

Shallow Water Porcelain Crabs  
from the Pacific Coast of Panama  
and Adjacent Caribbean Waters  
(Crustacea: Anomura: Porcellanidae)

ROBERT H. GORE  
and  
LAWRENCE G. ABELE

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## ABSTRACT

Gore, Robert H., and Lawrence G. Abele. Shallow Water Porcelain Crabs from the Pacific Coast of Panama and Adjacent Caribbean Waters. (Crustacea: Anomura: Porcellanidae). *Smithsonian Contributions to Zoology*, number 237, 30 pages, 4 figures, 3 tables, 1976.—Collections of porcellanid crabs were made in over 130 areas in the Republic of Panama in order to sample as completely as possible all the major marine, estuarine, and freshwater biotopes on both coasts of the isthmus. Additional collections were carried out on Uva Island in the Gulf of Chiriqui, the Perlas Islands in the Bay of Panama on the Pacific coast, and at Galeta Island on the Atlantic coast. Red mangrove *Rhizophora mangle*, rocky intertidal, pocilloporid coral *Pocillopora damicornis*, and the coralline back reef biotopes were extensively sampled, as well as selected areas in Miraflores, Pedro Miguel, and Gatun locks in the Panama Canal itself. As a result of the present study, 65 species of porcelain crabs are now known to occur in the tropical waters on either side of the Panamanian isthmus, 43 in the eastern Pacific and 22 in the Caribbean Sea. Included in these are seven species newly recorded for Panama and three recently described species. The porcellanid faunal component in Panama comprises 66% of the total tropical porcellanid component in the Panamic, and 67% of the Caribbean and Antillean faunal subprovinces. A key is provided to aid in identification of the porcellanid crabs that are known, or that are expected to occur in the waters on either side of the isthmus.

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# Shallow Water Porcelain Crabs from the Pacific Coast of Panama and Adjacent Caribbean Waters (Crustacea: Anomura: Porcellanidae)

*Robert H. Gore  
and Lawrence G. Abele*

## Introduction

The porcellanid crab fauna in the Caribbean and Pacific waters of the Panamanian isthmus have received sporadic attention for over 100 years. Among the first species to be noted from Panama were *Petrolisthes occidentalis* (= *P. galathinus* (Bosc)) and *P. armatus* (Gibbes). These species were recorded by Stimpson in 1858 and 1859.\* Additional studies on eastern Pacific porcellanids have been provided by several authors, notably A. Milne Edwards (1869) on material from the Pearl Islands; T. H. Streets (1871), who repeated the listing of Isthmian porcellanids of Stimpson; Faxon (1893) on material collected by the USCSS *Albatross* from the Bay of Panama; Nobili (1901) on material from Flamenco Island, Bay of Panama; Rathbun

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\*As Haig has pointed out (1960:38), the designation "Panama" probably referred to Panama City on the Pacific coast of the isthmus. Atlantic coast references were generally to "Aspinwall," today called Colon.

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(1910), who listed Panamic Province material likely to occur in the Peruvian Province; Boone (1931) on material obtained from the Bay of Panama and the Canal Zone; and Haig on material from the Panama Bight (1957), a monographic study on eastern Pacific Porcellanidae (1960), and material collected by the R/V *Zaca* along the Pacific coast of Central America (1968).

Studies on the porcellanid fauna from the Caribbean side of Panama are less extensive. In addition to the above-mentioned work of Stimpson, Nobili (1897) provided notes on material from the Caribbean shore of Panama, Boone (1930) made brief mention of material from Limón Bay, Haig (1956, 1960, 1962, 1966) contributed to our knowledge in reporting on material collected by the *Velero III* and other expeditions in the vicinity of Atlantic Panama, and finally Gore and Shoup (1968) and Gore (1970, 1974) provided notes on material collected by the University of Miami R/V *John Elliott Pillsbury* in Caribbean waters adjacent to the Republic of Panama as well as areas of the southwestern Caribbean. The results of all these studies indicated that, prior to the initiation of the present investigation, the porcellanid crab fauna of Panama consisted of at least 36 species

from the Pacific coast and 17 species from the Caribbean coast.

The present study began in 1968 when a survey of the total decapod crustacean fauna of Panama was undertaken (Abele, 1972). Biotope diversity is more extensive on the Pacific coast than on the Atlantic, although comparisons can in many instances be made among both series of biotopes across the isthmus. Collections of porcellanid crabs were made in order to sample as completely as possible all the major biotopes occurring on both coasts of the Panamanian isthmus. Thus, during the first year of study, over 100 areas were sampled along the shores of the Bay of Panama, as well as some of the offshore islands. On the Caribbean coast 30 major areas were sampled between the towns of Piñas and Portobelo. Additional collections were made in Panama from 1972 to 1974 with special attention to Galeta Island on the Caribbean coast, Uva Island in the Gulf of Chiriqui, the eastern Pacific Ocean, and selected areas of the Panama Canal itself.

For this study the following biotopes were sampled on the Pacific side of the isthmus: (1) the red mangrove (*Rhizophora mangle*) areas along the shores of the Bay of Panama, and some of the offshore islands, (2) the *Pocillopora damicornis* coral community offshore of some islands, (3) the rocky intertidal areas along the shores of the isthmus, and (4) selected areas inside the Panama Canal. On the Caribbean side, collections were carried out in the rocky intertidal areas, including the coralline back reef and shelf at Galeta Island, and inside the Gatun Locks on the Atlantic side of the Panama Canal. Collections were also made in the Caribbean mangrove areas around Galeta Island, but no porcellanids were taken, although the area supports a substantial xanthid and gecarcinid decapod fauna. Porcellanids probably occur among oysters and other epifauna on the subtidal roots of mangroves but none are associated with the mangroves themselves. A list of all the stations at which material was collected for this study is presented in Table 1 and mapped in Figure 1.

All specimens were measured using either dial calipers or an ocular reticle calibrated with a stage micrometer on a Wild M-5 stereomicroscope. Measurements are given in millimeters rounded off to the nearest tenth. Carapace length is followed by carapace width. Specimens are deposited in the

National Museum of Natural History, Washington, D.C., and the Allan Hancock Foundation, University of Southern California, Los Angeles. Other material is deposited in the Smithsonian Institution, Ft. Pierce Bureau Reference Museum, Florida.

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### Ecological Considerations

The porcellanid crab fauna of Panama, like the vast majority of species in the family in other parts of the world, is primarily littoral. For the discussion that follows the distribution and number of individuals in each species per biotope is summarized in Table 2. Number of individuals does not refer to density (i.e., number/m<sup>2</sup>) but is merely an estimate of each species' relative abundance in the habitat.

PACIFIC RED MANGROVE FAUNA.—Four species and 67 individuals were collected from Pacific red mangrove (*Rhizophora mangle*) swamps. *Petrolisthes zaca* was the most abundant species. It occurred in shallow burrows and in "crab runs" (Warner, 1969), viz., anastomosing tunnels formed by brachyuran crabs and the breakdown of mangrove roots. *Petrolisthes lindae* was also common



TABLE 1.—List of stations on the Pacific and Atlantic sides of Panama at which Porcellanidae were collected

PACIFIC STATIONS	Station Description
1. Golfo de Chiman	Bay of Panama, Golfo de Chiman; trawl; 3-8m, 27 May 1969.
2. Isla Chepillo	Bay of Panama, Isla Chepillo; intertidal, 26 May 1969.
3. Juan Diaz	Bay of Panama, offshore from town of Juan Diaz; trawl; 6-7 m; 15 January 1969.
4. Panama City	Albert Einstein Institute; intertidal, 17 February 1969.
5. Punta Paitilla	Panama City; intertidal, 27 November 1968, 7 December 1968, 14 April 1969, 15 April 1969, 1 July 1969, 7 July 1969, 29 October 1970.
6. Panama Canal, Pacific	Canal Zone, east bank of Panama Canal; intertidal, 27 October 1968.
7a. Panama Canal, Pacific Entrance	Canal Zone, entrance to Canal; intertidal, 16 April 1969.
7b. Diabolo	Canal Zone, Diabolo boat ramp; intertidal, 3 July 1969, 10 August 1973.
8. Miraflores Locks	Canal Zone; Miraflores Locks; sides and bottom of locks while drained for cleaning, 17 February 1972, M. L. Jones, collector.
9. Pedro Miguel Locks	Canal Zone, Pedro Miguel Locks; sides and bottom of locks while drained, 3 February 1969.
10. Fort Amador	Canal Zone, Ft. Amador, Smithsonian Tropical Research Institute; intertidal, 26 December 1968.
11. Rodman Naval Station	Canal Zone, Rodman Naval Station; intertidal, 17 April 1969.
12. Fort Kobbe	Canal Zone, Fort Kobbe, Venado Beach; intertidal, 8 May 1969, 1 July 1969.
13. Taboga Island	Bay of Panama, Taboga Island, 2 m, 11 April 1969.
14. Taboguilla Island	Bay of Panama, Taboguilla Island; intertidal to 2m, 7 April 1969, 11 April 1969, 12 July 1969, 8 January 1973.
15. Saboga	Bay of Panama, 8 miles west of Saboga Island, no depth available; 12 December 1970.
16. Perlas Islands	Bay of Panama, Perlas Islands, Espirito Santo Bay, Rey Island; intertidal, 25 January 1969, 12-13 June 1973, W. Patton & A. Glamm, collectors.
17. Aguadulce, Salado Playa	Aguadulce, south end of Salado Playa; intertidal, 9 November 1968.
18. Aguadulce, Rio Palo Banco	Aguadulce, Aguadulce Yacht Club, Rio Palo Banco; 3-5m, 9 November 1968.
19. Uva Island	Gulf of Chiriqui, Pocillopora reef; 21 January 1974; P. Glynn, collector.

TABLE 1.—Continued.

ATLANTIC STATIONS	Station Description
1. Portobelo Bay	Portobelo Bay, Intertidal, 14 May 1969.
2. Maria Chiquita	Caribbean, intertidal indurated reef, tidepools; 18 July 1969.
3. Galeta Island	Canal Zone, Galeta Island, Smithsonian Tropical Research Institution; intertidal 11 March 1969; 6 m, 3 May 1969; intertidal to 2 m, 15 July 1969; intertidal, 24 April 1969, P. Glynn collector; intertidal, 11-12 August 1973, 13-14 June 1974.
4. Fort Randolph	Canal Zone, Fort Randolph; intertidal, 22 April 1969.
5. Coco Solo	Canal Zone, Coco Solo Naval Station; intertidal, 22 April 1969.
6. Gatun Locks	Canal Zone, Gatun Locks, 5 March 1974.
7. Ft. Sherman	Canal Zone, Ft. Sherman, on fossil reef; 0-3 m, 18 January 1969; Shimmy Beach; intertidal, 8 February 1969.

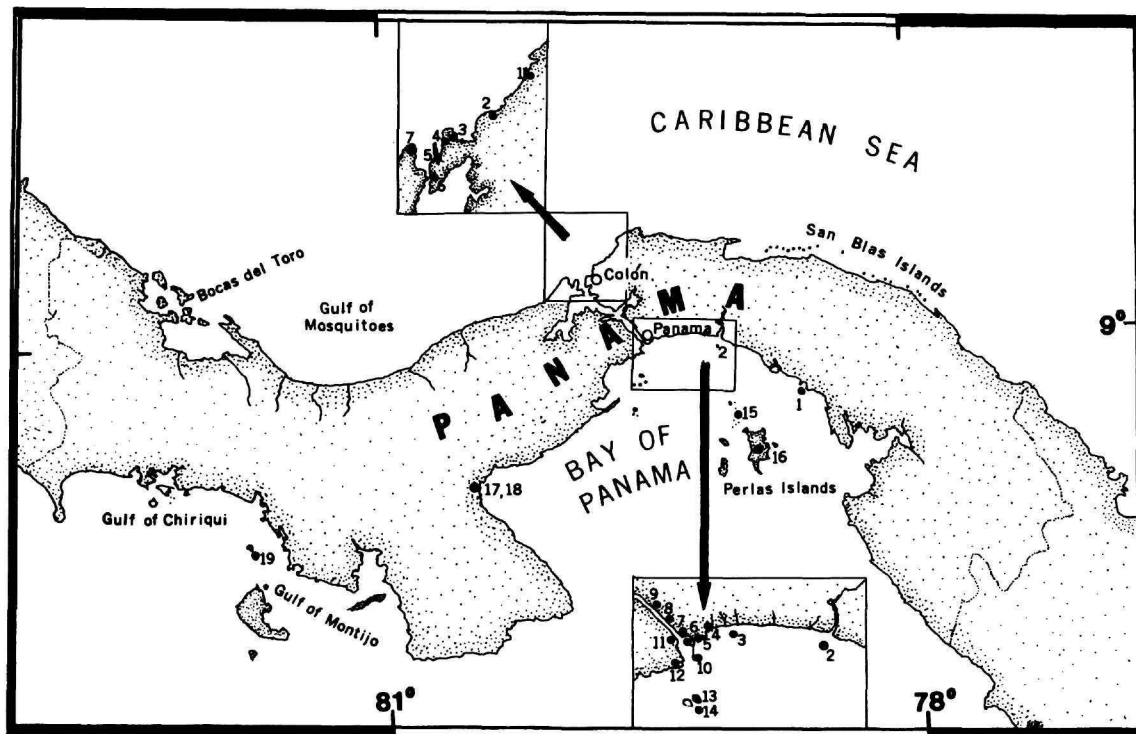


FIGURE 1.—Map of the Republic of Panama showing general localities of stations at which porcellanid crabs were collected, as noted in Table 1 and in the text.

TABLE 2.—The porcellanid crab fauna of Panama (specimens taken by hand)

Species	No. individuals examined		
<b>Pacific Red Mangrove Fauna*</b>			
<i>Petrolisthes zaca</i> .....	38		
<i>Petrolisthes lindae</i> .....	24		
<i>Petrolisthes armatus</i> .....	4		
<i>Petrolisthes nobilii</i> .....	1		
(1 genus, 4 species)			
Total .....	67		
<b>Rocky Intertidal Fauna</b>			
Pacific coast			
<i>Petrolisthes armatus</i> .....	175		
<i>Petrolisthes tridentatus</i> ....	20		
<i>Petrolisthes nobilii</i> .....	8		
<i>Megalobrachium pacificum</i> ....	7		
<i>Pisidia magdalenensis</i> .....	6		
<i>Petrolisthes edwardsii</i> .....	3		
<i>Petrolisthes galathinus</i> .....	3		
<i>Petrolisthes platymerus</i> .....	2		
<i>Pachycheles chacei</i> .....	2		
<i>Pachycheles calculosus</i> .....	1		
<i>Pachycheles panamensis</i> .....	1		
(4 genera, 11 species)			
Total .....	228		
Atlantic coast			
<i>Pachycheles serratus</i> .....	45		
<i>Petrolisthes galathinus</i> ....	20		
<i>Petrolisthes armatus</i> .....	17		
<i>Pachycheles chacei</i> .....	15		
<i>Petrolisthes jugosus</i> .....	12		
<i>Neopisosoma angustifrons</i> ....	12		
<i>Megalobrachium roseum</i> .....	10		
<i>Pachycheles susanae</i> .....	8		
<i>Pachycheles cristobalensis</i> ..	4		
<i>Megalobrachium poeyi</i> .....	4		
<i>Megalobrachium soriatum</i> .....	1		
<i>Clastocheilus nodosus</i> .....	1		
(5 genera, 12 species)			
Total .....	151		
<b>Pocillopora damicornis Fauna on Pacific Panamanian Islands</b>			
	Taboguilla	Perlas	Uva
<i>Petrolisthes haigae</i> .....	156	79	108
<i>Petrolisthes edwardsii</i> .....	9	4	5
<i>Petrolisthes glasselli</i> .....	4	-	9
<i>Petrolisthes agassizii</i> .....	2	38	-
<i>Petrolisthes nobilii</i> .....	2	-	-
<i>Petrolisthes tridentatus</i> ....	2	-	-
<i>Petrolisthes polymitus</i> .....	1	2	-
<i>Petrolisthes galathinus</i> .....	-	3	-
<i>Pisidia magdalenensis</i> .....	5	180	-
<i>Pachycheles biocellatus</i> .....	13	2	13
<i>Pachycheles vicarius</i> .....	-	1	-
<i>Ulloaia perpusillia</i> .....	-	1	-
<i>Megalobrachium erosum</i> .....	-	2	-
<i>Megalobrachium tuberculipes</i> ..	-	2	3
<i>Megalobrachium smithi</i> .....	-	3	-
(5 genera, 15 species)			
Totals .....	194	317	135
<b>Panama Canal Fauna</b>			
	Miraflores	Pedro Miguel	Gatun
	upper-lower	upper	lower
<i>Petrolisthes armatus</i> .....	-	-	52
<i>Petrolisthes lindae</i> .....	25	8	1
<i>Petrolisthes robsonae</i> .....	5	30	-
(1 genus, 3 species)			
Totals .....	30	38	52

\* No porcellanid crabs occurred in mangroves on the Atlantic coast.

in this habitat but did not overlap in distribution with *P. zaca* within the swamp. *Petrolisthes lindae* was found among litter in areas of very low salinity, usually less than 16‰. This is consistent with the distribution of *P. lindae* within the Panama Canal; it is rarely found in freshwater but is common in water from about 10‰ to 20‰. The other two species, *P. armatus* and *P. nobilii*, rarely occur within the swamp itself. *Petrolisthes nobilii* is more often taken in mud areas at the edge of the swamp, while *P. armatus* can be found almost anywhere there is hard substrate.

No species of porcellanids were collected from the inter- or supratidal regions of Caribbean mangroves. This may be due in part to the feeding mechanism of porcellanids as well as to the difference in tidal range on the Caribbean and Pacific coasts. For example, the Pacific coast has diurnal tides of about 5 m height which consistently flush out the mangroves and provide a regular water current with all its contained plankton. The Caribbean coast, on the other hand, has mixed diurnal tides of about 0.3 m in height which may inundate the mangroves only occasionally. Since species of *Petrolisthes*, like all porcellanids, are filter feeders they may not be able to obtain sufficient food in the intertidal area due to the absence of regular flooding in Caribbean mangroves.

**ROCKY INTERTIDAL FAUNA.**—Eleven species and 228 individuals were collected from the Pacific rocky intertidal habitat. *Petrolisthes armatus* was by far the most abundant species, occurring under rocks from upper to mid-lower tidal levels. A common density for this species, the most abundant intertidal decapod on the Pacific coast of Panama, was 20 individuals per m<sup>2</sup>. *Petrolisthes tridentatus*, *P. edwardsii*, *P. galathinus*, and *Pisidia magdalenensis* occurred under rocks and among shell hash in tide pools in the mid-intertidal regions. *Petrolisthes nobilii* and *Megalobrachium pacificum* occurred in areas where mud and sand-mud were the dominant substrates among the lava-flow rocks. *Petrolisthes platymerus* and *Pachycheles chacei* were always found clinging to the undersides of boulders (diameter 0.3 m) and often occurred among sponges. *Pachycheles calculosus* and *P. panamensis* were found only in the lower intertidal zone.

Twelve species and 151 individuals were collected from the Caribbean rocky intertidal coast. The Caribbean coastline, in the areas sampled,

lacks the rocky lava-flow intertidal zone so characteristic of the eastern Pacific. However, distinct zones of seagrass, red algae, and zoanthid anemones can nevertheless be recognized along reef flats. There are five discrete and recognizable zones progressing seaward from shore (Birkeland, Reimer, and Young, 1976): plant zones with (1) *Thalassia* or (2) *Acanthophora*; an intermediate zone characterized by (3) *Zoanthus* and (4) *Laurencia*, and (5) a coralline region that extends to the edge of the steep seaward slope. The coralline zone had the greatest number of species; 10 of the 12 that were collected occurred among the cracks and crevices of the coral rocks. As seen from Table 2, *Pachycheles serratus* and *Petrolisthes galathinus* were the two most abundant species. Both *Pachycheles susanae* and *Petrolisthes jugosus* were very common in species of the stinging coral, *Millepora*. *Neopisosoma angustifrons*, *Pachycheles chacei*, *P. cristobalensis*, *Megalobrachium roseum*, and *M. poeyi* were found here and among clumps of the calcareous green alga *Halimeda* in this zone. The remaining species seemed to be confined primarily to the calcareous rocky substratum. In the red alga *Laurencia* of the fourth zone, *Petrolisthes jugosus* occurred again, and both *Clastocheilus nodosus* and *Pachycheles serratus* were also found. In the *Zoanthus*, *Thalassia*, and *Acanthophora* zones, there occurred only one species each, i.e., *Petrolisthes galathinus*, *P. armatus*, and *P. galathinus*, respectively. The single specimen of *Megalobrachium soriatum* was taken from coralline rubble along the seaward edge of the reef.

It is interesting that these distributions show the majority of porcellanid species each to be restricted to a particular zone despite the fact that all the species have planktonic larvae and the zones are contiguous across the reef flat, a distance of about 100 meters. For example, over a three-year period only a single specimen of *Pachycheles serratus*, the dominant coralline species, was collected outside this zone in the adjacent *Laurencia*. Furthermore, six of the coralline zone species were found only in that zone and nowhere else.

*Pocillopora damicornis* (L.) FAUNA.—Three *Pocillopora* communities were sampled in Panama: Taboguilla Island, the Perlas Islands in the Bay of Panama, and Uva Island in the Gulf of Chiriqui. The species and numbers of individuals from each area are shown in Table 2 where the disparity

between species abundance in the three areas can be seen. These areas can be compared in terms of both species composition and abundance because we are comparing approximately the same number (30–35) and size range (1000–20,000 cm<sup>3</sup>) of coral heads in each area. *Petrolisthes haigae* was the dominant species at Taboguilla and Uva, and the second most common species in the Perlas Islands. It appeared to be restricted to *Pocillopora* coral and was not collected by us in any other habitat. Contrarily, *Pisidia magdalenensis* was the dominant species in the Perlas Islands, though uncommon at Taboguilla and apparently absent from Uva Island.

Of additional interest is the observation that these porcellanids were not evenly distributed over the reef at Uva Island. The front and rear of the reef crest were similar in species richness and abundance, but the deeper reef flanks, especially to the rear, contained only a few individuals of a single species. This difference may be related to variant current patterns and amounts of suspended sediments on the deeper reef which could, therefore, conceivably restrict feeding by these filter feeders.

FAUNA OF THE PANAMA CANAL.—Three species of porcellanids were commonly found in the Panama Canal and all were apparently able to withstand the great variation in salinity that occurs there. Moreover, the distribution pattern of these three species is quite interesting and strongly suggests competitive interactions.

On the Atlantic coast *Petrolisthes armatus* was very common in the lower chambers of Gatun Locks, an area where the salinity may vary from 10‰ to 15‰ (Jones and Dawson, 1973). A few specimens were taken at the lower entrance of the middle chambers in water of about 5‰. A second species, *P. robsonae*, was reported by Haig (1960) based on a single specimen collected from the lower chamber of Gatun Locks. It is the only Atlantic record of this eastern Pacific species which otherwise was common in the Miraflores Locks, especially in the lower chambers where the salinity may vary from 10‰ to 30‰.

A single specimen of *P. lindae* was collected in the freshwater of Pedro Miguel Locks on the Pacific side, although the species is quite common in the upper and, to a lesser extent, lower chambers of the nearby Miraflores Locks. The species is thus known to occur in waters of salinity from 0‰ to

30‰. The eastern Pacific form of *Petrolisthes armatus* was collected just below the lower chambers of Miraflores, where it was very common.

On the Atlantic coast *P. armatus* shows a wide tolerance to varying salinities, being found in water from 28‰ outside of the Panama Canal, as well as in waters of about 10‰ inside the Gatun Locks. Yet on the Pacific coast, *P. armatus* is absent from all the locks, although it occurs outside of Miraflores Locks (in the mouth of the Canal); *P. robsonae* and *P. lindae*, however, occur on the Pacific side in the zone occupied by *P. armatus* in Gatun Locks on the Atlantic side. Furthermore, the distribution of *P. lindae* and *P. robsonae* in the Panama Canal is somewhat disjunct, with *P. lindae* occurring in lower salinity waters, and *P. robsonae* being found in waters of higher salinities. Thus, three species occur along a salinity gradient on the Pacific coast, whereas on the Atlantic coast this gradient is apparently occupied by only a single species, albeit either a close relative or conspecific of the three Pacific species in question.

#### Zoogeographical Considerations

As a result of the present study 43 species of porcelain crabs are now known to occur in the tropical eastern Pacific coastal waters of Panama. Of these species, four may be extralimital. They are *Megalobrachium erosum*, *M. smithi*, *Porcellana corbicola*, and *Petrolisthes brachycarpus*. The first three species were previously thought to be restricted to the Gulf of California, Mexico, or its environs. The fourth species, known previously from the Galapagos Islands, has been previously recorded by Haig (1960) from Panama. Two other species recently described by us, *Petrolisthes lindae* and *Megalobrachium pacificum* (Gore and Abele, 1974), are also new from Pacific Panama.

The present study and previous records in the literature indicate that at least 21 species of porcelain crabs (excluding the questionable record for *Petrolisthes robsonae*) are found on the Caribbean coast of Panama. Three of these, *Clastocheilus nodosus*, *Neopisosoma angustifrons*, and *Megalobrachium roseum* are new to Caribbean Panama. The first two species, previously recorded by several authors from the eastern and southwestern Caribbean or Brazil, were recently noted from

El Moro, Mexico, in the southwestern Gulf of Mexico (Rickner, 1975). A single record for the third species, *M. roseum* from Santa Marta, Colombia, was given by Haig in 1956. A fourth species, *Porcellana sigsbeiana*, has been collected in waters both north and south of Panama but not yet from the waters of the country itself. A fifth and new species, *Pachycheles susanae*, was previously described by us in an earlier paper (Gore and Abele, 1974).

Of the 48 eastern Pacific species of porcellanid crabs that were previously recorded as occurring in, or whose ranges encompassed, the waters of Panama, the present study has accounted for 29 of 48, or 60 percent (Table 3). This study has also accounted for 12 of the 21 species of porcellanids presently known from Caribbean Panama, or over 57 percent of the total. The seven new records and three new species for the isthmian region included herein bring the total of the porcellanid crab species known from Atlantic and Pacific Panamanian waters to 65 (including the five trans-Panamanian conspecifics; see Table 3).

If we define the Panamic Province as extending from the head of the Gulf of California and the outer Baja Peninsula at about the vicinity of Magdalena Bay, southward to Guayaquil, Ecuador (Garth, 1961; Haig, 1968), then the total number of porcelain crab species in this region stands at 65, of which 43 (66 percent) occur in the waters of Pacific Panama.

The porcellanid fauna is equally well represented on the Atlantic side of Panama, where 31 species have been recorded from both Caribbean and Antillean Faunal Provinces. Of these 31 species, 21 (67 percent) of the known total occur along the Caribbean coast of Panama.

The importance of the Panamanian porcellanid faunal component can be easily seen when one considers its relationship to the total American porcellanid fauna. Data available from several authors indicate that the total number of porcellanid species in the eastern Pacific Ocean now stands at 88, while in the western Atlantic Ocean at least 34 species are known, for a total American faunal component of at least 122 species. The porcellanid fauna of Panama thus accounts for over 57% of the total American porcellanid fauna. Moreover, approximately 250 species of Porcellanidae are known throughout the world, so that the American faunal component com-

TABLE 3.—Species of Porcellanidae recorded from or with ranges encompassing the Pacific or Atlantic coast of Panama

Pacific species	Collected herein	New to Panama	Collected herein	Atlantic species
<i>Clastocheilus diffractus</i> .....	+		+	... <i>Clastocheilus nodosus</i>
<i>Euceramus panatelus</i> .....	-			
<i>Euceramus transversilineatus</i> ....	-			
<i>Megalobranchium erosum</i> .....	+	+	-	... <i>Megalobranchium mortensenii</i>
<i>Megalobranchium festai</i> .....	-		+	... <i>Megalobranchium poeyi</i>
<i>Megalobranchium garthi</i> .....	-		+	... <i>Megalobranchium roseum</i>
<i>Megalobranchium pacificum</i> .....	+		+	... <i>Megalobranchium soriatum</i>
<i>Megalobranchium smithi</i> * .....	+	+		
<i>Megalobranchium tuberculipes</i> .....	+		-	... <i>Minyocerus angustus</i>
<i>Neopisosoma dohenyi</i> .....	-		+	... <i>Neopisosoma angustifrons</i>
<i>Neopisosoma mexicanum</i> .....	-			
<i>Orthocheila pumila</i> .....	-			
<i>Pachycheles chacei</i> .....	+		+	... <i>Pachycheles chacei</i>
<i>Pachycheles biocellatus</i> .....	+		-	... <i>Pachycheles ackleianus</i>
<i>Pachycheles calculosus</i> .....	+		+	... <i>Pachycheles cristobalensis</i>
<i>Pachycheles crassus</i> .....	-	+	+	... <i>Pachycheles susanae</i>
<i>Pachycheles panamensis</i> .....	+		+	... <i>Pachycheles serratus</i>
<i>Pachycheles spinidactylus</i> .....	-			
<i>Pachycheles trichotus</i> .....	-			
<i>Pachycheles vicarius</i> .....	+			
<i>Petrolisthes armatus</i> .....	+		+	... <i>Petrolisthes armatus</i>
<i>Petrolisthes galathinus</i> .....	+		+	... <i>Petrolisthes galathinus</i>
<i>Petrolisthes tridentatus</i> .....	+		-	... <i>Petrolisthes tridentatus</i>
<i>Petrolisthes agassizii</i> .....	+		+	... <i>Petrolisthes jugosus</i>
<i>Petrolisthes artifrons</i> .....	-		-	... <i>Petrolisthes politus</i>
<i>Petrolisthes brachycarpus</i> * .....	-		-	... <i>Petrolisthes quadratus</i>
<i>Petrolisthes edwardsii</i> .....	+			
<i>Petrolisthes glasselli</i> .....	+			
<i>Petrolisthes haigae</i> .....	+			
<i>Petrolisthes hians</i> .....	-			
<i>Petrolisthes holotrichus</i> .....	-			
<i>Petrolisthes lewisi austrinus</i> .....	-			
<i>Petrolisthes lindae</i> .....	+	+		
<i>Petrolisthes nigrunguiculatus</i> .....	+			
<i>Petrolisthes nobilii</i> .....	+			
<i>Petrolisthes ortmanni</i> .....	-			
<i>Petrolisthes platymerus</i> .....	+			
<i>Petrolisthes polymitus</i> .....	+			
<i>Petrolisthes robsonae</i> .....	+		-	... <i>Petrolisthes robsonae</i> **
<i>Petrolisthes tonsorius</i> .....	-			
<i>Petrolisthes zaca</i> .....	+	+		
<i>Pisidia magdalenensis</i> .....	+			
<i>Polyonyx nitidus</i> .....	-		-	... <i>Polyonyx gibbesi</i>
<i>Porcellana corbicolata</i> * .....	+	+	-	... <i>Porcellana sayana</i>
<i>Porcellana cancrisocialis</i> .....	+		-	... <i>Porcellana sigsbeiana</i>
<i>Porcellana hancocki</i> .....	+			
<i>Porcellana paguriconviva</i> .....	+			
<i>Ulloaia perpusillia</i> .....	+			
Totals ..... (29+ and 19-)	48	6	4	22 (12+ and 10-)

Data taken from Haig, 1956, 1960, 1962, 1968; Haig et al., 1970; Gore, 1970; Gore and Abele, 1974.

\* Possibly extralimital.

\*\* Known only from a single recording, Gatun Locks, Panama Canal; locality needs verification.

prises almost 50% of the total number of species worldwide.

#### Systematic Considerations

In the following text we restrict synonymies to those of the original author, the first use of the

taxon in its presently accepted sense, the work providing the best description or illustration of the species under consideration, the more important references which have appeared since Haig's monographs (1956, 1960) on the porcellanid crabs from the western Atlantic and eastern Pacific, or the recent update of Caribbean species by Gore (1974).

The key that follows may be used to determine the species of Porcellanidae which are known to occur on either side of Panama. The key is modified primarily from those that appeared in the previously cited monographic studies by Ms. Janet Haig (esp. 1960). Species that we have collected and examined are preceded by a number which refers to the discussion of the species in the text of this

study. Species not so numbered in the key are those that are known to occur in Panamanian waters, or have ranges which extend to either north or south of the country, but have not yet been collected by us. Those species that have not yet been recorded from Panama but which might occur in the shallow waters on either side of the isthmus are followed in the key by an asterisk.

### Key to the Species of Porcellanid Crabs

(Known to occur on the eastern Pacific and Caribbean coasts of the Republic of Panama)

1. Carapace at least 1.5 times as long as broad; form elongate, "Hippra"-like; a large orbit-like concavity on hepatic margin, its outer angle marked by a tooth ..... *Euceramus* (2)  
Carapace less than or nearly 1.5 times as long as broad; form not elongate or "Hippra"-like; no large orbit-like concavity on hepatic margin ..... 4
2. Carapace about 1.5 times as long as broad, with distinct transverse striations; antennal flagellum shorter than carapace, without hairs .....  
..... *Euceramus transversilineatus* (Lockington) (Pacific)  
Carapace at least twice as long as broad or longer, lightly plicate; antennal flagellum longer than carapace, and distinctly hairy ..... 3
3. Median lobe of frontal region distinctly longer than lateral lobe; basal segment of the antenna with broad inward projection, and narrowly in contact with anterior margin of the carapace; propodus and dactylus of walking leg 2 normal .....  
..... *Euceramus praelongus* Stimpson (Atlantic)\*  
Median lobe of frontal region equal or slightly longer than lateral lobes; basal segment of antennae without inward or forward projections; dactylus of walking leg 3 flat, without a nail ..... *Euceramus panatelus* (Glassell) (Pacific)
4. Chelipeds normally held more or less straight out in front of carapace; carapace about 1.5 times as long as broad, lateral margins armed with a series of 12-15 minute, close-set spinules posterior to the cervical groove ..... *Orthochela pumila* Glassell (Pacific)  
Chelipeds normally bent sharply at articulation of carpus and manus; carapace never as much as 1.5 times as long as broad, lateral margins never with as many as 12-15 minute, close-set spinules posterior to cervical groove ..... 5
5. Basal segment of antennae short, not strongly produced forward to meet anterior margin of the carapace, movable segments with free access to the orbit ..... 6  
Basal segment of antennae strongly produced forward and broadly in contact with the anterior margin of the carapace so that movable segments are far removed from the orbit ..... 51
6. Posterior portions of side walls of carapace lacking, or consisting of one or more small pieces, separated by membranous interspaces behind the epibranchial region ..... 7  
Posterior portions of side walls of carapace entire, without small pieces or membranous area behind epibranchial region ..... 27
7. Side walls of carapace incomplete, the portion posterior to epibranchial or mesobranchial area occupied by membrane ..... *Neopisosoma* (8)  
Side walls of carapace consisting of one or more pieces separated by membranous interspaces in epibranchial or mesobranchial area ..... 12
8. Chelipeds large, robust, markedly differing in size, covered with numerous rounded, projecting granules; carpus without distinct crests; telson 5-plated; male pleopods lacking ... 9  
Chelipeds as above, but covered with flattened granules, carpus with three more or less distinct crests; telson 7-plated (occasionally 5- or incompletely 7-plated); male pleopods present ..... 10
9. Side wall of carapace consisting only of small anterior wedge ending at epibranchial level; outer surface of manus at junction of fingers without large noticeable whitened granulate tubercle ..... *Neopisosoma dohertyi* Haig (Pacific)  
Side wall of carapace consisting of narrow, curved portion extending posteriorly to meso-

- branchial area; outer surface of manus with distinct, whitened, granulate tubercle at junction of fingers ..... 10. *Neopisosoma angustifrons* (Benedict) (Atlantic)
10. Carpus of chelipeds with 3 teeth, these occupying not more than the proximal two-thirds of the anterior margin; surface of carpus with three low, often obsolescent crests .....  
..... *Neopisosoma mexicanum* (Streets) (Pacific)
- Carpus of chelipeds with 4-5 teeth, occupying entire anterior margin; surface of carpus with three, distinct longitudinal crests and a fourth along the posterior margin ..... 11
11. Manus of both chelipeds thickly covered with long hair; telson 7-plated .....  
..... *Neopisosoma bicapillatum* Haig (Pacific)\*
- Manus of one, or both chelipeds usually lacking pubescence (except in females in which both hands are pubescent); telson 5-, incompletely 7-, or 7-plated .....  
..... *Neopisosoma curacaoense* (Schmitt) (Atlantic)\*
12. Chelipeds somewhat flattened, subequal; front strongly produced and distinctly trilobate in dorsal view; telson of abdomen with 5 plates, male pleopods present ..... *Clastotoechus* (13)
- Chelipeds thick, robust, distinctly dissimilar in size; front not prominent, usually transversely sinuate or rounded in dorsal view, often with distinct tuft of hairs, never distinctly trilobate in dorsal view; telson of abdomen with 5 or 7 plates; pleopods present or lacking in males ..... *Pachycheles* (15)
13. Front not greatly produced, lateral lobes pointed, not truncate; orbital margin deeply concave, not angular or oblique ..... 2. *Clastotoechus nodosus* (Streets) (Atlantic)
- Front greatly produced, lateral lobes truncate; orbital margin angular, shallow and oblique ..... 14
14. Carapace strongly granulate and rugose; front not markedly elongate; brush of hair on outer margin of manus of chelipeds usually present only in females .....  
..... 1. *Clastotoechus diffractus* (Haig) (Pacific)
- Carapace not strongly granulate and rugose; front markedly elongate; brush of hair on outer margin of chelipeds may be present in both males and females .....  
..... *Clastotoechus vanderhorsti* (Schmitt) (Atlantic)\*
15. Carapace with a distinct tuft of hairs on front, or surface covered with distinct hairs ..... 16
- Carapace devoid of hairs, or at most with scattered, isolated plumose or nonplumose hairs, often scarcely visible except under magnification ..... 18
16. Frontal region with distinct tuft of mixed plumose and nonplumose hairs; carpus of cheliped with 3-4 teeth, dorsal surface of same covered with small conical tubercles; manus with tufts of long nonplumose and short plumose hairs; telson 7-plated in males; 5- or incompletely 7-plated in females; male pleopods absent .....  
..... *Pachycheles spinidactylus* Haig (Pacific)
- Frontal region without a distinct tuft of hairs, although some hairs may be present; carpus of chelipeds with 2-3 teeth, these not tuberculate on dorsal surface; telson 7-plated or incompletely so ..... 17
17. Carapace covered with short, nonplumose setae; chelipeds with nonplumose setae only, carpus of same with short rugae or flattened granules; telson 7-plated; male pleopods present ..... 15. *Pachycheles panamensis* Faxon (Pacific)
- Carapace with a few short plumose and nonplumose hairs on front; chelipeds with short, nonplumose setae, but a few plumose hairs on posterior margin, carpus of same nearly smooth anteriorly, noticeably granulate posteriorly; telson 7-plated or incompletely so; male pleopods absent ..... *Pachycheles trichotus* Haig (Pacific)
18. Telson of abdomen with 5 plates ..... 19
- Telson of abdomen usually with 7 plates (except *P. vicarius* females) ..... 22
19. Carpus and manus of chelipeds nearly smooth; manus with distinct groove near outer margin; anterior margin of carpus with broad lamellar lobe, indistinctly divided into 3 teeth ..... 11. *Pachycheles biocellatus* (Lockington) (Pacific)
- Carpus and manus of chelipeds granulate; anterior margin of carpus a broad lobe divided into 8 or more small teeth, or cut into 4-5 large distinct teeth ..... 20
20. Carapace slightly roughened, plicate, not markedly convex from front to back; dactylus of walking legs without two strong fixed spines; anterior margin of carpus a broad lobe armed with about 8 small teeth or serrations; male pleopods present .....  
..... 13. *Pachycheles chacei* Haig (Atlantic and Pacific)
- Carapace smooth, shining, strongly convex front to back; dactylus of walking legs with 2 strong fixed spines on posterior margin in addition to terminal claw; carpus armed an-



- teriorly with 4 or 5 strong teeth; male pleopods absent .....21
21. Granules on chelipeds tending to form longitudinal rows; a distinct tubercle near the base of the pollex, pubescent on distal side .....  
*Pachycheles ackleianus* A. Milne Edwards (Atlantic)
- Granules on chelipeds evenly distributed over surface; no distinct tubercle near the base of the pollex .....  
*Pachycheles crassus* (A. Milne Edwards) (Pacific)
22. Carpus and manus of chelipeds with strong crests and grooves .....23  
Carpus and manus of chelipeds covered with granules .....24
23. Dorsal surface of cheliped carpus with three, long, low, gently rounded crests, not interrupted and broken into large tubercles; side wall of carapace broken about midway down its length; male pleopods absent .....  
17. *Pachycheles susanae* Gore and Abele (Atlantic)
- Dorsal surface of cheliped carpus with 4, high, distinct crests of which the third is often interrupted and broken into large irregular tubercles; side wall of carapace broken about two-thirds down its length; male pleopods present .....  
18. *Pachycheles vicarius* Nobili (Pacific)
24. Carpus and manus of chelipeds thickly covered with long, plumose hairs; no large tubercle on cutting edge of the dactyl of cheliped; first movable antennal segment without a distinct conical tubercle; male pleopods present .....25  
Carpus and manus of chelipeds devoid of hair, or at most with traces of pubescence; a large tubercle on the cutting edge of dactyl of cheliped; first movable antennal segment with a distinct conical tubercle; male pleopods absent .....26
25. Anterior margin of the carpus of cheliped indistinctly divided into 3 teeth; pubescence on chelipeds extremely thick and fine .....16. *Pachycheles serratus* (Benedict) (Atlantic)
- Anterior margin of the carpus of cheliped cut into 3 strong, distinct teeth; pubescence not as thick as preceding species, often scarcely evident on carpus .....  
*Pachycheles setimanus* (Lockington) (Pacific)
26. Carapace with posterolateral plications low, often scarcely developed; granulation on chelipeds reduced; walking legs sparsely and irregularly covered with long plumose hairs .....14. *Pachycheles cristobalensis* Gore (Atlantic)
- Carapace with well-developed plications posterolaterally; granulation of chelipeds distinct; walking legs thickly covered with long, plumose hairs .....  
12. *Pachycheles calculosus* Haig (Pacific)
27. Basal segment of antennule not laterally expanded; basal antennal segment neither produced inward nor forming partial suborbital margin; front triangular, prominent; carapace with distinct frontal, epibranchial and mesobranchial spinules; cheliped fingers distorted, gaping, deeply grooved along cutting edges, spooned and truncate at tips; telson 7-plated .....  
*Parapetrolisthes tortugensis* (Glassell) (Atlantic)\*
- Basal antennular segment as above; basal antennal segment either not produced inward, or if with a distinct inward projection, forming only a partial suborbital margin; front triangular or trilobate, usually prominent; carapace without mesobranchial spinules; cheliped fingers normal, not grooved along cutting edges nor spooned at tips; telson almost invariably 7-plated .....  
*Petrolisthes* (28)
28. Telson of abdomen with 5 plates .....29  
Telson of abdomen with 7 plates .....30
29. 3 or 4 teeth on carpus of chelipeds pointed, denticulate; outer margin of manus with longitudinal groove; carapace chelipeds, and gape of fingers lightly pubescent .....  
25. *Petrolisthes jugosus* (Streets) (Atlantic)
- 3 or 4 teeth on carpus of chelipeds rounded, broad; outer margin of manus with distinct longitudinal groove; carapace, chelipeds, and gape of fingers without pubescence .....  
*Petrolisthes hians* Nobili (Pacific)
30. Epibranchial spine present (if obsolescent or vestigial its position distinctly marked at epibranchial angle by a notch); anterior margin of merus of walking legs usually spined .....31  
Epibranchial spine absent; anterior margin of merus of walking legs without spines .....42
31. Carapace with distinct, transverse, piliferous striations, usually interrupted only at grooves defining the various regions .....32  
Carapace smooth, granulate, plicate or roughened, but never with distinct transverse piliferous striations .....36

32. Two epibranchial spines present ..... 23. *Petrolisthes glasselli* Haig (Pacific)  
 A single epibranchial spine present ..... 33
33. Carpus with three, low, wide-set teeth on anterior margin ..... 34  
 Carpus with 4 or 5 broad, close-set teeth on anterior margin ..... 35
34. Carpus of cheliped about twice as long as wide, covered with large, flattened tubercles; piliferous striations of carapace interrupted at the metabranchial regions .....  
 ..... 21. *Petrolisthes edwardsii* (Saussure) (Pacific)  
 Carpus of cheliped about 3 times as long as wide, covered with 3 longitudinal rows of rugae; piliferous striations of carapace continuing across the metabranchial regions .....  
 ..... 19. *Petrolisthes agassizii* Faxon (Pacific)
35. Front narrow, strongly produced, a distinct supraocular spine present, and often several spinules distally; carpus of cheliped about twice as long as wide, its surface covered with distinct, oblique striations; merus of walking legs with row of anterior spines, that of legs 1 and 2 (occasionally 3) armed with a posterodistal spine .....  
 ..... 22. *Petrolisthes galathinus* (Bosc) (Atlantic and Pacific)  
 Front broad, not strongly produced, a small supraocular spine present as well as minute denticles distally; carpus of cheliped about one and a half times as long as wide, its dorsal surface covered with short flattened rugae; merus of walking legs with 1 or 2 anterior spines, a posterodistal spine on merus of leg 1 only .....  
 ..... 29. *Petrolisthes polymitus* Glassell (Pacific)
36. Anterior margin of carpus of cheliped with 4 to 6 broad, close-set teeth; no strong supraocular spine but one or more usually close-set supraocular spinules present .....  
 ..... 24. *Petrolisthes haigae* Chace (Pacific)  
 Anterior margin of carpus of cheliped with 1 to 3 (rarely four) low, wide-set teeth, a distal lobe may be present in lieu of teeth; carapace never with a strong supraocular spine or spinules ..... 37
37. Epibranchial spine vestigial or absent, but a distinct notch visible if absent ..... 38  
 Epibranchial spine distinctly present, never vestigial ..... 40
38. Carapace distinctly granulate; carpus of cheliped 2.5 times as long as wide, its anterior margin with one spine plus an elongate lobe distally (rarely two small spines present); anterior margin of walking legs with one or no spines .....  
 ..... 26. *Petrolisthes lindae* Gore and Abele (Pacific)  
 Carapace granulate and plicate; carpus of cheliped about 2.5 times as long as wide, 3 spines present on the anterior margin; anterior margin of the walking legs usually with a row of spines ..... 39
39. Carapace widest posterior to midbranchial regions; orbits strongly oblique; chelipeds with the anterior lobe of merus rounded; posterior margin of carpus proximal to the posterodistal spine with 1 or 2 spinules; manus with a narrow line of pubescence on ventral surface along its outer margin ..... 27. *Petrolisthes nobilii* Haig (Pacific)  
 Carapace widest slightly posterior to midbranchial regions; orbits slightly concave to oblique; chelipeds with anterior lobe of the merus spined; posterior margin of the carpus proximal to the posterodistal spine with 3 or 4 spinules; manus without a narrow line of pubescence on the ventral surface along the outer margin .....  
 ..... *Petrolisthes politus* (Gray) (Atlantic)
40. Anterior margin of carpus of the cheliped with 2 teeth; merus of the walking legs with 1 or 2 anterior spines ..... 30. *Petrolisthes robsonae* Glassell (Pacific)  
 Anterior margin of carpus of the cheliped with 3 or occasionally 4 teeth; merus of walking legs with 2 to 6 anterior spines ..... 41
41. Carapace finely rugose; merus of walking legs with 2 to 4 spines on the anterior margin; dactyl of walking legs with only a single movable spinule on the posterior margin .....  
 ..... 32. *Petrolisthes zacae* Haig (Pacific)  
 Carapace granulate or plicate; merus of walking legs with 2 to 6 spines on the anterior margin; dactyl of walking legs with more than a single movable spinule on the posterior margin ..... 20. *Petrolisthes armatus* (Gibbes) (Atlantic and Pacific)
42. Carpus of the cheliped armed on the anterior margin with strong teeth or tubercles ..... 43  
 Carpus of the cheliped not armed on the anterior margin, although a distinct lobe may be present ..... 45
43. Carpus with wide-set conical tubercles on the anterior margin; manus with a thick fringe of hairs on its outer margin; fingers dissimilar in the 2 chelipeds .....

- ..... *Petrolisthes nigrunguiculatus* Glassell (Pacific)  
 Carpus with strong teeth on the anterior margin; manus without a thick fringe of hair on the anterior margin; fingers not distinctly dissimilar in the 2 chelipeds ..... 44
44. Manus with 2 longitudinal crests on the dorsal surface, and a heavy rounded crest along the outer margin; proximal 2 or 3 teeth on carpal margin partially or wholly coalesced to form a broad tooth, this followed by a smaller tooth .....  
 ..... *Petrolisthes lewisi austrinus* Haig (Pacific)  
 Manus without dorsal crests, no heavy rounded crest along the outer margin; anterior margin of carpus with 3 broad teeth ..... *Petrolisthes ortmanni* Nobili (Pacific)
45. Carpus of cheliped about 1.5 times as long as wide manus with 2 low crests on dorsal surface separated by indistinct grooves, proximal two-thirds of anterior margin of carpus with a broad, strongly projecting lobe, its edge obscurely divided into 3 parts .....  
 ..... *Petrolisthes artifrons* Haig (Pacific)  
 Carpus of cheliped more than 1.5 times, and up to twice as long as wide, manus with at most a single crest; anterior margin of carpus unarmed; lobe, if present, entire and not divided ..... 46
46. Carapace subquadrate, lateral margins nearly parallel posterior to the epibranchial angle; fingers often short and stubby ..... 47  
 Carapace subovate, occasionally nearly subquadrate, lateral margins not parallel; fingers not short and stubby ..... 48
47. Proximal two-thirds of the anterior margin of the carpus lobed, distal third subparallel with posterior margin; merus of walking leg 3 inflated; front narrow, triangular .....  
 ..... *Petrolisthes tonsorius* Haig (Pacific)  
 Proximal two-thirds of the anterior margin of the carpus entire, not lobate, distal third subparallel with posterior margin; merus of walking leg 3 not noticeably inflated; front broadly triangular, without lobiform teeth at inner orbital angles .....  
 ..... *Petrolisthes quadratus* Benedict (Atlantic)
48. Carapace smooth overall, front distinctly trilobate; manus not swollen, its outer edge thin; gape of fingers without a tuft of pubescence ..... 49  
 Carapace roughened, or granulate; if smooth only anteriorly; front sinuously triangular; manus somewhat swollen on its dorsal surface, its outer margin with a crest; gape of fingers with thick tuft of pubescence ..... 50
49. Carapace and chelipeds naked or with traces of pubescence; lateral lobes of front narrower than median lobe; carpus unarmed, its margins slightly converging distally .....  
 ..... 31. *Petrolisthes tridentatus* Stimpson (Atlantic and Pacific)  
 Entire crab covered with a short, fine tomentum, produced into a long fringe on the outer margin of the manus; frontal lobes about equal in breadth; anterior margin of the carpus with a strong proximal lobe, anterior and posterior margins converging distally from its highest point ..... *Petrolisthes holotrichus* Nobili (Pacific)
50. Entire carapace rough and uneven; carpus of cheliped unarmed; merus of walking leg 3 broad, inflated ..... 28. *Petrolisthes platymerus* Haig (Pacific)  
 Carapace nearly smooth anteriorly, but with large, low, rough, granules posterior to cervical groove; anterior margin of carpus with a few enlarged granules or spinules proximally, otherwise unarmed; merus of walking leg 3 not inflated .....  
 ..... *Petrolisthes brachycarpus* Sivertsen (Pacific)
51. Dactylus of walking legs ending in 2 or more large, strong, fixed spines; carapace markedly broader than long, front nearly transverse in dorsal view ..... *Polyonyx* (52)  
 Dactylus of walking legs ending in a single spine, usually with accessory movable spinules on the posterior margin ..... 54
52. Dactylar ventral spines (progressing distally) subequal, the second slightly smaller and not overreaching imaginary line connecting apices of first and third; propodus of walking legs with no (or rarely one) spinule ventrally plus usual three posterodistally .....  
 ..... *Polyonyx gibbesi* Haig (Atlantic)  
 Dactylar ventral spines disparate, the second by far the largest (progressing distally), overreaching imaginary line connecting apices of first and third ..... 53
53. Propodus of walking legs without ventral spinules except for usual three posterodistally .....  
 ..... *Polyonyx confinis* Haig (Pacific)\*  
 Propodus of walking legs with 2 spinules ventrally plus usual 3 posterodistally .....  
 ..... *Polyonyx nitidus* Lockington (Pacific)

54. Movable segments of the antenna minute, flagellum rudimentary, their total length less than or scarcely exceeding the width of the eye; carapace about  $1\frac{1}{3}$  times as long as broad, front strongly tridentate in dorsal view; a single strong spine on the lateral margin ..... *Minyocerus* (55)  
 Movable segments of antenna normal; not as above ..... 56
55. Cheliped merus with a large, strong spine on inner upper distal angle plus additional smaller spines or spinules dorsomedially on distal margin; carpus usually with 1 to 3 sharp strong spines on anterior margin; carapace noticeably pubescent .....  
*Minyocerus angustus* (Dana) (Atlantic)  
 Spine on cheliped merus short, acute; dorsomedial spinules on distal margin little developed or wanting; carpus with a single spine about midway on anterior margin, followed by several smaller spinules; carapace not noticeably pubescent .....  
*Minyocerus kirki* Glassell (Pacific)\*
56. Front prominent, tridentate or trilobate in dorsal view; carapace only slightly longer than broad ..... 57  
 Front deflexed, appearing rounded or faintly trilobate in dorsal view, but may appear strongly tridentate when viewed frontally, carapace either as broad as long, or distinctly longer than broad ..... 63
57. Lateral margin of carapace with a series of spinules posterior to the epibranchial angle; fingers on one or both chelipeds twisted out of the plane of the palm .....  
 33. *Pisidia magdalenensis* (Glassell) (Pacific)  
 Lateral margins of the carapace unarmed posterior to the epibranchial angle; fingers on the chelipeds not twisted out of the plane with the palm, more or less normal .....  
*Porcellana* (58)
58. Telson of abdomen with 5 plates; fingers opening vertically .....  
 35. *Porcellana corbicola* Haig (Pacific)  
 Telson of abdomen with 7 plates; fingers opening horizontally or somewhat obliquely ..... 59
59. Lateral margin of the carapace with a deep, narrow notch at the cervical groove; manus of cheliped slender, its surface somewhat swollen ..... 60  
 Lateral margin of the carapace without a notch at the cervical groove; manus of cheliped broad, its surface flattened or slightly rounded ..... 61
60. Chelipeds with fingers short, blunt, cutting edges of movable fingers with 2 small blunt teeth; walking legs short, somewhat stout .....  
*Porcellana sigsbeiana* A. Milne Edwards (Atlantic)  
 Chelipeds with fingers not as short as preceding, cutting edges lacking 2 small blunt teeth; walking legs longer, more slender ..... 36. *Porcellana hancocki* Glassell (Pacific)
61. Carapace with epibranchial angles unarmed; frontal teeth rounded at their tips, the median tooth not spinulate on its margin ..... 37. *Porcellana paguriconwiva* Glassell (Pacific)  
 Carapace with epibranchial angle armed with 1 to 3 small spinules; frontal teeth pointed at their tips, median tooth spinulate on its margins ..... 62
62. Epibranchial angle rounded, with a single large spinule which may be followed by 2 or 3 much smaller, or nearly obsolete spinules, or be entirely lacking in large individuals; spinules on median frontal tooth often developed into small lobes in larger individuals .....  
*Porcellana sayana* (Leach) (Atlantic)  
 Epibranchial angle rounded, bearing 2 or 3 small spinules; median frontal tooth usually with spinules, rarely tending to become lobate in large individuals .....  
 34. *Porcellana cancrisocialis* Glassell (Pacific)
63. Carapace distinctly longer than broad; front with a broad rectangular rostral process, visible only in frontal view; basal segment of antennules large, produced anteriorly to fill the notches between the rostral process and the inner orbital angles; an extremely small species ..... 38. *Ulloaia perpusillia* Glassell (Pacific)  
 Carapace about as broad as long; front trilobate to tridentate in frontal view; basal segment of antennules very small, recessed behind the front, the latter projecting over the antennules like a shelf ..... *Megalobrachium* (64)
64. Telson of abdomen with 5 plates ..... 65  
 Telson of abdomen with 7 plates ..... 68
65. Carapace, chelipeds and walking legs covered with small, shallow pits .....  
*Megalobrachium garthi* Haig (Pacific)  
 Carapace, chelipeds and walking legs tuberculate ..... 66

66. Anterolateral and posterolateral margins forming a distinct angle behind mid-branchial level; lateral margins unarmed ..... *Megalobrachium festai* (Nobili) (Pacific)  
Lateral margins rounded, dentate ..... 67
67. Frontal, postfrontal and protogastric lobes, when viewed frontally, appearing low, rounded, indistinct, usually smooth, rarely granular ..... 8. *Megalobrachium soriatum* (Say) (Atlantic)  
Frontal, postfrontal, and protogastric lobes, viewed frontally, appearing raised, distinctly rounded and elevated, often slightly roughened or lightly granular .....  
..... 9. *Megalobrachium tuberculipes* (Lockington) (Pacific)
68. Carapace and chelipeds heavily eroded, uneven ..... 69  
Carapace and chelipeds smooth or roughened, never heavily eroded ..... 70
69. Frontal region of carapace tridentate in frontal view, lateral lobes narrow, truncate, separated from median lobe by deep, rounded notches; proximal third of anterior margin of carpus of the cheliped with a broad, low triangular tooth; anterior margin of merus, carpus and propodus of walking legs with a distinct high crest .....  
..... 3. *Megalobrachium erosum* (Glassell) (Pacific)  
Frontal region as above but lateral lobes broad and truncate, separated from median lobe by broad U- or V-shaped notches; proximal third of anterior margin of cheliped carpus with strongly projecting, narrow granular lobe; anterior margin of merus, carpus, and propodus of walking legs with a more or less sharp crest .....  
..... *Megalobrachium mortenseni* Haig (Atlantic)
70. Carapace and chelipeds thickly covered with coarse hairs; chelipeds heavily and evenly granulate ..... 71  
Carapace and chelipeds naked or lightly pubescent; granulation on chelipeds somewhat roughened, less even ..... 72
71. Protogastric regions, when viewed frontally, indistinct, not higher than the frontal and hepatic regions; propodi of walking legs robust, 2 to 2.3 times longer than wide .....  
..... 4. *Megalobrachium pacificum* Gore and Abele (Pacific)  
Protogastric regions, viewed frontally, distinct, and clearly elevated above the frontal and hepatic regions; propodi of walking legs more slender, from 2.8 to 3 times longer than wide .....  
..... 5. *Megalobrachium poeyi* (Guerin) (Atlantic)
72. Carapace roughened; front with 3 shallow lobes, strongly projecting beyond eyes, rounded in dorsal view ..... 7. *Megalobrachium smithi* (Glassell) (Pacific)  
Carapace nearly smooth; front with 3 teeth separated by deep rounded notches, strongly projecting beyond eyes, usually triangular in dorsal view .....  
..... 6. *Megalobrachium roseum* (Rathbun) (Atlantic)

## Family PORCELLANIDAE Haworth, 1825

### Genus *Clastotoechus* Haig, 1960

#### 1. *Clastotoechus diffractus* (Haig, 1957)

*Petrolisthes diffractus* Haig, 1957:36, pl. 9: figs. 1-6.  
*Clastotoechus diffractus*.—Haig, 1960:8, 175, 176, fig. 5(1), pl. 30: fig. 1.—Birkeland, et al., 1975:67.

**MATERIAL EXAMINED.**—Punta Paitilla; 2 ♂, 2 ♀, 1 ovigerous; 29 Oct 1970.

**MEASUREMENTS.**—3.7 × 3.8 to 6.3 × 6.5 mm; smallest ovigerous female, 3.7 × 3.8 mm.

**REMARKS.**—Although its size would not necessarily cause it to be overlooked, it is apparently a rare species. The four specimens collected at Paitilla Beach and reported herein bring the total of known individuals to 27.

**DISTRIBUTION.**—Known in the eastern Pacific from

Cabo San Lucas, Gulf of California to Acapulco, Mexico, and Malpelo Island. The specimens herein from Panama City constitute a first recording for Panama; littoral.

#### 2. *Clastotoechus nodosus* (Streets, 1872)

##### FIGURE 2

*Petrolisthes nodosus* Streets, 1872:133.—Haig, 1956:27.  
*Clastotoechus nodosus*.—Haig, 1960:177, fig. 5(3); 178.—Rickner, 1975:163.

**MATERIAL EXAMINED.**—Galeta Island; 1 juvenile; 8 Mar 1972.

**MEASUREMENTS.**—2.0 × 2.0 mm.

**REMARKS.**—Haig (1956) has commented on the small size of this species. It may therefore have been overlooked in previous collections made in Panama.

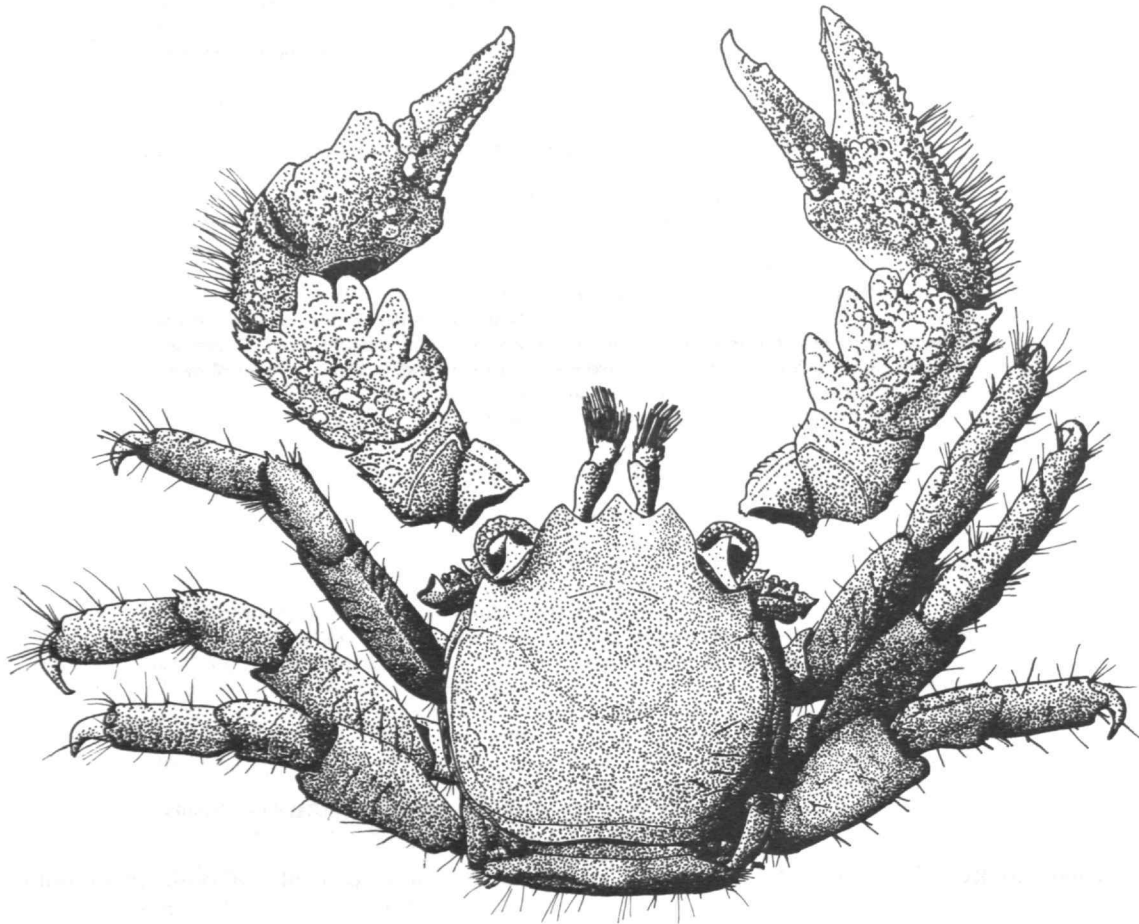


FIGURE 2.—*Clastotoechus nodosus* (Streets, 1872): juvenile specimen from Galeta Island, 8 March 1972. Left cheliped damaged.

**DISTRIBUTION.**—The species was previously known from the littoral zone in the southwestern Gulf of Mexico, the southeastern Caribbean, and Venezuela. The Galeta Island material is the first recording for Panama and the southwestern Caribbean; littoral.

**Genus *Megalobrachium* Stimpson, 1858**

**3. *Megalobrachium erosum* (Glassell, 1936)**

*Pisosoma erosa* Glassell, 1936:289.

*Megalobrachium erosa*.—Chace, 1942:100.

*Megalobrachium erosum*.—Haig, 1960:213, 222, pl. 16: fig. 8, pl. 40: fig. 2; 1962:191; 1970:26.

**MATERIAL EXAMINED.**—Perlas Islands; 1 ♂, 1 ♀; 12–13 Jun 1973.

**MEASUREMENTS.**—4.0 × 4.4 to 4.4 × 5.0 mm.

**REMARKS.**—The two specimens appeared typical.

**DISTRIBUTION.**—Known previously from the Gulf of California and outer coast of Baja California, Mexico, the two Panamanian specimens are a first recording for Panama and constitute a range exten-

sion southward of nearly 4000 km. This species, like other Gulf of California endemics noted elsewhere in this report, is possibly extralimital; from the intertidal zone to 50 m.

#### 4. *Megalobranchium pacificum* Gore and Abele, 1974

*Megalobranchium poeyi*.—Haig, 1960:213, 214, 339, 340, pl. 16: fig. 4, pl. 39: fig. 1 [not *M. poeyi* (Guérin-Méneville, 1855)].  
*Megalobranchium pacificum* Gore and Abele, 1974:568, fig. 3F.

**MATERIAL EXAMINED.**—Panama City; 3 ♂, 4 ♀, 3 ovigerous; 14–15 Apr and 5 Jun 1969.

**MEASUREMENTS.**—Males 3.2 × 2.8 to 6.7 × 7.4 mm; female 6.3 × 6.8 mm; ovigerous females 3.7 × 3.5 to 8.2 × 9.0 mm.

**REMARKS.**—This species has been reported on previously by Gore and Abele (1974). It was considered conspecific with *M. poeyi* across the Panamanian isthmus for many years, but larval characters and meristic adult features allowed it to be separated from its present Atlantic geminate, *M. poeyi*.

**DISTRIBUTION.**—Known only from the Pacific coast of Costa Rica and the Bay of Panama; littoral.

#### 5. *Megalobranchium poeyi* (Guérin, 1855)

*Porcellana poeyi* Guérin-Méneville, 1855: pl. 2: fig. 4; 1857a: xvi; 1857b:xxxix, pl. 2: fig. 4.  
*Megalobranchium poeyi*.—Benedict, 1901:136, pl. 3: fig. 8.—Abele and Gore, 1973:105.—Gore, 1974:704 [not Haig, 1960:213, 214, 339, 340, pl. 16: fig. 4, pl. 39: fig. 1 (= *M. pacificum* Gore and Abele, 1974)].

**MATERIAL EXAMINED.**—Galeta Island; 2 ♂, 1 ♀; 23 Nov 1971 and 22 May 1972, respectively.

**MEASUREMENTS.**—Males 3.4 × 3.6, 3.8 × 4.3 mm, female 3.3 × 3.5 mm.

**REMARKS.**—These specimens were identified by Ms. Janet Haig of the Allan Hancock Foundation, who also provided the measurements at our request. They were collected from the coralline zone on the reef flat at Galeta.

**DISTRIBUTION.**—Widely distributed from eastern central Florida throughout the eastern Caribbean to Brazil, the species has only rarely been collected in Panama. *Megalobranchium poeyi* has been collected from the intertidal zone to depths of 46 m.

#### 6. *Megalobranchium roseum* (Rathbun, 1900)

*Porcellana rosea* Rathbun, 1900:148, pl. 8: fig. 3.  
*Porcellanopsis rosea*.—Haig, 1956:34.—Côelho, 1966:59.  
*Megalobranchium roseum*.—Haig, 1960:225, 227.  
*Pachycheles rugimanus*.—Côelho, 1964:255 [not *P. rugimanus* A. Milne Edwards, 1880; fide Côelho, 1966:60].

**MATERIAL EXAMINED.**—Ft. Sherman; 1 ♂; 8 Feb 1969. Galeta Island; 6 ♂, 2 ♀, 1 ovigerous; 12 Aug 1973.

**MEASUREMENTS.**—Males 2.0 × 2.0 to 3.4 × 3.6 mm; female 3.7 × 4.1 mm; ovigerous female 2.8 × 2.8 mm.

**REMARKS.**—In one male from Galeta Island the telson was aberrant, having only five, instead of the usual seven plates.

**DISTRIBUTION.**—This species is known along the continental margin of northern South America from Brazil, Venezuela, and Colombia. The specimens reported herein mark the first recordings from Panama and Central America; littoral.

#### 7. *Megalobranchium smithi* (Glassell, 1936)

*Pisoma smithi* Glassell, 1936:286.  
*Megalobranchium smithi*.—Chace, 1942:100.—Haig, 1960:213, 215; pl. 16: fig. 5, pl. 39: fig. 2.

**MATERIAL EXAMINED.**—Perlas Islands; 1 ♂, 2 ♀, 1 ovigerous; 12–13 Jun 1973.

**MEASUREMENTS.**—Male 2.6 × 2.8 mm; female 3.0 × 3.4 mm; ovigerous female 2.6 × 3.0 mm.

**REMARKS.**—Sexual dimorphism is exhibited in the movable finger of the female and male chelipeds.

**DISTRIBUTION.**—Previously restricted to the Gulf of California, Mexico, the Panamanian specimens reported here are possibly extralimital. They nevertheless constitute the first recording for Panama and a range extension of nearly 4000 km; littoral.

#### 8. *Megalobranchium soriatum* (Say, 1818)

##### FIGURE 3

*Porcellana soriata* Say, 1818:456.—Leary, 1967:28 [listed].  
*Porcellanopsis soriata*.—Haig, 1956:35.—Côelho, 1966:60.  
*Megalobranchium soriatum*.—Haig, 1960:229.—Williams, 1965:112, fig. 89.—Felder, 1973:32, pl. 4: fig. 12.

**MATERIAL EXAMINED.**—Galeta Island; 1 ♂; 12 Aug 1973.

MEASUREMENTS.—Male  $3.0 \times 3.0$  mm.

REMARKS.—The single male specimen appeared typical.

DISTRIBUTION.—The species is widely distributed from Isla Contoy, in the Gulf of Mexico, to Florida and along the eastern coast of the United States as far as North Carolina; also Barbados in the eastern Caribbean and Brazil. Haig (1956) reported it for the first time from Panama at Bahia Caledonia based on a single female. The Galeta Island specimen, a male, is thus only the second recording. This small species is apparently quite rare in the southwestern Caribbean, and its recorded occurrences suggest that it may be a continental species; shore to 111 m.

#### 9. *Megalobrachium tuberculipes* (Lockington, 1878)

FIGURE 3

*Pachycheles tuberculipes* Lockington, 1878:396, 404.

*Megalobrachium tuberculipes*.—Haig, 1960:213, 227, pl. 16: fig. 11, pl. 40: fig. 4; 1968:57, 72.—Haig et al., 1970:24, 26.

MATERIAL EXAMINED.—Perlas Islands; 1 ♂, 1 ♀, ovigerous; 12–13 Jun 1973.

MEASUREMENTS.—Male  $2.8 \times 2.7$  mm; female  $2.7 \times 3.0$  mm.

REMARKS.—The lateral margins of the carapaces in both specimens were rounded, without the usual dentition characteristic of the species.

*Megalobrachium tuberculipes* is extremely close to its western Atlantic geminate, *M. soriatum*. Unfortunately, comparison of trans-Panamanian material was impossible since our material from Panama of both species consisted of only three specimens. The two specimens of *M. tuberculipes* noted above, however, were compared with a large series of *M. soriatum* from the Indian River region of the central eastern Florida coast. In general, *M. soriatum* appeared to be a smoother species; the frontal and postfrontal lobes were, for the most part, only slightly developed, and in many instances could not be distinguished at all. The protogastric region appeared to be more coalesced, and the lobes were more shallow and rounded than those seen in *M. tuberculipes*. These differences, admittedly slight, could best be seen when specimens of each species were viewed frontally and slightly from below.

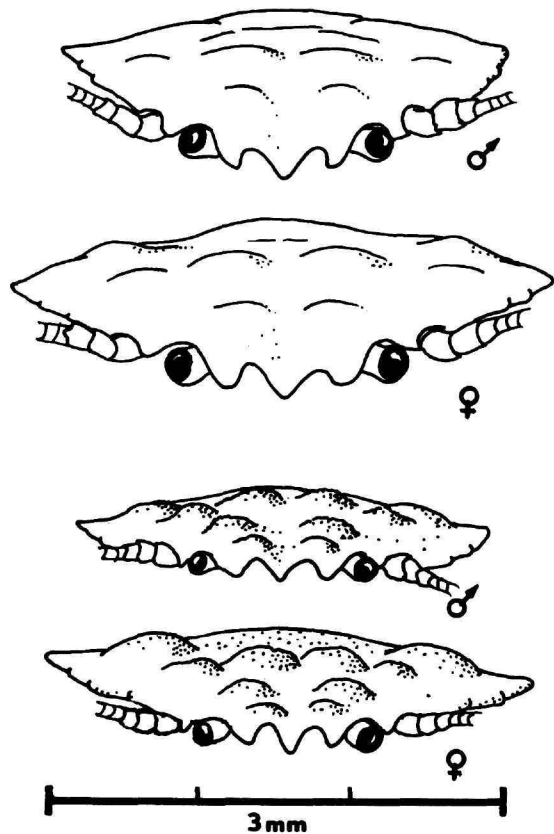


FIGURE 3.—Frontal view of carapaces of *Megalobrachium soriatum* (upper), Vero Beach, Florida, and *M. tuberculipes* (lower), Perlas Islands, Panama, illustrating differences in frontal, postfrontal, and protogastric regions between the species.

When viewed this way, *M. tuberculipes* appeared to have more developed protogastric lobes, not as coalesced as in *M. soriatum*. The frontal and postfrontal lobes were distinct and separate. It remains to be seen, however, whether these differences will be constant in a large series of *M. tuberculipes*.

DISTRIBUTION.—From northern Baja California, and the Gulf of California, Mexico to Santa Elena Bay, Ecuador; shore to 20 m.

#### Genus *Neopisosoma* Haig, 1960

#### 10. *Neopisosoma angustifrons* (Benedict, 1901)

*Pisosoma angustifrons* Benedict, 1901:135, pl. 3: fig. 6.—Haig, 1956:15.



*Neopisosoma angustifrons*.—Haig, 1960:124, 131; 1962:181.—Rickner, 1975:163.

**MATERIAL EXAMINED.**—Galeta Island; 7 ♂, 4 ♀, 2 ovigerous, 1 juvenile; 12 Aug 1973.

**MEASUREMENTS.**—Males  $2.4 \times 2.5$  to  $4.6 \times 5.0$  mm; females  $2.2 \times 2.4$  to  $2.5 \times 2.8$  mm; ovigerous female  $2.0 \times 2.2$ ; juvenile  $1.7 \times 1.7$  mm.

**REMARKS.**—These specimens are easily recognized by using the characters pointed out by Haig (1956). In addition, at the base of the cheliped dactylus a large white clump of granules was always present. This drab little porcellanid was found primarily among coralline clumps on the outer reef margin at Galeta Island. Other material consisting of several males and ovigerous females collected on 12–13 June 1974 has been incorporated by Gore (in press) in a paper describing the larval development of this species.

**DISTRIBUTION.**—Known previously from the southwestern Gulf of Mexico, the lesser Antilles, Trinidad, Cubagua, Islas La Tortuga, Bonaire, Curacao, and from Venezuela, the Panamanian specimens extend the known range southwestward 1875 km, and constitute a first recording for the southwestern Caribbean and Central America; littoral.

#### Genus *Pachycheles* Stimpson, 1858

##### 11. *Pachycheles biocellatus* (Lockington, 1878)

*Petrolisthes (Pisosoma) biocellatus* Lockington, 1878:396, 403.  
*Pachycheles biocellatus*.—Glassell, 1937:84.—Haig, 1960:34, 144, pl. 32: fig. 1; 1968:57, 68.—Chace, 1962:619.—Birkeland, et al., 1975:67.

**MATERIAL EXAMINED.**—Taboguilla Island; 5 ♂, 7 ♀, 3 ovigerous; 7 and 11 Apr, 12 Jul 1969. Perlas Islands; 1 ♂, 1 ♀, ovigerous; 12–13 Jun 1973.

**MEASUREMENTS.**—Males  $2.2 \times 2.2$  to  $5.0 \times 5.5$  mm; females  $1.9 \times 2.0$  to  $3.0 \times 3.2$  mm; ovigerous females  $2.5 \times 2.5$  to  $4.1 \times 4.6$  mm.

**REMARKS.**—The smallest ovigerous female collected from Taboguilla Island is apparently the smallest yet recorded for the species. Chace (1962) noted that the smallest egg-bearing female in the series he examined had a carapace width of 3.3 mm.

**DISTRIBUTION.**—Known from the Gulf of California, Espiritu Santo Island, Mexico, to Ecuador and offshore to Malpelo, Isabel, Tres Marias, Revilagigedo, Clipperton, and the Galapagos Islands; shore to 26 m.

##### 12. *Pachycheles calcosus* Haig, 1960

*Pachycheles calcosus* Haig, 1960:135, 136, pls. 10, 31: fig. 4; 1968:57, 68.

**MATERIAL EXAMINED.**—Punta Paitilla; 1 ♀; 7 Jul 1969.

**MEASUREMENTS.**— $2.0 \times 2.7$  mm.

**REMARKS.**—The sole specimen did not appear as plicate posterolaterally as indicated in Haig's (1960) description.

**DISTRIBUTION.**—Sihuantenejo Bay, Mexico to La Libertad, Ecuador; littoral to 8 m.

##### 13. *Pachycheles chacei* Haig, 1956

*Pachycheles chacei* Haig, 1956:7, 9, pl. 1; 1960:134, 135, pl. 31: fig. 3; 1968:57, 68.

**MATERIAL EXAMINED.**—Punta Paitilla; 1 ♀, ovigerous; 8 Jun 1969. Galeta Island; 10 ♂, 11 ♀, 8 ovigerous, 3 juvenile; 24 May 1969 and 11–12 Aug 1973.

**MEASUREMENTS.**—Males  $2.1 \times 2.2$  to  $3.7 \times 4.1$  mm; females  $2.0 \times 2.0$  to  $4.4 \times 5.0$  mm; ovigerous females  $3.0 \times 3.4$  to  $5.5 \times 6.8$  mm.

**REMARKS.**—The single Pacific specimen examined had only four plates in the telson instead of five, the distal plates being fused. The Atlantic specimens were normal. The species is found under large stones and in coralline rubble on both sides of the isthmus.

**DISTRIBUTION.**—In the eastern Pacific Ocean from Guatemala to Ecuador; in the Atlantic known only from the southwestern Caribbean off Panama and Colombia. Pacific, littoral to 8 m; Atlantic only in the littoral.

##### 14. *Pachycheles cristobalensis* Gore, 1970

*Pachycheles cristobalensis* Gore, 1970:958, figs. 1, 2.

**MATERIAL EXAMINED.**—Ft. Sherman; 1 ♀, ovigerous; 8 Feb 1969. Galeta Island; 2 ♂, 3 ♀, 2 ovigerous, 1 juvenile; 12 Aug 1973.

**MEASUREMENTS.**—Males  $2.3 \times 2.4$  to  $3.3 \times 3.9$  mm; female  $3.8 \times 4.4$  mm; ovigerous females  $2.5 \times 2.7$  to  $4.0 \times 4.6$  mm.

**REMARKS.**—To our knowledge this diminutive species has not been collected outside a narrow area around the Atlantic entrance to the Panama Canal.

**DISTRIBUTION.**—Known only from the type-locality, Limón Bay, and Galeta Island and the surrounding area, Atlantic side of Panama; littoral.

**15. *Pachycheles panamensis* Faxon, 1893**

*Pachycheles panamensis* Faxon, 1893:175; 1895:71, pl. 15: figs. 2, 2a.—Haig, 1962:182; 1968:57, 69.—Haig, et al., 1970:23, 26.

**MATERIAL EXAMINED.**—Panama City; 1 ♂; 17 Feb 1969.

**MEASUREMENTS.**—5.4 × 5.6 mm.

**REMARKS.**—The single specimen examined appeared typical for the species.

**DISTRIBUTION.**—Tiburón Island, Gulf of California to Santa Elena Bay, Ecuador, and Isabel Island; littoral to 8 m.

**16. *Pachycheles serratus* (Benedict, 1901)**

*Pisosoma serrata* Benedict, 1901:135, pl. 3: fig. 7 [in part].  
*Pachycheles serratus*.—Haig, 1956:7, 8; 1962:181.—Gore, 1970:962, fig. 2.

**MATERIAL EXAMINED.**—Ft. Sherman; 7 ♂, 20 ♀, 8 ovigerous; 18 Jan and 8 Feb 1969. Galeta Island; 20 ♂, 20 ♀, 11 ovigerous, 2 juvenile; 24 Apr 1969, 8 Sept and 5, 9 Oct 1970, 11, 12 Aug 1973.

**MEASUREMENTS.**—Males 2.0 × 2.0 to 4.8 × 5.0 mm; females 2.1 × 2.2 to 2.3 × 2.3 mm; ovigerous females 3.1 × 3.3 to 6.2 × 6.8 mm.

**REMARKS.**—This species is by far the most common porcellanid at Galeta Island where it may be found in nearly every interstice and crevice of coral-line rocks on the outer edge of the reef flat. It can be immediately distinguished in the field from a species similar in appearance, *Neopisosoma angustifrons*, by its heavily furred chelipeds.

**DISTRIBUTION.**—The range of this little porcellanid seems to be restricted to Puerto Rico, the Virgin Islands, and the Caribbean coast of Panama. Perhaps further collections in coralline intertidal areas will provide more recordings; littoral.

**17. *Pachycheles susanae* Gore and Abele, 1974**

*Pachycheles susanae* Gore and Abele, 1974:560, figs. 1, 3a.

**MATERIAL EXAMINED.**—Galeta Island; 1 ♂, 1 ♀, 2 juveniles; 5 Oct 1970, 12 Aug 1973.

**MEASUREMENTS.**—Male 3.6 × 3.9 mm; female 1.7 × 1.9 mm; juveniles not measured.

**REMARKS.**—This species was reported previously by Gore and Abele in 1974. It may be confused at first glance in the field with *Petrolisthes jugosus*, with which it shares similar red or red-orange coloration, and cryptic habitat, especially in thick clumps of the calcareous green algae *Halimeda*. *Pachycheles susanae*, however, possesses distinctive grooves and ridges on the manus of the chelipeds which are lacking in *P. jugosus*.

**DISTRIBUTION.**—Known only from the type-locality, Galeta Island, on the Atlantic side of Panama; littoral.

**18. *Pachycheles vicarius* Nobili, 1901**

*Pachycheles vicarius* Nobili, 1901:19.—Haig, 1960:147, pl. 32: fig. 2; 1968:57, 69.—Gore and Abele, 1974:563.

**MATERIAL EXAMINED.**—Perlas Islands; 1 ♂; 12–13 Jun 1973.

**MEASUREMENTS.**—3.9 × 4.4 mm.

**REMARKS.**—This species is easily identified by distinct longitudinal ridges on the chelipeds. It shows some affinity with an Atlantic species, *P. susanae*, but differs from that species in several respects. Males of *Pachycheles vicarius* have pleopods that are lacking in the latter species.

**DISTRIBUTION.**—Acajutla, El Salvador to Santa Elena Bay, Ecuador; shore to 8 m.

**Genus *Petrolisthes* Stimpson, 1858**

**19. *Petrolisthes agassizii* Faxon, 1893**

*Petrolisthes agassizii* Faxon, 1893:174; 1895:69, pl. 15: figs. 1, 1a.—Haig, 1962:174; 1968:57, 60.

**MATERIAL EXAMINED.**—Taboguilla Island; 1 ♂, 3 ♀, 2 ovigerous; 7, 11 Apr and 12 Jul 1969. Perlas Islands; 8 ♂, 11 ♀, 10 ovigerous; 12–13 Jun 1973.

**MEASUREMENTS.**—Males 3.1 × 3.0 to 6.6 × 7.0 mm; ovigerous females 3.5 × 4.0 to 6.0 × 6.9 mm.

**REMARKS.**—In this species and also *Petrolisthes edwardsii*, a distinct red spot surrounded by a blue margin occurs on the propodus of maxilliped 3. This spot remains quite noticeable even in preserved specimens.

**DISTRIBUTION.**—Known from the southern end of the Gulf of California and various localities along

the eastern Pacific coastline of Central America to Colombia; littoral to 4 m.

## 20. *Petrolisthes armatus* (Gibbes, 1850)

*Porcellana armata* Gibbes, 1850:190.

*Petrolisthes armatus*.—Stimpson, 1858:227 [listed].—Haig, 1956:19 [Atlantic synonymy]; 1960:50, pl. 19: fig. 2 [Pacific synonymy].—Leary, 1967:27, figure, 28 [listed].—Gore, 1974:702 [table], 709.

**MATERIAL EXAMINED.**—PACIFIC. Aguadulce, Salado Playa; 6 ♂, 13 ♀, 8 ovigerous; 9 Nov 1968. Punta Paitilla; 19 ♂, 33 ♀, 28 ovigerous; 21 Oct 1967, 27 Nov and 7 Dec 1968, 14, 15 Apr and 1, 7 Jul 1969. Albert Einstein Institute; 7 ♂, 13 ♀, 11 ovigerous; 17 Feb 1969. Panama Canal, Pacific entrance; 3 ♀, ovigerous; 16 Apr 1969. Rodman Naval Station; 4 ♂, 3 ♀, ovigerous; 17 Apr 1969. Fort Kobbe; 20 ♂, 18 ♀, 17 ovigerous; 8 May and 1 Jul, 1969. Perlas Islands; 1 ♂; 25 Jan 1969. Isla Chepillo; 5 ♂, 4 ♀, 3 ovigerous; 26 May 1969. Miguel River, Fort Clayton; 1 ♂, 1 ♀, and its molt; 10 Jun 1974. ATLANTIC. Fort Sherman; 5 ♂, 2 ♀, ovigerous, plus 8 dried specimens not sexed; 18 Jan and 8 Feb 1969. Coco Solo; 6 ♂, 8 ♀, 5 ovigerous; 22 Apr 1969. Galeta Island; 4 ♂, 3 ♀, ovigerous; 11 Mar, 3 May, and 15 Jul 1969. Portobelo Bay; 1 ♀, ovigerous; 14 May 1969.

**MEASUREMENTS.**—PACIFIC. Males 2.6 × 2.4 to 13.2 × 13.0 mm; females 3.3 × 3.9 to 12.6 × 12.6 mm; ovigerous females 3.9 × 3.8 to 11.5 × 11.5 mm. ATLANTIC. Males 2.9 × 2.6 to 9.7 × 9.0 mm; females 2.8 × 2.6 to 7.2 × 7.0 mm; ovigerous females 4.0 × 3.9 to 8.0 × 7.6 mm.

**REMARKS.**—This highly variable species is widespread on both sides of the Panamanian isthmus and is apparently able to tolerate conditions otherwise adverse to other species of porcelain crabs. Primarily a rocky intertidal species, it has been collected in muddy mangrove areas of the Pacific coast and in the rocky coralline intertidal zone at Galeta.

**DISTRIBUTION.**—Widely distributed from the tropical western coast of Africa, the east central coast of Florida, the Gulf of Mexico and throughout the Caribbean as far south as Santa Catharina, Brazil; in the eastern Pacific from the Gulf of California, Mexico, to Peru. It has been known from the Pacific coast of Panama since 1859, well before con-

struction of the Panama Canal; intertidal zone to a maximum of 20 m.

## 21. *Petrolisthes edwardsii* (Saussure, 1853)

*Porcellana edwardsii* Saussure, 1853:366, pl. 12: fig. 3.

*Petrolisthes edwardsii*.—Haig, 1960:33, pl. 21; 1962:175; 1968:57, 60.—Haig, et al., 1970:26.—Brusca and Haig, 1972:56.

**MATERIAL EXAMINED.**—Panama City; 1 ♀; 17 Feb 1969. Taboguilla Island; 3 dried specimens, 1 juvenile, 1 ♂; 7, 11 Apr and 12 Jul 1969. Perlas Islands; 3 ♂, 1 ♀, ovigerous; 12–13 Jun 1973.

**MEASUREMENTS.**—Males 4.0 × 3.9 to 11.2 × 11.9 mm; female 5.0 × 4.6 mm; ovigerous female 9.2 × 9.6 mm.

**REMARKS.**—There is a change in the length-width ratio of the carapace as the species matures, with young specimens to about 6 mm long being longer than wide, whereas those of about 9 mm carapace length are wider than long. This species exhibits a red spot surrounded by a blue margin on the outer surface of maxilliped 3, similar to that seen in *P. agassizii* (q.v.).

**DISTRIBUTION.**—Found from outer Baja and the upper Gulf of California, Mexico, to La Plata Island, Ecuador, and Isabel, Tres Marias, Revillagigedo, and the Galapagos Islands; littoral to 40 m.

## 22. *Petrolisthes galathinus* (Bosc, 1802)

*Porcellana galathina* Bosc, 1802:231–233, pl. 6: fig. 2.

*Petrolisthes galathinus*.—Haig, 1960:36, pl. 19: fig. 4; 1962:175. —Leary, 1967:28 [and as *P. sexspinosus*].—Gore, 1974:702, 703 [table], 712.—Rickner, 1975:164.

**MATERIAL EXAMINED.**—PACIFIC. Panama City; 1 ♂, 1 ♀, ovigerous; 17 Feb 1969. Perlas Islands; 1 ♂, 2 ♀, ovigerous; 12–13 Jun 1973. ATLANTIC. Ft. Sherman; 7 ♂, 5 ♀, 2 ovigerous, 1 juvenile; 8 Feb 1969. Ft. Randolph; 1 ♀, juvenile; 22 Apr 1969. Galeta Island; 3 ♂, 4 ♀, 1 ovigerous; 15 Jul 1969 and 11 Aug 1973.

**MEASUREMENTS.**—Males 3.0 × 2.8 to 11.0 × 10.0 mm; females 2.4 × 2.0 to 4.6 × 4.1 mm; ovigerous females 4.4 × 4.2 to 8.1 × 9.0 mm.

**REMARKS.**—Some variation appears in the color pattern for this species, with juveniles not as noticeably striate or as deeply colored as adults. This material indicates that ovigerous females are present

from January to August in the southwestern Caribbean.

**DISTRIBUTION.**—In the Atlantic from Cape Hatteras to Brazil, including Gulf of Mexico. Pacific distribution records come from the vicinity of the Panama Canal, and from Costa Rica and Ecuador; from shore to 54 m.

### 23. *Petrolisthes glasselli* Haig, 1957

*Petrolisthes glasselli* Haig, 1957:33, pl. 8: figs. 1–3; 1962:176; 1968:57, 61.—Chace, 1962:623.—Birkeland, et al., 1975:67.

**MATERIAL EXAMINED.**—Taboguilla Island; 1 ♂, 2 ♀, ovigerous, 1 juvenile; 11 Apr and 12 Jul 1969.

**MEASUREMENTS.**—Male 5.8 × 5.6 mm; 2 females, ovigerous 5.6 × 5.0 and 5.6 × 5.4 mm; juvenile 2.8 × 2.5 mm.

**REMARKS.**—The specimens were typical.

**DISTRIBUTION.**—Widely distributed in the tropical eastern Pacific from Gulf of California, Mexico, to Gorgona and Malpelo Islands, Columbia, and Tres Marias, Isabel, Revillagigedo, Galapagos, and Clipperton Islands offshore; shore to 8 m.

### 24. *Petrolisthes haigae* Chace, 1962

*Petrolisthes marginatus*.—Haig, 1960:25, 47, pl. 20: fig. 1 [not *P. marginatus* Stimpson, 1859].

*Petrolisthes* sp. Haig, 1962:177.

*Petrolisthes haigae* Chace, 1962:620, fig. 1.—Haig, 1968:57, 61.—Birkeland, et al., 1975:67.

**MATERIAL EXAMINED.**—Taboguilla Island; 61 ♂, 89 ♀, 70 ovigerous; 7, 11, Apr and 12 Jul 1969. Perlas Islands; 27 ♂, 28 ♀, 24 ovigerous; 12–13 Jun 1973.

**MEASUREMENTS.**—Males 2.3 × 2.1 to 8.8 × 8.6 mm; females 2.6 × 2.2 to 8.9 × 8.7 mm; ovigerous females 3.2 × 3.0 to 8.0 × 8.4 mm.

**REMARKS.**—Some variation was noted in the supraocular spinules on several specimens. One small male from Taboguilla Island had only a single spine on each side, a feature which might lead one to identify it with *Petrolisthes hirtispinosus* from the Gulf of California. This and other specimens similar to it, however, all possessed salient features of *P. haigae*. Apparently, variation along these lines is not uncommon in the species. Ovigerous females in the Bay of Panama occur from April through at least August.

**DISTRIBUTION.**—Guaymas Bay, Gulf of California to Santa Elena Bay, Ecuador; Malpelo Island, Colombia, and offshore to Isabel, Tres Marias, Revillagigedo, Galapagos, Clipperton Islands; shore to 12 m.

### 25. *Petrolisthes jugosus* Streets, 1872

FIGURE 4

*Petrolisthes jugosus* Streets, 1872:134.—Haig, 1960:23, 122, 123; 1962:180.

*Pisosoma jugosum*.—Haig, 1956:16.

**MATERIAL EXAMINED.**—Galeta Island; 2 ♂, 3 ♀, 2 ovigerous; 12 Aug 1973.

**MEASUREMENTS.**—Males 2.0 × 1.8 and 2.1 × 2.0 mm; female 2.4 × 2.4 mm; ovigerous females 2.8 × 2.8 to 2.9 × 2.9 mm.

**REMARKS.**—The following color notes were taken on specimens collected from *Millepora* stinging coral at Galeta Island. Crab a deep red or brick red overall; white spots on each epibranchial area, and dorsally on the inner margin of the metabranchial region adjacent to the posterolateral delimitation of the cardiac region; a white stripe vertically along the eipera extending from the antenna to the anterior ventral margin; legs and abdomen mottled red and white. The bright red color of this small species holds in alcohol for at least one year. This same color makes the species readily distinguishable in the field from most other porcellanids that inhabit coralline rocks and rubble.

**DISTRIBUTION.**—The species is known from the southwestern Gulf of Mexico, the Antilles in the eastern Caribbean, Trinidad, Tobago, and some islands along the northern coast of South America, westward to Panama. In addition, we have seen specimens collected by Mr. Jacques Von Montfrans of Florida Atlantic University, from phragmatopomid worm reefs at Boca Raton, Palm Beach County, Florida; littoral.

### 26. *Petrolisthes lindae* Gore and Abele, 1974

*Petrolisthes lindae* Gore and Abele, 1974:564, figs. 2,3b,c.

**MATERIAL EXAMINED.**—Twenty-seven specimens (17 males, 10 females, 8 ovigerous) constituting our original material were reported previously (Gore and Abele, 1974). The following material was dis-

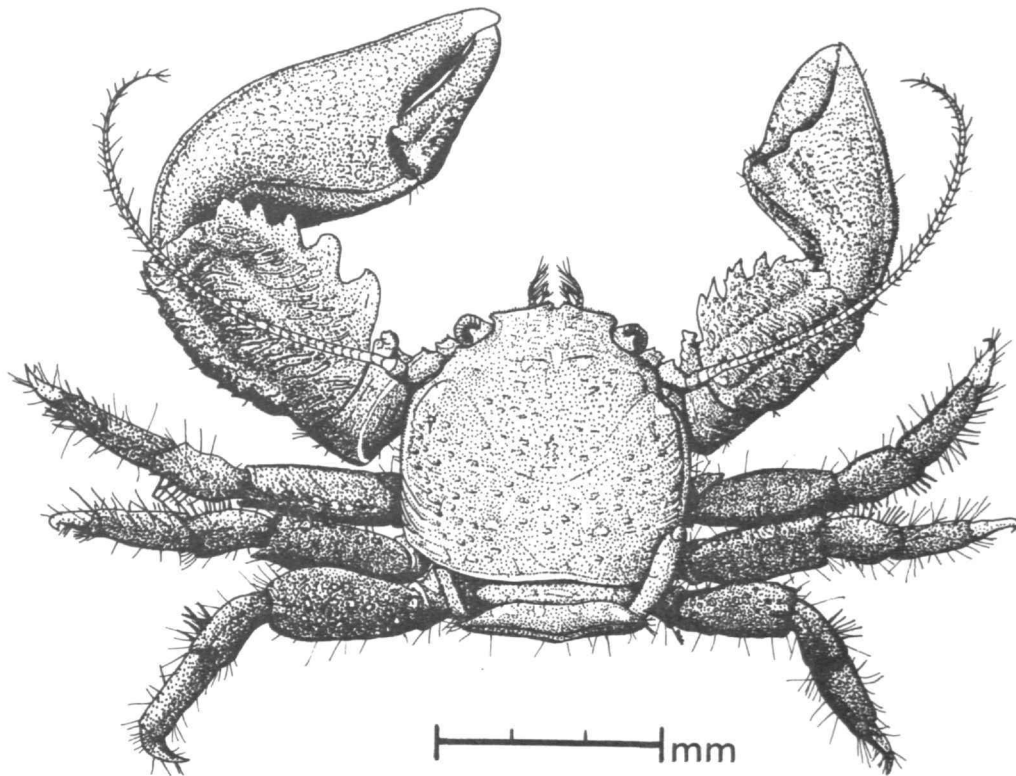


FIGURE 4.—*Petrolisthes jugosus* Streets, 1872: male specimen from Galeta Island, 5 June 1975.

covered after the original description of the species had been published: Pacific side, east bank of Panama Canal; 1 ♂; 27 Oct 1968. Pedro Miguel locks; Panama Canal; 1 ♀; 3 Feb 1969.

MEASUREMENTS.—Male  $5.8 \times 5.6$  mm; female  $2.8 \times 3.0$  mm.

REMARKS.—The male specimen, lacking all but two pereiopods, but with both chelipeds intact, showed features similar to *P. robsonae* in the spination on the outer ventral margin of the chelipeds, and in possession of two vestigial epibranchial spines. The outer orbital angle, however, was rounded, not acute, the cheliped merus had one spine plus a lobe with a small spinule, the carpus length-width ratio was 2.5, and the two pereiopods present were unarmed, all features indicative of *P. lindae*. The specimen thus seems to be another example of those individuals noted in the original description suggesting that *P. lindae* may be a re-

sult of hybridization between either *P. robsonae* or *P. nobilii*, and *P. armatus*. Notes on the female specimen indicated that it was a molted carapace from a very small specimen, obviously a juvenile, possessing no epibranchial spine, and having a deflexed tridentate front. Unfortunately, in the process of shipping the specimen to Florida from Panama it was severely damaged and now consists only of bits and pieces.

DISTRIBUTION.—Known at present only from the vicinity of the Pacific entrance to the Panama Canal; onshore.

#### 27. *Petrolisthes nobilii* Haig, 1960

*Petrolisthes nobilii* Haig, 1960:25, 55, pl. 1, 18: fig. 3; 1968:57, 62.—Gore and Abele, 1974:567, 568.

MATERIAL EXAMINED.—Punta Paitilla; 2 ♀ ovigerous; 9 Jul 1967 and 27 Nov 1968. Taboga Is-

land; 3 ♂, 2 ♀, 1 ovigerous; 11 Apr 1969. Taboguilla Island; 1 ♀, ovigerous; 11 Apr 1969. Ft. Kobbe; 3 ♂; 8 May 1969.

MEASUREMENTS.—Males  $4.8 \times 4.5$  to  $13.7 \times 12.7$  mm; female  $6.0 \times 5.8$  mm; ovigerous females  $7.0 \times 6.8$  to  $7.5 \times 7.8$  mm.

REMARKS.—One ovigerous female from Punta Paitilla, and the smallest male from Ft. Kobbe, were extremely close in several morphological features to *Petrolisthes armatus*. Although the female carapace was much expanded posteriorly and the chelipeds had a tuft of setae on the outer ventral margin (both features characteristic of *P. nobilii*), this specimen had distinct epibranchial spines. The male also had distinct epibranchial spines, and a carapace only slightly expanded posteriorly; unfortunately the chelipeds were missing. Consequently, both these specimens are placed in this taxon with some hesitation.

DISTRIBUTION.—From Cabeza Bellena, Gulf of California to Santa Elena Bay, Ecuador, and Isabel Island; intertidal zone.

### 28. *Petrolisthes platymerus* Haig, 1960

*Petrolisthes platymerus* Haig, 1960:29, 108, pl. 4, pl. 29: fig. 3; 1968:57, 66.—Gore, 1972:336, figs. 1–6 [larval development].

MATERIAL EXAMINED.—Punta Paitilla; 1 ♂; 7 Jul 1969.

MEASUREMENTS.— $3.8 \times 3.6$  mm.

REMARKS.—A male and female of this species, collected at Punta Paitilla in December, 1968 were reported previously by Gore (1972). The species was considered uncommon, and only 18 specimens had been previously collected from the eastern Pacific. We subsequently found the species, however, to be common in the extreme lower intertidal under large boulders at Punta Paitilla and Venado Beach.

DISTRIBUTION.—The range of this little species seems to be restricted in the eastern Pacific from Port Parker, and the Gulf of Nicoya, Costa Rica, to the Bay of Panama. As Haig (1968:66) points out, its small size, as well as its cryptic habit and heavy pilosity may well cause it to be overlooked by collectors; intertidal zone.

### 29. *Petrolisthes polymitus* Glassell, 1937

*Petrolisthes polymitus* Glassell, 1937:81, pl. 1: fig. 1.—Haig, 1962:176; 1968:57, 61.

MATERIAL EXAMINED.—Taboguilla Island; 1 ♂, 2 ♀, ovigerous; 11 Apr 1969. Perlas Islands; 1 ♀, ovigerous; 12–13 Jun 1974.

MEASUREMENTS.—Male  $3.9 \times 4.0$  mm; ovigerous females  $3.5 \times 3.2$  to  $4.6 \times 4.8$  mm.

REMARKS.—The specimens examined appeared typical for the species and fit the description provided by Haig (1960) very well. Ovigerous females have been reported in February and March from Costa Rica and in November and December from Mexico. The Panamanian records suggest that the species may breed year round in the eastern Pacific.

DISTRIBUTION.—Gulf of California to La Libertad, Ecuador, Tres Marias and Galapagos Islands; shore to 8 m.

### 30. *Petrolisthes robsonae* Glassell, 1945

*Petrolisthes robsonae* Glassell, 1945:227, fig. 3.—Haig, 1957:10; 1960:57, pl. 18: fig. 2; 1968:65.—Gore and Abele, 1974:567, fig. 3c.

*Petrolisthes armatus*.—Hildebrand, 1939:23 [not *Petrolisthes armatus* (Gibbes, 1850)].

MATERIAL EXAMINED.—Miraflores Locks, Panama Canal; 5 ♀, ovigerous; 17 Jan 1972 (M. L. Jones).

MEASUREMENTS.— $4.9 \times 4.8$  to  $5.5 \times 5.4$  mm.

REMARKS.—It is quite interesting that despite our collecting in the mouth of the Panama Canal and areas of low salinity adjacent to it our only specimens come from the Miraflores Locks. Haig (1960) also reported a single female from the lower chamber of Gatun Locks on the Atlantic coast of Panama. The species may thus occur only in areas of large fluctuations in salinity. Unfortunately, no detailed data are available on the specimens known from other localities.

DISTRIBUTION.—Mexico, El Salvador, Panama, and Guayaquil, Ecuador; intertidal zone.

### 31. *Petrolisthes tridentatus* Stimpson, 1859

*Petrolisthes tridentatus* Stimpson, 1858:227 [nomen nudum]; 1859:75, pl. 1: fig. 4.—Haig, 1968:57, 65.—Gore, 1971:485, figs. 1–6 [larval development].

MATERIAL EXAMINED.—Punta Paitilla; 2 ♂, 5 ♀, 2 ovigerous; 27 Nov 1968, 14, 15 Apr, and 7 Jul 1969. Taboga Island; 1 ♂, 1 ♀, ovigerous; 11 Apr 1969. Panama Canal entrance, Pacific side; 1 ♂, 1 ♀, ovigerous; 16 Apr 1969. Isle Chepillo; 4 ♀, 3 ovigerous; 26 May 1969.

MEASUREMENTS.—Males  $4.5 \times 4.6$  to  $5.7 \times 5.8$  mm; female  $4.3 \times 4.5$  mm; ovigerous females  $3.5 \times 3.7$  to  $6.6 \times 6.6$  mm.

REMARKS.—In many of the specimens the carapace appeared distinctly quadrate, a feature which might lead to misidentification with *Petrolisthes galapagensis* were not the front region triangular in that species, instead of being distinctly trilobate as it is in this one. Ovigerous females are known from November through July in the Bay of Panama and it is likely that the species breeds the entire year.

DISTRIBUTION.—Although the species is widely distributed from the Bahamas to Venezuela in the Caribbean and has also been recorded from Atlantic Panama (Haig, 1956), no Atlantic specimens were collected or examined. In the eastern Pacific the species is found from San Juan del Sur, Nicaragua, to Puna Island, Ecuador; littoral.

### 32. *Petrolisthes zaca* Haig, 1968

*Petrolisthes zaca* Haig, 1968:57, 63, fig. 2.—Abele, 1972:132.—Gore and Abele, 1974:567.—Gore, 1975:181, figs. 1–6 [larval development].

MATERIAL EXAMINED.—Pacific side, east bank of Panama Canal; 1 ♂; 27 Oct 1968. Diablo Boat Ramp; 15 ♂, 16 ♀, 7 ovigerous, 1 juvenile; 3 Jul 1969, and 10 Aug 1973.

MEASUREMENTS.—Males  $2.6 \times 2.4$  to  $9.1 \times 8.7$  mm; females  $3.4 \times 3.0$  to  $6.6 \times 6.0$  mm; ovigerous females  $4.6 \times 4.2$  to  $8.6 \times 7.6$  mm.

REMARKS.—This species can be found on high, exposed, muddy banks in brackish mangrove swamps on the Pacific side, where it inhabits burrows and depressions in the mud. Among the material examined are 14 specimens with two rather than three carpal spines and one specimen with four carpal spines. In all other features, however, they are typical specimens of *P. Zaca*.

DISTRIBUTION.—Previously known in the eastern Pacific only from the type-locality, Ballenas Bay, Costa Rica. Specimens reported by Abele (1972) include those noted herein and ovigerous females collected concurrently and reported on in another paper by Gore (1975) These are the first records for Pacific Panama; intertidal zone.

## Genus *Pisidia* Leach, 1820

### 33. *Pisidia magdalenensis* (Glassell, 1936)

*Porcellana magdalenensis* Glassell, 1936:295.

*Pisidia magdalenensis*.—Haig, 1960:209, fig. 10, pl. 38: fig. 4; 1962:187; 1968:57, 71.—Haig, et al., 1970:24, 26.—Del Solar, 1970:46.

MATERIAL EXAMINED.—Taboguilla Island; 20 ♂, 13 ♀, 9 ovigerous; 7 Apr 1969 and 18 Jan 1973. Rodman Naval Station; 6 ♂, 17 ♀, 15 ovigerous; 17 Apr 1969. Punta Paitilla; 2 ♂, 1 ♀, ovigerous; 29 Oct 1970. Perlas Islands; 76 ♂, 67 ♀, 62 ovigerous; 12–13 Jun 1973.

MEASUREMENTS.—Males  $2.4 \times 2.4$  to  $3.8 \times 3.9$  mm; ovigerous females  $3.2 \times 3.2$  to  $4.8 \times 5.1$  mm.

REMARKS.—Ovigerous females that mature at about 3 mm carapace length, are known in the Bay of Panama from January through October. The specimens from Taboguilla Island in January 1973 were reported associated with holothurians, according to field notes in the jar. Although the species is not known to be commensal it has been collected among hydroids as well.

DISTRIBUTION.—Santa Maria Bay, outer Baja California, Petatlan Bay, Mexico, south to the area of Tumbes, Peru; from the intertidal zone to 76 m.

### *Pisidia* species

MATERIAL EXAMINED.—Panama City; 2 ♂, 2 ♀, 1 ovigerous; 17 Feb 1969. Taboguilla Island; 1 ♂; 12 Jul 1969.

MEASUREMENTS.—Males  $2.5 \times 2.0$  to  $3.0 \times 3.2$  mm; female  $3.1 \times 3.3$  mm; ovigerous female  $3.1 \times 3.0$  mm.

REMARKS.—All the specimens have lost chelipeds and pereopods thus making positive identification uncertain. They agree, however, in all other respects with *Pisidia magdalenensis*.

DISTRIBUTION.—As with *P. magdalenensis*, if that species.

## Genus *Porcellana* Lamarck, 1801

### 34. *Porcellana cancrisocialis* Glassell, 1936

*Porcellana cancrisocialis* Glassell, 1936:292.—Haig, 1960:200, fig. 9(2), pl. 38: fig. 2; 1962:187; 1968:57, 70.—Haig et al., 1970:23, 26.—Del Solar et al., 1970:46.

**MATERIAL EXAMINED.**—Pacific Coast, Panama; 8 ♂, 7 ♀, 5 ovigerous; 29 Oct 1967. Aguadulce, Rio Palo Blanco; 1 ♀; 9 Nov 1968. Offshore from Juan Diaz; 1 ♀; 15 Jan 1969. Golfo de Chiman; 53 ♂, 36 ♀, 20 ovigerous, 1 juvenile; 27 May 1969.

**MEASUREMENTS.**—Males  $2.5 \times 2.1$  to  $9.3 \times 8.0$  mm; females  $2.8 \times 2.6$  to  $4.9 \times 4.3$  mm; ovigerous females  $4.0 \times 3.8$  to  $8.6 \times 7.6$  mm.

**REMARKS.**—The female from Aguadulce, although not noted in material examined above as being ovigerous, had just produced larvae when preserved. All other specimens agreed well with descriptive notes provided by Haig (1960). The majority of the specimens from Golfo de Chiman were noted as commensals with hermit crabs of the genera *Dardanus* and *Petrochirus*.

**DISTRIBUTION.**—Now known from San Juanico Bay, outer Baja California, and Punta Peñasco, Gulf of California southward along the eastern tropical Pacific coast to the area of Tumbes, Peru; offshore to Isabel Island. It is found from shore to 108 m.

### 35. *Porcellana corbicola* Haig, 1960

*Porcellana corbicola* Haig, 1960:197, 205, pl. 15.

**MATERIAL EXAMINED.**—Taboguilla Island; 1 ♂, 1 ♀, ovigerous; 19 Feb 1975.

**MEASUREMENTS.**— $2.4 \times 1.8$  and  $2.8 \times 2.4$  mm, respectively.

**REMARKS.**—To our knowledge this material constitutes only the second and third known specimens of this species which was described from a unique ovigerous female holotype. Our material agrees well with the description and illustration provided by Haig (1960). The two specimens examined had either one or no spinules of the distal ventral margin of the propodus of the walking legs; the dactyli, as noted by Haig, are without armature of any kind.

*Porcellana corbicola* occurs on the ahermatypic coral *Phyllangia dispersa* where it appears to mimic the polyps. Field notes shared by Dr. Peter Glynn state that the crab has the same ground color as the polyps and possesses green splotches on the anterior portion of the carapace which correspond to the green beads seen on the tentacles of the coral.

**DISTRIBUTION.**—Our material extends the known range from Rocas Consag, Gulf of California, to

Taboguilla Island, Panama, a distance of 3800 kms; intertidal zone to 50 m.

### 36. *Porcellana hancocki* Glassell, 1938

*Porcellana hancocki* Glassell, 1937:87 [listed only]; 1938b:5.—Haig, 1960:197, 198, fig. 9(1), pl. 38: fig. 3; 1962:185.—Del Solar, et al., 1970:23.

**MATERIAL EXAMINED.**—Saboga Island; 1 ♂; 12 Dec 1970.

**MEASUREMENTS.**— $6.6 \times 5.7$  mm.

**REMARKS.**—Previously restricted to the Gulf of California, this species may be yet another extralimital form that apparently reaches the Bay of Panama on occasion.

**DISTRIBUTION.**—Gulf of California, Mexico, to area of Chiclayo, Peru; from shore to 80 m.

### 37. *Porcellana paguriconviva* Glassell, 1936

*Porcellana paguriconviva* Glassell, 1936:293.—Haig, 1960:198, 203, fig. 9(3), pl. 38: fig. 1; 1962:185; 1968:70.—Haig, et al., 1970:24, 26.

**MATERIAL EXAMINED.**—Pacific coast, Panama; 2 ♀, 1 ovigerous; 29 Oct 1967.

**MEASUREMENTS.**— $5.1 \times 4.7$  mm and  $6.1 \times 5.7$  mm (ovigerous).

**REMARKS.**—The two specimens agree with those features noted by Haig (1960) in her description. A note in the specimen jar states that they (along with several *Porcellana cancrisocialis*, q.v.) were commensal with hermit crabs of the genus *Dardanus* and *Petrochirus*.

**DISTRIBUTION.**—From Bahia Magdalena, outer Baja California, Punta Peñasco, Gulf of California to Taboga and Taboguilla Islands, Bay of Panama; shore to 100 m.

### Genus *Ulloaia* Glassell, 1938

#### 38. *Ulloaia perpusillia* Glassell, 1938

*Ulloaia perpusillia* Glassell, 1938:434, pl. 33: fig. 1.—Haig, 1960:230, fig. 11, pl. 37: fig. 2; 1962:191.

**MATERIAL EXAMINED.**—Perlas Islands; 2 ♂, 2 ♀, ovigerous; 12–13 Jun 1973.

**MEASUREMENTS.**—Males  $2.0 \times 1.6$  to  $2.2 \times 2.0$  mm; ovigerous females  $2.5 \times 2.2$  to  $2.7 \times 2.1$  mm.

**REMARKS.**—In these specimens the frontal region



is definitely visible in dorsal view, and the dorsal carapace ridge is broken into two or three more or less distinct lobes. The general appearance of the carapace is much smoother than that illustrated by Glassell (1938). Haig (1962) also noted some variability in the rostrum of specimens she examined. The four individuals reported herein of this extremely small and rare species brings the total known from the eastern Pacific to nine specimens. However, this very small species may not be as rare as the paucity of material would indicate, since recent collections show that it may be found among the calices of the branching coral, *Pocillopora damicornis*, to which it bears a close resemblance.

**DISTRIBUTION.**—Gulf of California to Perlas Islands, Bay of Panama; shore to 16 m.

#### Discussion

Despite the many stations sampled during this study, we must emphasize that our knowledge of Panamanian porcellanid crabs and, indeed, the Panamanian biota in general is far from complete. As can be easily seen in Figure 1, most of the coastline in Pacific Panama remains to be sampled. For example, on the Pacific coast we have collections from a single habitat and only one locality in the entire Gulf of Chiriqui. There are no collections from the Gulf of Montijo, and only two from all of the Darien coast. The area around Panama City and the Pacific entrance to the Panama Canal, however, has been well collected. Additional collections are also available from the nearby offshore islands of Taboga, Taboguilla, and the Perlas Archipelago in the Bay of Panama. As might be expected, logistical problems are a major consideration in Panama, thus accounting in part for the

sampling bias toward populated or easily reached areas in the country.

A similar situation prevails on the Caribbean coastline. Again, we have collections from the Atlantic entrance to the Panama Canal and the nearby vicinity extending to the town of Portobelo. On the other hand, the coastline of Bocas del Toro, the Gulf of Mosquitoes, and the San Blas Archipelago have not, as yet, been adequately investigated. This is unfortunate since several major habitats occur in these regions, among them rocky outcroppings in Bocas del Toro and deep living coral reefs in the San Blas Islands. Both are attractive habitats for porcelain crabs.

Despite these obvious limitations our collections have increased the known porcellanid crab fauna of Panama by about 20%, and added three new species. Yet, we were working with a faunal component that is typically restricted to shallow waters inshore where collecting is often easier than in deeper water or in more cryptic decapod faunas such as the Alpheidae or some genera of the Xanthidae. It is entirely possible that additional new species will be discovered in the smaller members of the fauna (e.g., 2–3 mm carapace width) and commensal species on the coral reefs of the areas on both coasts of Panama.

It is our hope that the data of this report will sufficiently encourage other students to continue explorations in Panama, especially in the vast stretches of as yet unsampled coastline on either shore. In our opinion, it is imperative that such explorations be carried out not only for the Porcellanidae, but also for all groups of marine organisms occurring in Panama. This country is in a region that appears ready to undergo far-reaching and permanent alterations (urban growth, industrialization, and possibly a sea-level canal) before the end of this century.

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