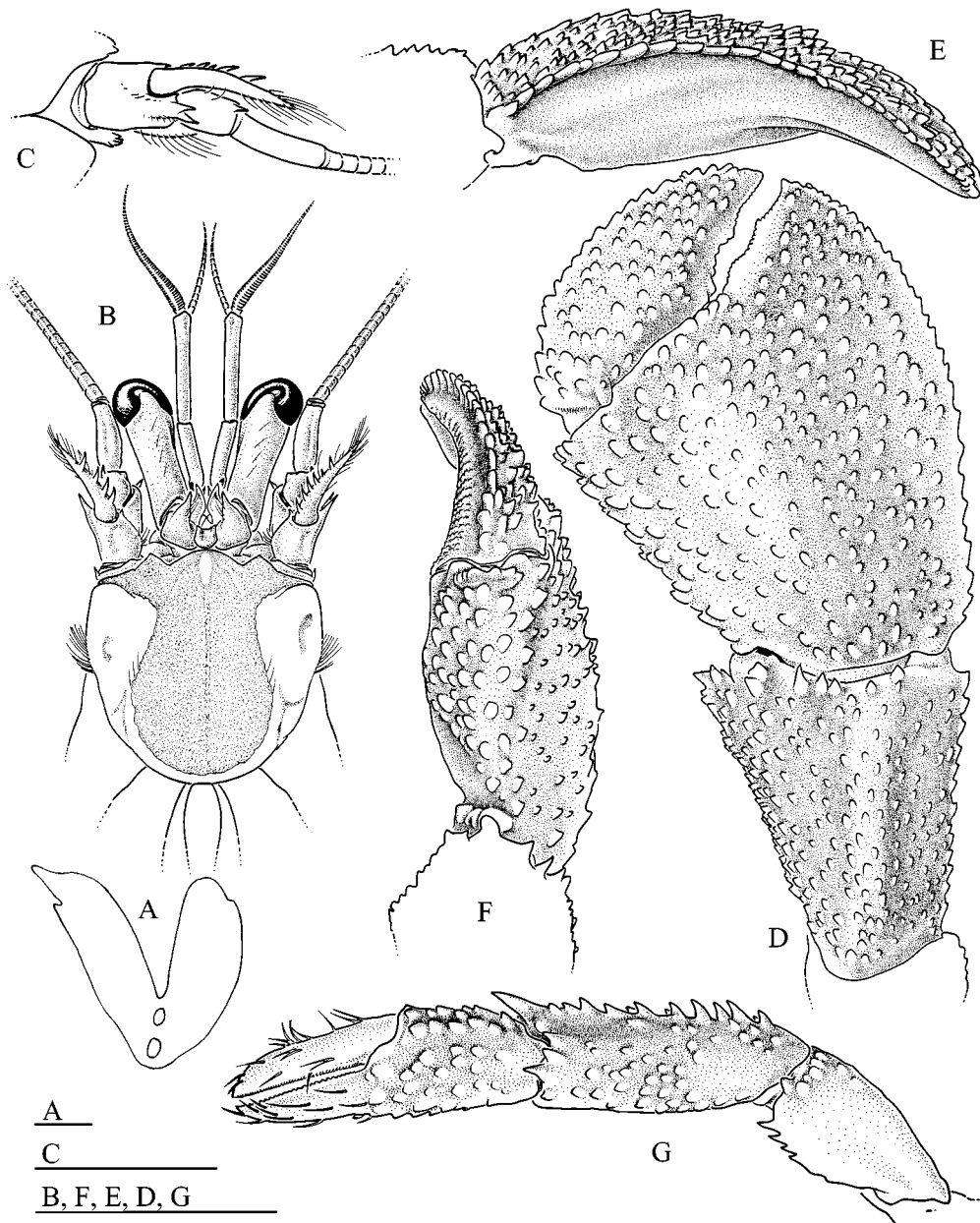
*Description.* Eleven pairs of biserial or quadriserial gills (Fig. 1A) weakly divided distally. Shield (Fig. 1B) approximately as broad as long; dorsal surface weakly calcified along midline and anterior portions; with scattered short setae. Rostrum broadly rounded, with short mid-dorsal ridge, or sometimes narrowing and extending posteriorly for about one-third of shield. Anterior margins of shield concave; lateral projections subtriangular, with terminal spine; anterolateral margins sloping; posterior margin broadly rounded. Anterodistal margin of branchiostegite rounded, unarmed, setose.

Ocular peduncles more than half length of shield, with longitudinal row of short setae on dorsal surface. Cornea slightly dilated. Ocular acicles subtriangular, terminating in strong, simple spine with mesial margins nearly parallel; separated basally by less than width of 1 acicle.

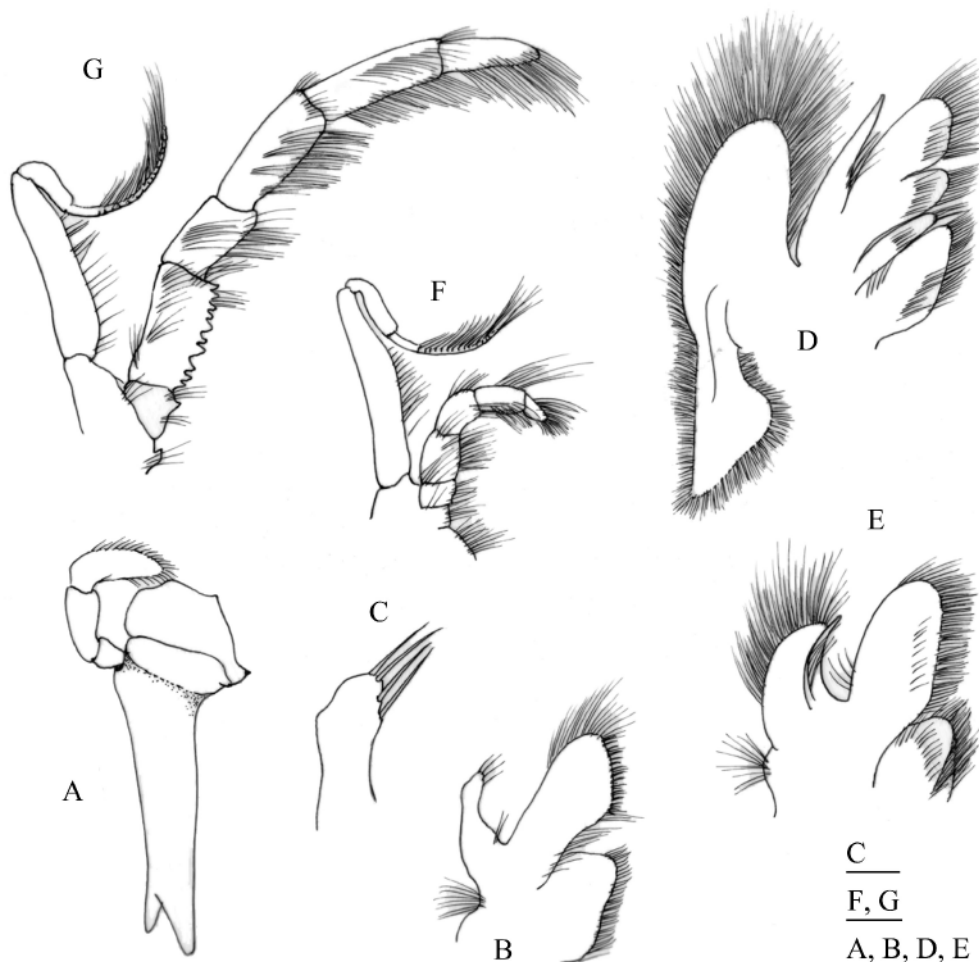
Antennular peduncles exceeding distal margins of corneas by nearly entire length of ultimate segment, with scattered setae dorsally; ventral flagellum with about 6 (juvenile) or 11–15 (adults) articles. Ultimate segment about twice as long as penultimate. Basal segment with strong ventromesial spine; lateral face with distal subrectangular lobe armed with 1–3 spines, and strong spine proximally.

Antennal peduncles (Fig. 1C) not exceeding distal margins of corneas, at most reaching to about midpoint of corneas. Fifth segment unarmed except for setae on laterodistal and mesial margins. Fourth segment with strong spine on dorsolateral distal angle. Third segment with strong ventromesial distal spine. Second segment with dorsolateral distal angle produced, terminating in strong, simple or multifid spine (sometimes with 1 or 2 small spines dorsally) reaching to about midpoint of acicle; mesial margin with spine on dorsolateral distal angle. First segment with spine on lateral surface; ventromesial angle produced, with row of 2 or 3 spines laterally. Antennal acicle weakly curved outward (dorsal view), reaching at most to midpoint of cornea, terminating in strong spine; mesial margin setose, armed with row of 3 (juvenile) to 7 (adults) strong spines. Flagellum well exceeding distal end of right cheliped; with few short (<1 article in length) setae throughout, and at least distally with long setae (1–3 articles in length) every 15–20 articles.

Mandible (Fig. 2A) with 3-segmented palp; cutting edge calcified, with blunt triangular tooth medially. Maxillule (Fig. 2B, C) with external lobe of endopod obsolete, internal lobe with 4 long terminal setae. Maxilla (Fig. 2D) with endopod exceeding distal margin of scaphognathite. First maxilliped (Fig. 2E) with endopod slightly exceeding exopod in distal extension. Second maxilliped (Fig. 2F) without distinguishing characters. Third maxilliped (Fig. 2G) slender; crista dentata with 10–12 corneous-tipped teeth; coxa and basis each with small mesial tooth. Sternite of third maxillipeds with small spine on each side of midline. Epistomial spine short, straight.



**FIGURE 1.** *Paragiopagurus fasciatus* n. sp. A, paratype ♀ 8.6 mm, BENTHAUS, stn DW 1915 (USNM 1016947); B–G, holotype ♂ 9.9 mm, BENTHAUS, stn CAS 1916 (MNHN Pg 6919). A, gill lamella; B, shield and cephalic appendages, dorsal view (stippled area of shield indicates weakly calcified portion); C, right antennal peduncle, lateral view; D, carpus and chela of right cheliped, dorsal view; E, chela of same, lateral view; F, same chela, mesial view; G, left cheliped, lateral-rodorsal view. Scale bars: A = 0.5 mm; B, F, E, D, G = 10 mm; C = 5 mm.



**FIGURE 2.** *Paragiopagurus fasciatus* n. sp., paratype ♀ 8.6 mm, BENTHAUS, stn DW 1915 (USNM 1016947). Left mouthparts, internal view: A, mandible; B, maxillule; C, distal end of endopod of same; D, maxilla; E, first maxilliped; F, second maxilliped; G, third maxilliped. Scale bars: A, B, D, E = 1 mm; C = 0.25 mm; F, G = 1 mm.

Chelipeds markedly dissimilar. Right cheliped (Fig. 1D–F) massive, shorter in juvenile than in adults. Chela dorsoventrally flattened, somewhat operculate, naked or at most with scattered setae; dorsal surface in adults with numerous blunt to sharp spines or tubercles diminishing in size distally on fingers, in juvenile with few tubercles and small, sharp spines; ventral surface minutely granulose; lateral margin of palm and fixed finger well delimited by row of spines. Fingers curved ventromesially, terminating in small, blunt corneous claw; cutting edges each with row of unequal, blunt calcareous teeth. Dactyl about 1.5 times as long as mesial margin of palm, set at strongly oblique angle to longitudinal axis of palm; mesial margin well defined by row of spines; ventromesial face moderately concave. Fixed finger broad at base. Palm distinctly broader than long; dorsomesial mar-

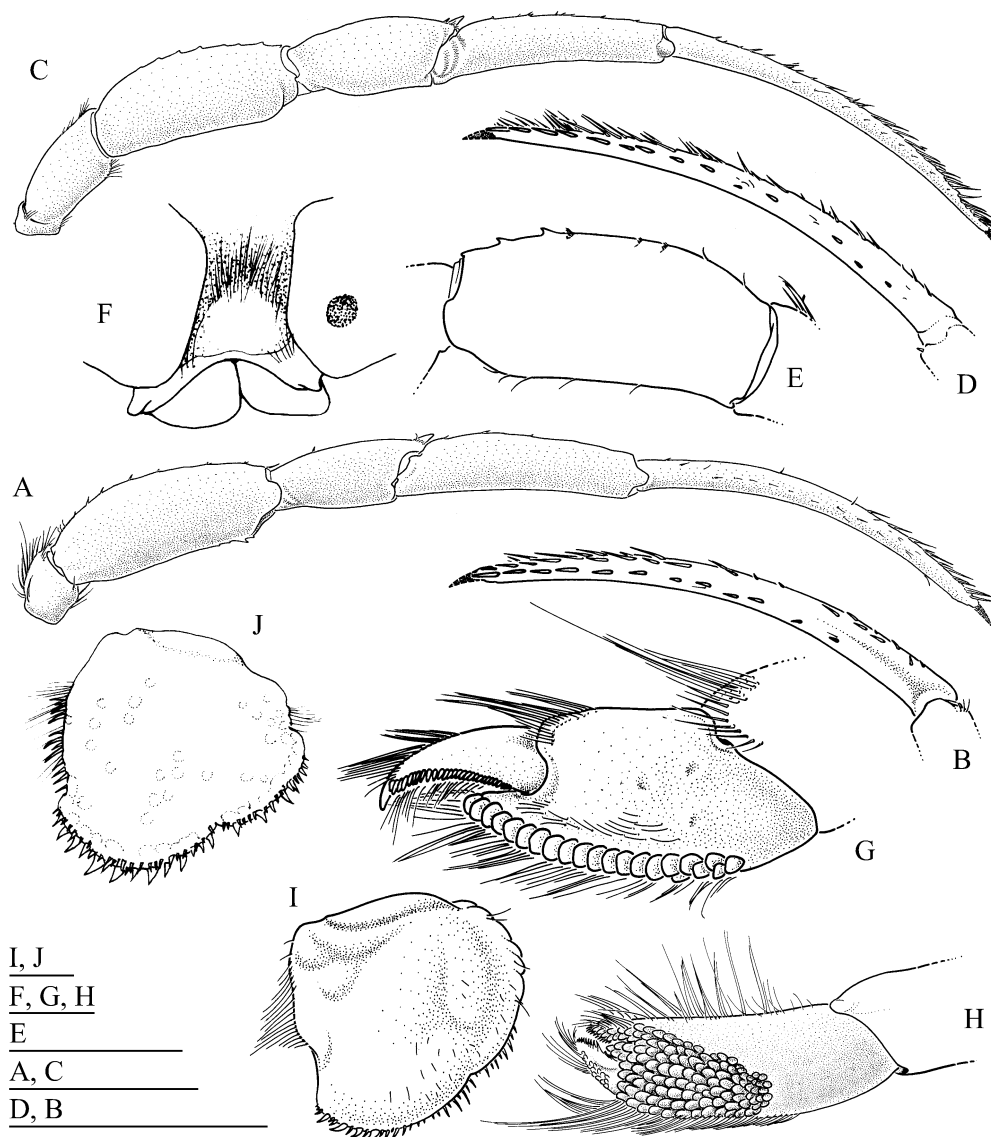
gin delimited by row of small spines; mesial face rounded, with blunt to sharp spines or tubercles. Carpus dorsal surface with armature similar to that of chela but with smaller, sharper spines or tubercles, and with moderately dense, short setae; dorsodistal margin with row of spines increasing in size from lateral to mesial, dorsolateral margin with row of spines; ventral surface with small tubercles; mesial surface rounded, with low tubercles, ventromesial distal margin with row of small blunt spines. Merus with 1 or 2 small dorsodistal spines; lateral and ventral surfaces nearly smooth; ventral surface with small tubercles; ventromesial distal margin with row of small spines. Ischium with ventromesial row of small blunt spines, and some setae on dorsal and ventral surfaces; coxa with ventrodistal row of spines, and row of ventromesial setae.

Left cheliped (Fig. 1G) well calcified. Fingers terminating in sharp corneous claws; dorsal and ventral surfaces unarmed except for tufts of setae; cutting edge of dactyl with row of closely-set small corneous teeth, cutting edge of fixed finger with row of small calcareous teeth. Dactyl longer than palm. Palm with scattered setae; dorsal surface with blunt to sharp spines or tubercles, and dorsomesial and dorsolateral row of spines; ventral surface smooth except for scattered setae. Carpus with long setae mostly dorsally; dorsal margin with row of 8–10 spines (3 in juvenile), and strong dorsodistal spine; dorsodistal margin with 1–3 spines laterally; mesial surface nearly smooth, lateral surface with small spines or tubercles; ventral surface with scattered small tubercles and setae. Merus with row of setae on dorsal margin, and row of bristles on dorsodistal margin; ventrolateral and ventromesial distal margins each with row of spines; ventral surface with long setae and some small tubercles. Ischium unarmed except for dorsal and ventral setae, and ventromesial distal row of small blunt spines. Coxa with spine on distomesial margin, and ventromesial row of long setae.

Ambulatory legs (Fig. 3A–E) similar from right to left, exceeding extended right cheliped by about 0.25 length of dactyl. Dactyl nearly twice as long as propodus, broadly curved, terminating in sharp corneous claw; with dorsal and dorsomesial rows of bristle-like setae, and ventromesial row of small corneous spinules numbering 12–16 in adults or 7–9 in juvenile. Propodus, carpus, and merus with short, bristle-like setae on dorsal margins, usually arranged in groups of 2–4 setae. Carpus with small dorsodistal spine. Merus with dorsal margin lacking spines (first leg), or with row of calcareous spines (second leg). Ischium and coxa unarmed. Anterior lobe of sternite of third pereopods (Fig. 3F) slightly bulging, setose, unarmed.

Fourth pereopod (Fig. 3G) subchelate; merus, carpus, and propodus with setae on dorsal and ventral margins. Dactyl subtriangular, terminating in sharp corneous claw; with ventrolateral row of small corneous spinules. Propodus longer than wide, rasp formed of 1 row (at least distally) of rounded scales. Carpus with long setae on dorsal margin. Merus with rows of long setae on dorsal and ventral margins.

Fifth pereopod (Fig. 3H) chelate. Propodal rasp extending slightly beyond mid-length of segment. Dactyl with small subterminal corneous tooth on prehensile margin laterally.



**FIGURE 3.** *Paragiopagurus fasciatus* n. sp. A–E, G–I, holotype ♂ 9.9 mm, BENTHAUS, stn CAS 1916 (MNHN Pg 6919); F, J, paratype ♀ 8.6 mm, BENTHAUS, stn DW 1915 (USNM 1016947). A, right second pereopod, lateral view; B, dactyl of same, mesial view; C, right third pereopod, lateral view; D, dactyl of same, mesial view; E, merus of left third pereopod, lateral view; F, anterior lobe of sternite of third pereopods, ventral view; G, propodus and dactyl of left fourth pereopod, lateral view; H, propodus and dactyl of left fifth pereopod, lateral view; I, J, telson dorsal view. Scale bars: A, B, C, D = 10 mm; E = 5 mm; F, G, H, I, J = 1 mm.

Uropods markedly asymmetrical. Telson (Fig. 3I, J) asymmetrical, with weak or obsolete transverse suture; dorsal surface with scattered short setae, and sometimes with some

low, blister-like tubercles; posterior margin separated by narrow, V-shaped shallow cleft, into rounded projections armed with short corneous spines (more numerous in females), some often ventrally curved; left anterior ventrolateral margin with long setae in males, or with long setae mixed with row of slender, corneous spinules in females (Fig. 3J).

Male with paired first and second gonopods well developed. First gonopod with concave distal lobe setose on margins. Second gonopod sometimes with rudimentary exopod; distal segment with row of short bristles on lateral margin medially, and long setae distomesial face; basal segment with long setae on posterior face. Female with rudimentary second right pleopod; in juvenile, second left pleopod distinctly smaller than third to fifth.



**FIGURE 4.** *Paragiopagurus fasciatus* n. sp., live coloration, paratype ov ♀ 9.6 mm, BENTHAUS, stn CAS 1878 (MNHN Pg 6916).



*Coloration in life* (Fig. 4). Shield white, with pair of broad, submedian red stripes; lateral margins red. Posterior carapace whitish to pale red, with red stripes over cardiobranchial grooves. Ocular peduncles with white dorsal surface, and red ventral and lateral surfaces (peduncles slightly twisted in Fig. 4, showing part of lateral surfaces in red, and dorsal surface in white). Antennular and antennal peduncles whitish-pink; flagella pale yellow. Right cheliped with chela and carpus mostly cream or white, with white spines; chela also with well-spaced small red spots; palm with dorsal surface iridescent; carpus cream or light brown, with white spines, and iridescent dorsal surface. Left cheliped white; chela with well-spaced red spots; carpus with dorsolateral, dorsomesial, and ventrolateral red stripes, and scattered red spots; merus with dorsolateral and dorsomesial red stripes. Ambulatory legs white with narrow dorsolateral and ventrolateral red stripes; merus, carpus and propodus with dorsolateral, dorsomesial, and ventrolateral red stripes; dactyl with light red dorsolateral stripe. Fourth and fifth pereopods with continuous red stripe on lateral faces of merus, carpus, and propodus, and on dactyl of fourth pereopod. Abdomen purple or pinkish, with red spots on tergites, and dorsal surface of telson.

*Habitat.* Hard bottom of coral origin; shells used as housing include gastropods of the family Cassidae, genus *Phalium*.

*Distribution.* Austral Islands, French Polynesia. Depth: 112 to 200 m.

*Etymology.* The species name is from the Latin *fasciatus*, striped, and is given in reference to the striped colour pattern of the shield, ocular peduncles, left cheliped, and ambulatory legs.

*Remarks.* *Paragiopagurus fasciatus* n. sp. is most similar to two species also distributed in French Polynesia, *P. bougainvillei* and *P. wallisi*. All three share at least the following characters: ocular acicles terminating in strong, simple spine; shield weakly calcified medially and anteriorly behind rostrum, anterior and lateral margins; endopod of maxillule with obsolete external lobe and four or more long, terminal setae on internal lobe; right cheliped massive, with chela dorsoventrally flattened and somewhat operculate; propodal rasp of fourth pereopods with single row of scales; and in males, well developed first and second gonopods. Also, individuals of *P. fasciatus*, *P. bougainvillei*, and *P. wallisi* grow to relatively large sizes, and are known to reach shield lengths of 9.9 mm, 12.2 mm, and 12.5 mm, respectively. The new species, however, distinctly differs morphologically from those other two in the relative length of the antennal peduncles and acicles (reaching at most to midpoint of corneas in *P. fasciatus*, reaching or exceeding the corneas in *P. bougainvillei* and *P. wallisi*); armature of the carpus of the left cheliped (strongly armed in *P. fasciatus*, unarmed or weakly armed in *P. bougainvillei* and *P. wallisi*); armature of telson (at least in females, with row of corneous spinules on left anterolateral margin in *P. fasciatus*, lacking spinules in *P. bougainvillei* and *P. wallisi*).

Coloration in the new species *P. fasciatus* is strikingly different from that of *P. bougainvillei* and *P. wallisi* (see Lemaitre 1994, fig. 28f, g). In *P. fasciatus* the shield is white with a pair of broad red stripes; the shield is white or light orange with red spots in *P. bou-*

*gainvillei*, or orange–brown in *P. wallisi*. The ocular peduncles are red except for the white dorsal surfaces in *P. fasciatus*; the peduncles are light orange in *P. bougainvillei*, or amber in *P. wallisi*. The left cheliped has stripes on the merus and carpus in *P. fasciatus*; the merus and carpus have red spots in both *P. bougainvillei* and *P. wallisi*. The ambulatory legs have red stripes on the segments in *P. fasciatus*; there are red spots in *P. bougainvillei* or the legs are more or less uniformly pinkish in *P. wallisi*.

As far as distribution is concerned, *P. fasciatus* has so far been found only in the Austral Islands. *Paragiopagurus wallisi* is known from Tuamotu (Lemaitre 1994), and the Austral Islands (R. Lemaitre, pers. obs. based on MNHN material), and *P. bougainvillei* from Tuamotu and the Marquesas Islands (Lemaitre 1994).

### Parapaguridae from French Polynesia

The following is an updated list of species of the family Parapaguridae from French Polynesia, including their general distributions:

#### Genus *Oncopagurus* Lemaitre, 1996

*O. oimos* Lemaitre, 1998; central Pacific (French Polynesia only); 200 m.

*O. tuamotu* (Lemaitre, 1994); central Pacific (French Polynesia only); 400 to 760 m.

#### Genus *Paragiopagurus* Lemaitre, 1996

*P. boletifer* (de Saint Laurent, 1972); Indo-Pacific; 85 to 350 m.

*P. bougainvillei* (Lemaitre, 1994); central Pacific (French Polynesia only); 190 to 280 m.

*P. fasciatus* n. sp.; central Pacific (French Polynesia only); 112 to 200 m.

*P. wallisi* (Lemaitre, 1994); central Pacific (French Polynesia only); 200 to 300 m.

#### Genus *Strobopagurus* Lemaitre, 1996

*Strobopagurus gracilipes* (A. Milne-Edwards, 1891); eastern Atlantic; western and central Pacific; 110 to 1200 m.

#### Genus *Sympagurus* Smith, 1883

*S. affinis* (Henderson, 1888); Indo-Pacific; 147 to 1450 m.

*S. dofleini* (Balss, 1912); Indo-Pacific; 183 to 950 m.

*S. planimanus* (de Saint Laurent, 1972); Indo-Pacific; 100 to 1450 m.

*S. poupini* Lemaitre, 1994; western and central Pacific; 300 to 600 m.

*S. trispinosus* (Balss, 1911); Indo-Pacific; 350 to 1500 m.

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## References

- Lemaitre, R. (1994) Crustacea Decapoda: Deep-water hermit crabs (Parapaguridae) from French Polynesia, with descriptions of four new species. *In*: Crosnier, A. (Ed.), Résultats des Campagnes MUSORSTOM, Vol. 12. *Mémoires du Muséum national d'Histoire naturelle*, 161, 375–419.
- Lemaitre, R. (1996) Hermit crabs of the family Parapaguridae (Crustacea: Decapoda: Anomura) from Australia: species of *Strobopagurus* Lemaitre, 1989, *Sympagurus* Smith, 1883, and two new genera. *Records of the Australian Museum*, 48(2), 163–221.
- Lemaitre, R. (1998) A new species of hermit crab of the family Parapaguridae (Decapoda, Anomura) from French Polynesia. *Zoosystema*, 20(1), 101–107.
- Lemaitre, R. 2004 Crustacea Decapoda: A worldwide review of hermit crab species of the genus *Sympagurus* Smith, 1883 (Parapaguridae). *In*: Marshall, B. & Richer des Forges, B. (Eds.), *Tropical Deep-Sea Benthos*, volume 23. *Mémoires du Muséum national d'Histoire naturelle*, 191, 85–149.
- Lemaitre, R. (in press) A review of *Strobopagurus* Lemaitre, 1989 (Crustacea, Decapoda, Paguroidea, Parapaguridae), with description of a new species. *Scientia Marina*.
- Poupin, J. (1996a) *Atlas des Crustacés marins profonds de Polynésie Française. Récoltes du navire MARARA (1986/1996)*. Service mixte de Surveillance radiologique et biologique (SMSRB). Monthéry, 59 pp.
- Poupin, J. (1996b) Crustacea Decapoda of French Polynesia (Astacidea, Palinuridea, Anomura, Brachyura). *Atoll Research Bulletin*, 442, i–iv, 1–114.
- Poupin, J., Tamarii, T. & Vandenboomgaerde, A. (1990) Pêches profondes aux casiers sur les pentes océaniques des îles de Polynésie Française. (N/O MARARA–1986/1989). *Notes et Documents ORSTOM Papeete, sér: Océanographie*, (42), 1–97.