

**Three New Species of Porcellanidae (Crustacea: Anomura)  
from the Mariana Islands and a Discussion of  
Borradaile's *Petrolisthes lamarckii* Complex<sup>1</sup>**

ROY K. KROPP

*Department of Zoology, University of Maryland, College Park, Maryland 20742*

**Abstract**—Three new species of intertidal porcellanid crabs are described from the Mariana Islands. These are *Petrolisthes mesodactylon*, *P. miyakei*, and *P. borradailei*. The last species was formerly recognized as a variety of *P. lamarckii* but is now described as a valid species. A diagnosis of each of the other species considered as varieties of *P. lamarckii* by Borradaile (1898) is provided.

**Introduction**

Among recent (1979–1981) collections of porcellanid crabs from the Mariana Islands, I discovered two previously undescribed species of *Petrolisthes* and data which supported the elevation of a variety of *P. lamarckii* to species rank. These collections were supplemented by material from the collections of the Cambridge Natural History Museum (CNHM), the National Museum of Natural History, Smithsonian Institution (USNM), and the Yale Peabody Museum (YPM). In this paper I describe the new species and discuss the *P. lamarckii* complex of Borradaile (1898).

The carapace length and width of all specimens were measured to the nearest 0.1 mm with dial calipers, and are given in the text as (length × width). Other abbreviations used in the text are: AHF—Allan Hancock Foundation; BPBM—Bernice P. Bishop Museum.

*Petrolisthes mesodactylon*, new species

Fig. 1

*Petrolisthes rufescens*: Nakasone and Miyake, 1972: 139, fig. 2; Miyake, 1978: 163 (key), 186 (list). Not *P. rufescens* (Heller).

**HOLOTYPE**: Male (3.8 mm × 4.0 mm); Salafa, Pagan, Mariana Islands; 9-III-1981; Coll. L. G. Eldredge; USNM 210624.

**PARATYPES**: Salafa, Pagan, Mariana Islands; 17-VII-1981; two females (ovigerous) (3.4 mm × 3.8 mm, 3.2 mm × 3.7 mm), male (4.2 mm × 4.4 mm), USNM 210625; male (3.6 mm × 3.8 mm), BPBM S10569; female (ovigerous) (3.1 mm ×

<sup>1</sup> Contribution Number 197 from the University of Guam Marine Laboratory. *Micronesica* 19(1-2): 91-106. 1983 (December).

[1983] 1985

3.4 mm), AHF 814. Guguan, Mariana Islands; 14-VII-1981; female (4.1 mm × 4.4 mm); USNM 210626; female (3.8 mm × 4.0 mm), BPBM S10570; female (3.6 mm × 3.9 mm), AHF 815. Observation Spot, Anatahan, Mariana Islands; 19-VII-1981; male (4.2 mm × 4.6 mm), USNM 210627; male (4.1 mm × 4.4 mm), BPBM S10572; male (3.7 mm × 3.9 mm), AHF 816. All collected by L. G. Eldredge.

**DESCRIPTION:** Carapace slightly broader than long, smooth, without setae; some regions (especially lateral margins and front) with shallow eroded, irregularly shaped pits; no epibranchial spine. Front relatively broad, triangular, deflected, and rounded; no supraocular spine or lobe; shallow longitudinal furrow at midfront; no frontal-gastric ridge.

Chelipeds unequal; all segments smooth, nonsetose, and pitted similar to

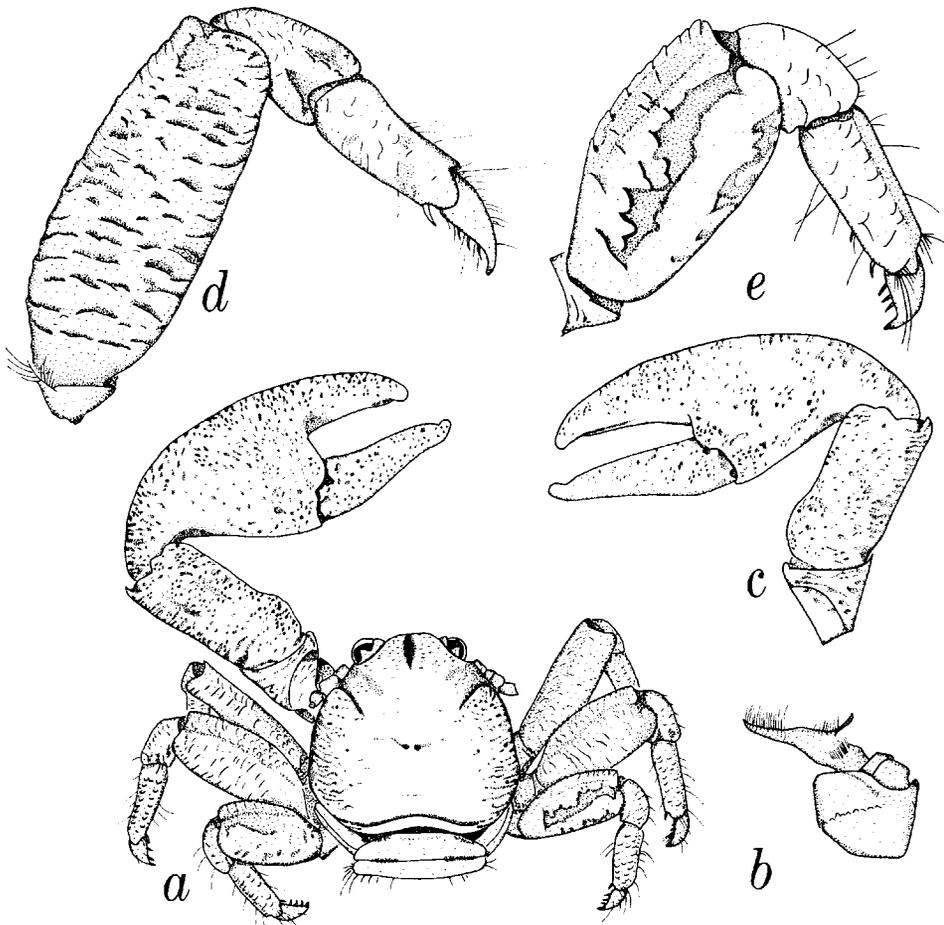


Fig. 1. *Petrolisthes mesodactylon*, male holotype, carapace length 3.8 mm. a, dorsal view; b, antennule; c, right cheliped; d-e, pereopods 1, 3. b, enlarged; c-e, slightly enlarged.

carapace. Merus with anterior margin produced into a blunt knob. Anterior margin of carpus unarmed but with rounded lobe at proximal end; posterior margin unarmed, distal end produced into a blunt tooth. Manus broad, unarmed; fingers with rounded occlusal surfaces; dactyl rounded, tip slightly deflected; large gape between fingers when closed; gape nonsetose.

Merus of walking legs fairly smooth, having a few scattered, nonplumose setae on the anterior margin; with shallow, longitudinal furrow about one-third down from anterior margin; anterior and posterior margins unarmed. Carpus with a few scattered, long, nonplumose setae; posterior margin with three small, moveable spines.

**COLOR ALIVE:** Overall color of dorsal surface of carapace, chelipeds, and walking legs light brown, Underside off-white.

**ETYMOLOGY:** From the Greek "mesodactylon", meaning a space between the fingers or toes, a noun in apposition referring to the distinctive gape between the fingers of the chelae.

**REMARKS:** Nakasone and Miyake (1972) reported this species from the Bonin Islands, calling it *Petrolisthes rufescens* (Heller). In doing so they were referring to Heller's species, now thought to be an Indian Ocean endemic (Haig, 1964), not the *P. lamarckii* var. *rufescens* of Borradaile (1898). *P. mesodactylon* seems to be most similar to *P. unilobatus* or *P. japonicus*, but is easily distinguished from those two species by the distinctive gape between the fingers of the chelae in *P. mesodactylon* and by the small spine on the proximal anterior margin of the carpus of the chelipeds in *P. unilobatus* and *P. japonicus*.

**HABITAT:** Low intertidal, among small (< 2 cm) pebbles underneath small volcanic boulders.

**DISTRIBUTION:** At present known from Kitayuo-jima and Kita Iwo Jima in the Bonin Islands (Nakasone and Miyake, 1972) and the Mariana Islands of Anatahan, Guguan, and Pagan (present study).

*Petrolisthes miyakei*, new species

Fig. 2

**HOLOTYPE:** Male (11.3 mm × 10.7 mm); Cabras Island, Guam, Mariana Islands; 23-V-1981; Coll. R. K. Kropp; USNM 210628.

**PARATYPES:** All same collection data as holotype. Male (16.7 mm × 16.2 mm), female (ovigerous) (10.1 mm × 9.7 mm), USNM 210269; male (11.0 mm × 10.5 mm), BPBM S10567; female (14.1 mm × 13.7 mm), BPBM S10568; two males (11.3 mm × 10.9 mm, 16.2 mm × 15.2 mm), AHF 817.

**DESCRIPTION:** Carapace about as broad as long, broadest at posterior branchial region; not rugose. Front narrow, sinuously triangular, median lobe most produced; frontal margin fairly smooth; definite supraocular lobe but no supraocular spine; margin of lobe slightly crenulated. Protogastric lobes separated by a distinct groove. Orbits shallow, outer orbital angle not produced. Carapace margin finely

serrated posterior to outer orbital angle. Epibranchial region with well-developed, sharp spine and several pronounced scalloped tubercles posterior to spine. Hepatic region with scalloped tubercles; a short, stout seta is located just anterior to each tubercle; tubercles light in color. Postbranchial region with low striae on outer margin. Lateral borders produced into a ridge.

Chelipeds subequal. Merus with weak squamiform lines on dorsal surface; posterior margin with two to three strong, scalloped tubercles; anterior margin with well-developed, rounded lobe; plumose setae along distal margin, at lobes, and at tubercles. Posterior margin of carpus with three sharp spines distally and three to four short ridges proximally, anterior margin with four finely serrated, well-developed teeth; proximal tooth largest and sharp, distal three teeth blunt; posterior dorsal surface with scalloped tubercles, largest toward midline; anterior surface with

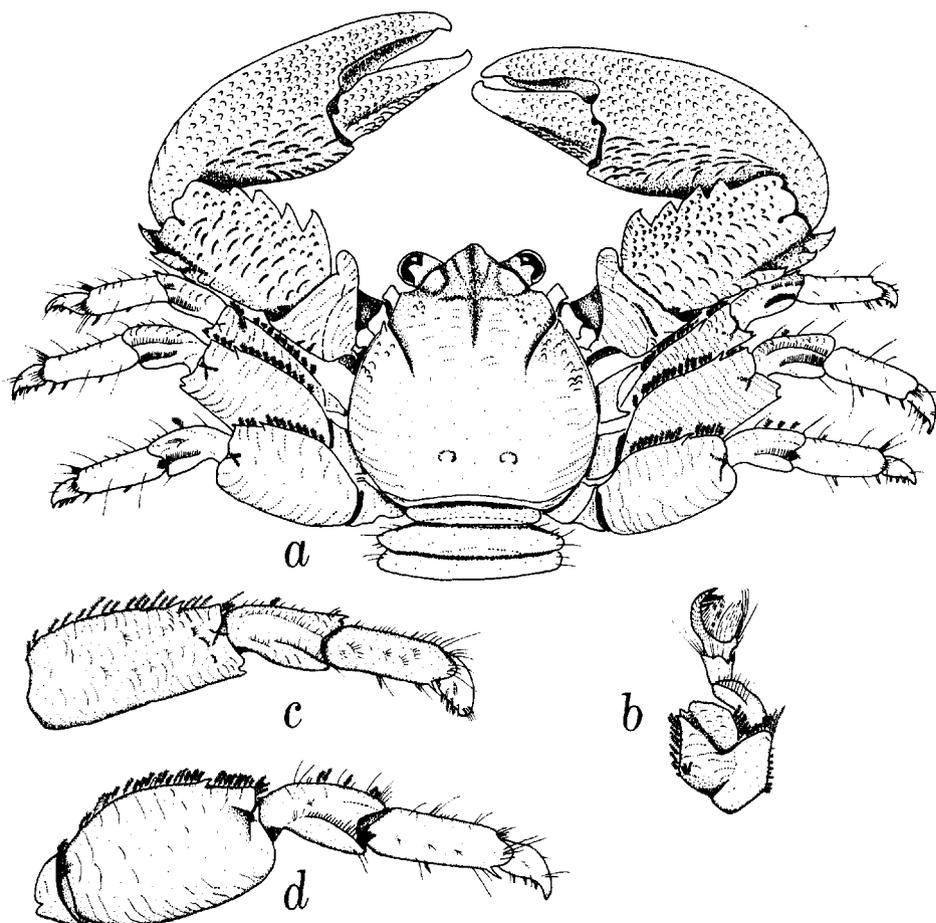


Fig. 2. *Petrolisthes miyakei*, male holotype, carapace length 11.3 mm. a, dorsal view; b, antennule; c-d, pereopods 1, 3. b, enlarged; c-d, slightly enlarged.

small, triangle-shaped tubercles. Outer margin of manus smooth, minutely serrated proximally; dorsal surface covered with many small triangular tubercles; no obvious setation; no longitudinal ridge; upper surface with flattened squamae. Dactylus of hand with flattened, scalloped squamae; gape closes completely and has no pubescence; tips of fingers strongly curved, overlapping; cutting surfaces toothless, finely serrated.

Merus of walking legs with scalloped tubercles anteriorly, squamiform lines posteriorly; anterior margin with a single spine about three-quarters of distance out from ischium and with long, plumose setae arising from its ventral portion; dorsal surface with stout setae on distal sides of tubercles; posterodistal spines 1-1-0. Carpus with several crenulate, longitudinal lines, each line fringed with setae; posterior setae plumose, also several long, nonplumose setae and many short and stout setae, carpus of first walking leg with anterodistal spine. Posterior margin of propodus with two moveable spines on midline, one at midpoint and one near distal margin; and a distal pair of spines. Dactylus with several clusters of long, nonplumose setae and three transparent, moveable spines proximal to claw.

**COLOR ALIVE:** Overall color of carapace tan with a prominent reddish purple reticulated pattern. Rostrum with patches of light blue. Cheliped overall similar to carapace. Outer margin of palm with azure blue stripe extending from near carpal joint to tip of immovable finger. Tips of fingers reddish orange. Antennal filament red-orange. Ventral surface mostly white with patches of purple.

**ETYMOLOGY:** This species is dedicated to Professor Sadayoshi Miyake in recognition of his many studies of Indo-Pacific decapod crustaceans.

**REMARKS:** *P. miyakei* appears most similar to the species of Borradaile's *P. lamarckii* complex and may be distinguished from all members of the complex except *P. asiaticus* by having armature on the anterior margin of the merus of each walking leg. *P. miyakei* and *P. asiaticus* may be separated by the number and shape of the teeth on the anterior margin of the carpus of the cheliped. *P. miyakei* has four or more relatively broad teeth, whereas *P. asiaticus* has three narrow teeth. Also, *P. miyakei* lacks the longitudinal ridge on the manus of the cheliped which is characteristic of *P. asiaticus*.

**HABITAT:** Intertidal. Collected from sand-covered pavement underneath small limestone blocks and boulders at the landward edge of an erosion bench.

**DISTRIBUTION:** At present known only from Guam, the type locality.

### **The *Petrolisthes lamarckii* complex of Borradaile (1898)**

*Petrolisthes asiaticus* was described by Leach (1820). It was subsequently considered as a variety of *P. lamarckii* by Miers (1884) and then restored to specific rank by de Man (1896). Borradaile (1898) again considered *P. asiaticus* as a *P. lamarckii* variety. Several others between de Man (1896) and Miyake (1942) also considered *P. asiaticus* a valid species, and it has been considered as such to the present.

Borradaile (1898) described *Petrolisthes fimbriatus* as a variety of *P. lamarckii*. This variety was given species rank by Miyake (1942).

The greatest amount of confusion has involved Borradaile's (1898) *Petrolisthes lamarckii* var. *rufescens*. Ortmann (1894:25, 26) included *P. rufescens* (Heller) in synonymy with *P. lamarckii*. Borradaile (1898) designated *P. lamarckii* var. *rufescens*, characterized by lacking an epibranchial spine. In this he was followed by Miyake (1942, 1943). However, the taxon that Borradaile and Miyake called *P. lamarckii* var. *rufescens* is not Heller's species. *P. rufescens* (Heller), which is apparently an Indian Ocean endemic (Haig, 1964; Lewinsohn, 1979), does lack an epibranchial spine, but differs from *P. lamarckii* var. *rufescens* (*sensu* Borradaile and Miyake) in lacking spines on the posterior margin of the carpus of the cheliped. Because the latter character also separated *P. rufescens* from *P. lamarckii* specimens having an epibranchial spine, Haig (1964) removed it from synonymy with *P. lamarckii*. However, Haig retained *P. lamarckii* var. *rufescens* within the synonymy of *P. lamarckii*.

In this paper I remove the taxon previously known as *P. lamarckii* var. *rufescens* from synonymy with *P. lamarckii* and describe it as a new species. Also, I compare the species originally included in Borradaile's *P. lamarckii* complex.

***Petrolisthes borradailei*, new species**

Fig. 3

*Petrolisthes lamarckii* var. *rufescens* Borradaile, 1898:465; Chilton, 1911:551; Miyake, 1942:345, pl. 1, fig. 2, text-figs. 9-10; Kropp et al., 1981:39 (list).

Not *P. rufescens* (Heller).

*Petrolisthes lamarckii*: Laurie, 1926:140 (in part); Haig, 1964:363 (in part, not *P. lamarckii* var. *rufescens* in synonymy).

HOLOTYPE: Male (10.0 mm × 9.6 mm); Unai Dikiki, Pagan, Mariana Islands; 10-III-1981; USNM 210630.

PARATYPES: Unai Dikiki, Pagan, Mariana Islands; 10-III-1981; female (ovigerous) (11.6 mm × 11.1 mm), USNM 210631. Wing Beach, Saipan, Mariana Islands; 21-XI-1980; female (ovigerous) (12.4 mm × 11.1 mm), USNM 210633. Cabras Is., Guam, Mariana Islands; 23-VI-1979; male (10.6 mm × 9.8 mm), BPBM S10566; female (ovigerous) (8.4 mm × 8.0 mm), AHF 796. Pago Bay, Guam, Mariana Islands; 4-III-1979; female (9.7 mm × 9.0 mm), BPBM S10565; female (13.7 mm × 13.3 mm), AHF 797. Anabar Beach, Nauru; 5-VI-1980; female (ovigerous) (8.8 mm × 8.1 mm), USNM 210634. Rotuma; reg. 15-IX-1897; Coll. J. S. Gardiner; male (120 mm × 11.8 mm), CNHM; female (ovigerous) (12.1 mm × 11.9 mm), CNHM. Funafuti, Ellice Islands; reg. 11-I-1897; Coll. J. S. Gardiner; male (7.3 mm × 6.8 mm), CNHM; female (ovigerous) (10.4 mm × 10.3 mm), CNHM. Menai Is., Seychelles; male (9.2 mm × 8.3 mm), female (6.6 mm × 6.5 mm); Coll. A. J. Kohn; YPM 4228. All collected by the author unless otherwise designated.

DESCRIPTION: Carapace longer than broad, not rugose, but covered with

low squamate lines giving a slightly roughened appearance, most obvious on gastric and hepatic lobes; mid carapace regions smooth. Front relatively narrow, sinuously triangular, somewhat deflected; prominent supraocular lobe but no supraocular spine; center of rostrum with isolated triangular tubercles. Frontal-gastric ridge strong, protogastric lobes separated by a strong groove. Orbits shallow, outer orbital angle not produced, margin serrated. No epibranchial spine. Lateral borders of carapace produced into a ridge which extends to the epibranchial region.

Chelipeds subequal, covered with very short setae. Mid regions of merus with low semicircular squamae, largest at outer proximal corner; anterior margin with a well-developed, rounded lobe; densely plumose setae in bunches along posterior

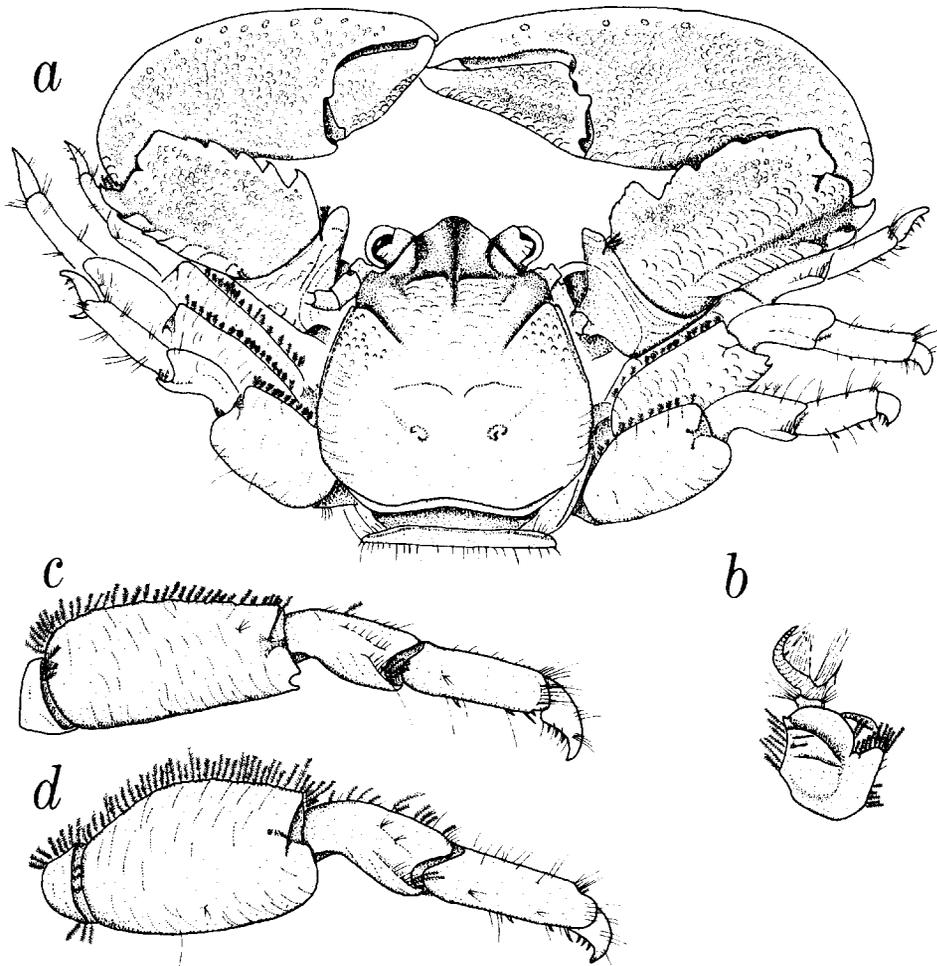


Fig. 3. *Petrolisthes borradalei*, male holotype, carapace length 10.0 mm. a, dorsal view; b, antennule; c-d, pereopods 1, 3. b, enlarged; c-d, slightly enlarged.

margin. Posterior margin of carpus with two sharp distal spines preceded proximally by one blunt spine and several elevated squamae, each fringed with a few plumose setae; anterior margin with four rounded teeth; proximal tooth largest, each successively distal tooth smaller; second tooth bilobed; dorsal surface covered with numerous semicircular, crenulated squamae which are directed distally; clumps of short setae arise from most squamae. Manus covered dorsally by numerous small subcircular squamae; outer margin fairly smooth, but having a slightly serrated appearance because of squamae near margin; dorsal surface covered with short setae; no longitudinal ridge. Upper edge of dactylus ridge-like; gape closes completely and is without setae; finger tips strongly bent, overlapping; tip of dactyl closes behind tip of propodus.

Merus of walking legs fairly smooth, having a few striae posteriorly; anterior margin spineless, but with long, thickly plumose setae arising from ventral edge; posterodistal spines 1-1-0. Carpus with several longitudinal squamate lines and scattered long, plumose and nonplumose setae; no anterodistal spines. Propodus smooth, posterior margin with two stubby, moveable spines, one at the midpoint and one near the distal corner; distal margin also with two moveable spines, one anterior, one posterior. Dactylus with three moveable spines proximal to claw and with several clusters of long, nonplumose setae.

**COLOR ALIVE:** Overall color of carapace dark green, mottled with blue and burgundy patches. Chelipeds similar to carapace. Outer portion of manus with a distinctive line of irregularly spaced, pale orange dots. Dactyl deep red-purple with blue-dotted striations. Antennal filament dark amber. Color based on Marianas specimens.

**ETYMOLOGY:** This species is named for L. A. Borradaile who first described it as a variety of *P. lamarckii*.

**REMARKS:** The lack of an epibranchial spine distinguishes *Petrolisthes borradailei* from all other members of Borradaile's *P. lamarckii* complex.

**HABITAT:** Intertidal, found under small blocks and boulders.

**DISTRIBUTION:** See Table 1.

### *Petrolisthes fimbriatus* Borradaile, 1898

*Petrolisthes lamarckii* var. *fimbriatus* Borradaile, 1898: 466.

*Petrolisthes fimbriatus*: Miyake, 1942: 339, text-fig. 5-6; 1943: 89, text-fig. 22.

**MATERIAL EXAMINED:** Okat, Kosrae, Caroline Islands; 27-V-1979; Coll. R. K. Kropp; female (4.1 mm × 3.9 mm). Lelu, Kosrae, Caroline Islands; 23-V-1979; Coll. R. K. Kropp; female (4.1 mm × 4.1 mm). Ngaremediu Reef, Palau, Caroline Islands; 19-VIII-1955; Coll. F. M. Bayer group; female (ovigerous) (5.4 mm × 5.4 mm), USNM 137270. Ngadarak Reef, Palau, Caroline Islands; Coll. F. M. Bayer group; male (4.1 mm × 3.8 mm), USNM 137270. Padaido Island, New Guinea; 2-X-1944; Coll. A. G. Humes; female (3.1 mm × 2.9 mm), USNM 137301. Eua, Tonga Islands; 28-XI-1899-1900; "Albatross"; male (6.4 mm × 6.9 mm), USNM

55908. Canton, Phoenix Islands; Coll. unknown; two females (ovigerous) (6.0 mm × 5.7 mm, 4.6 mm × 4.7 mm); USNM 190762. Kosrae specimens deposited in the USNM and AHF.

**DIAGNOSIS:** Carapace smooth, sparsely setose; with an epibranchial spine. Front broad, rostrum indistinctly trilobate, middle lobe most projecting; no supraocular spine. Cheliped subequal or slightly unequal. Carpus with three teeth on anterior margin and two to three spines on posterior margin; slight median longitudinal swelling. Outer margin of palm with a fringe of plumose setae. Merus of walking legs without spines on anterior margin, but fringed with plumose setae; posterodistal spines 1-1-0; carpus of walking legs without anterodistal spines.

**REMARKS:** *Petrolisthes fimbriatus* differs from other members of the *P. lamarckii* complex primarily by the fringe of setae on the outer surface of the manus of the chelipeds.

**HABITAT:** Intertidal, underneath rocks on reef flats.

**DISTRIBUTION:** See Table 1.

*Petrolisthes asiaticus* (Leach, 1820)

Selected Synonymy:

*Pisidia asiatica* Leach, 1820: 54.

*Petrolisthes asiaticus*: Stimpson 1858: 227; de Man, 1896: 376; 1902: 694; Sendler, 1923: 41; Miyake, 1942: 334, text-figs. 1-2; 1943: 95, text-fig. 27; Haig, 1964: 361; Nakasone and Miyake, 1971: 1; Kropp et al., 1981: 39 (list).

*Petrolisthes lamarckii* var. *asiaticus*: Miers, 1884: 269; Borradaile, 1898: 464.

*Petrolisthes leporinoides* Ortmann, 1892: 263.

*Petrolisthes yaeyamensis* Miyake, 1937: 157, 1 text-fig.

**MATERIAL EXAMINED:** Lelu, Kosrae, Caroline Islands; 24-V-1979; male (6.6 mm × 6.4 mm), female (ovigerous) (6.6 mm × 6.9 mm). Cabras Is., Guam, Mariana Islands; 23-VI-1979; male (5.1 mm × 5.0 mm), female (ovigerous) (5.5 mm × 5.7 mm). Pago Bay, Guam, Mariana Islands; 22-VI-1979; female (ovigerous) (6.1 mm × 6.3 mm). Agingan Pt., Saipan, Mariana Islands; 19-XI-1980; male (7.0 mm × 7.3 mm), female (ovigerous) (5.3 mm × 5.3 mm). Nananu-i-Ra, Viti Levu, Fiji; 3-VI-1980; female (7.0 mm × 6.9 mm). Menai Is., Seychelles; 10-VII-1957; Coll. A. J. Kohn; female (ovigerous) (5.0 mm × 5.0 mm); YPM 4229. All (except YPM specimens) collected by the author and deposited in the USNM and AHF.

**DIAGNOSIS:** Carapace fairly smooth, having small tubercles toward the lateral margin; very sparsely setose; lateral margins formed into a ridge anteriorly; epibranchial spine well-developed. Front broad, approximately triangular; low squamous lines on front, no supraocular spine. Chelipeds subequal. Carpus with three teeth on anterior margin and three spines on posterior margin and with a median longitudinal ridge of relatively large squamae. Manus with a distinct longitudinal ridge dividing upper and lower halves; lower half with large, rounded tubercles, upper half with smaller granules. Dactylus cristate on upper surface, gape

not setose. Walking legs smooth, sparsely setose; anterior margin of merus of one or more legs with a single spine three-quarter of the distance to the carpal joint; posterodistal spines 1-1-0; carpus of walking legs without anterodistal spines.

**COLOR ALIVE:** Two color forms exist. One is dark green with an overlay of many large and small burgundy spots. The other form is similarly spotted but lacks the green coloration. Color based on Marianas specimens.

**REMARKS:** *Petrolisthes asiaticus* is distinguished from other members of the complex by the presence of the spine on the anterior margin of the merus of at least one walking leg.

**HABITAT:** Intertidal, found under rocks.

**DISTRIBUTION:** See Table 1.

*Petrolisthes lamarckii* (Leach, 1820)

Selected Synonymy:

*Pisidia lamarckii* Leach, 1820: 54.

*Porcellana dentata* H. Milne Edwards, 1837: 251.

*Porcellana pulchripes* White, 1847: 129 (nomen nudum).

*Porcellana speciosa* Dana, 1852: 417; 1855: pl. 26, fig. 8; Balss, 1913: 30.

*Petrolisthes lamarckii*: Stimpson, 1858: 227; Ortmann, 1894: 26; Borradaile, 1898: 464; Laurie, 1926: 140; Miyake, 1942: 342, text-figs. 7-8; 1943: 98, text-fig. 29; Haig, 1964: 362; 1979: 124; Johnson, 1970: 12; Nakasone and Miyake, 1971: 1; Lewinsohn, 1979: 40; Kropp et al., 1981: 39 (list).

*Porcellana bellis* Heller, 1865: 76.

*Petrolisthes dentatus*: Rathbun, 1910: 314; Gravier, 1920: 377; Sandler, 1923: 41.

*Petrolisthes obtusifrons* Miyake, 1937: 155.

Not *Petrolisthes rufescens* (Heller). Not *P. lamarckii* var. *rufescens* Borradaile.

**MATERIAL EXAMINED:** Okat, Kosrae, Caroline Islands; 27-V-1979; Coll. L. G. Eldredge, T. L. Smalley; male (8.0 mm × 8.3 mm), female (ovigerous) (4.7 mm × 4.3 mm), female (ovigerous) (8.1 mm × 8.2 mm). Agingan Pt., Saipan, Mariana Islands; 19-XI-1980; male (6.6 mm × 6.2 mm), female (ovigerous) (6.3 mm × 6.0 mm). Natadola Beach, Viti Levu, Fiji; 30-V-1980; male (6.6 mm × 6.2 mm), also two crabs with rhizocephalan barnacle parasites, USNM 210609. Point Elizabeth, Ceylon; 22-VIII-1957; Coll. A. J. Kohn; female (ovigerous) (6.0 mm × 5.5 mm), YPM 4160. Anse a la Mouche, Mahe Island, Seychelles; 10-XI-1957; Coll. G. P. Melante; female with bopyrid isopod, YPM 4199. Beau Vallon, Mahe Island, Seychelles; 1-II-1958; Coll. A. J. Kohn; three males, two females, YPM 4206. Maliki Point, off Cerf Island, Seychelles; 2-XI-1957; Coll. W. D. Hartman; two females (3.8 mm × 3.5 mm, 4.5 mm × 4.5 mm), YPM 4191. All collected by the author, unless otherwise noted, and deposited in the USNM and AHF (except YPM specimens).

**DIAGNOSIS:** Carapace usually smooth, but often a shallow epibranchial groove extends to cardiac region; fairly nonsetose; with an epibranchial spine; lateral margins of carapace cristate. Front fairly broad, rostrum indistinctly trilobate; no

supraocular spine. Chelipeds subequal, fairly nonsetose. Anterior margin of carpus with three low teeth, proximal tooth largest, distal teeth often poorly developed; infrequently a fourth distal tooth; three sharp spines on posterior margin. Dorsal surface of manus with many small, low, rounded granules; no longitudinal ridge; cutting edge of immovable finger produced into a crenulate ridge, gape not setose. Walking legs smooth, merus with scattered long plumose setae on anterior margin; anterior margin without spines; posterodistal spines 1-1-0. Carpus of first walking leg with an anterodistal spine.

**COLOR ALIVE:** Overall color dark green with overlay of many light blue spots and some burgundy spots. Manus of chelipeds with row of irregularly spaced light blue dots along outer margin. Color based on Marianas specimens.

**REMARKS:** This species differs from *P. asiaticus* by the lack of spines on the anterior margin of the merus of the walking legs; from *P. fimbriatus* by the lack of a fringe of setae on the outer edge of the manus of the chelae; and from *P. borradailei* by having an epibranchial spine.

Based on literature descriptions or figures it appears that *Pisidia lamarckii*, *Porcellana dentata*, *P. pulchripes*, *P. speciosa*, *P. bellis*, and *Petrolisthes obtusifrons* were all based on specimens having an epibranchial spine. Also, the teeth on the anterior margin of the carpus of the cheliped seem to be typical for *P. lamarckii* for most of the synonyms. However, a photograph of the type of *Porcellana dentata* shows four fairly well-developed teeth which Janet Haig tells me is suggestive of *Petrolisthes haswelli* Miers, 1884.

**HABITAT:** Intertidal, found under rocks.

**DISTRIBUTION:** See Table 1.

#### ACKNOWLEDGMENTS

I appreciate very much the patient assistance and support of L. G. Eldredge, University of Guam and Janet Haig, Allan Hancock Foundation, both of whom are valued teachers. Without their help this project never would have been completed. I thank the Yale Peabody Museum, Cambridge Natural History Museum, the USNM, for the loan of specimens used in this study, and the Museum National d'Histoire Naturelle for providing a drawing and a photograph of the type of *Porcellana dentata*. I also thank D. E. Schindel, W. D. Hartman, both of Yale University, and R. B. Manning, USNM, for logistic support during the latter portion of the study. I am indebted to Lilly Manning for assistance with the figures and Jane Dominguez for help in preparing the manuscript. This work was supported in part by a grant to Geerat Vermeij by the Biological Oceanography Program of the National Science Foundation.

#### References Cited

- Balss, H. 1913. Ostasiatische Decapoden. I. Die Galatheiden und Paguriden. K. B. Akad. Wiss., Math-

- Phys. Kl., Suppl. Bd. 2, Abh. 9. Munchen.
- Barnard, K. H. 1950. Descriptive catalogue of South African decapod Crustacea. *Ann. S. Afr. Mus.* 38: 1-837.
- Borradaile, L. A. 1898. On some crustaceans from the South Pacific. Part II. *Macrura Anomala*. *Proc. Zool. Soc.*, London 1898: 457-468.
- . 1900. On the Stomatopoda and *Macrura* brought by Dr. Willey from the south seas. Pages 395-428. *In* *Zoological results based on material from New Britain, New Guinea, Loyalty Islands and elsewhere, collected during the years 1895, 1896, and 1897, by Arthur Willey ... Part IV.* (Cambridge).
- Chilton, C. 1911. The Crustacea of the Kermadec Islands. *Trans. Phil. Inst. Canterbury* 43: 544-573.
- Dana, J. D. 1852. Crustacea. United States Exploring Expedition during the years 1838, 1839, 1840, 1841, 1842, under the command of Charles Wilkes, U. S. N. 13: 1-685.
- . 1855. Crustacea. United States Exploring Expedition during the years 1838, 1839, 1840, 1841, 1842, under the command of Charles Wilkes, U. S. N. 14 (Atlas): 1-27.
- Derijard, R. 1966. Note préliminaire sur les Crustacés Stomatopodes et Décapodes récoltes à l'île Europa du 6 au 24 Avril 1964. *Mém. Mus. Natn. Hist. Nat., Paris (A)* 41: 159-180.
- Edmondson, C. H. 1923. Crustacea from Palmyra and Fanning Islands. With descriptions of new species of crabs from Palmyra Island by M. J. Rathbun. *B. P. Bishop Mus. Bull.* 5: 1-40.
- Gordon, I. 1931. *Brachyura* from the coast of China. *J. Linn. Soc.* 37: 525-558.
- Gravier, C. 1920. Sur une collection de Crustacés recueillis à Madagascar par M. le lieutenant Decaray. *Bull. Mus. Hist. Nat.* 26: 376-383.
- Haig, J. 1964. Papers from Dr. Th. Mortensen's Pacific Expedition 1914-1916. 81. Porcellanid crabs from the Indo-West Pacific, part I. *Vidensk. Meddr. Dansk. Naturh. Foren.* 126: 355-386.
- . 1979. Expedition Rumphius II (1975) Crustacés parasites, commensaux, etc. (Th. Monod et R. Serène, éd.) V. Porcellanidae (Crustacea, Decapoda, Anomura). *Bull. Mus. Natn. Hist. Nat., Paris (4)1 (A)*: 119-136.
- Heller, C. 1865. Crustaceen. *In* *Reise der oesterreichischen Fregatte "Novarra" um die Erde, in den Jahren 1857, 1858, 1859, unter den Befehlen des Commodore B. von Wullerstorf-Ubair.*
- Highsmith, R. 1981. Coral bioerosion at Enewetak: agents and dynamics. *Int. Revue Ges. Hydrobiol.* 66: 335-375.
- Johnson, D. S. 1970. The Galatheidea (Crustacea:Decapoda) of Singapore and adjacent waters. *Bull. Natn. Mus. St. Singapore* 35: 1-44.
- Kensley, B. 1970. A small collection of decapod Crustacea from Mocambique. *Ann. S. Afr. Mus.* 57: 103-121.
- Kropp, R. K., D. S. Wooster, and L. G. Eldredge. 1981. Preliminary checklist of anomuran crustaceans from Guam. Pages 39-41. *In* *A working list of marine organisms from Guam.* Univ. Guam Mar. Lab. Tech. Rep. No. 70.
- Laurie, R. D. 1926. Anomura collected by Mr. J. Stanley Gardiner in the Western Indian Ocean in H. M. S. "Sealark". *Trans. Linn. Soc. London, ser. 2, Zool.*, 19: 121-167.
- Leach, W. E. 1820. Galatéadées. *Dict. des Sci. Nat.* 18: 49-56.
- Lenz, H. 1910. Crustaceen von Madagaskar, Ostafrika and Ceylon. Pages 539-576. *In* *Voeltzkow's Reise in Ostafrika in den Jahren 1903-1905.* 2.
- Lewinsohn, Ch. 1979. Researches on the coast of Somalia. The shore and the dune of Sar Uanle. 23. Porcellanidae (Crustacea, Decapoda, Anomura). *Monit. Zool. Italiano n. s. suppl.* 12(6): 39-57.
- Man, J. G. de. 1896. Bericht über die von Herrn Schiffs captain Storm zu Atjeh, an den westlichen Küsten von Malakka, Borneo und Celebes sowie in der Java-See gesammelten Decapoden und Stomatopoden. *Dritter Theil. Zool. Jahrb., Syst.*, 9: 339-386.
- . 1902. Die von Herrn Professor Kukenthal im Indischen Archipel gesammelten Dekapoden und Stomatopoden. *Abh. Senckenb. Gesell.* 25: 467-929.
- Miers, E. J. 1884. Crustacea. Report on the zoological collections made in the Indo-Pacific Ocean during the voyage of the H. M. S. "Alert" in 1881-82: 178-322, 513-575.
- Milne Edwards, H. 1837. *Histoire naturelle des Crustacés, comprenant l'anatomie, la physiologie et la classification de ces animaux* 2: 1-531.

- Miyake, S. 1937. Description of a new species of *Petrolisthes* from Yaeyama-Group, Riukiu Islands (Anomura, Porcellanidae). *Dobutsugaku Zasshi (Zool. Mag.)* 49: 155-157.
- . 1942. Studies on the decapod crustaceans of Micronesia. III. Porcellanidae. *Palao Trop. Biol. Sta. Stud.* 2: 329-379.
- . 1943. Studies on the crab-shaped Anomura of Nippon and adjacent waters. *J. Dept. Agric. Kyushu Imp. Univ.* 7: 49-158.
- . 1978. The Crustacean Anomura of Sagami Bay. Imperial Household. 200 p. (English part); 161 p. (Japanese part).
- Nakasone, Y., and S. Miyake. 1971. Porcellanid crabs (Anomura:Porcellanidae) from New Caledonia and the Fiji Islands. *Biol. Mag. Okinawa* 8: 1-13.
- . 1972. Four unrecorded porcellanid crabs (Anomura:Porcellanidae) from Japan. *Bull. Sci. Engng. Div. Univ. Ryukyu, Math. nat. Sci.* 15: 136-147.
- Ortmann, A. 1892. Die Decapoden-krebse des Strassburger Museums. IV. Theil. Die Abtheilungen Galatheidea und Pagurida. *Zool. Jahrb., Syst.* 6: 241-326.
- . 1894. Zoologisch Forschungsreisen in Australien und dem Malayischen Archipel ausgeführt in den Jahren 1891-1893 von Dr. Richard Semon. Funfter Band: Systematik und Thiergeographie. I. Lieferung. Crustaceen. *Denkschr. Med.-Naturw. Gesell. Jena* 8: 3-80.
- Rathbun, M. J. 1910. Decapod crustaceans collected in Dutch East India and elsewhere by Mr. Thomas Barbour in 1906-1907. *Bull. Mus. Comp. Zool.* 52: 305-317.
- Sankolli, K. N. 1967. On the Porcellanidae (Crustacea-Anomura) of Ratnagiri along the west coast of India. *Proc. Symp. Crust. Cochin* 1: 295-313.
- Sendler, A. 1923. Die Decapoden und Stomatopoden der Hanseatischen Sudsee-Expedition. *Abh. Sencken. Natur. Gesell. Bd. 38 Heft 1*: 21-47.
- Stimpson, W. 1858. *Prodromus descriptiones animalium evertibratorum, quae in expeditione ad oceanum pacificum septentrionalem, a republica federata missa, Cadwaladaro Ringgold et Johanne Rodgers ducibus, observavit et descripsit.* *Proc. Acad. Nat. Sci. Philadelphia* 10: 225-252.
- Taylor, J. D. 1971. Crustacea: Brachyura and Anomura from Diego Garcia. *Atoll Res. Bull.* 149: 93-101.
- White, A. 1847. List of the specimens of Crustacea in the collection of the British Museum, London: 1-143.
- Yaqoob, M. 1979. Rearing of *Petrolisthes lamarckii* (Leach, 1820) under laboratory conditions (Decapoda, Porcellanidae). *Crustaceana* 37: 253-264.

Table 1. Geographic records of species of Borradaile's (1898) *Petrolisthes lamarckii* complex. Note: + = species present at locality according to reference cited; ++ = species recorded from locality only as a synonym according to reference cited; ? = record uncertain but listed in reference cited; PS = present study; USNM = in the collection of the USNM; P. a. = *P. asiaticus*; P. b. = *P. borradaile*; P. f. = *P. fimbriatus*; P. l. = *P. lamarckii*.

|                     | P. a. | P. b.           | P. f. | P. l. | References                |
|---------------------|-------|-----------------|-------|-------|---------------------------|
| <b>INDIAN OCEAN</b> |       |                 |       |       |                           |
| Somalia             |       |                 |       | +     | Lewinsohn, 1979           |
| Mozambique          |       |                 |       | +     | Kensley, 1970             |
| South Africa        |       |                 |       | +     | Barnard, 1950             |
| Europa              |       |                 |       | ?     | Derijard, 1966            |
| Madagascar          |       |                 |       | +     | Lenz, 1910; Gravier, 1920 |
| Seychelle Is.       |       |                 |       |       |                           |
| Darros Id.          | +     |                 |       | +     | Miers, 1884               |
| Cerf Id.            |       |                 |       | +     | PS                        |
| Mahe Id.            |       |                 |       | +     | PS                        |
| Praslin Id.         |       |                 |       | +     | Laurie, 1926              |
| Menai Id.           | +     | +               |       |       | PS                        |
| Mauritius           | +     |                 |       |       | Leach, 1820               |
| Pakistan            |       |                 |       |       |                           |
| Karachi             |       |                 |       | ?     | Yaqoob, 1979              |
| Chagos Archipelago  |       |                 |       |       |                           |
| Diego Garcia        |       |                 |       | ?     | Taylor, 1971              |
| Salomon Is.         |       | ++ <sup>a</sup> |       | +     | Laurie, 1926              |
| Coin, Peros Banhos  |       | ++ <sup>a</sup> |       |       | Laurie, 1926              |
| Nicobar Id.         |       |                 |       | +     | Heller, 1865              |
| Cocos-Keeling Id.   | ?     |                 |       |       | Miers, 1884               |
| Mergui Archipelago  |       |                 |       | ?     | de Man, 1896              |
| India               |       |                 |       |       |                           |
| Ratnagiri           |       | ?               |       | +     | Sankolli, 1967            |
| Ceylon              |       |                 |       |       |                           |
| Pt. Elizabeth       |       |                 |       | +     | PS                        |

|                           | P. a. | P. b.           | P. f. | P. l. | References                      |
|---------------------------|-------|-----------------|-------|-------|---------------------------------|
| <b>INDO-MALAYSIA/ASIA</b> |       |                 |       |       |                                 |
| Indonesia                 |       |                 |       |       |                                 |
| Sumatra                   |       |                 |       |       |                                 |
| Atjeh                     | +     |                 |       | ?     | de Man, 1896                    |
| Moluccas                  |       |                 |       |       |                                 |
| Ternate                   | +     |                 |       |       | de Man, 1902                    |
| Ambon                     |       |                 |       | ++    | Rathbun, 1910                   |
| New Guinea (Irian Jaya)   |       |                 |       |       |                                 |
| Padaido Id.               |       |                 | +     |       | USNM                            |
| Sariba                    |       |                 | +     | +     | Borradaile, 1900                |
| Singapore                 |       |                 |       |       |                                 |
| Raffles Light             |       |                 |       | +     | Johnson, 1970                   |
| Gulf of Thailand          |       |                 |       |       |                                 |
| Koh Chang                 | +     |                 |       |       | Haig, 1964                      |
| Koh Kahdat                | +     |                 |       |       | Haig, 1964                      |
| Hong Kong                 |       |                 |       |       |                                 |
|                           |       |                 |       | +     | Gordon, 1931                    |
| Philippine Is.            |       |                 |       |       |                                 |
| Mindoro                   | +     |                 |       |       | Haig, 1964                      |
| Mindanao                  |       |                 |       | +     | USNM                            |
| Dinigat                   | +     |                 |       |       | Haig, 1964                      |
| Taiwan                    |       |                 |       |       |                                 |
| Suao                      |       |                 |       | +     | Miyake, 1943                    |
| Ryukyu Is.                |       |                 |       |       |                                 |
| Ishigaki Id.              | +     | +               |       | +     | Miyake, 1943                    |
| Amami-Osima               |       |                 |       | +     | Miyake, 1943                    |
| Australia                 |       |                 |       |       |                                 |
| Capricorn                 |       |                 |       | +     | USNM                            |
| Bustard Head              |       |                 |       | +     | USNM                            |
| Yamba Coast               |       |                 |       | +     | USNM                            |
| Flinders                  |       |                 |       | +     | Miers, 1884                     |
| Port Molle                |       |                 |       | +     | Miers, 1884                     |
| New Ireland               |       |                 |       | ?     | H. Milne Edwards, 1837          |
| Solomon Is.               |       |                 |       |       |                                 |
| Green Id.                 |       |                 |       | +     | USNM                            |
| New Caledonia             |       |                 |       |       |                                 |
| Noumea                    | +     |                 |       | +     | Nakasone and Miyake, 1971; USNM |
| Loyalty Is.               |       |                 |       |       |                                 |
| Lifu                      |       | +               |       |       | Borradaile, 1900                |
| Fiji                      |       |                 |       |       |                                 |
| Viti Levu                 | +     |                 |       | +     | PS; Nakasone and Miyake, 1971   |
| Kermadec Is.              |       |                 |       |       |                                 |
| Meyer Id.                 |       | ++ <sup>b</sup> |       |       | Chilton, 1911                   |
| Sunday Id.                |       | ++ <sup>b</sup> |       |       | Chilton, 1911                   |

|                        | P. a. | P. b. | P. f. | P. l. | References                      |
|------------------------|-------|-------|-------|-------|---------------------------------|
| <b>OCEANIC PACIFIC</b> |       |       |       |       |                                 |
| Bonin Is.              |       |       |       | +     | Miyake, 1943                    |
| Mariana Is.            |       |       |       |       |                                 |
| Pagan                  |       | +     |       |       | PS                              |
| Saipan                 | +     | +     |       | +     | PS                              |
| Guam                   | +     | +     |       | +     | PS                              |
| Caroline Is.           |       |       |       |       |                                 |
| Palau                  | +     | ++    | +     | +     | Sendler, 1923; Miyake, 1942; PS |
| Yap                    |       | ++    |       | +     | USNM                            |
| Engalap/Falarik        |       | ++    |       | +     | USNM                            |
| Ponape                 |       |       |       | +     | USNM                            |
| Kosrae                 | +     |       | +     | +     | Miyake, 1942; PS                |
| Marcus Is.             |       | +     |       |       | USNM                            |
| Wake Is.               |       |       |       | +     | Dana, 1852                      |
| Marshall Is.           |       |       |       |       |                                 |
| Enewetak               |       | +     | +     | +     | USNM; Highsmith, 1981           |
| Bikini                 |       | +     |       | +     | USNM                            |
| Rongelap               |       | +     |       | +     | USNM                            |
| Jaluit                 |       | ++    |       | +     | Miyake, 1942; USNM              |
| Nauru                  |       |       |       |       |                                 |
| Anabar Beach           |       | +     |       |       | PS                              |
| Kiribati (Gilbert Is.) |       |       |       |       |                                 |
| Onotoa                 |       |       |       | +     | USNM                            |
| Tuvalu (Ellice Is.)    |       |       |       |       |                                 |
| Funafuti               | +     | ++    | +     | +     | Borradaile, 1898                |
| Rotuma                 | +     | ++    | +     | +     | Borradaile, 1898                |
| Tonga Is.              |       |       |       |       |                                 |
| Eua                    |       |       | +     |       | USNM                            |
| Niuafoou               |       | +     |       |       | USNM                            |
| Western Samoa          |       |       |       |       |                                 |
| Apia                   | +     |       |       | +     | Haig, 1964; USNM                |
| American Samoa         |       |       |       |       |                                 |
| Pago Pago              |       | +     |       | +     | Borradaile, 1898; USNM          |
| Line Is.               |       |       |       |       |                                 |
| Palmyra Id.            |       |       |       | ++    | Edmondson, 1923                 |
| Fanning Atoll          |       | +     |       | ++    | USNM; Edmondson, 1923           |
| Phoenix Is.            |       |       |       |       |                                 |
| Canton Id.             | +     |       | +     |       | USNM                            |
| Society Is.            |       |       |       |       |                                 |
| Huahine                |       | +     |       |       | USNM                            |
| Moorea                 |       | +     |       |       | USNM                            |
| Tahiti                 |       | +     |       |       | USNM                            |
| Marquesas Is.          |       |       |       |       |                                 |
| Pacua Pass             |       | +     |       |       | USNM                            |
| Nukuhiva               |       | +     |       |       | USNM                            |
| Tuamotu Archipelago    |       |       |       | ++    | Dana, 1852                      |
| Tikahua                |       | +     |       |       | USNM                            |
| Rangiroa               |       | +     |       |       | USNM                            |
| Fakarova               |       | +     |       |       | USNM                            |
| Makeno                 |       | +     |       |       | USNM                            |
| Raroia                 |       | +     |       |       | USNM                            |

<sup>a</sup> Laurie states that these specimens have posterior marginal spines on the carpus of the cheliped, therefore, they are probably not *P. rufescens* and the record seems valid.

<sup>b</sup> Chilton mentions spinules on the merus of the walking legs of some specimens, this casts doubt on the validity of this record.